CITIZENS GUIDE

to the

UNITED STATES DEPARTMENT OF ENERGY'S

IDAHO NATIONAL LABORATORY

Sixteenth Edition
Revision 962

Compiled for

Environmental Defense Institute
By
Chuck Broscious

Updated February 2013
Revision 963

Guide.963 http://www.environmental-defense-institute.org

Dedicated in Memory of
Jeanne McClenahen Broscious
and
Gertrude Hanson

Every gun that is made, every warship launched, every rocket fired, signifies, in the final sense, a theft from those who hunger and are not fed, those who are cold and are not clothed. This world in arms is not spending money alone; it is spending the sweat of its laborers, the genius of its scientists, the hopes of its children.

Dwight David Eisenhower

Along with the possibility of the extinction of mankind by nuclear war, the central problem of our age has therefore become the contamination of man's total environment with such substances of incredible potential for harm ---substances that accumulate in the tissues of plants and animals and even penetrate the germ cells to shatter or alter the very material of heredity upon which the shape of the future depends.

Rachel Carson

The ultimate test of a moral society is the kind of world it leaves to its children.

Dietrich Bonheoffer

If you love this planet, you are going to have to change the priorities of your life. People from all walks of life, many of whom identify themselves as non-political, have discovered that hopeful action is better than hopeless inaction.

Helen Caldecott

Acknowledgements

Basic to the democratic process is the concept of informed consent. The goal of the *Citizens Guide to Idaho National Laboratory* formerly called Idaho National Engineering and Environmental Laboratory (INEEL) is to provide the reader with a candid history of INL operations, and the environmental, health, and safety impact that are the legacy of nearly six decades of nuclear activities at this nuclear site. The reader will hopefully be better prepared to make informed decisions on nuclear policy issues, cleanup activities, and new nuclear projects planned for INL by reading this Guide.

The first edition of the *Guide*, released in January 1991, would not have been possible without the ongoing support of hundreds of individual contributions that have sustained the Environmental Defense Institute (EDI) over the years. The Harder Foundation provided funding for the publishing costs of the first edition. Special credit and appreciation also go to the W. Alton Jones Foundation, the Deer Creek Foundation, the Peace Development Fund, the Norman Foundation, the Bridge Builders Foundation, Jeanne M. Broscious, Carol B. Ferry, Russell K. Broscious, P.E., Dr. Allen Benson and Tri-State Distributors for their generous financial support. EDI's Board of Directors has tirelessly worked for over a decade to ensure the organization stays on track and keeps focused on our mission.

Patricia Diaz, Ph.D. contributed indispensable editing talent to the first edition of the *Citizens Guide*. Jonathan Stoke, Karen Hallgren, and Lynn Mineur also contributed their essential editing skills through the first seven editions of the Citizens Guide. Elaine Broscious Dawson's creative publishing talents on the eighth and ninth editions provided the building blocks for the tenth edition. Since each new edition builds on previous editions these editors continue to contribute. Margaret Carde contributed the section on EPA waste standards, Daniel Hirsch, Ph.D. contributed the section on breeder reactors, Daniel Horner contributed the section on pyroprocessing, and Daryl Kimball contributed the section on epidemiological research activities. Tim Connor, Keith Stormo, Arjun Makhijani, Ph.D., Philip Deutchman, Ph.D., T. Alan Place, Ph.D., Kate Schalck, Russell Broscious, P.E., Alice Stewart, M.D., Allen Benson, Ph.D., Todd Martin, Don Hancock, Michael Blaine, Ph.D., Duane Allen, Dirk Dunning, William Weida, Ph. D., and Bret Leslie, Ph.D. offered considerable technical assistance. Allan Bowles, J.D., Kellie Youmans, J.D., Kenneth Gallant, J.D., and John Norton, J.D. contributed extensive legal assistance. Daniel Jones' Anyware Computers kept EDI computers literally running. Michael Cawley, Richard Hanson, Gertrude Hanson, Mary Burkett, and Jean Dennis' willingness to share their personnel histories and litigation documents and Alan Lifton's compelling *Faces of Victims* video record ensured the prominence of the victims dominated.

The core documentation cited in this *Citizens Guide* was obtained through Freedom of Information Act (FOIA) requests to the Department of Energy. Robert Alvarez provided the inspiration and principal formulation of these FOIA requests that were first initiated in 1987. His generous guidance in subsequent years was indispensable during the denials and administrative appeals for these FOIA requests. Tom Carpenter, J.D., Daniel Berger, J.D., also assisted in FOIA request formulation. Additionally, the six member organizations of the INL Research Bureau, who were the original FOIA requesters, made it ultimately possible to obtain these Department of Energy (DOE) documents because of the restrictive DOE interpretation of FOIA to meet "in the public interest" and "dissemination" requirements.

Table of Contents

Acronyms

AEC	U.S. Atomic Energy Commission (ERDA and later DOE's predecessor)
AFSR	Argonne Fast Source Reactor
ANL-W	Argonne National Laboratory-West on INL site
ANP	Aircraft Nuclear Propulsion
ARA	Auxiliary Reactor Area on INL site
ARFM-1	Advanced Reactivity Measurement Facility No. 1
ARVF	Army Reentry Vehicle Facility
ATR	Advance Test Reactor
ATRC	Advanced Test Reactor Critical
ATSDR	Agency for Toxic Substances and Disease Registry
BORAX	Boiling Water Reactor Experiment
CDC	(National) Centers for Disease Control and Prevention
CERCLA	Comprehensive Environmental Response, Compensation, and Liabilities Act
CERT	Controlled Experimental Release Test
CFA	Central Facilities Area on INL site
CFRMF	Coupled Fast Reactivity Measurement Facility
CTF	Core Test Facility
DEIS	Draft Environmental Impact Statement
DOB	Daily Operations Brief for Secretary of Energy
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOE/ID	U.S. Department of Energy Idaho Operations Office
EBR-I	Experimental Breeder Reactor Number 1
EBR-II	Experimental Breeder Reactor Number 2
ECF	Expended Core Facility
EDI	Environmental Defense Institute
EG&G	Edgerton, Germeshausen & Grier (DOE Contractor)
EIS	Environmental Impact Statement
EOCR	Experimental Organic Cooled Reactor
EPA	U.S. Environmental Protection Agency
ERDA	Energy Research and Development Administration (DOE's predecessor)
ETR	Engineering Test Reactor
ETRC	Engineering Test Reactor Critical
EXCES	Experimental Cloud Exposure Study
FAST	Flourinel and Fuel Storage Facility
FCF	Fuel Cycle Facility
FECF	Fuel Element Cutting Facility
FEET	Fuel Element Effluent Test
FFCA	Federal Facilities Compliance Act
FOIA	Freedom of Information Act
FPFRT	Fission Product Field Release Test
FMF	Fuel Manufacturing Facility
GAO	U. S. Congress General Accounting Office
GCRE	Gas-Cooled Reactor Experiment
GOCO	Government Owned Contractor Operated
GTCC	Greater Than Class-C Low-Level Waste

HEDR	Hanford Environmental Dose Reconstruction Project
HFEF	Hot Fuel Examination Facilities
HTRE	Heat Transfer Reactor Experiment
ICRP	International Commission on Radiological Protection
ICPP	Idaho Chemical Processing Plant (now called INTEC)
IDHW	Idaho Department of Health and Welfare
IET	Initial Engine Test (ANP Reactor Program)
IFSF	Irradiated Fuel Storage Facility (CPP-603)
IHES	INL Health Effects Subcommittee (CDC Dose Reconstruction Study)
INEL	Idaho National Engineering Laboratory (now INL)
INEEL	Idaho National Engineering and Environmental Laboratory (now INL)
INTEC	Idaho Nuclear Technology and Engineering Center (formerly ICPP)
IRB	INEL Research Bureau
IFR	Integral Fast Reactor
LDDT	Long Distance Diffusion Test
LIME	Limited Melt Experiment (Reactor)
LESAT	Lockheed Environmental Services and Technologies (now LMAES)
LITCO	Lockheed Idaho Technologies Company (now LMITCO)
LMITCO	Lockheed Martin Idaho Technologies Company
LMAES	Lockheed Martin Advanced Energy Systems
LOFT	Loss of Fluid Test (Reactor)
LPT	Low Power Test (Reactor)
M&O	Maintenance and Operations
MFC	Materials and Fuels Complex (formerly ANL-W)
MPF	Mixed Fission Product
MTR	Materials Test Reactor
NCEH	National Center for Environmental Health (Division of CDC)
NIOSH	National Institute for Occupational Safety and Health (Division of CDC)
NRC	U.S. Nuclear Regulatory Commission
NRAD	Neutron Radiography Facility
NRF	Naval Reactors Facility
NRTS	National Reactor Testing Station (Currently called INL)
NWCF	New Waste Calcine Facility
OMRE	Organic-Moderated Reactor Experiment
OTA	U.S. Congress Office of Technical Assistance
PBF	Power Burst Facility (Reactor)
PM-2A	Portable Medium Nuclear Power Plant
PREPP	Process Experimental Pilot Plant
RCRA	Resource Conservation Recovery Act
RDT	Relative Diffusion Test
RESL	Radiological and Environmental Sciences Laboratory
RTC	Reactor Technology Center (formerly Test Reactor Area)
RWMC	Radioactive Waste Management Complex
SCRC	Special Cavity Reactor Critical Experiment
SDA	Sub-surface Disposal Area at RWMC
SDIO	Strategic Defense Initiative Organization
SL-1	Stationary Low-Power Reactor No. 1
SNAPTRAN	Special Nuclear Auxiliary Power Transient
SPERT	Special Power Excursion Reactor Tests I, II, III, and IV

SWEEP	Stored Waste Examination Pilot Plant
STR	Submarine Thermal Reactor (S1W) at Naval Reactor Facility
TAN	Test Area North on INL site
TRA	Test Reactor Area on INL site (now Reactor Test Complex)
TREET	Transient Reactor Test Facility
TSF	Transuranic Storage Facility
WCF	Waste Calcine Facility
WERF	Waste Experimental Reduction Facility
WRRTF	Water Reactor Research Test Facility
WIPP	Waste Isolation Pilot Plant in New Mexico
WINCO	Westinghouse Idaho Nuclear Company
ZPPR	Zero Power Physics Reactors (I, II, and III)

Introduction

The *Citizens Guide to INL* is intended as a resource tool for individuals and public interest groups seeking information on the U.S. Department of Energy's (DOE) historical, current, and planned operations in Idaho. DOE owns and operates the Idaho National Laboratory (INL) formerly (and hereafter referred interchangeably) as the Idaho National Engineering and Environmental Laboratory (INL) near Idaho Falls, Idaho as a nuclear weapon materials production and reactor testing site. INL has gone through four name changes. The original site name bestowed by the U.S. Atomic Energy Commission in 1949 was the National Reactor Testing Station. In the mid 1970's the site name was changed to the Idaho National Engineering Laboratory, in 1996, the name was changed again to Idaho National Engineering and Environmental Laboratory, and finally the name was changed to INL.

The *Citizens Guide to INL* is published by the Environmental Defense Institute (EDI), a non-profit public interest organization dedicated to promoting responsible public policy concerning Idaho's human and natural environment. EDI was the sponsor and coordinator of a coalition of six organizations called the INL Research Bureau (IRB), which functioned between 1988 and 1995. The IRB coalition focused on accessing documents through the Freedom of Information Act on the operating history of the INL. These INL documents are used by IRB member organizations as part of their on-going analysis of the health and safety impact of INL operations. Periodically, the *Citizens Guide* is updated to reflect new information, disclosures, and changes in the issues that the *Guide* addresses. EDI's first edition of its *Citizens Guide* was published in January 1991. DOE Idaho Operations Office started publishing a "Citizens Guide, INL Reporter Supplement." When asked why they were copying the Citizens Guide name, one DOE official said that: "EDI should consider it a complement since being copied is the highest form of praise." DOE has also plagiarized EDI's *INL News* letter name that has been in constant use since December of 1990 when it was first published.

Since the last update to the *Citizens Guide*, INL Superfund cleanup activities have been initiated, and additional information has come to light challenging DOE's "no action" decision at some waste sites. Also, public participation initiatives have developed in an attempt to implement substantive public involvement in the health study decision making process.

Citizens of Idaho are facing important choices concerning the DOE's Idaho operations. For over forty-seven years, INL operations were conducted in secret. The public had no choice but to accept decisions made by the federal government. Today, the public has the opportunity to participate in current policy decisions concerning the INL that include:

- Expansion of INL pyro-processing of reactor fuel to recover plutonium and highly enriched uranium;
- Expansion of INL as a national radioactive waste treatment center;
- Expansion of INL burial grounds for permanent disposal of radioactive wastes;
- Superfund cleanup of radioactive and chemical wastes from past and present nuclear programs;
- Health studies of affected populations to determine impact of INL releases on workers and off-site residents.

Due to safety and environmental violations at many DOE sites across the country, the government has been forced to close some facilities. In an effort to revive its breeder reactor program, DOE is funding Argonne National Laboratory West's (now called Materials Fuels Complex) Integral Fast Reactor (IFR) pyro-processing plant. This is process recovers plutonium and enriched uranium that is then refabricated into new reactor fuel. This fissile material can also be used for nuclear weapons which poses significant issues related to the proliferation and violation of nuclear proliferation treaty agreements.

This planned expansion of INL will increase the already significant negative impact on Idaho's environment and the health and safety of its residents. The fall of the Soviet Union and Nuclear Weapons Treaties have significantly changed the arsenal requirements. However, U.S. government funding for development and production of new nuclear weapon systems has increased. Despite a surplus of plutonium and highly enriched uranium that are the primary components of nuclear bombs, the nuclear alchemists still want to build reserve production capacity in case it is needed in the future.

INL's expansion proposal says Idaho is best because it "provides added safety by virtue of a distance shield to protect the public in case of a low probability, high consequence event."[NWCRS/INL @ 1-6] In plain English, this means that DOE still believes that; if and when, an accident releases radiation, there will be no significant impact on Idahoans. DOE assesses risk to public as low because Idaho is a state with a low population density.

Resistance to addressing INL's environmental contamination problems are rooted in protecting the site's image and ability to attracting new nuclear projects. Resistance to owning up to decades of mismanagement of the site's waste streams is another factor not to mention the government's reluctance to pay the estimated $19 to 29 billion Superfund cleanup bill. Former INL site manager John Wilcynski believed that a site mission composed largely of environmental cleanup work is a certain road to shutdown. The nuclear culture has sunk deep roots into the socioeconomic consciousness of southeastern Idaho. As the single largest employer in the State, INL's political clout cannot be underestimated.

In order for the reader to be able to make informed decisions concerning INL's present and future activities, it is essential to have an understanding of the site's operating history. Section I of this *Guide* offers as candid a view of INL's history as current publicly available information allows. Unfortunately, much of INL's operating history remains secret and documentation classified. Hundreds of thousands of pages of DOE and other government source documents gained through Freedom of Information Act requests were reviewed to provide a fully referenced *Guide*. Citations are placed in [brackets] in abbreviated form that are also listed in alphabetical order in the Reference Section at the end of the *Guide*. The reason for this unconventional reference format is to facilitate the updating process with each new edition of the *Guide*.

With this understanding of the site, the reader will be better able to evaluate the cumulative impacts of nuclear activities as opposed to a snap shot of a new project taken out of the context of existing contamination. As of this printing, the reader must understand that this is only what we know now about INL, and that new revelations occur on a daily basis. Even other government agencies such as the Centers for Disease Control with a Congressional mandate to study the INL radioactive releases, is blocked from using classified documents that DOE and the Department of Defense refuse to declassify. This classified information is nearly five decades old and has no credible national security implication. Rather, it represents an embarrassment to the government's mismanagement of its operations in Idaho.

DOE's internal documents record massive radioactive and chemical contamination resulting from releasing tens of millions of curies of radioactive material into the atmosphere and subsequent dumping of millions of cubic feet of solid radioactive waste containing millions of curies into Idaho's soil. To put these releases of radioactivity into perspective, the Environmental Protection Agency (EPA) sets maximum concentration standards for radionuclide's' in drinking water. These standards are expressed in pico curie units, or one trillionth of one curie, or one part per trillion. In short, radionuclides are biologically extremely hazardous so that the regulations only allow minuscule amounts in the environment. INL, operating in secret and without outside regulatory oversight, used Idaho's southeastern desert as a dumping ground for the most hazardous materials known to humankind.

Public pressure and Congressional mandate giving EPA and the host states jurisdiction over some of DOE cleanup activities has generated some change in recent years. Because of the federal government's dumping of radioactive and chemical wastes, the EPA put INL on its Superfund cleanup National Priority List. Concern over the health effects from these radioactive releases spurred the Congressional General Accounting Office (GAO) to conduct an investigation of INL's emissions and accidents. The GAO report was released in February 1992 by Senator John Glenn who concluded that an independent health study was needed, "These [GAO] results raise key questions about the health effects of radiation exposure on both the workers and residents near the facility at INL. I certainly hope this report will open some eyes and get such a study underway."[Glenn (b)] This *Citizens Guide* discusses in some detail the progress of the INL health studies for which Senator Glenn was instrumental in gaining Congressional research funding. Centers for Disease Control initiated a full scale INL Environmental

Dose Reconstruction Health Study in 1992. Section VI of the *Guide* offers an analysis of this health study's Phase II of a four phase process.

The Congressional Office of Technology Assessment (OTA) released a report in February 1993 that declared that DOE was unprepared to protect tens of thousands of workers involved in hazardous activities at its production sites. "The DOE and its contractors continue to operate under an organizational structure that presents serious obstacles to progress in safeguarding worker health and safety," the report said. OTA further found that DOE's managers, employees and contractors were not convinced that occupational health and safety is truly a top priority. [OTA-BP-O-85] DOE's lack of protection for its workforce extends past the site boundary to affected populations living in INL's shadow. A September 1997 Notice of Violation for Work Deficiencies under the Price Anderson Act leveled at INL primary contractor Lockheed Martin for six Severity Level III violations by workers suggests that the problems OTA identified in 1993, still persist.

Cleanup of DOE's whole Complex is the most expensive single public works effort in the history of the United States. Cleanup estimates for the DOE Complex in over 20 states is estimated at between $227 and $360 billion. Cleanup of the INL is now estimated between $18.65 and $29.24 billion. These cleanup estimates are not for complete environmental restoration (return to original condition); but rather for designation of nuclear sacrifice zones that will require institutional control to prevent public access for perpetuity. DOE's declaration of fenced off sacrifice zones is a deliberate ploy to excuse them from cleanup obligations. This literally shifts the costs and hazards on to future generations and away from the perpetrators. In view of the fact that these wastes will be lethal for tens of thousands of years, the reliance on fences to keep people and animals out is ludicrous at best. This *Guide* reviews nine waste area group remediation decisions in Section IV made by DOE, the State, and the Environmental Protection Agency (EPA) under the Federal Facility Agreement and Consent Order. Generally speaking, there is more cover-up than cleanup in these remediation decisions. A typical decision is to put a soil cap over the waste dump to reduce the radiation field at the surface, put a fence around it, and call it "cleaned up". The government simply will not pay the cost of exhuming the waste and vitrifying it to create a stable waste form that will not pose an environmental hazard. This vitrified waste could then be safely stored on-site until a safe permanent repository is built for its final internment. Unfortunately, the State and EPA as regulatory agencies are acquiescing to DOE's cleanup shortcuts.

Funding for Superfund cleanup at DOE sites is found in the Department's environmental management budget category. The relative degree of commitment to environmental restoration and paying off the nuclear mortgage legacy can be best seen in the budget. The Clinton Administration's DOE FY-94 budget for INL showed a temporary shift from defense production programs to environmental management. DOE's Complex-wide FY-94 nuclear weapons activity budget request was only 17.5% lower than that appropriated for 1993. For FY-95 and 96 however, the nuclear weapons appropriations increased 10% each year while environmental restoration decreased. In 1997 DOE launched a five year program to reduce environmental restoration by 4.4 billion over five years while increasing nuclear weapon development by over $10 billion. Considerable uncertainty exists in the budget primarily due to DOE's creative accounting shifts of defense program allocations to environmental management accounts. Hundreds of millions of dollars in INL projects that support defense programs have turned up in the environmental management accounts. The net effect of this creative accounting is to make the defense budgets appear artificially lower and the environmental restoration budgets appear artificially higher.

DOE's commitment to move ahead with its Argonne-West (ANL-W) - now called Materials Fuel Complex - reactor fuel pyro-processing capability may contain a hidden agenda. Nuclear weapons materials are produced by processing reactor spent fuel rods and extracting highly enriched uranium and plutonium. Currently, DOE's old production facilities including the Idaho Chemical Processing Plant (ICPP) – now called INTEC - violate environmental laws and must be either shut-down or extensively upgraded. DOE's hidden agenda in this Plan is to rebuild its nuclear weapons materials production capacity under the guise of waste processing for final disposal. Yet, reactor fuel rods do not require processing prior to internment in a repository other than in some cases re-canning (putting the fuel into stainless containers). Former Governor Andrus challenged DOE's erroneous assumption of the need to process spent nuclear fuel to meet waste repository acceptance criteria. Andrus' concerns are well founded due to the significant radioactive emissions that result from fuel processing. Congressional funding and public acceptance will be radically different if DOE is candid about its true mission for the ICPP and ANL-W pyro-processing of spent nuclear fuel. Therefore, DOE's subterfuge may be a well- planned ploy to build new nuclear materials production capacity that involves reactor fuel processing, while publicly the Department claims it is a waste management project. DOE's 1996 State air pollution permit application for the ICPP (INTEC) describes the assigned objectives as "the safe and economical receipt, storage, and **recovery of highly enriched uranium from fuel elements** discharged from Naval Nuclear Propulsion Reactors, Research and Test Reactors (foreign and domestic as well as from other unique fuels) that cannot be **processed elsewhere**". [Emphasis added] This State permit is prima-fascia evidence that the Department's public rhetoric about discontinuing nuclear weapons material production is inaccurate.

Congressional appropriations for DOE's FY-97 nuclear energy programs are twice what the Clinton Administration requested. These programs include a broad range of commercial and military nuclear reactor development and construction - many of which are slated for INL. Congressional intransigence in perpetuating these questionable projects while cutting environmental restoration is a testament to DOE nuclear reactor development contractors' ability to influence the purse strings. This funding brings into question this nation's commitment to the nuclear weapon reduction treaties. Additionally, more nuclear waste will be generated at a time when we have no permanent internment site.

DOE's abuse of Idaho's open spaces and sparse population is a continuation of the misguided notion that "dilution is the solution to pollution." The hundreds of billions of gallons of radioactive waste dumped via injection wells directly into the Snake River Plain Aquifer and dumped into unlined percolation ponds may never be cleaned up. According to sweetheart deals between DOE, the State, and EPA, groundwater contamination exceeding 176,000 times the regulatory limits for radionuclide's in drinking water is not bad enough to warrant a pump and treat cleanup action. DOE stubbornly contends that: "The large size and remote nature of the INL enables the Super-Site to be several miles from existing INL facilities, thus lowering the risk to the public of combined radionuclide emissions." This is yet another example of DOE's disregard for radioactive contamination in the Snake River Plain Aquifer that underlies the INL site. This sole source aquifer provides water to more than 270,000 Idahoans. The continued use of unlined percolation ponds for INL process wastes contaminates the aquifer at a staggering rate. Radioactive and hazardous chemical wastes are dumped in unpermitted, unlined pits at the Radioactive Waste Management Complex that would not even meet current municipal garbage landfill standards. This illegal dumping continues today violating the Recourse Conservation Recovery Act (RCRA). The Environmental Protection Agency (EPA), as early as 1987, identified these waste ponds among the 368 sites at INL that are to be reviewed for cleanup under Superfund. Unfortunately, EPA and the State are reluctant to force INL to comply with environmental laws because INL is the single largest employer in the state.

The public is demanding that the State of Idaho take a more critical oversight role of INL. However, changing decades of laissez-faire oversight of DOE will require continued public involvement and pressure. The Environmental Defense Institute (EDI) supported former Governor Andrus's ban on additional nuclear waste shipments to INL. The ban is based upon decades of broken DOE promises on waste disposal that has turned INL into a defacto nuclear dump. According to Andrus, "It's pretty clear they [DOE] never intended to keep their word. You just can't do business with those lying so-and-so's." Idaho's then Governor Batt pressured by public opposition to more radioactive waste shipments to the state, initially appeared to take a hard stand against DOE and the Navy. Unfortunately, the agreement signed by Batt on October 1995, will eventually increase waste shipments because it allows INL to be a national radioactive waste treatment center. Emissions from these waste incinerators are a crucial issue to Idahoans, and the Department's refusal to conduct the legally required Environmental Impact Statements on these plants demonstrates the government's lack of commitment to full disclosure.

Of particular concern today is the nearly 2 million gallons of high-level radioactive liquid waste currently stored in eleven tanks at the Idaho Chemical Processing Plant (ICPP) tank farm at INL. Three-fourths of this volume (1.5+ million gallons) was generated in the 1950s and stored in tanks that have since corroded and that do not meet current earthquake, structural, or containment standards. Though DOE is required under a court order to solidify the liquid portion in the tanks (which it has only solidified/incinerated ~ 1 million of the 2 million gallons), the Department wants to leave the equally radioactive tank sediments. Additionally, numerous reactor spent fuel storage facilities at INL are old and too decrepit to safely store this hazardous material. Nuclear reactors operating at INL do not meet current containment and safety regulations imposed on commercial nuclear plants by the Nuclear Regulatory Commission.

Continued public pressure is needed to convince the State of Idaho and the Environmental Protection Agency to exercise their full enforcement authority to ensure that DOE complies with all applicable environmental laws. Environmental Defense Institute, together with other public interest groups, was instrumental in the creation of two INL "Citizen Advisory Boards," one for INL Superfund cleanup and one for Centers for Disease Control's INL health studies. Originally it was thought that these advisory bodies had the potential to expand public participation and to hold all agencies accountable. Unfortunately, these advisory boards were packed with INL boosters that are more interested in preserving INL's good name so that the site will continue to attract new nuclear missions. The citizen advisory board concept evolved out of intense frustration with the lack of response by the enforcement agencies to address critical compliance issues. Sites where Advisory Boards are working are those where it is in an undeniable shutdown mode – like Hanford. Production sites, like INL, Oak Ridge and Savannah River, that still vie for new nuclear missions remain in denial of the massive environmental contamination at the site. DOE continues to obfuscate this nation's environmental, health, and safety laws. Only an active and involved citizenry will change decades of intransigence to outside oversight and regulation.

The INL radiation release data offered in the *Citizens Guide*, though fully documented, must be interpreted as extensively understated. The reason for these understatements is that the DOE (and its predecessors) often created the illusion to successive Presidents that their operations were safe and functioning within guidelines in force at the time. Therefore, publicly available summary documentation is less than accurate about radioactive releases and the impacts of those releases. These inconsistencies in federal documents and regulatory agency documents are reflected in this *Citizens Guide* not to confuse the reader, but to give the reader the opportunity to decide for themselves which data is more reliable. The reader must never conclude that information herein offered is conclusive nor anywhere near what was actually released to Idaho's environment. Considerable analysis of INL's operating history, industrial processes, emission system efficiencies (or lack thereof), reactor meltdown experiments, etc. must be conducted before the whole truth will be known. Significant political will is needed to force declassification of currently secret operating history documents and financial resources will be required to uncover these past activities. Due to the liability implications of such revelations, resistance continues for a full disclosure to the citizens of Idaho. It is a sad commentary on the state of democracy here in the United States when the federal government refuses to declassify fifty-year old environmental, health, and safety information on the grounds of national security.

The US District Court Ordered DOE to conduct a site specific INL Environmental Restoration Waste Management Environmental Impact Statement (EIS). Even this massive 4,200 page document lacks the waste stream characterization required by the National Environmental Policy Act. One of many fundamental flaws of the EIS is its lack of consideration of where DOE intends to put all its waste that has been piling up over the past fifty years. Reliance on the Waste Isolation Pilot Project to solve INL's waste constipation problem is unrealistic due to the limited capacity of WIPP.

This *Citizens Guide* discusses national policy issues such as cleanup standards, radiation exposure standards, regulatory oversight, secrecy, transportation of waste, and budget priorities because these policy issues directly affect if and how problems at INL will be addressed. The issues at INL must be seen within the greater context of the national agenda so that the reader will have a more accurate understanding of the scope of these problems. Through this understanding, the reader will hopefully be able to interact more effectively with their elected officials and enforcement agency representatives. The *Guide* also chronologically lists INL accidents and unusual occurrences as a graphic portrait for individuals needing to correlate their own experiences with incidents on the site.

This nation cannot afford to continue to operate its nuclear weapons complex as it has in the past sixty+ years. Already huge areas of our country are nuclear sacrifice zones for perpetuity. Large segments of our population have been exposed to intentional radioactive emissions that have caused serious health effects and death. These populations were not informed nor were they given the opportunity to give informed consent. This is not the democratic process that we agreed to in our Constitution. If we as a country are to meet the challenges before us on nuclear issues we must immediately reevaluate how public policy is formulated and start developing a truly equitable and democratic process free of secrecy. Public interest groups can only advocate for change. Real substantive change will only occur if everyday citizens make the commitment to be activists on these issues of health and safety.

The victims are acknowledged in this *Citizens Guide* because ultimately that is the real issue. Millions of curies of radiation released to Idaho's environment are just another statistic and relatively meaningless without being in the context of the impact on the biosphere. To their credit these individuals were willing to come forward and share their experiences out of their own personal commitment to setting the record straight. The human element to this tragedy will likely take decades to be fully revealed as it was for the Cold War American human radiation experiments to finally surface. "Only the truth can make us free".

I. INL Operating History

A. Site History

The Idaho National Laboratory was originally a 173,000 acre Naval Proving Ground used mainly as a gunnery range. In 1948 the Atomic Energy Commission (AEC) made the decision to expand reactor development and spent fuel chemical processing for nuclear weapons materials. Initially, the AEC decided to expand the Argonne National Laboratory near Chicago, yet, "Any accident releasing the fission products built up in the fuel elements could be hazardous to the [then] 4 million people of the nations' second largest urban center." [Hewlett and Duncan, 1969 @187] The AEC's safety committee established citing criteria that, "Simply stated, the higher the power level the greater the area over which control was needed. Ideally a reactor location should meet three criteria: complete Commission control over the immediate area; a population of less than 10,000 in the surrounding country; and no installations vital to the nation's defense in the region." [Ibid @ 196]

Ironically, the Montana Congressional delegation was pressing the Joint Committee on Atomic Energy of Congress for designation of Fort Peck in their state as the best site for the new reactor testing station. At Congressional hearings held April 14 and May 10, 1948, Montana Congressmen challenged the AEC's decision to build the reactor site in Idaho citing that the Snake River would be more likely to be contaminated than the Missouri River. Fort Peck had solid rock under the site as opposed to Idaho's porous soil and fractured basaltic rock. The Montanans further cited evidence of coliform contamination of the Thousand Springs area that was the result of farm wastes on the Snake River Plain. Clearly, the Congressmen argued, this was an indication that water flows quickly through the Snake River Plain Aquifer. The AEC's choice of Idaho, however, prevailed.

Originally the AEC named the new Idaho reactor site the National Reactor Testing Station (NRTS), and 141,000 additional acres were acquired north and east of the NRTS (for a total of 572,000 acres) as further environmental safeguard and buffer zone for expanded operations. In 1974 the AEC split into two separate agencies because of intense criticism for its lack of concern for nuclear safety practices and overzealous promotion of nuclear power development. These two new nuclear agencies were the Energy Research Development Administration (ERDA), predecessor to DOE and the Nuclear Regulatory Commission (NRC). At this time the AEC was also terminated because of the public pressure to divide military and civilian nuclear activities into two separate agencies. Thus, the ERDA (military) and the Nuclear Regulatory Commission (civilian) were created to replace the old AEC. Also in 1974 ERDA changed the NRTS name to the Idaho

National Engineering Laboratory (INEL). DOE in 1996 changed the name a third time to the Idaho National Engineering and Environmental Laboratory (INL).

INL is now 890 square miles in size and located in the north eastern section of the Snake River Plain Aquifer in southeastern Idaho. Idaho Falls lies approximately 29 miles southeast of the nearest site boundary. INL is 23 miles northwest of Blackfoot, 44 miles northwest of Pocatello, and 7 miles east of Arco. (See map in Figures) In 1977 approximately 144,000 people lived within a 50 mile radius of the site. The region of influence for the INL is a seven-county area comprising Bingham, Butte, Bonneville, Clark, Jefferson, Bannock, and Madison counties. This region had a 1990 population of 219,713. [ANL-EA@ 67] Projections based on current demographic trends indicate that about 240,000 people will live within the 50 mile radius by the year 2000. [ERDA-1552@I-2] Under annual permits from the Bureau of Land Management, 63,600 sheep and 3,300 cattle raised for human consumption are pastured on the INL site. [ERDA-1536@III-43] In the winter as many as 4,500-6,000 pronghorn (antelope) are on the INL site. [Blain, p.35] The pronghorn is a game animal hunted off-site for human consumption. In 1992 the site employed nearly 12,000 workers that directly supported a population of 38,000 people on an annual budget of $1.2 million. In 1997, about 6,000 contract people and about 400 DOE people are employed at the site that operates on an annual budget of about $ 784 million.

INL is a government-owned, contractor-operated (GOCO) site with the exception of the recently defrocked contractor- owned Pit-9 treatment plant and the Advanced Mixed Waste Treatment Facility. Since the beginning of the Manhattan Project, the government has contracted with private industry to operate its nuclear facilities. INL is geographically the largest of the DOE production sites. In 1994, Lockheed Martin Idaho Technologies Company[1] (LITCO) became the primary maintenance and operations (M&O) contractor on the site and assumed duties previously conducted by Westinghouse Idaho Nuclear Company (WINCO), EG&G Idaho, B&W Idaho, MK-Ferguson, and PTI. After a merger between Lockheed and Martin Marietta, the LITCO name was changed to Lockheed Martin Idaho Technologies Company (LMITCO). WINCO previously operated the Idaho Chemical Processing Plant. The Argonne National Laboratory, owned by the University of Chicago, operates Argonne West. The Naval Reactors Facility is operated for the US Navy by Westinghouse Electric under separate jurisdiction of DOE's Pittsburgh Naval Reactors Office. Lockheed Martin Advanced Energy Systems owns and operates (new privatized operation) the waste treatment plant at RWMC Pit-9. The Advanced Mixed Waste Treatment Facility (also new privatized) is owned by British Nuclear Fuels Limited (BNFL) that subcontracts to BNFL Engineering, GTS Duratek, Manufacturing Sciences, Morrison Knudsen, Rocky Mountain Remediation Services, and Science Applications. Currently, Battelle Energy Alliance (BEA) is the INL site-wide contractor to present;

Former ICPP contractors include:
- Phillips Petroleum Co, Atomic Energy Division 1950-1966;
- American Cyanamid Co. 1966-1971
- Allied Chemical Corp. 1971 to 1980
- Exxon Nuclear Idaho Company 1980 to 1984
- Westinghouse Idaho Nuclear Co. 1984-1994;

Former Naval Reactor Facility contractors:
- Combustion Engineering Inc., Nuclear Division 1959 to 1965
- Westinghouse Electric 1965 to present

Miscellaneous former facility contractors:
- Aerojet General Corp. and Aerojet General Nucleonics, 1959 to 1965
- Aerojet General, 1965 to 1966

---

[1] Lockheed Martin Idaho Technologies Company (LMITCO) is a subsidiary of Lockheed Martin Corporation. LMITCO is a consortium including Babcock & Wilcox Idaho, Coleman Research, Duke Engineering and Services, Parsons Environmental Services, Rust International, and the Thermo Electron Corporation.

General Electric Company, 1959 to 1968
Idaho Nuclear Corp., (a subsidiary of Aerojet General Corp. 1966-1971
Allied Chemical Corp.1966 - 1971
Phillips Petroleum Co., 1969 - 1971;
Aerojet Nuclear Co., (a wholly owned subsidiary of Aerojet General Corp., 1971 - 1976
EG&G Idaho Inc., 1984 to 1994;
Special Manufacturing Capability (SMC) for M1-A1/A2 tank armor
Rockwell International Corp. 1986 to 1991
Babcock and Wilcox 1991 to 1994. [Schwartz]
CH2M.WG Idaho, LLC. INTEC and M&FC Hazardous Waste Management. Present
Battelle Energy Alliance (BEA) is the INL site-wide contractor to present
Bechtel operates the Navel Reactor Facility at INL to present

DOE's own internal "Tiger Team" report on INL concluded: "that the Field Office had not been effectively carrying out its management responsibilities over the INL. Many deficiencies were identified including; a general lack of [DOE] Idaho leadership; lack of a comprehensive, cohesive management approach; virtually no independent environmental, safety, and health oversight program; lack of an arms-length relationship with the contractors; and ineffective management of the award fee process. [Tiger @ES-2] Award fees are bonuses granted to contractors beyond cost plus contracts. INL contractors received $14.35 million in bonuses in 1995[AP (d)] and $7.96 million for 1997. Between 1994 and 1997 LMITCO received $40 million in bonuses. These bonuses are offered at the same time that the State of Idaho charged DOE with 135 hazardous waste management violations and fines of $892,725. Additionally, EPA and the State fined DOE a million dollars for missing the Pit-9 cleanup milestone.

The Government-Owned-Contractor-Operated (GOCO) system provides for an artificial oversight structure where, theoretically, the DOE is the federal regulator over private contractors who operate various areas at the INL. In practice, however, there is little or no distinction between the DOE and its contractors, and consequently, little regulation. This breakdown in oversight between the DOE and the INL contractors has resulted in massive abuse and mismanagement of nuclear materials. Additionally, as the above list shows, the frequent contractor turnover provides for abuses to be blamed on previous contractors.

The GOCO operating system at INL has resulted in a strangle hold by on-site contractors. Exorbitant administrative charges beyond actual operating expenses are routine. With respect to Superfund cleanup, what money does finally make it to Idaho is eaten up by these site contractors who charge 60% overhead for their management functions. Cleanup contractors at private (non-government owned) Superfund sites allow less than 20% overhead charges, and consequently get twice the work accomplished. Taxpayers are justifiably outraged by the systematic milking of the cleanup cow by the very polluters who caused the contamination in the first place. Additionally, multi-million dollar bonuses are granted each contractor annually without any real basis, according to the General Accounting Office.

There is a difference in how long-term the planning is carried out because of the stability of the funding at INL. There is a difference in the accountability. At a place like the INL, it’s always been this shuffle. The new contractor and DOE blame the bad old contractor for “legacy problems.” Then the new contractor begins to learn about all the skeletons in the closet and snakes in the basement, screws up a few times, can’t get the money needed to fix problems and leave in disgrace, and the cycle begins anew. DOE usually pins the blame on the contractor as opposed to taking responsibility for its flawed contractor management.

Responding to this problem, Congress passed in 1993 the Federal Facility Compliance Act (FFCA) that removed many sovereign immunity exemptions that the DOE and its predecessors functioned under. Prior to this law, the DOE operated in a virtual self-regulated environment. FFCA, however, only applies to Resource Conservation Recovery Act (RCRA) listed hazardous wastes. Radioactive materials are not RCRA listed however, when mixed with RCRA listed hazardous wastes, FFCA applies. The State of Idaho and EPA do not agree with this legal mixed radioactive-hazardous distinction.

“The National Nuclear Security Administration (NNSA) was established by Congress in 2000 as a separately organized agency within the U.S. Department of Energy, responsible for the management and security of the nation’s nuclear weapons, nuclear nonproliferation, and naval reactor programs. In 2002 NNSA reorganized, removing a layer of management by eliminating its regional operations offices in New Mexico, California and Nevada. NNSA headquarters retained responsibility for strategic and program planning, budgeting and oversight of research, development and nonproliferation activities.

“NNSA is responsible for the management and security of the nation’s nuclear weapons, nuclear nonproliferation, and naval reactor programs. It also responds to nuclear and radiological emergencies in the United States and abroad. Additionally, NNSA federal agents provide safe and secure transportation of nuclear weapons and components and special nuclear materials along with other missions supporting the national security.

“In 2002 NNSA reorganized, removing a layer of management by eliminating its regional operations offices in New Mexico, California and Nevada. Contract and project management oversight responsibility for NNSA’s labs, plants and special facilities was given to the site offices. NNSA headquarters retained responsibility for strategic and program planning, budgeting and oversight of research, development and nonproliferation activities.

“NNSA’s mission is responsible for the management and security of the nation’s nuclear weapons, nuclear nonproliferation, and naval reactor programs. It also responds to nuclear and radiological emergencies in the United States and abroad. Additionally, NNSA federal agents provide safe and secure transportation of nuclear weapons and components and special nuclear materials along with other missions supporting the national security including:

* Managing the Stockpile: Maintaining the safety, security and effectiveness of the nuclear deterrent without nuclear testing – especially at lower numbers – requires increased investments across the nuclear security enterprise;

* “Preventing proliferation: Keeping weapons of mass destruction (WMD) out of the hands of state and non-state actors requires a coordinated effort on the part of suppliers of proliferation-sensitive materials, equipment, and technologies;

* “Powering the Nuclear Navy: The Naval Nuclear Propulsion Program provides militarily effective nuclear propulsion plants and ensures their safe, reliable and long-lived operation. This mission requires the combination of fully trained U.S. Navy men and women with ships that excel in endurance, stealth, speed, and independence from supply chains;

* “Emergency Response: NNSA ensures that capabilities are in place to respond to any NNSA and Department of Energy facility emergency. It is also the nation's premier responder to any nuclear or radiological incident within the United States or abroad and provides operational planning and training to counter both domestic and international nuclear terrorism;

* “Recapitalizing Our Infrastructure: The FY2011 Budget Request increase represents the investment need to transform a Cold War nuclear weapons complex into a 21st century Nuclear Security Enterprise;

* “Continuing Management Reform: NNSA is responsible for the management and security of the nation’s nuclear weapons, nuclear nonproliferation, and naval reactor programs. It also responds to nuclear and radiological emergencies in the United States and abroad. Additionally, NNSA federal agents provide safe and secure transportation of nuclear weapons and components and special nuclear materials along with other missions supporting the national security.” [2]

So, is the difference that NNSA just needs a way from DOE safety regulations to go away, because the smoke screen is too troublesome to bother with? The intent of 10 CFR 830 was to force DOE to come into a higher level

---
[2] http://NNSA.energy.gov/

of safety – yet, it was ambiguous on back-fit. DOE retains tons of wiggle room and the ability to formally ask the DOE secretary permission to be excluded from any requirement deemed too onerous. Yet, even this is not enough for the NNSA facilities. But, is the charade to act like 10 CFR 830 is being met actually accomplishing anything at those facilities?   Basically, NNSA only adds another ineffective layer of bureaucracy much the same as Home Land Security provided ineffective coordination with the many national security and emergency response agencies.

Over its 60+ year history, 52 nuclear reactors were built at INL - currently 3 are operating and another10 are shutdown but operable. This represents the largest concentration of reactors in the world. [DOE/EH/OEV-22-P,p,2-8] In addition to these reactors are facilities that process large quantities of radioactive and chemical materials. The INL is also the birthplace of the Nuclear Navy Propulsion Program initiated under Admiral Hymand Rickover. The Navy, single largest radioactive dumper at INL, passes its responsibilities on to DOE as its nuclear garbage collector.

Primary operation areas include the Idaho Chemical Processing Plant (ICPP) that (up until 1993) reprocess spent reactor fuel from around the country and the world and extracts isotopes and enriched uranium for the US nuclear military programs. DOE recently announced termination of reprocessing at the ICPP. The Naval Reactor Facility (NRF) has three reactors for its nuclear navy training, and also spent reactor fuel testing facility. The Navy announced that it intends to shutdown its training reactors at NRF. The Test Reactor Area (TRA) now called Reactor Technology Complex, has three experimental reactors and process facilities. At this time only the Advanced Test Reactor is operating. Argonne National Laboratory - West (ANL-W) now called Material Fuels Comples has several experimental breeder reactors including the new Integral Fast Reactor, fuel reprocessing, TREET and reactor fuel manufacturing facilities. Auxiliary Reactor Area (ARA) has had several Army experimental reactors but currently only the Power Burst Reactor is operable. Test Area North (TAN) formally conducted open air reactor tests, but currently only has Abrams tank uranium armor and radioactive materials process facilities. Radioactive Waste Management Complex (RWMC) is INL's main radioactive dump site. For a complete listing of facilities by area, and operational status see Appendix B.

INL's airborne radioactive releases between 1952 and 1989 contained 18,564,868 curies.[DOE-ID-12119@A-190] Total discharge to the environment for the period 1952 to 1992 was 39,597,934 curies. See Section I(E)(2). [ID-10054-81@12][DOE/ID-10087-85@5][DOE/RW-0006,rev 7][RWMIS] A curie (Ci) is a unit of measurement of radioactivity in a given material. Safe drinking water standards for radioactive contaminates are expressed in pico curies (pCi), or one trillionth of one curie. Because radioactive contaminate standards are in pCi's it is the best way to explain how extremely toxic and biologically damaging these pollutants are to the human body. This environmental insult from the radioactive dumping at INL is of enormous proportions.

Additionally, 35,550 cubic meters containing 371,200,000 curies of high-level liquid wastes have been generated over the ICPP’s operating history. This waste is stored in old corroded underground tanks, or calcined in INL's ICPP high-level calcine waste incinerator. The Calciner is an incinerator that volatilizes the liquid portion of the waste and mixes the residue with a granular calcine. The calcine in storage as of 1981 accounted for 64,120,000 Ci. [IDO-10054-81 @ 19]   What distinguishes INL from other DOE production sites is its calcine incineration of liquid high-level wastes. The Integral Waste Treatment Unit (IWTU) is the new incinerator for the remaining high-level liquid waste at INTEC tank farm. The IWTU however does not produce a waste form that can be sent to a permanent repository. Consequently, INL has only 11 high-level liquid waste tanks. Hanford by contrast put all its waste in 177 underground tanks.

One of many unanswered questions is the mass balance discrepancy between the number of curies that went into the incinerator and the number of curies that DOE acknowledges in the calcine ash after incineration and ICPP stack monitoring of curies that were released to the atmosphere. Radioactive material does not lose its activity during incineration - only by gradual decay. Radioactive elements are basic elements as opposed to compounds that are made up of two or more elements.

Emissions to the environment from the totality of the nuclear operations at INL significantly impact the health of the surrounding human and wildlife populations. The long-term impacts are not fully characterized. The Dose Reconstruction study of INL started in 1992 by the Centers for Disease Control will hopefully offer an accurate assessment of how much radiation was released, and what the probable radiation dose was to affected populations around INL. However, the commitment to adequately clean up the massive contamination generated over nearly five decades remains an open question. Recently, "no action" decisions on major INL cleanup sites by DOE are an indication that the government's commitment to environmental restoration continues to be in name only. Only continued public pressure will force the federal government to own up to its responsibilities.

I.B. INL Accident History

INL has had forty two reactor meltdowns in its history of operations. Sixteen of these meltdowns were accidents. The remaining twenty six were experimental/intentional meltdowns to test reactor design parameters, fuel design, and radiation releases. These nuclear experiments were conducted with little regard to the radiation exposure to workers and surrounding residents. Below is a partial listing of the more notable meltdowns and criticality releases. See IX Appendix (A) for a listing of acknowledged melt-downs, accidents, and experimental radioactive releases. The term accidental, used by DOE, is perhaps not an appropriate term any more than when the term is applied to a hot-rodder who "accidentally" crashes his car while speeding at 100 miles per hour down a road designed for 30 mph. Hot-rodding a nuclear reactor just to see what it will take is no accident and no less irresponsible.

According to Boyd Norton, manager of the SPERT tests in the early 1960s notes, "These reactors are, essentially, stripped-down hot-rodders; they had no radiation shielding and no elaborate safety systems. Sitting as they were, in the middle of more than nine hundred square miles of desert, there wasn't much concern over such things. Not back then." [Norton]

An ICPP criticality accident on October 16, 1959 required evacuation of the facility. "Outside the building and for 130 yards west to the area entrance the radiation field was 5 R/hr or greater." [IDO-10035 @ 4] Thankfully, it was a night shift and less than 10% of the normal work-force was on the site. Twenty-one workers were considered at immediate risk from exposure. Film badge dosimetry and calculations on internal radiation exposure found the highest skin exposure was 50 rem and the highest penetrating exposure was 8 rem. Highest internal dose was 29 mrem. [IDO-10035 @ 5 & 38] This accident followed a Rala run the previous day. [see I(D)(1)] Over the course of the accident 337,717 Ci of long-lived fission product was released to the atmosphere. [DOE/ID-12119@A-99]

“The accident at the Stationary Low-Power Reactor Number One (SL-1) occurred on January 3, 1961. Located in the Auxiliary Reactor Area, SL-1 was a small compact Army nuclear power plant designed to generate electricity at remote military locations such as the Arctic or Antarctic. The reactor served both as an experimental prototype and as a training facility for military personnel. On the bitterly cold afternoon of January 3rd, three Army technicians arrived at the facility for the four to midnight shift. The SL-1 reactor had been shut down for routine maintenance, and the task of the three men that evening was to complete certain preparations for nuclear startup. Apparently, in the process of attaching control rods to drive motors, one of the men raised the central control rod too far and too fast. Evidence indicates that the rod might have stuck momentarily. In the past, there had been sticking problems with that rod. When it came unstuck, it moved upward much higher than anticipated and triggered a supercritical power excursion in the reactor core. In a fraction of a second the power reached a magnitude of an estimated several billion watts, melting and perhaps even vaporizing a large part of the core. The water in the core region was vaporized, creating a devastating steam explosion. The remaining water in the reactor vessel was hurled upward at high velocity, striking the underside of the reactor's pressure lid and lifting the whole nine-ton vessel upward, shearing cooling pipes in the process. The three men, who had been standing atop the reactor vessel, were crushed against the ceiling of the building before the huge vessel dropped back into place. One of the men remained impaled on the ceiling by a piece of control rod rammed through his groin. It all happened in a second or so." [Norton]

"It [SL-1]was a terrible accident, made even more grisly because the intensely radioactive fission products scattered inside the building by the accident hampered the work of recovering the bodies. Staying in the building for mere seconds resulted in a year's allowable dose of radiation for rescue workers. And it took six days to remove the body that was impaled on the ceiling by use of a remotely operated crane and a closed circuit television. The bodies were so badly contaminated, the heads and hands of the victims had to be severed and buried with other radioactive wastes at the Radioactive Waste Management Complex." [Norton] The Oil Chemical and Atomic Workers Union protested vigorously that the government refused to provide a proper Christian burial for the workers.

The SL-1 reactor explosion not only resulted in three deaths but also serious exposure of 0.1-0.5 roentgens [rem] to nearly 100 personnel. Over 12 workers received exposure greater than 10 roentgens [rem]. [IDO-19301@138] The maximum acknowledged personnel exposure was 1,000 R/hr (Rad per hour). [ERDA-1536,p.II-243] The exposed reactor was still emitting 22,000 R/hr five months after the accident. Readings above the reactor one month after the accident were 410 R/hr. [IDO-19301,p.109] 1,128 Ci including 80 Curies of radioactive Iodine were also released during the SL-1 accident. [ERDA-1536,p.II-243] [DOE/ID-12119@A-53] A temperature inversion kept the radiation plume close to the ground and at 25 miles the radioactive iodine levels were 10 times above background. At 100 miles the radiation levels were above background.

The author interviewed the widow of James Dennis who was a member of the SL-1 **in**voluntary Army demolition crew brought in to dismantle the reactor after the accident. Dennis died of a rare blood cancer called Waldenstrom's micro globulin anemia, which his medical documents confirm, was caused by exposure to 50 rem/hr for nine hours and ten minutes at the SL-1 site. [Dennis ,p.10] Dennis' documents further challenge the government's acknowledged exposure of whole body - 2135 mrem, and skin - 3845 mrem [Dennis citing AEC/SL-1,CAB] as grossly understated. Dr. Charles Miller M.C., hematologist / oncologist, chief of Medical Services at Letterman Army Medical Center and Dennis' internal physician, supports the allegation that Dennis' cancer was caused by exposure to radiation. [Dennis, p.17] The government refused to grant Dennis any compensation for his radiation exposure injuries that caused his early death. John Horan, an INL health physics technician, was an expert witness brought in by the Atomic Energy Commission to refute Dennis' claims to radiation induced injuries. Dennis is only one of thousands of individuals who are victims of the health effects of radiation exposure caused by radioactive releases from DOE facilities.

Another ICPP criticality accident on January 25, 1961 released 5,200 Ci [ERDA-1536 @ C-5] and required full evacuation of the plant. Two hundred fifty one workers were on-site at the time. The highest exposure as determined from film badge readings did not exceed 55 mrem of penetrating radiation. The maximum thermal neutron exposure detected in the 65 badges analyzed was less than 10 mrem. Excessive cesium-138 was detected at the Central Facilities Area three miles south of the ICPP after the accident. [IDO-10036@5&6] "Highest personnel exposure received for the four-week period of January 20 through February 16, 1961 by any Phillips' employee in the ICPP at the time of the incident was 240 mrem gamma, 310 mrem beta." [Ibid.@37] Considerable uncertainty exists in relying on the badge reading due to variability in isotope exposure, and the distance the badge is from the worker's hands. More often than not, the badges are considerable understatements of exposure.

I.C. Experimental Reactors and Atmospheric Releases

The original name for INL was the National Reactor Testing Station (NRTS). The name more accurately characterizes the activities undertaken at the site. Idaho was the proving ground for military and commercial reactor designs. Reactors were deliberately run to high power levels (excursioned or melted down) to establish operating limit parameters and component durability under accident scenarios. The power stability of different types of fuel and their configuration inside the core were also the subject of many tests. During INL's six decade history, experimental nuclear projects contributed significantly to the site's radioactive emissions to the environment. Detailed information about these projects is still largely classified as secret and unavailable to the public. Therefore, the complete history of INL may await an executive order from the President. To his credit, President Clinton is releasing more information than the previous two Presidents; however, the Defense Department (DOD) remains intransigent. Because most of the reactor and fuel reprocessing programs at INL were military related, DOD has claimed jurisdiction over DOE in the declassification decisions. The Air Force has claimed jurisdiction over some of the intentional radioactive releases from the ICPP during operation Bluenose.

I.C.-1 Aircraft Nuclear Propulsion Program

The US Air Force's Aircraft Nuclear Propulsion (ANP) program in the 1950's designed built, and flight tested a nuclear jet powered bomber which employed more than 10,000 workers. The plane was a modified B-36 (called NB-36) built by Convair and flight tested at Carswell Air Force Base in Fort Worth, Texas. Between 1955 and 1957, the NB-36 made 47 test flights. In 21 of these flights, the nuclear jets were operating. This particular prototype was powered by six conventional propeller engines and two nuclear jets powered by a reactor in the fuselage of the bomber. Considerable radiation was released by the unshielded reactor and by the exhaust resulting from the reactor driven jet engine nozzles, which meant the plane was radioactive after each flight. To protect the flight crew from radiation from the reactor, up to 2.5 inches of lead and 17 inches of special rubber were used to line the crew compartment. WFAA-TV's American Portrait program on the "History of the Nuclear Jet Engine" offers original Air Force footage of the NB-36 and related ANP programs.

The Air Force was intent on building a bigger long-range nuclear powered bomber that could stay aloft indefinitely over the North Pole and deliver a nuclear attack on the Soviet Union. Pratt and Whitney, General Electric, and Lockheed were competing for contracts on reactor designs on this next generation of nuclear powered bombers. GE won the contract and proceeded to build and ground test the 44,000 horsepower nuclear jet engines at INL where a 20,000 foot runway was also slated to be built for the plane. The 8-foot concrete shielded hanger for the plane was built at INL's Test Area North where the runway was also to be built. This test program was called the Initial Engine Tests (IET), and it lasted from 1955 through 1961 when it was canceled by President Kennedy. By 1961, the ANP program consumed $4.6 billion. [American Portrait, 1993] Another analysis in 1995 included all related ANP activities and found the price tag to be over $6 billion. [Wald(b)] Other space related reactor testing programs at INL, however, continued with the SPERT, SNAPTRAN, and NASA's Light-bulb reactor tests.

"The power plant design concept selected for development by the General Electric Company was the direct air cycle turbojet. Air is the only working fluid in this type of system. The reactor receives air from the jet engine compressor, heats it directly, and delivers it to the turbine. The high-temperature air then generates the forward thrust as it exhausts through the engine nozzle." [Wilks]

One Initial Engine Test (IET) series at INL released from April to June of 1956 over 1.9 million curies of activity including significant amounts (453,350 Ci) of Iodides. [DOE-ID-12119@A-114] Between 1956 and 1970, fifty-nine ANP tests released an estimated 4,635,724 curies of radiation. [DOE/ID-12119 @A55] By comparison, the Three Mile Island reactor accident, generally considered this nation's worst nuclear incident, released 15 curies (Ci) of radioactive iodine to the environment.

"The ANP Reactors were direct, open cycled air cooled. This means that air was driven into the jet engine, compressed, passed through the reactor fuel element where heat energy was extracted, and then discharged through the turbine and jet engine nozzle." ... "Any radioactivity leaking from the fuel elements was also discharged to the air stream." [ERDA-1536@II-239]

Many deliberate fuel element failure tests by blocking reactor coolant were conducted to test a full scale aircraft reactor accident. One of these tests went awry resulting in significant portions of reactor core to melt and considerable additional radiation to be released to the environment. [Ibid.] DOE publicly denies that any ANP reactors were buried at INL yet the literature specifically acknowledges that jet engines are buried at the Radioactive Waste Management Complex (RWMC) Subsurface Disposal Area (SDA). [PR-W-79-001 @ 4-1] The SDA does not meet the Environmental Protection Agency's Subtitle D garbage landfill standards let alone Nuclear Regulatory Commission greater than class C radioactive waste disposal standards. The IET series involved three reactor assemblies that were constructed at INL for the ANP program. "These three assemblies were designated HTRE No. 1, HTRE No. 2, and HTRE No. 3." [DOE/ID-12119@A-87] Though two ANP nuclear jet engine shells are on display at the Experimental Breeder Reactor-I, the disposition of the other engines and reactor cores for these engines was to the RWMC. The HTRE experiments included the following:

- "HTRE-1. The HTRE-1 reactor operated a modified J47 turbojet engine exclusively on nuclear power in January 1956. It accumulated a total of 150.8 hours of operation at high nuclear power levels."
- "HTRE-2. The HTRE-2 reactor was a modification of HTRE-1. Testing began in July 1957. The reactor accumulated 1,299 hours of high-power nuclear operation."
- "HTRE-3. The HTRE-3 reactor was built in a full-scale aircraft reactor configuration. Two modified J47 turbo jets engines were operated by this reactor. Full nuclear power was achieved in 1959 and the system operated for a total of 126 hours." [RE-P-82-053 p.2]

Knowing full well how hazardous the emissions from these reactors would be, the IET managers built a remote test site called the IET Core Test Facility some distance north of TAN's Technical Support Facility. The two sites were connected by a 4-rail track on which the reactors were moved on rail dollies between test series. The Technical Support Facility Hot Shop assembled and disassembled the reactors. The Core Test Facility (CTF) is where the reactors actually operated. CTF consisted of an underground bunker control building where personnel ran the reactors, and a 214 foot-exhaust duct connected to a 150-foot exhaust stack. The reactors were rolled up to the exhaust duct using a shielded locomotive. When the reactors were operating, a plume rose from the exhaust stack to a height of over 1,200 feet. Jackrabbit thyroids sampled downwind from the IET in March 1958 showed radioactivity at 293,700 disintegrations per minute per gram (d/m/g). [IDO-12082(58)@74]

The HTRE-2 and 3 were disassembled in the IET Hot Shop where the highly radioactive plug shield and core assembly were removed and shipped intact to the RWMC. Radiation levels (300 R/h) were too high to allow further disassembly of the reactor vessel and its shielding. Then the reactor vessels were moved back out to the IET test pad where the 200 ton HTRE-2 (with dollies) and the 90 ton HTRE-3 (w/o dollies) were jacked up off the rail tracks and a special 350-ton transporter was moved under for shipment to the RWMC burial grounds at INL. Bridges between TAN and the RWMC had to be blocked up to take the heavy transporter, and special ramps made into the trench where they were buried. [PR-W-79-001 @4-3] The 106,000 pounds of radioactive mercury used in a tank for shielding around the HTRE-3 and considerable volumes of related radioactive parts were dumped at the RWMC. [See Section IV(C)] These dumping practices are another reason why the RWMC is a Superfund cleanup site today.

The Strategic Defense Initiative Organization (SDIO) revived the nuclear jet engine project for use in the space program. This new Black Budget program's (code name Timberwind) purpose is to develop the technology and demonstrate the feasibility of a high-temperature particle bed reactor propulsion system to be used to power an advanced nuclear rocket engine. The Strategic Defense Initiative involves orbiting space platforms that theoretically will have the capacity to shoot down missiles launched at the USA. To build these platforms, heavy payloads would have to be launched - requiring powerful rockets. SDIO believes that the nuclear rocket offers a greater thrust to weight ratio than conventional rocket designs. SDIO generated a secret Environmental Impact Statement (EIS) on Timberwind in 1990. When the existence of this EIS was discovered by the Federation of American Scientists, they demanded that it be released. A declassified Environmental Impact Statement (EIS) was released in 1991, however most substantive (classified) sections have been blacked out. This violates the intent of the National Environmental Policy Act which requires full disclosure of the environmental impacts of proposed federal activities. The Timberwind program was later officially transferred to the Air Force and a new EIS was released in 1992. The 103rd Congress, however, eliminated funding for nuclear rocket program in the FY-1994 budget after spending $464 million. Black Budget projects rarely survive the light of day. The 104th Congress revived the SDI program so Timberwind may also be revived. Since INL was originally selected as the Timberwind ground test site, it is possible that Idahoans will again be subjected to massive radioactive emissions if the nuclear propulsion part of SDIO's program is built and tested. For a more detailed assessment of Timberwind, the Environmental Defense Institute's written comments upon the EIS are available on request.

In other nuclear aircraft related tests, General Electric conducted two open air burning tests on March 20, 1957 of reactor fuel rods to see how much radiation would be released in a nuclear powered plane crash. These tests, called Operation Wiener Roast because of the live animals used to test radiation exposure, also released over 78.3 curies of radiation to the air. [DOE/ID-12119 p. A-55]

The US Air Force conducted the Fission Products Field Release Tests (FPFRT) between July and September 1958. "The tests were performed to obtain information for evaluating the release of radioactivity from potential accidents involving nuclear powered aircraft using metallic reactor fuel." [DOE-ID-12119 @A-176] These open air, furnace induced hot burns of reactor fuel rods released 502.7 curies of radiation to the atmosphere. [Ibid. p. A-54] "The experiments at Idaho using 'fresh' fuel elements were cooled from 21 days before meltdown, thus losing essentially all of the short lived isotopes of iodine." [Dunning(b)] The Atomic Energy Commission put a limit on the ANP individual releases of iodine at 1500 rads. [Dunning (b)] See ANP Test Table.

The Special Power Excursion Reactor Test (SPERT) reactor test series were "planned integral core destructive tests to investigate the consequences of reactor accidents." [DOE/ID-12119@79] "The accident scenarios tested included reactors suddenly being made greatly supercritical and undergoing a severe power excursion or transient. In just hundredths of a second the power, or fission rate, could leap from zero to billions of watts, with the potential for severe core damage." [Norton] Each of the four SPERT reactors was different. "SPERT-I, built in 1954 was the simplest of the four, with a large open tank containing the core and moderator. Before it [SPERT-I] was shut down in 1967, seven different cores had been used in it and more than two thousand power excursions conducted."... "In 1962, it was decided to conduct the ultimate test on SPERT-I. Blow it up, deliberately. It would be an answer to ... how far could you push a highly enriched core in a power excursion?" [Norton] The November 15, 1962 SPERT-I experimental reactor "destruct" test resulted in a release of 240,000 Curies including Iodine. [DOE/ID-12119@79] The reactor was placed in an open tank 16 feet deep and 5 feet in diameter. Coolant water was spewed 100 feet in the air in less than one hundredth of a second after the 2 and a half billion watt power surge. Gross reactor damage occurred. Wind direction and the arrival of a monitoring airplane were factors in the timing of the meltdown. [Norton] SPERT-I site would later be used for the Power Burst Facility.

SPERT-II was a scale prototype of a modern nuclear power plant except that it used low pressure and heavy water as a moderator. SPERT-II first went critical in 1959, performed tests for five years, and was retired in 1964. The reactor was remotely controlled from a control center one half mile away. The SPERT-II reactor "destruct test" experiment on November 10, 1963 produced 24,000,000 curies; 530 curies were released including iodine. This was a pressurized heavy water reactor.

SPERT-III was a high temperature, pressurized (2,500 psi) light water reactor built in the late 1950's, went critical in 1958, and was placed on standby in 1968. The April 14, 1964, SPERT-III test released 1900 Ci. to the atmosphere producing a radioactive cloud that was tracked for 2.5 miles. The reactor surged in one hundredth of a second from zero to thirty billion watts. [Norton] Using different cores the reactor continued to run until an accidental melt-down in 1968. [Norton] The SPERT-III site was later to be used for the WERF incinerator. SPERT-IV, constructed in 1960, and was called a swimming pool reactor; was immersed in a 30 foot diameter tank and was placed on standby in 1970. These tests demonstrated reactor instability and power oscillations. SPERT project manager Boyd Norton acknowledges "...that it got pretty scary in the control room when the power began oscillating out of control and threatened to blow the thing apart. Being at the reactor console was ... a total exercise in sphincter control. SPERT-IV was later converted to the Capsule Drive Core, forerunner of the

Power Burst Facility, which was built a few years later." [Norton] What was left of the SPERT reactors and components were buried at the RWMC. [ERDA-1536,p.II-244-246]

The Space Nuclear Auxiliary Power Transient (SNAPTRAN) destructive reactor tests were part of the space nuclear power program. The tests were conducted at Test Area North's IET site. These reactors lacked shielding because of the added weight limitations. The tests were "designed to provide information on the radiological consequences of accidental immersion of a SNAP 2/10A reactor in water or wet earth such as could occur during assembly, transport, or a launch abort." [ERDA-1536,@II-247] The SNAPTRAN involved the following tests:

- "A series of tests aimed at providing information about beryllium-replicated reactor performance under atmospheric conditions and assessing hazards during reactor assembly and launch."
- "Nuclear excursions resulting from immersion of the reactor in water or wet earth."
- "Non-destructive tests including static tests and those kinetic tests in which minor damage to the reactor occurred, and"
- "Destructive tests in which the reactor was destroyed". [RE-P-82-053,p.3]

The first April 1, 1964 SNAPTRAN destructive reactor test released 24,000 curies plus 9,500 gallons of highly contaminated water that blew out of the test tank when the operators intentionally allowed the reactor to blowup. The radioactive cloud was followed by an airplane for 21 miles before it dissipated. Estimated dose at INL boundary was 10 mRem. Reactor debris was buried at RWMC. [ERDA-1536,.@II-248] The SNAPTRAN second open air destructive tests in January 1966 exploded spreading reactor fuel 700 feet around the site and released 600,000 curies (Ci) including 0.1 Ci I-131 and created widespread heavy contamination of beryllium on the surrounding ground. The radioactive cloud was followed by aircraft for 19 miles before it was no longer visible. Estimated radiation dose at INL boundary was 10 mRem. Again, reactor debris and 300 cubic yards of contaminated soil were buried at RWMC. [Ibid@II-249]

Aircraft Nuclear Propulsion Program INL Tests 1956 to 1970

Test Number	Dates	Curies Released	Source
IET # 3 "HTRE-1"	12/27/55 to 2/11/56	46,134.76	B @ A-202
IET # 4	4/17/56 to 6/29/56	1,911,953.21	B @ A-114
IET # 6	9/24/56 to 12/3/57	8,953.12	B @ A-202
Burn # A	3/20/57	1.00	B @ A-202
Burn # B	3/20/57	74.11	B @ A-202
IET # 8 "HTRE-2"	7/31/57 to 8/28/57	2,152.00	B @ A-121
IET # 10	12/20/57 to 3/6/58	1,650,000.00	B @ A-126
IET # 11	3/20/58 to 4/14/58	4,635.00	B @ A-128
IET # 12 "Boot"	4/21/58 to 5/7/58	29,070.00	B @ A-132
FPFRT-1	7/25/58	9.80	B @ A-201
FPFRT-2	8/4/58	9.30	B @ A-201
FPFRT-3	8/6/58	9.90	B @ A-200
FPFRT-4	8/14/58	9.60	B @ A-200
FPFRT-5	8/27/58	140.00	B @ A-200
FPFRT-6	9/4/58	115.28	B @ A-200
FPFRT-7	9/17/58	90.79	B @ A-200

FPFRT-8	9/18/58	102.48	B @ A-200
FPFRT-9	9/26/58	10.08	B @ A-200
IET # 13	10/8/58 to 11/18/58	9,730.00	B @ A-137
IET # 14	4/24/59 to 5/19/59	13,456.00	B @ A-139
IET # 15	5/27/59 to 6/24/59	3,178.34	B @ A-199
IET # 16	7/28/59 to 10/28/59	294.42	B @ A-199
IET # 17	11/2/59 to 12/12/59	6,202.00	B @ A-147
IET # 18 "HTRE-3"	12/23/59 to 2/8/60	14,157.30	B @ A-153
IET # 19	2/9/60 to 4/30/60	11,381.00	B @ A-153
IET # 20	5/1/60 to 6/13/60	10,249.00	B @ A-155
IET # 21 "Feet # 1"	6/20/60 to 8/8/60	3,752.00	B @ A-158
IET # 22	8/12/60 to 8/25/60	10,526.80	B @ A-160
IET # 23 "Feet #2"	9/1/60 to 10/14/60	2,890.00	B @ A-163
IET # 24 "Lime"	10/17/60 to 10/26/60	7,725.90	B @ A-165
IET # 25	11/15/60 to 12/16/60	10,171.26	B @ A-197
IET # 26	12/22/61 to 3/31/61	12,110.00	B @A-173
SPERT-1	11/5/62	240,000.00	B @ A-79
SPERT-2	11/10/63	530.00	A @ II-246
SNAPTRAN-3	4/1/64	24,000.00	A @ II-248
SPERT-3	4/14/64	1,900.00	A @ II-244
SNAPTRAN-2	1/11/66	600,000.00	A @ II-249
7 Module # 1168 to # 1183	1967 to 1968	?	C @ 29 to 116
3 Module # 1185 to # 1192	1969	?	C @ 165 to 179
Total # Tests = 59		Total Curies* 4,635,724.45	
Total Uranium Released		1,635.82 grams	

* Only hot run tests are listed in the table above, therefore, missing test numbers indicate cold runs. Curie content of uranium released is not included in the total curies released. Releases for the 7 &3 Module are not yet fully analyzed. Between 1956 and 1966 the ANP reactors operated in excess of 3,064.24 hours. During this time the reactors were operated at high power for 1,575.8 hours.[DOE/ID-12119] [PG-WM-85-008 @2-3] Table sources: [A - ERDA-1536]; [B - DOE/ID-12219]; [C - IN-1376] Acronyms: IET = Initial Engine Test; FPFRT = Fission Product Field Release Test; SPERT- Special Power Excursion Reactor Test; SNAPTRAN = Special Nuclear Auxiliary Power Transient; Modular - NASA's Modular Cavity or "Light Bulb" Reactor.

Other nuclear jet engine projects that impacted INL were ground tested in Nevada. [Times News10/15/90] The nation's first nuclear-powered rocket engine, Kiwi-A, first fired for five minutes in July 1959 at the Nuclear Rocket Development Station about 100 miles northwest of Los Vegas. Several Kiwi-A's were test fired throwing smoke and dust hundreds of feet into the air. "The remains of the reactors from the development project collectively called the ROVER project are among the highly radioactive wastes stored at the INL's ICPP." [Ibid.] ICPP also has a ROVER fuel reprocessing building that has been identified in DOE's Highly Enriched Uranium vulnerability report as having criticality problems.

In 1972, after the ROVER program had shut down, 26,000 fuel elements were shipped from Jackass Flats, Nevada to INL. About 18,000 rods of ROVER program fuel were eventually processed at the ICPP between April 1983 and June 1984 removing about 3,200 kilograms of highly enriched uranium.[Times News10/15/90] The reprocessing of ROVER fuel was discontinued because burning the graphite off the fuel plugged up the off-gas systems and dissolved fuel raffinate plugged up process lines. These plugged lines remain as they were left at the end of the program. “For the contractor slated to deactivate the ROVER Facility...criticality risks are of paramount concern. The ROVER Facility which was shut down in 1984, houses a substantial amount of uranium in its processing lines, vessels, and related equipment.” [EM Progress, Winter 1996] Workers attempting to decontaminate the fuel burn cells in 1984 received significant exposures because the graphite plugged face masks and seeped into protective suits. Management refused to provide workers with pressurized air lines and suits so the workers refused to reenter the ROVER cells. After a dozen years and a belated commitment of over $23 million, DOE is finally willing to address this lingering criticality hazard.

The NERVA (Nuclear Engine for Rocket Vehicle Application) - engine, later developed by Aerojet-General and Westinghouse Electric, was designed to propel a rocket or space vehicle once it escapes the earth’s atmosphere. The heart of the engine is a little reactor that uses small ceramic-coated fuel pellets imbedded in graphite. The reactor heated liquid hydrogen, causing it to expand and turn to gas. The rapid expansion provided the propelling force of the engine. [Times News10/15/90]

Budget disputes in 1991 over the Strategic Defense Initiative revealed a secret program called Centaurus at INL. Bill Thielbahr, director of DOE Idaho’s energy technology division, acknowledged the difficulties of gaining continued Congressional funding for the $3 million annual requirements of the project. Thielbahr described the Centaurus as a “nuclear-pumped laser” testing program. The work could include studying methods to recover safely some space debris and new systems to produce electrical power. This INL research team consisted of about 20 workers. The $4 million total proposed for INL research is uncertain, since both chambers of Congress have voted to cut the 1991 SDI budget by at least $1 billion. [AP(k)] The basic SDI concept is a space-based network of nuclear powered lasers that could shoot down missiles launched at the United States. This secret program has never had any publicly available environmental monitoring data, which is a repetition of decades of non-accountability fostered by classified Black Budget projects.

I. C. 2 Atmospheric Release Experiments

OMRE Solvent Burning Experiment on November 16, 1960 was conducted to "determine the feasibility of open-air burning of contaminated solvents accumulated at the Organic Moderated Reactor Experiment (OMRE) facility. 400 gallons of radioactive solvents were placed in an open vessel and ignited." [DOE/ID-12119 @A-173]

Other “human guinea pig" experiments were carried out just to see how Iodine-131 is absorbed in humans and disperses in the surrounding ground. Twenty-nine Controlled Environmental Radio iodine Test (CERT) between May 1963 and December 1977 released over 32.72 Ci including 26 Curies of Iodine-131 to the environment. [ERDA-1536@II-250]&[DOE/ID-12119] “On three of these CERT releases, human subjects were deliberately exposed. The general design was that radioactive iodine was released in gaseous form, and prevailing winds took the iodine over an area designated the "hot pasture." Monitoring devices in the pasture determined the radioactivity deposited. A herd of cows was than led to the pasture to graze for several days. The cows were milked and the milk monitored for Radio iodine. Humans were exposed either by drinking the milk or by direct exposure to the released iodine gas. During CERT-1, conducted in May 1963, one curie of radioactive iodine was released into the hot pasture. Six cows were placed in the contaminated pasture. Cows were milked twice a day and the milk from one cow saved for human ingestion. Seven human subjects each drank 0.5 liter of radioactive milk over a period of 18 days. Radioactive iodine uptake was determined by counting the radioactivity absorbed in the thyroid of each subject. [IDO-12053]

CERT-2 was conducted in September 1964. Approximately one curie of radioactive iodine was again released over the hot pasture. Milk samples were again tested, but were not consumed by humans. Instead, three human subjects were placed on the pasture during iodine release, and the radiation accumulated in their thyroids was counted after exposure. This was not a food chain experiment, but was designed to measure the direct iodine dose from inhalation. During CERT-6 conducted in the summer of 1965, several vials of Radio iodine were broken and the contents (2-6 curies) released to the environment. [IDO-12053, 8/66 @2] "Several individuals were inadvertently exposed to airborne Radio iodine from the leaking and broken containers, and efforts were made to obtain data on the retention of this form of iodine in humans." [Ibid. @2] These exposures occurred over a four-day period, and a few people received multiple exposures; radiation accumulation in the thyroids of these individuals was counted. CERT-7 was conducted in November 1965; 1 curie of I-131 in the gaseous molecular form was released over the pasture at the INL Experimental Dairy Farm. Six cows grazed, and milk samples were counted. In addition, seven human 'volunteers' were placed seated on the pasture area. Uptake of radioactive material was determined by counting the subject's thyroids. "DOE reported to the Subcommittee that no medical follow up of the experimental subjects in the CERT tests was performed." Through the course of the CERT tests, twenty one individuals were exposed. [Congressional Research Service, 5-156 @ 22- 24]

"Between 1965 and 1972, 8 individuals were involved in 13 different human experiments. All eight were employees of the Idaho Division of the Atomic Energy Commission. In four experiments, subjects inhaled Argon-41; in nine experiments, subjects swallowed capsules containing micro curie amounts of radioactivity. These experiments were funded and carried out by the Atomic Energy Commission. The objective of this experiment was to calibrate instruments that measure radioactive substances inside the human body; such instruments are usually used to examine workers accidentally exposed or hospital patients receiving radioactive material for diagnostic purposes. A second objective of the experiments was to examine the metabolism of radionuclides ingested or inhaled by humans. In the first set of experiments, one subject was fed one micro curie of Manganese-54; another subject was fed an unspecified amount of Iodine-131. In a second set of experiments, individual subjects were fed 3.5 micro curie of Cesium-132, 1.9 micro curie of Potassium-42, or 1.1 micro curie of Manganese-54. In addition, 4 subjects inhaled Argon-41 in amounts of 1.3 to 2.2 micro curie. In a third experiment, one subject was fed 1.5 micro curie of Cobalt-60 and Cesium-137. The Department of Energy reported there was no medical follow up of any of these experimental subjects." [Congressional Research Service, 5-156 @ 35-36]

Intentional releases of Iodine-129 into the environment referred to as the Iodine-129 Technology Studies took place in August 1964. The studies were a collaborative effort of the US Weather Bureau Research Station at the INL and the Nuclear Science and Engineering Corporation of Pittsburgh, PA. The Iodine-129 Technology Studies were conducted to examine the atmospheric mixing and dilution of gases and particles containing small amounts of Iodine-129. There were a total of five tests: two with particles, one with gases, and two more with particles and gases combined. The first three tests were sampled to distances of about 10 miles over a densely instrumented grid located in the center of the INL site. The last two tests were sampled at distances of 25 to 35 miles in off-site areas to the north-east of the point of release. One mill curie of iodine-129 was released during the experiment. [DOE News, 7/31/95] The 17-million year half-life of Iodine-129 plus its ability to enter the food chain and subsequently concentrate in the thyroid makes this isotope especially toxic.

The Atomic Energy Commission (AEC) also collected human body parts that were used in radiation experiments from hospitals in the Idaho Falls area. Between 1954 and 1955, five samples of human bone obtained at surgery or autopsy from local hospitals were analytically compared with measurements of radioactivity in animals located at the INL. According to the US General Accounting Office report titled "Information on DOE's Human Tissue Analysis Work", the human bone samples appear to have been analyzed for two radioactive elements, strontium and yttrium. In other studies between 1968 and 1970 skin from amputated limbs or other surgical procedures was obtained from various hospitals in the Idaho Falls area. The study's ultimate objectives were to apply radioactive iodine to the human skin to evaluate the hazards caused by iodine permeation. The principal goals of the program were to establish procedures for making accurate predictions of the thyroid dose that would result from an accidental iodine exposure. Other goals were to help in selecting iodine impermeable materials for protective clothing and to develop improved decontamination procedures. In both of these studies informed consent was **not** obtained from the patients and/or family by the researchers. [GAO/RCED-95-109FS@39]

Three Long Distance Diffusion Tests (LDDT) between March 1971 and August 1972 were conducted by the National Oceanic and Atmospheric Administration and the Health Services Lab at INL. These tests released 1000 Ci of Krypton-85 and 12.3 Ci of Iodine-131 into the atmosphere. The stated purpose of these tests was to see how these radionuclides disperse in the atmosphere. [DOE/ID-12119@A-59] The Three Mile Island nuclear accident released more than 15 curies of Iodine-131.

Nine Experimental Cloud Exposure Study tests, appropriately named EXCES, released between May 1968 and April 1970, 987 Ci of Xenon-133 and Sodium-24.[DOE/ID-12119.@A-61] Another air dispersion testing series called Relative Diffusion Tests (RDT) released 10.4 Ci of Iodine-131 between November 1967 to October 1969. [Ibid]

The U.S. Army built support structures and reactors at the Auxiliary Reactor Area (ARA) between 1957 and 1965 when the program was phased out. ARA was divided into four areas (I through IV). ARA-I acted as support facility for the other ARA sites. ARA-III originally housed the Army Gas Cooled Reactor Experiment (AGCRE), water moderated, nitrogen-cooled reactor that generated heat but no electricity and was finally placed on standby on April 6, 1961. After the Army vacated ARA, the buildings were used for various INL projects such as sensor fabrication, experimental instrumentation, and a metallurgical laboratory for nuclear reactor experiments. In 1965, the U.S. Army built the ARVF in the center of INL. "The facility consisted of a test pit, an underground bunker, and a system of pulleys and cables. The steel-lined, open-top test pit was filled with water into which nuclear fuel elements were placed." [DOE/EH/OEV-22-P @2-39] Presumably, the tests were done to create an accident scenario of a nuclear plane or satellite crash and the resulting radioactive releases to the crash site. In 1974, "four drums of radioactively contaminated NaK from ERB-1 were placed in the bunker, where they remain today. In 1980, a protective shed and crane were built above the pit, and in 1980-81 a series of explosive tests were conducted in the pit." [DOE/EH/OEV-22-P @2-39]

INL has a long history of intentional reactor melt-downs that were conducted to test the operating parameters of military and civilian reactor designs. The Loss-of Fluid Tests (LOFT) were conducted at INL's Test Area North (TAN) beginning in late 1977 and ending in 1985 costing over $350 million.[Norton] As the name suggests, the purpose of LOFT was to test the effects of loss of coolant to a reactor, damage to fuel, and related reactor systems. DOE acknowledges eight LOFT test series over this period. [DOE-ID-12119@A-57] The main components of the LOFT facility were the Mobile Test Assembly that was a large four rail dolly capable of moving the reactor between the Technical Support Facility (TSF) Hot Cell and the test pad containment vessel. The Hot Cell assembled the reactor on the rail dolly, which then transported it to the test pad.

The LOFT test pad containment structure is 70 feet wide and 129 feet high with huge doors to allow the reactor and rail dolly to move in and out. As with the ANP, the tests were conducted at a site removed from the main TAN support area because of the known hazards. After the test run, the rail dolly was moved by a shielded locomotive back to the TSF Hot Cell for disassembly and inspection. After the reactor components were inspected, they were transported to INL's RWMC burial ground for shallow disposal. [ERDA-1536 @II-123]

A "blow-down emission suppression system" in the LOFT containment structure was intended to catch steam and water ejected during the intentional melt-downs resulting from loss of coolant. A 150-foot stack was used to exhaust the effluent into the atmosphere. ERDA’s "conservatively estimated airborne radioactivity releases from LOFT experiments" were 941,912 Ci per year which includes stack emissions and containment structure leakage. [ERDA-1536 @II-118] Annual solid radioactive waste generated by LOFT contained 27,000 Ci. [Ibid @ II-124] The last LOFT experiment (LP-FP-2) on July 9, 1985 released 8,800 Ci plus 0.09 Ci of Iodine. [DOE/ID-12119 @A-52]

These releases were done with full knowledge of the implicit hazards of radioactive emissions. "In 1950 the 'destructive force of the atom' and the 'harmful effects of radiation' were basically understood." [DOE-ID-12119@A-50] Yet, no public announcements or warnings were ever given to the public so that they could take some measure of precaution.

Indeed, INL operations were shrouded in absolute secrecy. Only recently have public interest groups had some limited success in gaining access to historical records through the Freedom of Information Act. Today, the vast majority of the most revealing documentation is still classified, technically unavailable in contractor files, or intentionally destroyed. DOE and Department of Defense's (DOD) claims of national security concerning the declassification of fifty-year old radiation release documents is not justified. DOE and DOD have yet to offer guarantees to agencies of the US Health and Human Services conducting health studies at INL that all operating history documents will be declassified. Moreover, DOE delayed for two years granting security clearances to public health agency researchers.

Bluenose Releases

In the late 1940s and 1950s a U. S. Atomic Energy Commission (AEC) and U.S. Air Force secret program code named Operation Bluenose attempted to determine Soviet plutonium production levels by analysis of fission product gases released during the reprocessing of reactor fuel. To test the instruments in their U-2 spy planes, the Air Force requested that large amounts of radiation be released from the Hanford, Washington and Oak Ridge, Tennessee process facilities. The Hanford Education Action League (HEAL) received a DOE document through the Freedom of Information Act (FOIA) describing the releases. "The April 1949 report obtained by HEAL recommends that another test be conducted at Hanford that would release more radiation and also suggests that the plant filters be disconnected. This was done for the Green Run experiment." [HEAL(d)] The Hanford Environmental Dose Reconstruction Health Study determined that the Green Runs released 740,000 curies of Iodine-131. The Richland Washington Tri-City Herald offered the following interpretation:

"In the 1940s Walt Singlevich headed a classified program known as Operation Bluenose whose object was to determine soviet plutonium production by analysis of fission product gases given off during the reprocessing of reactor fuel."... "The 340,000 curies intentionally released [from Hanford] in 1949 were part of this test program. This release was achieved by hauling 'green' irradiated fuel from the 100 area over to the 200-B Plant were it was dissolved in nitric acid and 'some purple iodine was vented up the stack'. It was later found that I-131 was not an accurate indicator of plutonium processing throughput ..." The noble gas Krypton-85 was found to be the only isotope which could not be removed from the off-gases and that is what Francis Gary Powers was sampling in 1960 when he was downed by the Soviets. His U-2 spy plane had a Cold Finger sampler in-take on its wingtip to sample air at 100,000 feet over the USSR for its Kr-85 content." [Tri-City Herald]

Michael D' Antonio's book *Atomic Harvest* notes a series of articles in the Portland Oregonian newspaper that interviewed Carl Gamertsfelder, a retired Hanford radiation control manager who was at the site during the infamous "Green Runs." Gamertsfelder seems to corroborate the above *Tri-City Harold* article. According to D' Antonio, Gamertsfelder's characterization of the "Green Runs" in the following way.

"It had related to the intrigue and espionage of the Cold War. The United States had been trying to spy on Soviet weapons factories from the stratospheric perspective of exotic surveillance aircraft. The aircraft, and monitoring stations at sites bordering the Soviet Union, could be equipped with devices that would measure the pollution coming out of Russian plutonium plants. But in order to know how the emissions related to the volume of uranium being processed, the Americans needed to simulate Soviet manufacturing methods. To do this, they ran the [Hanford] T-Plant Soviet style, shortening the cooling period and allowing higher levels of pollution. They then measured off-site radiation and worked out a formula that would turn readings from monitoring devices into estimates of the enemy's bomb-production rate. Since the Soviets processed green uranium, in order to stay competitive in the arms race, Hanford had to conduct a Green Run too. Of course, without documentation, no one could be sure that this explanation was accurate. Years later, HEAL would continue to suggest that there was more to the story. Jim Thomas theorized that the US scientists have to perform the Green Run in the way they did because their instruments were not sensitive enough to detect the small emissions." [D' Antonio@125]

Secret document titles obtained during the Hanford Environmental Dose Reconstruction suggest that the INL's ICPP was involved in this Bluenose program in the 1950s. The focus on Kr-85 is confirmed in a United States Government Office Memorandum titled Bluenose and Other Matters that was the transmittal document conveying the attached "Critique of Possible Methods of Computing the Amount of American Kr-85 in the Atmosphere." [HAN-40477] The INL Research Bureau (IRB) submitted a Freedom of Information Act (FOIA) request to both Hanford and INL for release of these documents. Though Hanford did send copies of some of the formerly secret documents, INL refuses to declassify these forty year old documents because of "national security." In a formerly secret memorandum from Paul G. Holsted, Chief of Planning and Reports Branch, Hanford Operations Division, titled "Review of Bluenose Program" dated May 26, 1955, Holsted notes the following:

"General Electric Company has been requested by the [AEC] Division of Research to make release calculations to cover operations of the ICPP at Arco. This work has not yet started although many Kgs of U-235 have been recovered. GE had indicated that it would be willing to do the calculations but that further information would be necessary before it could start. This program was discussed briefly and GE is now ready to start the work." [HAN-59174@4]

The Bluenose program precisely irradiated U-235 slugs under highly controlled reactor conditions by AEC prime contractor General Electric Hanford Atomic Products Operation. [HAN-58767] The slugs were shipped from Hanford to other sites where the slugs were dissolved in nitric acid and the gases allowed to escape. These other sites identified are Savannah River, Oak Ridge, Argonne National Laboratory, Knolls Atomic Power Laboratory, Brookhaven National Laboratory, and National Reactor Testing Station (now INL). [HAN-59174@][HAN-401931 Hanford has the INL release data related to the Bluenose program but refuses to release the documents, referring the Environmental Defense Institute (EDI) to INL who also refuses to release the documents. Dr. Charles Miller, Centers for Disease Control, Environmental Health Physicist, has a Q-security clearance and was shown a secret Bluenose document at INL. Dr. Miller's security cleared characterization of the document is that it had nothing to do with releases but was related to shipping of nuclear materials between sites. Verbatim transcript of the CDC May 25, 1994 meeting note:

"Mr. Miller: Let me tell you what I can tell you legally, I'm reading my notes very carefully because they have been approved. Bluenose was a measurement program, measurement of analytical samples. It did involve the shipment of what are called limited quantities. Now that is not a judgment [sic] on the part of anybody, that's a legal definition as defined by the U.S. Department of Transportation, a limited quantity of radioactive material. And it did involve the shipment of these limited quantities between DOE sites. There were no releases associated with the project. It was not a release project. INEL has been involved since 1970 and everything else was classified.

"Mr. Broscious: Was it the Air Force that was involved in it?

"Mr. Miller: I can't answer that."

"Mr. Broscious: so are they going to declassify that information?

"Mr. Miller: I would say absolutely no way.

"Mr. Broscious: No way?

"Mr. Miller: No way." [CDC(d)@175]

Dr. Miller concluded that the Bluenose program was not a relevant issue to the INL Dose Reconstruction Study because he was convinced no releases occurred. It is entirely possible that the Bluenose document Dr. Miller was shown only dealt with transporting the Hanford irradiated U-235 slugs to INL. However other declassified documents released under FOIA to EDI clearly show the Bluenose program objectives for releases at numerous chemical processing sites around the country including INL. For instance a document titled "Reporting Bluenose Releases" from S. G. English, Chief, Chemistry Branch, Division of Research, and Washington to G. Victor Board, Director, Health and Safety Division, Idaho Operations Office, Idaho Falls states: "Enclosed for your information are the November reports on the dissolving at the ICPP." [HAN-64357] Another declassified March 18, 1955 memo between AEC Washington, D.C. and Hanford titled Preparation of ICPP Release Data states: "Your wire of January 27, 1955, requested a review of the feasibility of having General Electric perform calculations on krypton releases from the ICPP plant at Arco." [HA-58488]

Jim Thomas, now with a law firm involved in a Hanford Downwinder class action suit against DOE still believes that the U.S. efforts to determine Soviet plutonium production rates first tried iodine releases and switched to Krypton-85 because it was more reliable. They used atmospheric inventories of Kr-85 through known U.S. and Allied releases and subtracted that sum from the global total to determine the Soviet production levels.

It appears that through ineptitude or conspiracy, CDC has allowed DOE to hide relevant information needed to establish radioactive releases from INL. These Bluenose revelations strike at the very core of public confidence in CDC's political will to conduct good science. Before a scientific finding can have any credibility in the real world the methodology and supporting data must be reviewed and the method replicated by other independent scientists. As long as information remains classified, independent researchers cannot review the source information that CDC relied on to do the INL Dose Reconstruction health study, and therefore cannot replicate the science. The public will remain justifiably skeptical as long as fundamental scientific method is not followed.

The INL Research Bureau (IRB), a coalition sponsored by the Environmental Defense Institute, filed a Freedom of Information Act (FOIA) request to DOE Richland Operations Office in September for copies of documents identified during the Hanford Dose Reconstruction. The Department's October 24th response was: "We have conducted a thorough search of the Department of Energy's Richland Operations Office (RL) and contractor offices and the following documents were not located." "Therefore, this portion of your request must be denied." Twenty seven documents were listed as lost.

The IRB's appeal to DOE's Office of Hearings and Appeals in Washington, DC notes that "if indeed the requested documents are no longer in existence, the more serious implications of document destruction raises issues of Department non-compliance with United States Code, Title 44 Chapter 31 "Records Management by Federal Agencies"; Chapter 33, "Disposal of Records"; Code of Federal Regulations, 36 CFR, Chapter XII, Subchapter B, "Records Management"; 41 CFR Chapter 201, "Agency Programs"; DOE Order 200.1; and Secretary of Energy memorandums dated March 26, 1990, and January 13, 1994 mandating the retention of epidemiological and other related health study records. The IRB requested that DOE stipulate the fate of these 'not located' records."

The reason these INL documents were at Hanford is both sites were involved in Operation Bluenose. In the 1950's, the Air Force 's U-2 spy plane would fly over the Soviet nuclear production sites, take pictures and take air monitoring samples. In order for the air samples to be useful, the instruments had to be calibrated. As previously noted, intentionally large amounts of fission products including Iodine-131 and later Krypton-85 were released from Hanford, INL and other US production sites and over flown by the U-2 planes. Since The US throughput (production rate) was known, the air sample instruments could be calibrated.

Hanford, being the older AEC sibling, was also involved in INL's start up. INL's original name was the National Reactor Testing Station which more accurately characterizes its five decade mission. No other site has had a more diverse range of operations. Because of this diversity, documents needed for a dose reconstruction study are spread out over the country at different sites and archives. Preservation of these records is essential until after the dose reconstruction studies are completed and all challenges resolved.

Missing documents are not the only problem researchers face. DOE's response to a June INL Research Bureau Freedom of Information Act request was to black out the important parts of the report. These documents quantified the amount of krypton-85 that was released from INL in support of the 1956 Bluenose project. DOE justified deleting the amount of krypton that was released by stating that:

"The Atomic Energy Act of 1954 prohibits the disclosure of information concerning atomic energy defense programs that is classified as Restricted Data pursuant to the Atomic Energy Act. The portions deleted from the subject documents pursuant to exemption 3 contain information about nuclear weapons design that has been classified as Restricted Data. Disclosure of the exempt data could jeopardize the common defense and the security of the nation." [DOE-9/23/97]

The only credible aspect of national security in jeopardy is the American public's confidence in its government to tell the truth. It is ludicrous to suggest that a person could figure out how to make a bomb from knowing how much iodine and krypton INL released over forty years ago. People living downwind or downstream have a right to know the truth about how these government activities affected their lives.

I.C.3. Summary of INL Radioactive Releases to Atmosphere

Facility	Date	Curies Released	Source
Naval Reactor Facility*	6/18/55	305	A @ A-203
ICPP*	10/58	1,200	B @ C-3
ICPP*	10/16/59	367,717	A @ A-99
ICPP*	1/25/61	5,200	B @ C-5
SL-1*	1/3/61	1,128	A @ A-196
BORAX-1*	7/22/54	714	A @ A-203
Aircraft Nuclear Propulsion*	1956-66	4,635,724	see ANP table
Other INL Operational Release	1952-89	13,552,880	A @ A-189
Total Air Release	1952-98	18,564,868	

Sources: (A) DOE/ID-12119; (B) ERDA-1536

* Significant episodic releases not included in general INL operational releases to the atmosphere. Curie releases less than 0.1 were not added in this summary and are considered understated due to lack of information.

I.D. ICPP Reactor Fuel Processing

The Idaho Chemical Processing Plant (ICPP) (now called Idaho Nuclear Technology and Environmental Center [INTEC]) opened in 1953 served (until 1993 when reprocessing was temporarily stopped) as the principal facility for storage and reprocessing of spent nuclear fuel (SNF). Man-made elements created by fissioning uranium in a nuclear reactor are isolated by reprocessing of the irradiated or “spent” reactor fuel. Because this is known as the most hazardous industrial operation in the world, these reprocessing plants were located in remote areas. Fuel cladding (metal covering around the uranium fuel) types reprocessed at ICPP included zirconium, aluminum, stainless steel, graphite and specialty cladding. The ICPP is a large complex made up of numerous individual buildings. Current major process buildings at the ICPP include Fluorinel and Storage Facility (FAST) (CPP-666) built in 1978 and is divided into two sections - Fluorinel Dissolution Process (FDP) and fuel storage facility. The FDP is the first step in zirconium clad spent fuel reprocessing primarily from the Navy reactors. The fuel is dissolved in a solution of hydrofluoric acid and other chemicals. The FDP hot cell contains three dissolves designed for remote operation. The last campaign (reprocess run) at FDP was in 1988, however the plant remains on standby status.

The Custom Dissolution Process Facility (CPP-627) customized small scale SNF reprocessing systems operated in the Hot Chemistry Laboratory located in CPP-627 to process nuclear materials that could not be handled in existing ICPP dissolution facilities. Only small quantities of material were processed in each campaign. The facility comprises the Multi Curie Cell, and anteroom and a radio chemistry laboratory.

The Head-end Processes (CPP-640) houses the Hot Pilot Plant which is a five level structure with each level containing one or more shielded dissolution process areas. Five process areas were used for the Rover Dissolution Process and one for the Electrolytic Dissolution Process. The Rover reprocessing facility recovered uranium from graphite-based SNF from a nuclear powered rocket project conducted in the 1960's. The facility consists of the Mechanical Handling Cave and four shielded cells. Cell 5 of the Hot Pilot Plant contains the electrolytic dissolver used to dissolve stainless-steel clad SNF.

Separations Facilities (CPP-601) contains a series of 29 cells used to extract uranium from dissolved fuel. Most cells are about 20 feet square and 28 feet deep and are lined with stainless steel. Most of the equipment is stainless steel except for some pieces made of more exotic alloys for resistance to sulfuric or hydrofluoric acids or to electrolytic currents. With the exception of four special cells provided with viewing windows and manipulators, the in-cell equipment was controlled from an operating corridor. The corridor runs the length of the building between two rows of cells and contains equipment for regulating the flow of liquids through the process.

The Denitrator (CPP-602) is where liquid uranium solutions from chemical extraction processes were converted to a solid in a heated, fluidized bed. The granular product was packaged and stored in an adjacent vault pending shipment to the Un-irradiated Storage Facility. CPP-602's last campaign was in 1994.

The Rare Gas Plant (CPP-604) has three off-gas cells on the west side that cryogenically recovered radioactive krypton and xenon from dissolver off gas streams for commercial use. The three cells range in size from 20 to 24 feet wide and nine to 24 feet long, and 35 feet high. All have thick concrete walls and ceilings and contain equipment used in the off-gas recovery process. The Fuel Processing Restoration Facility (CPP-691) is a new plant that was under construction when reprocessing was discontinued in 1992. It was intended to replace CPP-601 and 602.

The Waste Calcining Facility (WCF) was the world's first plant-scale facility for solidifying liquid high-level waste from reprocessing. WCF converted high-level radioactive liquid wastes into granular solids, which are less corrosive, more stable and have less volume. From 1963 to 1982, WCF calcined over four million gallons of liquid waste before it was replaced by the New Waste Calcine Facility (NWCF), which incinerated another 4 million gallons of high-level waste. Critics of the calcining process characterize it as a giant radioactive aerosol. In April of 2000, the Environmental Defense Institute, Keep Yellowstone Nuclear Free, and David McCoy filed a Notice of Intent to Sue DOE, EPA, and the state of Idaho for operating the NWCF for eighteen years without a RCRA permit. DOE immediately shut down the Calciner and implemented a closure plan.

I.D. 1 RaLa Process Runs

"The term "RaLa" is an abbreviation for **Ra**dioactive **La**nthanum-140 which is a decay product of barium-140. RaLa as used here refers to all phases of Barium-140 production from development to actual production facility operation." [IDO-14344 @10] The Three Mile Island reactor accident, considered to be America's worst nuclear accident, released 15 curies (Ci) of Iodine-131. [Benson, p.2] Yet, RaLa fuel process runs at INL's Idaho Chemical Processing Plant (ICPP) produced "Radio iodine which can also be released under certain conditions amounts to 50,000 to 100,000 curies." [IDO-14532@13] The highest radioactive release period - over half of the total - occurred between 1956 and 1966 and amounted to 15,256,015 curies to the atmosphere. [ERDA-1536, p. III-7] [DOE/ID-12119 @A 55]

The Idaho Chemical Processing Plant (ICPP) conducted 11 process runs in 1953 for the capture of Krypton-85 and 113 process runs between May 1954 and February 1963 to recover Barium-140, Uranium-235, and Lanthanum-140 for the radiological/chemical weapons program. These isotopes were produced for Atomic Energy Commission's Los Alamos National Laboratory. RaLa was used to produce material which Los Alamos used as a "substitute" for plutonium in certain types of radiological weapons tests. Barium-140 shared many of the physical properties of plutonium and could be used to disperse deadly fission products without destroying infrastructure. With a shorter half-life of twelve days it did not permanently contaminate the environs the way plutonium would with a half-live of 24,000 years. So it was a people killer weapon, not a building leveler that the nuclear priesthood was developing and testing on the residents of New Mexico.

"The government moved the RaLa project to Idaho from Oak Ridge, Tenn. because of concerns over the iodine releases connected with the processing "green fuel." The Oak Ridge plant was within five miles of the nearest site boundary, said [John] Horan who worked at the Tennessee facility during the early 1950s." [Times News(f)] In fact, a RaLa run blew up at ORNL when operators tried to produce a 100,000 curie batch of Barium-140 which resulted in a three day plant evacuation. Recent disclosures by the General Accounting Office about radiation warfare experiments conducted at Oak Ridge on American citizens where hundreds of thousands of curies of Lanthanum were released suggests the Barium-140 came from either from Oak Ridge or the ICPP depending on the date of the experiment. According to the extremely limited documentation EDI has on the Ba-140/La-140 shipments from ICPP to Los Alamos, over 502,000 curies were sent and used in open air tests to evaluate the killing power of this radiological weapon.

"Radioactive Lanthanum-140, daughter of Barium-140 has been used as an intense radiation source for a number of years. Historically, a need has developed for increasing batches of the Barium-140 sources material with additional emphasis on increasing specific activity of the barium. The increasing demand resulted in inadequacy of facilities of the original barium producer, the Oak Ridge National Laboratories (ORNL). The more recent availability of high specific activity fuel from the [INL] Materials Test Reactor indicates the desirability of locating production facilities in conjunction with that reactor. In fact, a RaLa production cell was provided for in the ICPP original design of the Chemical Processing Plant [ICPP] by ORNL. The popular term 'RaLa' is a misnomer since the research, development, and production is centered on the isotope barium-140."... "At this time [1951], ORNL commenced the development of a process [at ICPP], based on irradiated MTR elements as feed material, capable of consistently yielding batches of at least 30,000 curies." [IDO-14445 @ 14]

RaLa runs were conducted at ICPP during the nine year period of 1954-1963. During some periods in 1954-55 while the process was being developed, un-irradiated fuel was used. Between 1953 and 1963 the ICPP released 6,092,985 Ci to the atmosphere. [ERDA-1536@III-7] Discussions in this section focus primarily on pre-1957 Rala runs because DOE has not acknowledged them in their 1992 INL Historical Dose Evaluation report as Rala runs.

Acknowledged ICPP Iodine-131quantities released between 1957 and 1963 were 2,800 Ci, with the highest year being 1958 releasing 1,028 Ci of I-131. [ERDA-1536.@II-242] Internal DOE documents suggest the quantity of I-131 that may have been released in a single run was more than what DOE acknowledged for an entire year. This RaLa program is the INL equivalent of the infamous Hanford "Green-Runs" which also processed "green" reactor fuel. When reactor fuel is processed "green", that is, prior to a cooling period that allows short-lived radioactivity to "safely" decay, a significant amount of radioactivity is released to the environment when the fuel is processed. The ICPP emission control system during that period was very primitive. The veil of secrecy also allowed the nuclear alchemists to proceed without public notification or accountability. This secrecy persists today. DOE's 1991 INL Historical Dose-Assessment Report does not include nor acknowledge many RaLa runs or the 1956 Bluenose releases from ICPP. Some of the first process runs were conducted with non-irradiated simulated fuel. Full access to ICPP operations documentation is needed to accurately assess the RaLa program. It should be noted that it took nearly five years of public pressure on DOE to allow Q-clearance access to the daily fuel processing documentation at Hanford, however, all the documents are yet to be declassified. The same is true for INL. The Department of the Navy is a claiming jurisdiction over some of DOE's secret documents because they pertain to Navy fuel processing and they refuse to declassify the information.

"The RaLa process involves the dissolution and processing of a 2-day cooled MTR [Materials Test Reactor] fuel assembly for recovery of radioactive barium-140. The operation is performed over a 24 to 36 hour period several times each year and involves about 1,200,000 curies of short-lived fission products. While 1.2 million curies is not a great amount compared to the normal processing plant operations [ICPP], the quantities of such elements as xenon, iodine and lanthanum are tremendous compared to those normally encountered; furthermore, the 1.2 million curies is contained in a solution volume of only a few liters. Xenon and krypton, which go to the off-gas, amount to about 100,000 curies and special measures must be taken to prevent unauthorized release. Radio iodine, which can also be released under certain conditions, amounts to 50,000 to 100,000 curies." [IDO-14532,p.13]

Phillips Petroleum, then operator of the ICPP, reported in the second quarter of 1957, that; "The liquid waste system operated satisfactorily except for failure to remove iodine resulting from RaLa processing". [IDO-14419,p.7] RaLa Run 002-RH originally scheduled for process on November 26, 1956, was delayed until November 30 "due to weather conditions being too adverse to permit gas release to the stack." [IDO-14414 @ 156] During run 002-RH, "Area AEC radiation surveys indicated that activity in the dissolver off-gas discharging from the stack persisted for about five minutes. During this period, the AEC sky scanner radiation instruments read maximum and then dropped to zero." [Ibid. @ 158] During this run, the Process Makeup Area was contaminated by a burst of airborne activity into the work area when the shipping pot was removed from the process cell. [Ibid. @ 45]

"The Barium-140 recovery (RaLa) at ICPP produces a separate off-gas stream, treated with extreme care because it normally contains kilocurie quantities of radio xenon and Radio iodine. The xenon is released under controlled conditions. If the weather permits, it goes directly to the plant stack. If the weather does not allow immediate release, it is held in a 10,000 cubic foot shielded gas holder until a more opportune time, or until the xenon has decayed to a low level." [IDO-14532,p.26]

This holding tank was, however, not built and fully functional until 1958, two years after hot RaLa processing began. [IDO-14414 @ 170] Another problem, even after the off-gas holding tank was built, was that it could only hold 10 hours of operational emissions. [IDO-14414 @29&42] Since significant amounts of radionuclides continued to be released over days and weeks after the process run, the holding tank was of limited value even after it was installed.

RaLa Materials Test Reactor (MTR) fuel runs No.3 (12/56), and No.5 (2/57) contained 6,580 and 166,000 Ci of Iodine respectively. "Runs No. 3 & 5 weather conditions permitted venting all gases to the stack." [PTR-185 @6&7] Run No. 3 had significant equipment malfunctions that resulted in extensive contamination of the L Cell. "Four hundred man-hours were expended in reducing the general background radiation in L cell from an estimated 1000 R/hr to 0.3-1 R/hr." [Ibid. @45] Exposure to the decontamination workers under those conditions would be expected to be considerable.

Scrubbers were later installed as part of the off-gas emission control system. "There are indications that considerable iodine activity passed through the scrubber. Smears indicated the presence of iodine in the stack. AEC site surveys indicated that local rabbits showed significant increases in thyroid radiation count immediately following Runs 3, 4, and 5. Since gases from the runs were not collected and sampled it is not known how much activity was discharged from the stack. The stack monitor, which was put into service just prior to Run No. 4, indicated that significant iodine activity continued to be released for several days after each of the last two runs was completed. This would indicate that iodine has a tendency to plate out or deposit in lines and vessels only to be released gradually." [PTR-185 @19&20] The biological significance of the release of radioactive iodine is that the human body readily assimilates it into the thyroid gland.

Rala Run No. 001-RP (Feb.1, 1957) which processed 38,800 curies of barium and 70,000 curies of Iodine was delayed 17 hours until the wind changed directions away from populated areas. [PTR-185,p.6] February 20, 1957 run No. 002-RP contained 166,000 curies of Iodine. [Ibid.] The reason both Runs No.001-RP and 002-RP had such high Iodine content was because the cooling time for the fuel was two and less than one day respectively. Barium-140 runs in the third quarter of 1962 totaled 61,252 curies. [IDO-14599,P.1]

"RaLa off-gas involves a two-fold problem; namely, activity hazard due to contained active iodine and xenon, and explosion hazard due to contained hydrogen. The off-gas activity is too great to permit indiscriminate venting to the atmosphere and the hydrogen concentration is in the explosive region making mechanical compression and storage hazardous." [IDO-14414 @ 170] "Consequently operation was necessarily limited to periods when the weather was favorable for stack disposal." [Ibid] In other words, the ICPP operators were reluctant to put much off-gas into the holding tank because of the hydrogen explosion potential and therefore it was expedient to release it to the atmosphere. So processing was delayed until the radiation would be blown north away from the more populated areas to the southeast.

"The [ICPP] fission product noble gases are present in the dissolver off-gases, and any not recovered go to the atmosphere. Krypton-85 in amounts up to 2,000 curies per-day could be released from power fuel processing. Comparable quantities of Krypton-85 have been released during previous operations without hazard to personnel on or off the site. This will be diluted by stack gas to 0.3 micro curie per liter [3 x 10^5 pCi/L] at the top of the stack, about 100 times maximum permissible [at the time] level for air." [IDO-14532 @46] These documented statements by Atomic Energy Commission (AEC), predecessor to DOE, demonstrate the cavalier attitude about releasing large quantities of radiation to the environment. Moreover, no warnings were ever offered so that the public could take appropriate measures to protect themselves and their families.

"Total Iodine present in an [one] irradiated MTR fuel assembly after two days cooling approaches 76,000 curies with Iodine-131 accounting for 28,000 curies of the total. Approximately 80 % of this iodine was expected to reach the off-gas scrubber which was estimated to be 95% efficient in removing iodine. Thus about 3,000 curies of total iodine activity was expected to pass through the scrubber within a one hour period." [IDO-14414 @ 170] Even weeks after the fuel dissolution process is completed, iodine continues to escape. "It has been found that during quiescent conditions in the cell the iodine release will be from five to ten curies a day. Solution transfer or vessel decontamination will raise this to 20 to 50 curies per day. [IDO-14419, p.61] Considerable uncertainty exists between the design efficiency of scrubbers and the actual efficiency. See Stack Emission Section I(G). Uncontrolled iodine releases were also "escaping from centrifuges to cell off-gas which does not pass through the scrubber." [Ibid.] +[14494, p.19] The combined releases from these multiple sources were significant.

A postulated example of iodine releases applied to run number 002-RP would yield the following scenario. Run 002-RP had 166,000 ci of I-131. Using the extremely optimistic design standard of 95% efficiency of the scrubbers, and 80% release to the scrubber, and subtracting 80% from 166,000 Ci in the fuel, leaves 132,800 Ci released to the scrubber which theoretically had 95% efficiency. That leaves 6,640 curies of iodine going out the stack over a two-day period. This figure would not include any DOE acknowledged releases escaping the centrifuges and cell off-gas system.

The above assumption scenario (non-conservative) is supported by DOE internal documents. "Approximately 80% of the I-129 is released as an airborne effluent and 20% is in the liquid effluent." [DOE/ID-12119@A-18] A 1978 DOE engineering study by Allied Chemical Idaho Operations for INL proposed an I-129, C-14, Ru-106 and Kr-85 filtration system for ICPP fuel reprocessing to reduce the emission of these radionuclides. "More than 99% of these volatile isotopes were assumed to be released during dissolution of the fuel rods." [ICP-1126@iv] The design was to include a matrix of filters to trap these volatilized isotopes. Should these filters fail or become plugged the system would just go back temporally to normal operation. During Rala Run 003-RH, "Approximately 7 percent of charged iodine was found in the scrubber solution after the run was completed." [IDO-14414 @ 158] This suggests iodine release fractions in the range of 93%. "Since the current practice of releasing all airborne iodine species is acceptable, short-term releases in future reprocessing plant would be considered an inconsequential accident." [Ibid.@18]

The above discussion is supported by the 1977 INL Environmental Impact Statement (EIS) which stated that "the efficiency of this scrubber was low for iodine." [ERDA-1536 @ 242] The iodine content was so high in the RaLa reprocessing that the liquid waste evaporator would experience "Iodine-131 boil over during several batches when RaLa operations were in progress." [IDO-14430 @ 11] "Recent [1957] operational practices in the concentration of process equipment waste provided essentially no reliable decontamination of the condensate from iodine-131 in the feed. Many different schemes have been tried to retain iodine ..." ... "These schemes were not successful in improving the iodine decontamination of the stream." [IDO-14430 @ 18] RaLa Iodine releases varied widely depending on the fuel processed and the cooling time before processing. The extremely optimistically low figures for part of the Rala period (1957-63) offered in the EIS were 2,800 Ci. of Iodine-131 released to the atmosphere. Based on the crude emission system in use, these figures can only be considered as extremely understated. A thorough analysis of the entire process and the efficiency of the emission systems are needed to assess the probable radioactive releases.

Considerable variation existed in scrubber efficiency in removing Iodine-131 from 7% to 70% due to filter problems. [IDO-14287] These runs produced Barium-140 solutions averaging 5,400,000 R/hr [IDO-14306 @ 7] , and containing a minimum of 30,000 curies. [IDO-14445 @14] The RaLa process MTR throughput fuel had extremely high burnup rates of 24% which generated 55,600 curies of Ba-140 as opposed to undesirable 17% burnup fuel that only produced 38,800 curies of Ba-140 for every 168 grams processed. [IDO-14445 @21] The known hazard with reprocessing high burnup fuel with less than a two-day cooling time was the release of volatilized iodine, ruthenium and krypton. "Ruthenium accounted for about 10% of the volatile activity other than krypton, with about nineteen times as much ruthenium coming off during the acid dissolution as during the caustic dissolution." [IDO-14445 @31]

Efforts by ICPP operators to reduce iodine releases included dilution of the post process waste and neutralization of the caustic supernate. "In the case of the caustic solution diluted thirty-fold, the maximum amount of iodine trapped from the off-gas was 0.93 percent. Material balances were good. With the caustic solution diluted only fifteen-fold, the amount of iodine trapped averaged about 1 percent."[IDO-14445 @80] Another 1958 Phillips Petroleum report discussed attempts to improve the Process Equipment Waste (PEW) iodine scrub efficiency by adding neutralizing solutions. "With no neutralization of the evaporator feed, there was essentially no decontamination from Iodine-131 in the [PEW] condensate." But even this effort "yielded a condensate which contained about 0.5 percent of the iodine from the feed." [IDO-14443 @ 16][IDO-14430 @18] This documentation suggests extremely poor performance of emission control systems to filter/ scrub out iodine prior to release to the atmosphere. "Since the curies of activity associated with these elements [iodides] is of similar magnitude to that of the barium being produced [30,000 to 60,000 curies] provisions to conduct dissolution under meteorological control may be necessary or an accumulator vessel to retain the gases for several weeks; decay prior to venting may be required, in order to avoid possibilities of area contamination or personnel exposure if dispersion of the plant stack gas is inadequate." [IDO-14308 @8] Even at very low PEW efficiency rates for iodine the condensate was still extremely radioactive because of very high curie content of the fuel being dissolved as feed. "Because the feed to this [PEW] evaporator is usually fairly high in activity, the condensate represents a significant source of activity discharge to ground from the plant." [IDO-14362 @ 8] This is a reference to waste discharged to the injection well. 1959 Phillips Petroleum reports continue to acknowledge that low iodine scrubber efficiencies of 17.9% of the calculated iodine were found in the caustic and less than 1% in the acid solution. [IDO-14445 @94]

Recent revelations about Hanford releases from fuel reprocessing exposed by the Hanford Environmental Dose Reconstruction (HEDR) Project are germane to INL. [TSP News letter, 12/92] The original estimates or 530,000 curies of I-131 released from Hanford were based on unreliable stack monitoring data. The public and independent researchers knew this was not true. After nearly five years of public pressure, DOE finally allowed access to classified daily fuel reprocessing data that allowed scientists to do a physical reconstruction of the Green Runs. The results showed an increase of 70% over previously DOE acknowledged releases of 530,000 curies Iodine-131. [Benson @2] The key elements of the data needed for a physical reconstruction were:

1.) Cooling time of the fuel processed. Short cooling periods of hours or days rather than months means that short-lived isotope inventories such as I-131 will be much higher in the fuel.
2.) Release fractions. This figure is based on how much of the iodine present in the fuel is released to the environment. For Iodine-131, HEDR calculated the release fraction to be 90.5%.
3.) Reactor power levels of fuel used. A direct relationship exists between the reactor power level and the isotopes created in the fuel. The higher the power level, the more Iodine-131 is generated. [TSP News letter, 12/92]
4.) Fuel type and percentage U-235/Pu-239 enrichment.

HEDR now estimates Iodine-131 releases between 1944 to 1972 at about 740,000 curies which produced a 870 rad exposure to an infant born in Ringold, WA in 1943 or 1944. [Connections(a)] While working on the Hanford Downwinders class-action lawsuit, Owen Hoffman, President of the SENES Oak Ridge Center for Risk analysis, determined that approximately 900,000 curies of Iodine-131 were released by the AEC's Hanford plants between 1944 and 1957, a period known as the Hanford "Green Runs." This amount is 150,000 curies more than the "official" estimates from the Centers for Disease Control. [Hoffman]

The Hanford Health Information Network reports independent downwinder consultant research showing Plutonium-239 releases between 1945 and 1969 as high as 1600 curies. These plutonium release estimates are based on Hanford's George Brabb's 1961 internal memo assessing fuel reprocessing (Z Plant) "and found the filtering system was not adequate to capture the vaporized plutonium oxide which was essentially in a gaseous form when released by burning. This was revealed by the fact that a significant amount of plutonium was found in the ducts of the vacuum system...even though it was protected by filters. This convinced me that fine plutonium was being released into the atmosphere from Z Plant." [Connections(b)] The reason for citing the Hanford problems is not to compare the release numbers but to compare the emission control system problems because the technology in any given era was the same whether at Z Plant or the ICPP.

As of this writing, CDC refuses to do a physical reconstruction of the INL RaLa Runs as part of the INL Dose Reconstruction Health Study. CDC is opting for the use of discredited DOE stack monitoring data. This is another deliberate attempt by CDC to understate the radiation release estimates in the hope that the government's liability exposure will be minimized. There are extremely important "lessons learned" from the Hanford studies that the public justifiably wants applied to the INL studies.

Plutonium was also extracted from the high burnup power reactor fuels processed at the ICPP. F and V cells generated plutonium batches up to 500 grams. [IDO-14306] Plutonium emissions must be included in any analysis. The solvent burner is noted in numerous reports as a problem area. The solvent burner is used to incinerate the waste solutions used to dissolve the fuel rods containing plutonium. "Plutonium is the most bothersome contaminate" in this Solvent Burner and its "Combustion gases go directly to the main plant stack without filtering." [IDO-14287] "The solvent burner is probably the largest source of Transuranic discharged to the stack and the largest unfiltered radionuclide discharge at ICPP." [ENICO-1086 @1]

Acknowledged Chem Plant (ICPP) airborne radioactive releases during the Rala runs (1953 through 1963) totaled 6,092,985 curies of gross beta and gamma isotopes. RaLa runs in 1959 released the highest airborne radioactivity at 1,334,902 curies of gross beta and gamma isotopes. [DOE/ID-12119@A-41][Also see Appendix listing by year] These figures do not include other INL facilities that were also releasing considerable quantities of radiation. For instance, the Test Reactor Area's Materials Test Reactor that provided the RaLa Run fuel rods released excessive amounts of Strontium 90 both to the air and to effluent water used to cool the reactor. [IDO-16375, p.8-9] Between 1952 and 1968 alone, the Test Reactor Area released 5,035,572 curies of radioactivity to the atmosphere. [Ibid @ A-30] Iodine-131 (around ICPP) activity in jack rabbit thyroids for the 1958 sampling period peaked in March at 709,000 d/m/g. At sixteen and twenty miles distance from the ICPP the I-131 activity dropped respectively from to 140,000 d/m/g to 93,000 d/m/g. "The highest thyroid I-131 activity ever observed at the NRTS [up to 12/58] jack rabbits was observed in two animals collected on September 10 [1958]. Their mean I-131 activity was 7.7 x 10^6 [7,700,000]." [IDO-12082(58)@78-87]

INL's Historical Dose Assessment Report acknowledges only 78 Rala Runs. This DOE report list begins with what they call Rala Run 001 in February 1-3, 1957. [DOE/ID-12119 @ A-33] Yet, Phillips Petroleum, ICPP contractor at the time, documents that, "Hot runs were begun on November 24, 1956." [PTR-185 @ 5] Although fifteen runs are acknowledged, details are given for only eight runs up to June 1957. [IDO-14414 @ 131] It must be emphasized that the Environmental Defense Institute's analysis is limited due to DOE's unwillingness to declassify all INL operating history documents. Therefore, the information contained here is not by any means conclusive. As of this writing, DOE has yet to declassify documents requested by CDC for both the Hanford and the INL dose reconstruction health studies. This is discouraging since the Hanford requests are seven years old and the INL requests are three years old.

Partial Listing of EARLY Rala Run Fuel Iodine Content

Run Date	Run Number	I-131 Curies	Cooling Days	Ba-140 Curies
11/24/56	001-RH	?	3	?
11/30/56	002-RH	1,260	4	3,033
12/6/56	003-RH	6,580	1	18,000
2/1/57	001-RP	70,000	2	39,000
2/20/57	002-RP	166,000	4	55,000
4/5/57	003-RP	13,560	2	28,000
5/19/57	004-RP	14,500	?	29,150
6/24/57	005-RP	16,180	6	32,000

[IDO-14414][PTR-181 & 185] [IDO-14430][IDO-14419]

Incomplete Listing of RaLa Run Barium-140 Produced

Run Date	**Run Number**	**Ba-140 Curies**
	006 -RP	?
10/57	007-RP	22,800
12/57	008-RP	37,000
4/58	?	30,000
6/58	?	30,000
4/59	022-RP*	23,400
	023-RP	10,200
	024-RP	24,800
	025-RP	23,160
	026-RP	19,270
	027-RP	23,900
6/59	028-RP	26,200
10/59	034-RP*	19,695 #
	035-RP	21,620
	036-RP	14,075
12/59	037-RP	26,137
7/62	?	21,085
9/62	?	40,067
6/13 to 9/13/63	071RP to 079RP *	200,000
Last Run 4/63	?	?
Incomplete total	83 Runs	501,920 curies Ba-140

* break in run number sequence [PTR-749][IDO-14599][IDO-14494][IDO-14512][IDO-14453][IDO-14430][PTR-185][PTR-181][IDO-14419][IDO14414][IDO-14410][IDO-14344]

 # ICPP Criticality Accident (16 October 1959) "During the [accident] evacuation of the building airborne fission products (within the building) resulted in combined beta and gamma doses of 50 rem (one person), 32 rem (one person) and smaller amounts to 17 persons." A Review of Criticality Accidents, 2000 Revision, Los Alamos National Laboratory; pg.18; LA-12638.

Atmospheric Rala Releases of Iodides and Beta Activity

Year	**Run Numbers**	**Curies Released**

1957	006 through 008	6,399.00
1958 *	009 " 021*	5,334.87
1959	022 " 037	1,605.60
1960	038 " 049	246.44
1961	050 " 066	352.27
1962	067 " 075	253.26
1963	076 " 079	116.55
Totals	79	14,307.99

[DOE/ID-12119 @ A-33] [* IDO-12082(58) lists 13 RaLa runs between 1/6/58 & 10/23/58]

A criticality (uncontrolled nuclear chain reaction) accident at the ICPP on October 16, 1959, one day after a RaLa run on the 15th increased the atmospheric releases. An AEC accident report noted twenty-one workers were exposed and offered the following description of the RaLa run.

"A RaLa run had been completed on the afternoon of October 15. This process involves the separation of radio-barium from short-cooled MTR fuel elements. Dissolution of these short-cooled elements and even later disturbance of solutions in post-run cleanup usually cause some release of fission product iodine to the process vent system. On some occasions iodine has escaped to the access corridor and PEW control room in sufficient quantity to set off the sensitive air monitor alarms in those areas. Consequently, it was natural initially to suspect that the release of apparently short-lived air-borne activity was in some way related to the RaLa equipment. This assumption seemed to have been further substantiated by the fact that : the RaLa process instruments indicated that a pressure surge had occurred, no other instruments that were observed in the hurried re-entry [after ICPP accident evacuation] showed evidence of more than minor disturbance, and high level (greater than 25 R/hr) contamination was discovered around the RaLa slug chute. High level contamination noted in the PEW control room was a reasonable consequence of the pressure surge initiated in the RaLa system." [IDO-10035 @ 16]

Another ICPP criticality accident on January 25, 1961 during the RaLa period also released radioactivity to the atmosphere. This incident (requiring full evacuation) occurred during the work week when 251 employees were at the ICPP. The radioactive cloud traveled southwest toward Big South Butte where it stagnated for several hours before moving on south. Radiation readings at Big South Butte ranged over 200 counts per second. Readings at Central Facilities Area, 2 miles south ranged over 30 mrem. [IDO-10036@35] AEC accident report notes the following:

"Two processes in the plant handle gaseous and volatile fission products, viz., a radio-barium separation system (RaLa process) and the dissolver off-gas handling system. A RaLa processing run had been completed two days earlier and no operations were being performed in that equipment. However, post-run activities in the past had resulted in some release of Iodine-131. Chemical changes in the process and essentially eliminated this problem, but the associated high concentrations of short-lived fission products cause this system to be suspect in any unidentified radiation incident."
[IDO-10036@35]

I.D.2 Post RaLa ICPP Releases

This section discusses the post RaLa Idaho Chemical Processing Plant (ICPP) from 1964 to present. Within part of this period, (1964 to 1981) ICPP released 1,417,210 Ci of radioactivity to the atmosphere and 22,200 Ci to the aquifer via injection well and 6,523 Ci discharged to the percolation ponds. [ERDA-1536@II-89&III-7][INL-95/0056@2-13][IDO-10054(79)(81)@14] In 1974 the ICPP alone released over 259,955 curies (6,055 were not noble gases) of radiation into the air. These figures do not include what went into the soil and aquifer below INL via injection wells. [ERDA-1536, p. II-18] Airborne releases between 1980-81 included 416 curies of barium, 42 curies of cesium, 153,589 curies of krypton, 10,053 of xenon. [ID-10054-80&81, p.3-4] Between January and November of 1982 28,943 curies of radioactivity were released at INL (28,020 curies of that were airborne) 2,592 billion liters (683 billion gallons) of radioactive waste were dumped in the ground, 1,552 billion liters (409 billion gallons) of which were injected into the aquifer. [Williams, 1/31/83, 4-4]

The space vehicle nuclear rocket ROVER program used graphite reactor fuel that was reprocessed at the ICPP. The graphite around the fuel was first burned off in an auxiliary building not part of the head end fuel processing system, which at least has some emission scrubbers. After the graphite was burned off, the residual containing 80 to 90% enriched uranium was then put through the normal ICPP chemical extraction process. A full investigation is needed to determine how much ROVER fuel was burned, what emission systems (if any) were in use, and how much radiation was released. Workers sent in to decontaminate the ROVER burn cells were severely contaminated due to inappropriate protective clothing. Later attempts to decontaminate the burn cell caused additional personnel contamination due to the fine graphite powder plugging respirators and leaking through protective garments. Management refused to allow worker requests for pressurized air lines. Workers claim exposures of 800 to 2,000 rem per person per entry into a ROVER cell. [Allan] Decontamination operations were canceled and the ROVER process lines remain plugged with high activity material. In 1997, ROVER process decontamination was again attempted.

After a criticality accident in one interim storage tank under the ICPP Head End fuel dissolution building, a worker was sent in to inspect for damage. The criticality occurred because enough uranium and plutonium remained in the raffinate to cause a spontaneous reaction. Barium acting as a poison was dumped into the tank and the mix was pumped out to underground storage tanks. Instruments indicated that the tank was empty, but when the worker was lowered into the tank, he ended up in shin deep high-level raffinate before he was pulled out. Later after the tank was pumped out workers were sent in to move a robotic vacuum between the piping that laced the entire bottom of the tank. The radiation exposures these workers received during this and other decontamination projects must be fully included in CDC's worker dose reconstruction health study.

Congress's Office of Technology Assessment states that INL, "contaminates have migrated into surrounding soil; floods have enhanced migration." ... "Plutonium has been detected in a clay layer about 110 feet beneath the site." ... "Hazardous contaminates have been measured in the groundwater that is about 600 feet beneath the site." [OTA @ 34]

For decades public interest groups have tried to convince DOE that continued operation of the ICPP not only exacerbated waste generation but also diversion of precious resources needed for environmental restoration. A principal tenet to responsible waste management is source reduction or minimizing waste. The largest single liquid waste generator at INL is the Idaho Chemical Processing Plant (ICPP). The mission of the ICPP has been the recovery of highly enriched uranium for the four Savannah River reactors. These reactors have been shut down since 1988 because of safety violations and only one (K-Reactor) is likely to restart. According to DOE, K-Reactor will only restart for a short period of testing - not for a full production schedule. Therefore the ICPP mission has radically changed. DOE's recent decision to shut down the ICPP should be permanent not temporary. Jim Werner, former senior environmental engineer for the Natural Resources Defense Council, offered (at a 1/24/91 PEIS hearing in Boise) the following comments:

"The Chem Plant produces hundreds of millions of gallons of hazardous and radioactive wastes annually. From 1953 to 1974, DOE discharged nearly 7 billion gallons of radioactive wastes to an underground injection well at an average rate of more than 300 million gallons annually -- nearly a million gallons a day. In addition, 10,000 to 35,000 gallons of radioactive chemical wastes such as nitric acid raffinate, and 19,000 cubic feet of radioactive solid wastes were generated each year at the Chem Plant. Because of significant modifications to increase the capacity of the Chem Plant, the volume of wastes currently generated by the Chem Plant has approximately doubled and have more recently been estimated to be as much as two million gallons of radioactive liquid waste daily." [Werner, NRDC, PEIS Testimony, Boise, 1/24/91]

"For FY 1991, the operating cost of the Chem Plant is budgeted at more than $150 million. In addition, more than $120 million is budget in FY 1991 for additional construction and capital equipment costs. Hence, for

FY 1991 alone, DOE will likely spend nearly a quarter billion dollars on the Chem Plant. However, these costs do not account for the future waste treatment and disposal costs for the hazardous and radioactive wastes generated and in long-term storage at the Chem Plant. Moreover, the costs of this "temporary" long-term storage of calcined waste at the Chem Plant have increased substantially from 1981 when DOE estimated the costs of the sixth set of storage bins at approximately $14 million to a 1989 estimate for the eighth set of storage bins of more than $30 million." [Ibid.]

"In light of the significant quantities of hazardous and radioactive waste resulting from reprocessing, and the hundreds of millions of dollars that may be spent to renovate the Chem Plant, storage alternatives should be considered for naval reactor and other fuel now scheduled for reprocessing at the Chem Plant. A full and fair analysis of these and other alternatives may very well show that the construction of additional spent fuel pools or a dry cask facility would be far cheaper than renovating and operating the ICPP. Any funds saved could be spent on critical environmental restoration activities at INL and elsewhere. Since there does not appear to be any clear environmental advantage to reprocessing naval fuels compared to direct disposal, DOE should discontinue any Chem Plant operations that cannot be justified for national security purposes." [Werner, NRDC, Testimony, Boise, 1/24/91]

DOE will spend an additional $409 million through 1994 on upgrades to the ICPP just for standby capacity. [DOE 1993 Budget Request] As previously discussed, the $467.7 million ICPP Spent Fuel Program presented to former Idaho Governor Andrus is slated for converting the ICPP into DOE's complex wide incinerator of high-level waste. Since there is actually an increase in waste volume when reactor fuel is processed, the question is raised as to why DOE is proceeding with such a program. One logical scenario is that the ICPP waste program is only a guise for continued nuclear weapon materials production and other military nuclear material needs. A January 17, 1996 State Permit granted to DOE to construct air pollution emitting source describes:

"... the ICPP is a multipurpose, spent fuel recovery facility with the following assigned objectives: The safe and economical receipt, storage and recovery of highly enriched uranium from fuel elements discharged from Naval Nuclear Propulsion Reactors, Research and Test Reactors (foreign and domestic) as well as from other unique fuels that cannot be processed elsewhere. The safe storage and management of the resulting high level radioactive waste". [DEQ]

At a time when Congressional appropriations are being cut on cleanup programs, DOE has developed creative accounting approaches to shifting production projects over to so called "environmental" categories. Another waste issue involves the exhumed waste that will need to be dug up at the old burial sites. These quantities will be considerable. DOE waste management resources must be fully applied to isolating these wastes from the environment. It is not acceptable that environmental restoration activities must be made to compete with newly generated waste from nuclear materials production.

I.E. On-site Waste Hazard

Due to questions about the early certifiably of the Waste Isolation Pilot Project (WIPP) in New Mexico which was to receive 20% of INL stored Transuranic wastes (TRU), [WIPP,1/88] and the Yucca Mt. high-level repository in Nevada, INL continues to be a defacto nuclear dump. Pursuant to the 1995 U.S. Federal Court settlement between Governor Batt and DOE, all of INL's stored TRU waste, but none of the buried is to be shipped to WIPP. One fourth of all military nuclear waste is dumped at INL together with over one thousand metric tons total mass of commercial and military reactor spent fuel. DOE plans to add 15-20,000 metric tons of commercial spent fuel to its Complex wide inventory in the next decade. All the Three Mile Island contaminated Unit 2 reactor components (250,000 pounds) are stored at Test Area North. [Deadly @ 50] Little money has been spent on environmental restoration at the INL site relative to nuclear production spending. Current management practices indicate that adequate cleanup for volumes such as those dumped at INL require a financial commitment many times greater than currently allocated. Former Governor Andrus said; "This society has botched the job of managing by-products of nuclear energy and weapons production. It is our opportunity, perhaps our last opportunity, to make amends for this society's failures and treat with specific management plans the lasting curse of the nuclear age.” [Idaho State Journal 8/27/94]

INL has four areas where high-level reactor spent fuel is stored - Idaho Chemical Processing Plant (ICPP), Test Reactor Area, Test Area North, and Argonne-West. Each area has numerous individual storage facilities. The ICPP contains five facilities for spent fuel storage: the ICPP-603 Underwater Fuel Storage Facility (FSF), the ICPP-603 Irradiated Fuel Storage Facility (IFSF), the ICPP-666 Underwater Fuel Storage Area (FSA), and the ICPP-749 Underground Storage Facility, and the ICPP-603 Fuel Element Cutting facility (FECF). [DOE(a)]

ICPP-603 Underwater Fuel Storage Facility (FSF) has three unlined concrete pools - north, middle, and south basins. The north and middle basins were built in 1951 and the south basin was added in 1959. The FSF is loaded to about 52% capacity, and 23% of the positions are currently considered unusable because of corrosion. Largely because of its age and past operating practices, the FSF has many deficiencies. The spent fuel, aluminum storage structures, and the carbon steel storage yokes and buckets have severely corroded over time. Numerous racking failures have caused fuel to fall to the bottom of the basin. Since the racks provide criticality spacing between fuel, failure of the racks poses significant risk of a criticality incident. The pools are unlined. Radionuclides have diffused into the pools' concrete walls and there is limited capability to monitor the pools for potential leakage. One hundred gallons per day is estimated to be leaking from the pools based on the water volume required to maintain the water levels. [AP(g)] Seismic evaluations have shown that there are weak areas in the storage facility superstructure, resulting in some potential for loss of confinement, release of radioactive materials, and decreased margins for preventing criticality from rack failure. This is due to the unique system of hanging the fuel from an overhead monorail supported by the building superstructure. The basin wall failure and superstructure collapse due to a large seismic event poses a significant risk. Finally, the facility does not have a ventilation system for radionuclide confinement. [DOE(a)] Investigators noted that exposures and releases to the environment occurred during encapsulation of fuel in the CPP-603.

ICPP-603 Irradiated Fuel Storage Facility (IFSF), built in 1974, is composed of shielded dry vaults for storage of graphite fuels. The spent fuel is stored in 636 carbon steel canisters, which are approximately 18 inches in diameter and 11 feet long. Decay heat is removed by a forced-flow ventilation system. DOE's assessment team noted that a potential Category l fire hazard may exist because a few graphite fuel assemblies are stored in cardboard fuel containers inside this facility and the ventilation system for maintaining cooling appears to be unreliable.[DOE(a)] Investigators found that in the event of a large seismic event, the IFSF roof would collapse and there would be control room equipment failure. [SNF Vulnerability] Also see Guide Section I (H).

A WINCO Standing Root Cause Committee Report dated 6/14/93 analyzed the history of safety problems at the ICPP-603 storage facility. This report cites a long history dating back to 1969 and volumes of documents outlining the severity of the corrosion and fuel disintegration problems. Corrective measures were never taken. The report notes:

"The reason given by the supervisors was lack of time, people, and money. They indicated they knew of the problems and would like to have fixed them, but it was a continual battle with management over resources. They could not get the contractor priorities on fuel storage."... "Operating contractor management was asked to provide DOE a plan and schedule to get the fuel out of CP-603. Plans and schedules were transmitted but the operating contractor did not follow the plan for fuel removal.” [SPG-31-93 @ 14] "Even when the operating contractor was able to secure funding, the funds were spent on FDP start-up and other fuel reprocessing facilities, and fuel storage did not receive much priority.” [Ibid.@15] "Some of the work performed at CPP-603 resulted in high radiation exposure and personnel contamination. This violated 'As Low As Reasonably Achievable' (ALAR) considerations and interviews indicated this may also have contributed to the reduction of the work in CPP-603. Between the 1970s and 1988 the worker exposure in CPP-603 had been decreased from an average of 90 mrem per month per individual to 10 mrem." ... "Management always thought that they could move the fuel out of the CPP-603 by processing or moving the fuel before a major problem would occur." "There was a perception among the ICPP management that keeping the Navy happy was their most important mission. The Navy was the main source of operating money, and they could always pull the funding and the mission of the ICPP if management did not continue to accept and process Navy fuel." [SPG-31-93 @ 16-17]

ICPP-749 Underground Storage Facility has 218 underground dry vaults, built between 1971 and 1987.

One hundred twenty-eight of the 218 dry vaults contain fuel from Peach Bottom Core I and the Fermi Blanket stored in aluminum canisters. The carbon steel liners of the 61 first generation vaults have undergone significant corrosion due to seepage of moisture. Fifty-nine of these vaults contain fuel in aluminum canisters. Some of these canisters have been inspected and show moderate corrosion. Gas samples show some canisters may be breached but there is no current indication of failed fuel clad. Water that collects in these vaults may leak to ground. The dry well design offers limited confinement capabilities, since it must be opened during fuel handling and inspection. A significant hazard associated with the first generation wells is the potential for carbide-water reactions. If the fuel is damaged and water is allowed to contact it, the carbide-bearing fuels could react exothermal with water to produce acetylene and oxygen. Acetylene together with oxygen forms an explosive mixture.[DOE(a)] Other 1994 inspections found degraded Peach Bottom fuel and degrading aluminum fuel cans and baskets at ICPP-749. [SNF Vulnerability]

The following table showing spent fuel storage inventories are expressed in metric tons heavy metal (MTHM), which means only the weight of the plutonium, uranium, and thorium in the fuel is noted. This MTHM nomenclature is new (post-1994) to DOE since previous fuel inventories were expressed in total mass (i.e. weight of fuel element fissile material, cladding and end caps). DOE's stated reason for this change in nomenclature is that it more accurately describes the hazardous constituents. Notwithstanding the usefulness of the MTHM number, all parts (i.e.. entire assembly) of the fuel represent a significant hazard, and therefore the total mass number should be predominately used because it more accurately describes the total hazard. Inventories of spent nuclear fuel can be expressed with at least six different nomenclatures. In addition to the previously discussed MTHM and total mass, there is volume, number of storage units, uranium mass, fissile mass. Of the total (1,373 cubic meters) spent nuclear fuel volume held by DOE, INL has 53.5%.
Of the total (78 metric tons) spent nuclear fuel fissile mass held by DOE, INL has 49.9%.[Hoskins 7/11/94]

Early INL Spent Nuclear Fuel Wet Storage Facilities

ICPP	CPP-603 (3 water basins) *	2.900 MTHM
	CPP-666 (6 water basins)	10.800 MTHM
Test Reactor Area	TRA-603 (water canal)	0.257 MTHM
	TRA-660 (water canal)	0.231 MTHM
	TRA-670 (water canal)	0.725 MTHM
Power Burst Facility	PBF-620 (water basin)	0.834 MTHM
Test Area North	TAN-607 (water pit)**	85.200 MTHM
Argonne -West	NRSD (reactor pool)	0.010 MTHM
Naval Reactor Facility	ECF (water basin)	4.100 MTHM
	Totals	105.040 MTHM

Above figures in metric tons heavy metal (MTHM) (plutonium, uranium, and thorium) [Hoskins 7/11/94]
* spent fuel in CPP-603 has been transferred to CPP-666 under court order ** TMI fuel transferred to dry storage under the same court order

Early INL Spent Nuclear Fuel Dry Storage Facilities

ICPP	CPP-603 (IFSF)	10.00 MTHM
	CPP-749 (underground vaults)	78.40 MTHM
Test Area North	TAN-SFCTSP (above ground cask dry pad)	38.40 MTHM

Argonne-West	HFEF (hot cell)	11.90 MTHM
	RSWF (dry pit)	11.30 MTHM
	ZPPR (dry cask storage in concrete)	9.50 MTHM
	TREAT (concrete pits)	0.01 MTHM
	Total Dry Storage	159.51 MTHM
	Total Wet and Dry Storage	264.55 MTHM

1994 figures in metric tons heavy metal (plutonium, uranium, and thorium) [Hoskins 7/11/94]

Test Reactor Area (TRA) has spent fuel largely stored at three locations. These are TRA-603 Materials Test Reactor, TRA-660 Advanced Reactivity Measurement Facility (ARMF), and the Coupled Fast Reactivity Measurement Facility (CFRMF), and the TRA-670 Advanced Test Reactor (ATR).

TRA-603 Materials Test Reactor (MTR) facility design (i.e.., canal cleanup, seismic design, ventilation, leak detection, monitoring, and chemistry control) neither supports nor was intended for long-term fuel storage. Although it is stainless-steel-lined, the canal does not have a leak detection system. There is no programmatic ownership for this facility. In addition, the facility is not adequately funded for upgrades, analysis, and/or documentation update. Minor corrosion of the canisters has occurred. [DOE(a)]

TRA-660 ARMF and the CFRMF reactors, along with the neutron radiography facility, share a single canal. The facility is not designed to support long-term storage. It lacks leak detection and water cleanup systems. Corrosion monitoring is also inadequate at ARMF. Presently, preventive maintenance and surveillance activities by the M&O contractor are being performed with limited overhead funds and staff. Because these facilities have no active programs or funding, the facility has no qualified operating personnel that can manipulate the fuel that is currently in the reactors. For similar reasons, no program office oversight was observed by DOE inspection teams.[DOE(a)]

The Test Reactor Area (TRA) is second to the Navy by INL facility areas in radioactive solid waste disposal relative to curie content. DOE summary data between 1952 and 1991 cite 5 million Ci. of solid waste disposed. [EGG-WM-10903 @6-25] TRA supports the Advanced Test Reactor, Advanced Reactor Critical Facility Reactors, Hot Cell Facility, Nuclear Physics Research Program, Advanced Reactivity Measurement Facility, and Coupled Fast Reactivity Measurement Facility Reactors. TRA also leads the list of INL facilities for radioactive liquid waste discharges (83%). Between 1952 and 1981 TRA released 50,840 Ci. to the soil. This figure does not include "short-lived radioactivity less than 2-3 day half-life. [DOE(a)@ 14]

Test Area North (TAN) has two areas for spent fuel storage: TAN-607 Pool and the TAN-607 Cask Storage Pad. TAN-607 pool and supporting facilities were constructed in the 1950's. "TAN's North Hot Shop storage pool currently contains greater than 7.5 million curies of spent fuel and fuel debris consisting primarily of 342 canisters of core debris from the Three Mile Island reactor accident." [INL DEIS @ OP1-1] The pool is unlined and does not comply with leak detection and control requirements specified for new, stainless steel lined, concrete pools. Investigators found that there was not even a leak trending (tracking amount of additional water required to keep the pool full) of the Storage Pool Water Inventory. The positive pressure ventilation system at this facility is inappropriate for preventing airborne radioactive material release to the environment. Vulnerability was identified with respect to the seismic inadequacy of the pool. Failure of the pool during an earthquake would cause a criticality due to the loss of spacing between the fuels. Investigators also found that corrosion monitoring was inadequate at TAN spent fuel storage units. [SNF Vulnerabilities]

By mass, 75% of all U.S. buried transuranic waste is at INL. [Deadly Defense, p.50] Additionally, the site stores 68% of the retrievable stored waste. [GAO/RCED-91-56] The waste comes from all over the country: Argonne, Betts, Battelle-Columbus, Mound and Rocky Flats. [Deadly Defense, p.50] Waste is also being shipped from commercial reactor facilities such as Peach Bottom Reactor, Fort St. Vrain in Colorado in addition to the Nuclear Navy's reactor spent fuel. INL has 368 separate CERCLA (Superfund) hazardous waste cleanup sites. [DOE/ID/10253(FY91)@ 30] Between 1952 and 1970, 16 billion gallons of radioactive waste water containing 70,000 curies of radioactivity were pumped into the Snake River Aquifer using injection wells. [Deadly Defense, p.51] *Nuclear Legacy* also offers independent summary of INL waste:

"The service wastes are discharged to the water table through [ICPP] a 600-foot deep waste well. These wastes are monitored for radioactivity; when levels become too high, operations are halted until the source of the trouble is located and corrected. There is a discharge limit of three times drinking water tolerance, plus limits of 0.22 beta, except for a limit of 7 curies of iodine-131 per million gallons. Limits are based on known or assumed geo-hydrological conditions and are set to insure dilution and/or decay to drinking water tolerance levels before effluent reaches either the site perimeter or the nearest down stream water well at Central Facilities Area." [IDO-14532,p.13] See Section I(F), Snake River Contamination.

Most of the [solid] wastes at INL were dumped at the RWMC in cardboard boxes [IDO-14532,p.25] and pose such a significant threat to workers during excavation that DOE considers it "impracticable" to clean up. "Burial of high level waste [at INL] continued until 1957 with no upper limit for the level of radiation. Items of up to 12,000 rems per hour were buried [at INL]."[Deadly Defense@50] Standard operating practice throughout INL's history was to cut off the metal ends of all spent nuclear reactor fuel that was shipped to the site or generated at the site. These highly radioactive fuel element parts were then sent to the RWMC for burial as "low-level" waste.

DOE sources cite that ICPP high-level tank wastes can range in concentration between 12,000 Ci/gal or 5 million Ci per batch [IDO-14532 @18&23] to 25,000 Ci/gal. [IDO-14414] One gallon is equal to 3.79 liters. Converting the previous concentrations to metric would be 3,166.22 ci/L and 6,596.3 ci/L respectively. Plutonium concentrations can reach 30 millicurie of alpha activity per liter. [Ibid @ 13] If one were to apply the previous concentrations (3,166.22 & 6,596.3 ci/L) to the 7,582 cubic meters (7,582,000 L) in the waste tanks, the curie content might be in the range of 2.4×10^{10} (24 billion) to 5.0×10^{10} (50 billion) curies at the time of internment in the tank.

DOE's early public documents acknowledge that there are at least 800 pounds of plutonium dispersed throughout the buried waste at the Radioactive Waste Management Complex (RWMC). [DOE\ID-10253(FY91),@33] Other independent analysts cite "nearly 1000 pounds of plutonium, more than 200 tons of uranium, and 90,000 gallons of contaminated organic solvents were dumped into shallow trenches at the RWMC. [Facing Reality @ 6] N.S. Nokkentved cites 431,700 pounds (216 tons) of uranium including 250 pounds of U-235, and 808 pounds of plutonium including 757 pounds of Pu-235, and 33 pounds of americium. [Times News, 7/29/89] More recent DOE revelations acknowledge 3,208 pounds (1,455 kg) of plutonium were dumped at the RWMC or enough for over 70 Nagasaki-type bombs. [ER-BWP-82] The reason for these varying numbers is because plutonium inventories have been secret, and early numbers were based on DOE's misinformation. DOE's 1988 *Environmental Survey Preliminary Summary Report of the Defense Production Facilities* ranks INL first in its critical data category "A", and third in its ranking units of most concern from potential public hazard perspective, after Rocky Flats and Pantex. [DOE/EH-0072,p.ES-2]

I.E.1. Navy Waste Shipments to INL

History of Litigation

Safety concerns over the long-term storage of large volumes of spent reactor fuel at INL have reached a critical mass. Former Governor Andrus justifiably issued a unilateral ban on additional shipments to INL. Idaho's Department of Health and Welfare also filed a suit against DOE on the grounds that the shipments of nuclear waste from Fort St. Vrain into Idaho violated state air quality standards. [ID v. US] Public Service Co. (owner of Ft. St. Vrain) and the US Justice Department (on behalf of DOE) filed counter suits against Andrus. The Shoshone-Bannock Tribes also filed suit against DOE for National Environmental Policy Act (NEPA) violations related to the waste shipments. [SB v DOE] The lower courts found in favor of the Tribes and the State and issued an injunction against DOE on additional waste shipments until a comprehensive Environmental Impact

Statement (EIS) was conducted. DOE appealed this decision, and the Ninth Circuit Court of Appeals vacated the injunction and remanded the case back to the US District Court. On June 28, 1993, after nearly two years of litigation, Judge Harold Ryan issued a summary judgment enjoining DOE from shipping waste to Idaho until a comprehensive EIS is conducted. Judge Ryan stated in his summary that:

"DOE's strenuous opposition, and the tremendous efforts and taxpayer expense associated with such opposition, does not seem an appropriate course for an agency charged with overseeing such important, yet hazardous activities. DOE simply does not seem to understand that this nation is depending on it to protect the health and safety of all Americans from the dangers associated with its activities." [Ryan @ 30] "In light of the fact that DOE wishes to bring in spent fuel from civilian reactors and from foreign reactors, it appears that DOE is quietly attempting to make INL the nuclear waste repository for the US and the rest of the world." [Ibid. @37] "Such callous disregard for the legitimate concerns raised on behalf of the citizens of Idaho is exactly the type of conduct which tarnishes the image of federal government agencies in the eyes of the people." [Ibid. @ 39]

In July 1993 the Navy attempted to gain Congressional exemption to the National Environmental Policy Act (NEPA), and thereby exclusion from the June 28, 1993 court order enjoining waste shipments to INL. The Navy is claiming national security priority and lack of storage facilities at its shipyards for its spent fuel. Proposed amendment to the 1994 Defense Authorization Bill under consideration by the Senate Armed Services Committee would provide a NEPA exemption that would circumvent the court injunction requiring an EIS. Senator Werner and Congressmen Norm Dicks whose districts include the Puget Sound shipyards were the major proponents of this amendment.

On August 9, 1993, then DOE Secretary O'Leary and former Idaho Governor Andrus announced that an agreement had been reached that will permit 19 more shipments of spent fuel to INL over the next two years, with additional shipments if the Secretary of Defense formally certifies that national security requires them. [Andrus(d)] The Navy indicated in a statement that such a certification was likely before 1995 to prevent disruptions in refueling the USS Nimitz, a nuclear-powered aircraft carrier scheduled for refueling in 1996. Prior to the court order barring the spent fuel form being sent to Idaho, the Navy and DOE had anticipated 336 shipments between August 1993 and mid-1995.

Former Governor Andrus accepted the compromise after the DOE agreed to spend more money at INL to upgrade nuclear waste storage facilities and the Navy promised not to seek a congressional exemption from NEPA. Both the DOE and the Navy further pledged not to appeal the June 28 court ruling that instigated the confrontation over the Navy's nuclear waste. Both the DOE and Governor Andrus presented their agreement to Judge Ryan August 26 for his consideration of the proposed amendment to the courts' summary judgment.

According to the August 9 agreement, the other concessions that DOE agreed to include reracking of fuel in existing storage facilities that have experienced extensive corrosion and failure of fuel support racks. Fuel is also to be moved by the end of the decade from the forty-two year old INL ICPP-603 storage facility that is unsafe to the newer ICPP-666 facility. Some fuel in ICPP-603 is apparently in such an advanced state of corrosion that it cannot be moved and represents a significant hazard. The Navy has also committed to conducting Environmental Assessments of its shipyard reactor fuel storage facilities on the Atlantic and Pacific coasts. DOE also agreed to accelerate calcining of 500,000 gallons of non-sodium high-level liquid wastes by 1/1/98, and decide on technology for dealing with 1.5 million gallons of sodium bearing high-level liquid waste by 11/15/93, and accelerate technology development to vitrify the calcine waste.

The Environmental Defense Institute (EDI) filed a motion to intervene in this case August 25, 1993 to apprise the court of the unique nature of Navy spent fuel processing at the Naval Reactors Facility at INL. EDI was very supportive of Governor Andrus in his original position to block the waste shipments. However, the conditions stipulated in the August 9 agreement to allow 19 more shipments contains no provisions prohibiting continued dumping of Navy spent fuel parts at the INL burial grounds. DOE and Andrus filed a Joint Memorandum Opposing EDI's Motion to Intervene. [USA v. Andrus]

The fact that both the Governor and the Justice Department joined forces to prevent the facts about the Navy dumping to be presented before Judge Ryan seems suspect in light of the fact that Andrus litigated this to protect Idaho's citizens. The parties also opposed the Shoshone-Bannock Tribes' request to file an Amicus Brief.

The radioactivity in this Navy waste poses an immediate threat to continued contamination of the Snake River Aquifer that lies below the INL.

Judge Ryan issued his summary judgment September 21, 1992 which contained minor changes to the Andrus, DOE, and Navy agreement. One change included giving the State full veto rights over any additional shipments beyond the 19 shipments stipulated. The Navy appealed Ryan's final Order Modifying Order of June 28, 1993 decision in the Ninth Circuit Court of Appeals on September 24. The concessions that DOE and the Navy had agreed to be required by law anyway however they were overturned by the US Court of Appeals which remanded back to Judge Ryan. Economic threats from the single largest employer in the state of Idaho have clearly influenced the Governor's decision to allow the 19 additional Navy waste shipments. According to Judge Ryan, the immediate threat to Idaho's environmental security far outweighs the unsubstantiated military security issues presented by the Navy. Idaho's then Republican Governor Batt announced that the State will allow the Navy to send 18 additional spent fuel shipments to INL.

Navy Spent Reactor Fuel Operations

The US Nuclear Navy sends all its spent reactor fuel to INL for inspection and processing. As of 1992, the Nuclear Navy has 126 vessels active and 63 in retirement. The 126 active vessels contain 147 reactors. The 63 retired vessels contain 65 reactors. The Navy has produced, over its history, a total of 600 reactor cores for its 189 commissioned vessel fleet. Within the next eight years, the Navy will retire an additional 85 submarines. Counting refueling and retired reactors, INL has received a total of 259 core assemblies. In eight years that number will jump to 359 core assemblies. [Greenpeace©]

The Naval Reactor Facility's (NRF) Expended Core Facility at INL receives the whole reactor fuel assembly module. This facility is being expanded to include a Dry Cell for cutting reactor cores to accommodate the increased volume from refueling and decommissioning. The fuel rods are not easily removed from the rest of the assembly as are most conventional reactor cores. The steel structural core assemblies are designed to withstand combat shocks and maintain fuel rod configuration within the core during combat scenarios.

According to Thereon Bradley, Manager of the NRF, the Expended Core Facility cuts (or in some cases unbolts) the metal ends from the spent fuel elements in order to inspect fuel and cladding integrity and evaluate how the fuel survived service in the reactor. [Bradley'] Other core structural components are also cut off the spent fuel assembly. "All naval fuel modules have non-fuel bearing metal structures above and below the fuel region to facilitate coolant flow and maintain proper spacing within the reactor. These upper and lower non-fuel bearing structures must be removed to permit inspection of the modules. Removal reduces the storage space ultimately required for the fuel by approximately 50%." [DEIS(b) @ B-10] The core assembly components containing the uranium fuel sections are then sent intact to the Idaho Chemical Processing Plant (ICPP) for storage. The remaining reactor fuel element parts and structural components are sent to the INL Radioactive Waste Manage-Management Complex (RWMC) for shallow burial as "low-level" Class A or B waste. Until the mid 1970's this waste was dumped in the center of pits and trenches while less radioactive waste was dumped around it to provide additional shielding. Current practice is to use individual holes or "soil vaults" at the RWMC.

On some select core assemblies, the Navy does a destructive examination in the water pool by cutting up the fuel elements as a more detailed evaluation of the uranium fuel and its cladding. In the past this process of cutting away the structural components was routine when the fuel was being reprocessed at the ICPP and the structural parts had to be separated from the uranium fuel components prior to reprocessing, as was the practice prior to 1990. The ICPP and other spent fuel facilities also routinely cut off metal parts of fuel rods on non-Navy fuel that was slated for reprocessing or storage, and sent these metal components to the RWMC for shallow land burial as "low-level waste." The Navy now acknowledges that "some of the structural material exceeds the 10 CFR 61 Class C concentration limits and is being stored in the water pools. Under the Low-Level Radioactive Waste Policy Amendments Act of 1985 (P.L. 99-240), DOE is responsible for ensuring safe disposal of all Greater than Class C waste in a facility licensed by the Nuclear Regulatory Commission." [DEIS(b) @ B-10] This is a very recent policy shift by the Navy to even consider this waste Greater than Class C. Still, the Navy continues to ship this waste to the RWMC violating its own policy and DOE continues to receive and bury the waste in shallow holes. Extremely limited storage capacity in addition to DOE's inability to account for this waste in storage further challenges the Navy assertions that Greater than Class C waste is going any where but to the burial ground. As recently as 7/12/94 this writer observed a heavily shielded transport canister routinely used by the Navy at the RWMC beside a crane ready to unload.

Since this reactor core waste going to the burial grounds contains long-lived radioactive isotopes due to many years of exposure in the reactor core, it should be classified as high-level waste and treated according to Nuclear Regulatory Commission (NRC) disposal standards. At the very least this waste must be put in NRC Class C, or Greater than Class C waste category. NRC disposal criteria require that "waste that will not decay to levels which present an acceptable hazard to an intruder within 100 years is designated as Class C waste." [10 CFR 61.7] Class C waste, must, for this reason, be disposed at a greater depth than other classes, or, if that is not possible, under an intruder barrier with an effective life of 500 years. "At the end of the 500 year period," according to NRC regulations, "remaining radioactivity will be at a level that does not pose an unacceptable hazard to an intruder or public health and safety." [Ibid.] The adequacy of the NRC regulations is discussed more fully in the NRC Regulation section in this paper. There is considerable debate over NRC's non-enforcement that allows class-C and greater than class-C waste to be dumped in shallow land burial.

DOE data shows that individual NRF waste shipments to the RWMC containing greater than 81,000 curies are not uncommon. It also should be noted that this waste is currently dumped in shallow unlined holes (called "soil vaults") that would not qualify as a municipal garbage landfill, much less a RCRA Subtitle C hazardous waste disposal site, or a NRC high-level or Class C radioactive waste repository. At the RWMC/SDA there are 20 rows of soil vaults with over 1,200 waste holes each containing several drums. More recently, this remote handled highly radioactive greater than Class C waste is dumped in Pit 20 in about 600 concrete lined vaults each containing two drums.

Another category of Navy waste is irradiated test specimens. "The irradiated materials program evaluates small specimens of materials for use in naval reactor systems. The specimens are loaded in sample holders, and the holders are placed in test assemblies at ECF. The assemblies are irradiated at [Advanced Test Reactor] ATR, and returned to ECF for disassembly."... "After completion of the final examination, specimens are shipped to ICPP for storage or to the INL Radioactive Waste Management Complex for disposal." [DEIS(b) @ B-12] Over 4,450 specimen shipments to and from the ECF have occurred to date. [Ibid. @ A-9]

Releasable Radionuclides from Navy Test Specimens

Fission and Corrosion Products		Fission and Corrosion Products	
Nuclide	**Activity (curies)**	**Nuclide**	**Activity (curies)**
Iodine-131	1,300	Eu-156	37.5
Tritium	351	Lu-177	15.9
Iodine-132	310	Eu-152	14.1
Eu-156	37.5	Zr-95	10.7
Eu-152	14.1	Zn-65	10.7
Zr-95	10.9	Co-60	7.68
Zn-65	9.8	Ce-141	6.6
Co-60	7.68	Eu-154	6.15
Eu-154	6.15	Cs-136	4.69
Sc-46	3.25	Sc-46	3.25

Cs-137	1.78	Iodine-131	2.37
Ru-106	0.336		
Nb-95	0.264		
Pr-144	0.219		
Ce-144	0.219		[INL ER/WM DEIS @A-68]

The ECF was built in 1957. It has four separate unlined concrete water pools that contain 3 million gallons of water. The ECF does not meet current spent nuclear fuel (SNF) storage or seismic code requirements. NRF workers claim that 16,000 gallons per day are leaking from the pools. In an attempt to slow these leaks, NRF tried injecting grout around the perimeter of the pools. The grouting caused increased hydrostatic pressure that forced some horizontal leakage into the perimeter access corridor around the pools which then must be pumped out. ECF also a lacks leak detection system. All other fuel storage and processing facilities at the INL with similar characteristics have been designated unsafe and scheduled for closure. Therefore, the Navy's claim " that operation of the INL-ECF does not result in discharges of radioactive liquids" is inaccurate. [DEIS(b) @ 5.2-12] because "three separate milling machines in the water pools are used to separate spent fuel components into smaller sections for examination in the shielded cells" [DEIS(b) @ B-13] suggests that significant contaminates are released to the water in the pools. These processes make the uncontrolled leaks uniquely significant.

The Navy fails to provide seismic analysis documenting that the super structure of the ECF can sustain design basis earthquake and accident scenarios during transfer of fuel using the ECF bridge crane. Water Pits 1,2, and 3 were only constructed to "Zone 2 earthquake requirements which were judged to be appropriate under the USGS's classification of the area at the time [1957] of their construction." Subsequent USGS requirements for INL raised that standard to zone 3.

Flooding accident scenarios postulated in the INL Environmental Restoration/ Waste Management Draft Environmental Impact Statement (ER/WM DEIS) of Macky Dam acknowledges that the dam "was build without seismic design criteria" and "additionally, it is not clear how resistant the dam structure is to seismic events" and the fact that "a fault segment runs within 6 kilometers of the Mackay Dam" [DEIS(b) @ B-17] is more significant than the DEIS allows. Specifically, the 16 hours time delineated for the failed dam flood waters to reach NRF is incredible. Flood waters would move considerably faster than 2 miles per hour. The DEIS inaccurately describes the Borah Peak earthquake as 6.9 when it was actually 7.3 on the Richter scale. This is a significant inaccuracy when DOE analyst Rizzo calculated peak ground acceleration at 0.24. The Special Isotope Separator EIS used a "predicted peak ground accelerations were calculated assuming a 7.25 magnitude earthquake." [SIS EIS] The DEIS does acknowledge that " this beyond design basis earthquake might have a peak ground acceleration of 0.4 g at ECF" which is twice the 0.24 that the facility could sustain. [DEIS(b) @ B-18] Yet the DEIS fails to explicitly acknowledge that there is a significant seismic hazard.

"The [NRF] Expended Core Facility $44 million Dry Cell Project has a dry shielded fuel handling, disassembly, examination and shipping facility, a decontamination shop, and a shielded repair shop. The Dry Cell contains a semi-automated production line to receive and prepare fuel for shipment to the ICPP for chemical dissolution and recovery of unused uranium. The decontamination and repair shop will be integrally connected to the Dry Cell, and to existing water pits, to allow routine servicing of equipment without removing equipment from a shielded environment. A 10,000 foot extension to the existing facility will be used to house necessary control, receiving, storage and training spaces."

"Core examinations and preparations for shipping and dissolution are currently performed in water pits. This method is labor intensive, has notable technical disadvantages, and involves a significant burden of deliberately redundant administrative and physical controls for nuclear safety. The receipt of expended nuclear cores is expected to have increased by 1992. This surge will be compounded because many of these cores will be larger and heavier than those that are currently processed in the water pits. Existing facilities and systems cannot be economically upgraded and automated to meet the projected workload increases. The Dry Cell Project is essential to continued timely handling of expended cores in support of scheduled Naval nuclear-powered vessel refueling and inactivation's." [DOE Fy93]

An unreported nuclear fuel accident occurred at ECF that caused evacuation of the building when a transfer cask was not properly positioned over alignment posts. The bottom door cask had holes in it that are designed to receive the alignment posts on the deck above the water pools so that a tight seal is created when the bottom door opened and the fuel dropped into the water pool. In this accident the posts and holes were not aligned and therefore there was no seal. Workers claim that when the fuel was lowered into the pool, a 25 rad per hour beam escaped between the cask and the pool exposing workers in the area. The alignment occurred on one shift and the fuel transfer to the pool occurred on the next shift. [Allan] This type of accident would not occur at the newer ICPP-666 that is equipped with underwater cask loading and unloading capability as well as fully interconnected pools that keep the fuel below the water surface at all times. Because of severe deterioration of the concrete, leaks in the pool walls, and the gate seal leaks, the ECF pools cannot be isolated.

Navy Waste Characterization

Publicly available summary DOE data recorded between 1952 and 1981 cites the Navy's NRF as dumping 3,195,000 Ci. at the RWMC, making the Navy the second largest curie contributor to INL's dump. [ID-10054-81@15] Yet, DOE's restricted access Radioactive Waste Management Information System Solid Waste Master (RWMIS) Database attributes 187,050,351 curies to Navy's NRF dumping at the RWMC between 1960 and 1981. [RWMIS, P61SH090] Between 1960 and 1989 the Navy dumped 188,140,668 curies at the RWMC. [ibid] This figure makes the Navy the largest curie contributor to INL's dump. DOE recently revised these figures claiming a mistake in data entry more fully described below. DOE now claims that there was an entry error in their database that went undetected for 24 years.

DOE/ID recently provided Environmental Defense Institute (EDI) with a copy of EG&G's Radioactive Waste Management Information System (RWMIS) verification process that was initiated because EDI publicized the data. According to the RWMIS 1/4/88 and 10/24/89 computer runs, there were four waste shipments on 9/15/69 from the Naval Reactors Facility (NRF) to the Radioactive Waste Management Complex (RWMC). The RWMIS lists the times of the four shipments at 820, 830, 840, and 850. The 820 NRF shipment is listed as "metal scrap".

Kliss McNeel, Manager of EG&G's Environmental Technical Support Unit who reported to DOE/ID's Paul Allen (9/7/93) on their verification process of the RWMIS, made a correction to the 9/15/69 shipment number 850 entry that originally contained a 1.8 E+8 (180,000,000) curie entry. [McNeel] The correction included a new curie value of 1.8 E+4 (18,000). EG&G's accompanying explanation includes a copy of the Waste Disposal Request and Authorization form ID 124 that describes the waste as "SCRAP INSERT 176 With Dummy Source and S5W Misc. hardware from disposal effort." This description more accurately describes the 9/15/69 820 shipment listed as "metal scrap" in the 1/4/88 and 10/24/89 database runs. The 820 "metal scrap" waste shipment is missing from EG&G's "corrected" RWMIS 9/24/92 data base run.

Mr. McNeel makes no attempt to account for the deletion of the 820 NRF "metal scrap" shipment to the RWMC. The 850 shipment, which earlier was reported to have a curie content of 1.8 E+8 is described as "011 CORE + LOOP COMP." Clearly, the waste description on form ID 124 does not match the RWMIS 850 waste shipment description. Also, there is no explanation why the curie content on form ID 124 is hand written when the other data fields are type written. Do other shipping manifests for that period also contain hand written entries for curie content? Even if one accepts this change in the data, this still shows the Navy dumped nearly three times (8.14 million) more curies than publicly acknowledged total of 3.1 million curies.

The Navy's reactor core wastes that have been buried at the RWMC must be exhumed at considerable expense and hazard to workers. The core assemblies are extremely radioactive and require remote handling. Individual NRF shipments to the RWMC of 81,000 curies attest to this hazard. Furthermore, the cores are not packaged in any radiation containment unit. NRF officials only acknowledge that the waste is shipped in a canister from the NRF, and the shipping canister is returned to the facility.

Until the mid 1970's the Navy dumped fuel element parts and specimens into the RWMC pits and trenches. Since then, the Navy continues to dump reactor core assemblies at the RWMC in "soil vaults", which are defined as shallow (2 to 6 feet diameter) holes in the ground where the waste is dropped in and covered with 3 feet of soil. As of 1979, there are 1,150 "soil vaults" in 20 separate rows. Currently the RWMC is undergoing environmental restoration under the CERCLA Superfund cleanup process. Remediation projects have begun, starting with Pit 9. Even the most pedestrian of observers can see how ludicrous cleanup activities are when dumping continues in the immediate vicinity creating new Superfund cleanup actions. The Environmental Protection Agency is responsible in that the agency has been unwilling to promulgate radioactive exposure and waste disposal standards - mainly due to inter-agency disputes among DOE, NRC, and EPA. Previous attempts (1987) by EPA to establish standards were struck down by the courts as not protective of human health. It is outrageous that simultaneously the INL burial grounds are undergoing Superfund cleanup of radioactive wastes that are contaminating the aquifer below, and in the immediate vicinity, the Navy continues to bury highly radioactive waste that will be the object of future cleanup activities.

The unique nature of the Navy spent fuel assemblies and the Naval Reactor Facility's processing/ inspection operations is secret. The highly enriched Navy waste poses a significantly greater environmental threat than other conventional low-enriched reactor fuel that goes directly into storage cooling ponds. Additionally, the Navy waste going to the RWMC must be classified as high-level waste and/or Class C waste by virtue of the fact that it contains reactor core assembly sections contaminated with long-lived radionuclides. The extremely high curie content of these waste shipments attests to this fact. Institute for Energy and Environmental Research's book *High-Level Dollars, Low-Level Sense* challenges the NRC radioactive waste disposal standards:

"In examining the NRC regulations, one is thus led to believe that the class limits [Class A, B, C, and greater than C] were derived from the requirements imposed by these hazard definitions and time frames. However, even according to NRC's own definitions of what is 'hazardous' and what is 'acceptable' the time frames of 100 years [Class A] and 500 years [Class C] are logically incompatible with the class limit definitions, raising serious questions about their environmental and public health adequacy." ... "For example, much of the '100 year' waste (Classes A & B), for example, will not decay to NRC-defined 'acceptable' levels in 100 years. Consider nickel-63. Buried at Class B concentrations levels of just under 70 curies per cubic meter, waste containing nickel-63 would still have concentrations of about 35 curies per cubic meter after the institutional control period of 100 years had elapsed. According to NRC regulations, at this point the waste should have decayed to the point where it 'will present an acceptable hazard to an intruder.' Yet, at 35 curies per cubic meter, the waste, if retrieved from the disposal site and re-buried, would still be classified as Class B waste since it has concentrations levels which are 10 times higher than the Class A limits. As a matter of fact, this waste would take a total of well over 400 years to decay just to the Class A upper limits (at which point the NRC regulations would still define it as hazardous for another 100 years if it were being buried for the first time)." [IEER© @ 74&75]

"This analysis makes an even stronger case against the NRC regulations when applied to the Class C limits, which pertain to 'long-lived radionuclides'. Class C waste contaminated with technetium-99, however, buried at concentrations of just under the Class C limit of 3 curies per cubic meter, will be hazardous according to NRC definitions for far longer than 500 years. It will take such waste over the three half-lives - some 640,000 years - just to decay to the upper boundary of Class A levels. The illogical nature of the above regulatory approach is made even more explicit in the NRC's discussion of the 'long-lived' radionuclides in the waste. According to the NRC, in managing low-level waste, 'consideration must be given to the concentration of long-lived radionuclides ... whose potential hazard will persist long after such precautions as institutional controls, improved waste form, and deeper disposal have ceased to be effective. These precautions delay the time when long-lived radionuclides could cause exposures'". [IEER(c)]

"In essence, there is an admission that the hazard due to long-lived radionuclides 'will persist long after' the controls imposed by the regulations fade away. This is an extraordinary admission of the regulations fundamental inadequacy right in the text of the regulation. The only thing the NRC regulations will apparently do with respect to the long-lived components of low-level waste, is push the hazard into the future, since NRC-mandated controls will, at most, only 'delay the time when long-lived radionuclides could cause exposure'. In the case of many long-lived radionuclides, they will continue to be present in almost exactly the same concentrations when institutional controls have lapsed as when they were first buried." [IEER(c)]

The Nuclear Regulatory Commission (NRC) requires in classifying a specific waste shipment that the part of that volume that contains 90% of the radioactivity be separated and used to determine the concentration and thereby the waste classification. The Navy and DOE continue to use the entire volume of the shipment to calculate the average concentration. The result is that the radioactive concentration appears low because of dilution. The NRC's Staff Technical Position specifically prohibits this practice of factoring in other material as a means of dropping the average concentration. The Navy is also using total volume averaging to avoid NRC regulations in burial of reactor shells at the DOE Hanford site. An EG&G groundwater sampling report found radioactive contaminates at the 600 foot level under the INL burial grounds. (See RWMC section IV[D]).

Summary of Nuclear Navy Waste
Dumped at INL's RWMC Burial Ground

Year Dumped		Curie Content of Waste *
1960		1,364
1961		6,717
1962#		20,900
1963		34,933
1964 Navy Knolls Lab. Reactor	Core + Loop Comp.	6,400
1964		24,050
1965		517,571
1966		787,300
1967		801,100
1968#		198,600
1969#		644,000
1970		3,572,048
1971		54,669
1972		10,577
1973		9,411
1974		5,782
1975		4,911
1976		73,348
1977		144,758
1978		34,962
1979		109,171
1980		39,206
1981		19,219
1982		8,401
1983		39,035
1983 NRF S1G Reactor Vessel		5,579
1984		372,614
1985		141,748

1986	35,928
1987	29,664
1988	6,722
1989 #	126,400
1990 #	74,120
1991 #	102,600
1992 #	49,300
1993 #	27,560
Total 1960 through First Quarter 1993	8,140,668

Source for above table:
[Radioactive Waste Management Information System Master Database, P61SH090, 10/24/89]; [#][Senate Armed Services Committee, Subcommittee on Nuclear Deterrence, Arms Control and Defense Intelligence, Hearing on: shipment of Spent Nuclear Fuel, 28 July 1993, Questions and Answers for the Record, @ 25]

* Curie content of shipments less than 1 curie were not added to the above summary table, therefore, the totals are understated. Also **not included** are Navy contractors, General Dynamics' (Electric Boat Div. and General Atomics Div.) seven shipments of "irradiated fuel" to the RWMC; and General Electric's eleven shipments of "irradiated fuel" and ten reactor "core + loop" assemblies; and Office of Isotopes Specialists' one shipment of "irradiated fuel" to RWMC. DOE and Navy officials publicly deny that spent fuel was dumped at the INL burial ground (RWMC) in direct contradiction to their own data base entries. (See Spent Nuclear Fuel Dumped in Burial Ground that shows 90.282 metric tons of irradiated fuel dumped in RWMC)

Navy Waste Characterization
Partial listing of isotopes found in Navy waste dumped at INL

Isotope	Symbol	Half-Life in days	Half-Life in Years
Americium-241	Am-241	1.7 E+5	465.7
Antimony-125	Sb-125	877	2.4
Barium-133	Ba-133	12	
Cerium-144	Ce-144	290	
Cobalt-58	Co-58	72	
Cobalt-60	Co-60	1,900	5.2
Chromium-51	Cr-51	27	
Cesium-134	Cs-134	840	2.06
Cesium-137	Cs-137	1.10 E+9 [1.1 billion]	30.17
Europium-154	Eu-154	5,800	15.89
Hafnium-181	Hf-181	46	
Iron-55	Fe-55	110	
Iron-59	Fe-59	45	
Iridium-192	Ir-192	74	
Lead-210	Pb-210	7,100	19.4
Manganese-54	Mn-54	300	
Neptunium-237	Np-237	8.0 E+8	2,191,780
Nickel-59	Ni-59	2.9 E+7	79,452
Nickel-63	Ni-63	2.9 E+4	79.4

Niobium-95	Nb-95	35	
Potassium-40	K-40	.50	
Plutonium-238	Pu-238	3.3 E+4	87.7
Plutonium-239	Pu-239	8.9 E+6	24,131
Plutonium-240	Pu-240	2.4 E+6	6,575
Plutonium-241	Pu-241	4.8 E+3	14.35
Plutonium-242	Pu-242	1.4 E+8	383,561
Promethium-147	Pm-147	920	2.5
Radium-226	Ra-226	5.9 E+5	1,616
Ruthenium-106	Ru-106	365	
Silver-110M	Ag-110M	270	
Sodium-22	Na-22	950	2.6
Strontium-89	Sr-89	50	
Strontium-90	Sr-90	10,512	28.8
Technetium-99	Tc-99	7.7 E+7	210,958
Thorium-232	Th-232	5.1 E+12	13,972,600,000
Tin-119	Sn-119	112	
Uranium-233	U-233	5.9 E+7	161,643
Uranium-234	U-234	9.1 E+7	249,315
Uranium-235	U-235	2.6 E+11	712,328,767
Uranium-236	U-236	8.7 E+9	23,835,616
Uranium-238	U-238	1.6 E+12*	4,383,561,644
Zirconium-95	Zr-95	63	

Source; USDOE, Radioactive Waste Management Information System Master Solid Database, 10/24/89;
* Scientific notation; 1.6 E+ 12 = 1,600,000,000,000

The above table shows clearly how Navy waste dumped in the burial grounds contains Transuranic. One of the reasons for this is the lack of precision in cutting off the structural parts of the fuel element in preparation for reprocessing or storage. Destructive tests of fuel assemblies additionally add to the fissile content of the waste stream. In recent DOE documents characterizing the waste streams going to the RWMC they acknowledge presence of, “Irradiated fuel element end boxes that were cut off of the fuel plates in the hot cells. The end boxes may contain some fuel, but generally only activation products”. [EGG-WM-10903 @ 2-30] Independent characterization of this waste must be made before more is dumped at the RWMC.

The Environmental Protection Agency (EPA) found that INL violates the Resource Conservation and Recovery Act and "That the presence and/or release and potential release of hazardous waste from USDOE's facility may present a substantial hazard to human health and/or the environment ..." [EPA(a),9/15/87] Substantive corrective action has yet to occur because EPA does not have the authority to shut down any INL facility. Consequently violations are interpreted as a peer review without being binding according to a 1989 Government Accounting Office report. [GAO/RCED-89-13, p.3] EPA's 1993 Oversight budget had been cut by one percent by the Bush Administration at a time when its oversight obligations were the greatest at DOE cleanup sites. President Clinton further cut EPA's radiation standards and Federal Facility Enforcement Office , and Congress cut EPA’s 1996 budget by yet another one-third. EPA funding remains flat after the 1996 cuts. Clearly, EPA's regulatory authority will be forced to continue to rubber stamp whatever DOE wants.

The following summary of wastes at INL generated by the state INL Oversight Program is offered here to demonstrate that there is a range of volumes between different analysts and different information sources.

Idaho's INL Oversight Program 1991 Summary of INL Wastes

Waste Type	**Volume**
Buried Transuranic	56,630 cubic meters
Buried Low-Level	207,550 cubic meters
Stored Transuranic - Contact handled	64,750 cubic meters
Stored Transuranic - remote handled	77 cubic meters
Stored High-Level Liquid	7,582 cubic meters
Stored High-Level Calcine	3,600 cubic meters
Spent Fuel	660 metric tons
Hazardous Mixed Radioactive / Chemical	224,694,168 pounds

[IDHW INL Oversight Program, "Wastes at the INL"]

Considerable variation in the volume of buried transuranic (TRU) waste (and other waste types) exists between different source documents. For instance, INL contractor EG&G 1978 TRU management report acknowledges 65,136 cubic meters of buried TRU in the Subsurface Disposal Area (SDA). [Tree-1321] This EG&G report was the final report on the Early Waste Retrieval Project at the SDA; so the waste removed (4,397 cm) would have been factored into the buried TRU volume. DOE's 1996 Integrated Data Base acknowledges only 57,100 cubic meters of buried TRU at the SDA. In a January 1998 summary for the Idaho Forum on Remediation of Pits and Trenches presented by DOE's Kathleen Hain, Manager of their Environmental Restoration Program, puts the TRU volume at 78,000 cubic yards (59660 cm).

This discrepancy in volumes is not an academic issue when the hazards related to this waste are understood. The Waste Retrieval Project report notes: "Of the retrieved drums, 70% from Pit-2 and Trench 10 and all from Trench-8 were severely breached. Free liquid leaked from about 9% of the drums and 5% had external contamination, and alpha-contamination levels greater than 2×10^6 (2 million) counts per minute were frequently encountered."These container breaches resulted in: "Alpha contaminated soil measured with activity levels up to 1×10^6 (one million) counts per minute. Samples of alpha contaminated soil that were analyzed showed the plutonium content to be greater than 10 nano curies per gram." [Tree-1265@ii and 20] The volume of contaminated soil estimated at 275,763 cubic meters must be included in the cleanup projects because of the contaminate migration risk. Unfortunately, DOE wants to ignore the contaminated soil. See Guide section on INL Cleanup Plans for the Radioactive Waste Management Complex for more discussion on the waste migration problems of the SDA.

Spent fuel rods from over 40 reactors around the US and the world are being stored at various sites around INL. Current inventory is 1,225 metric tons total mass. [A.Hoskins, WINCO, 7/11/94] DOE plans on considerable expansion (15-20,000 metric tons) of its spent fuel processing and storage. This Plan is called "Directed Monitored Retrievable Storage", which is the product of nuclear electric utilities forcing the government to take possession of spent fuel. Since a high-level waste repository has yet to be built, the utilities do not want to store the spent fuel on their sites.

Spent Reactor Fuel Dumped at INL's RWMC
Burial Grounds 1952 to 1980 [RWMIS]

INL Generator	Mass in grams
Argonne National Laboratory-West	2,177,150
Idaho Chemical Processing Plant	
Naval Reactor Facility	27,707,700
Special Power Excursion Reactor Test	14,517
Test Area North	16,433193
Test Reactor Area	273,866
Other Generators	
General Dynamics, General Atomics Div. San Diego, CA	22,861,440
General Electric, Vallecitos Atomic Lab. Pleasenton, CA	11,568,800
Total Mass in Grams	90,282,972
Total Mass in Metric Tons	90.282

The above preliminary numbers, compiled by the Environmental Defense Institute, are drawn from DOE's Radioactive Waste Management Information System Database (P61SH090, and P61SH070, Run Date 10/24/89) and represent about 57 shipments specifically identified as "irradiated fuel". Not included in the above listing are even more numerous shipments called "unirradiated fuel", "fuel rods", "control rods", and other reactor fuel not identified specifically as "irradiated". The curie content of these shipments identified as "fuel rods" (>7,000 curies) suggests that they are also irradiated reactor fuel. The above listing also does not include 7 shipments of "irradiated fuel" during the same period to the RWMC Transuranic Storage Area amounting to 621.549 kilograms, and which also were not included in the Spent Nuclear Fuel EIS.

Equally significant are spent nuclear fuel related waste shipments to the RWMC burial grounds. This waste includes spent nuclear fuel parts cut off the fuel elements prior to storage and fuel storage "canal trash" that represents over **9,866,112 curies.** The burial grounds are a shallow disposal area that would not meet municipal garbage landfill regulations.

Summary of Radioactive Waste at INL

Released Waste Type	Volume	Activity (curies)
Solid Low-Level	148,990 cubic meters [D]	11,501,706 [E]
Solid Transuranic	57,100 cubic meters [D]	249,000 [D]
Solid Navy LLW/GTCC	65,000 cubic meters [G]	8,140,668 [H]
Solid Plutonium	1,455 kilograms [I]	493,600 [I]
Spent Nuclear Fuel	90.282 metric tons [H]	?
Contaminated Soil	690,000 cubic meters [D]	?
Liquid	63,870,000 cubic meters [A]	64,092 [A,B,F]
Airborne	112 E+9 cubic meters [A]	18,564,868 [C ,J]

Stored Waste Type	Volume	Curies
Low-Level	14,080 cubic meters [D]	1,222,662 [D]
Mixed Low-Level	25,879 cubic meters [D]	?
Solid Transuranic	64,880 cubic meters [D]	372,490 [D]
Solid HLW @ ANL-W	81 cubic meters [A]	9,823,000 [A]
Solid Plutonium	6 metric tons [K]	?
Uranium (highly enriched)	23.4 metric tons [K]	?
Spent Fuel (total mass)	1,458 metric tons [D]	6,530,000,000 [D]*
Solid Calcine High-Level	3,800 cubic meters [D]	49,600,000 [D]
Liquid High-Level	7,200 cubic meters [D]	2,000,000 [D]

Sources: [A] IDO-10054-81; [B] DOE/ID-10087-87; [C] DOE/ID-12119; [D] DOE/RW-0006.Rev.7; [E] DOE/RW-0006.Rev.7; [F] DOE-ID-10087-85; [G] GAO 7/92; [H] RWMIS; [I] EGG-WM-10903; [J] ERDA-1536; [K] DOE-2/6/96; [L] DOE/EH-0525. Mixed= Mixed Radioactive and Hazardous RCRA listed Waste; GTCC = Greater than Class C. [D*] at page 257 the spent nuclear fuel activity range is between one and twenty million curies per cubic meter so the author chose an average of 10 million curies per cubic meter and on page 41 the spent fuel inventory is 653 cubic meters.

I.E. 3. ICPP High-Level Waste Tank Farm

The reprocessing of reactor fuel involves dissolving the metal rods in acid and solvent solutions from which select radioactive isotopes are extracted. The remaining highly radioactive and toxic liquid waste (raffinate) is then stored in underground tanks. This raffinate can range in concentration between several to12,000 Ci/gal or 5 million Ci per batch. [IDO-14532 @18&24] Radioactive decay of the short-lived isotopes reduces the total activity levels over time. DOE's 1997 *Linking Legacies* credits INL's high-level liquid waste at 300 curies per cubic meter, or 2,430,000 curies in 8,100 cm of waste.[DOE/EM-0319@38] Plutonium concentrations of wastes discharged to the tanks can reach 30 millicurie of alpha activity/liter.[IDO-14532 @ 13]

Current ICPP-601 spent fuel raffinate waste goes to the tank farm for temporary storage before being sent to the ICPP New Waste Calcine Facility incinerator. Earlier raffinate from the 1950's that contains sodium is still in the underground storage tanks because of incompatibility with the Calciner. The ICPP underground tank farm has eleven 300,000 gal.(1100 cm) tanks, eight of which have cooling lines; four 30,000 gallon (113 cm) tanks. Three additional 18,000 gal.(70 cm) tanks are located in the Waste Treatment Building (CPP-604). [ICPP RI/FS] Coolant is required because the highly radioactive waste also generates considerable thermal heat that must be cooled. The rate of decay heat in a tank is 373,000 btu per hour. [IDO-14502 @9] Other documents quantify decay heat generation at 100 watts/cubic meter. [DOE-EA-0831] "The [1100 cm] tanks are, however, slightly over stressed in compressive bending, according to criteria of the [American Society Mechanical Engineers] ASME Code, Section VIII, Division 2 regarding buckling." [RE-A-80-102 @ 7] This assessment did not allow for a full tank, or corrosion which has occurred in the tanks, some of which are 38 years old. [ENICO-1131@13] Also see Earthquake Section.

Corrosion resulting from the highly toxic acids, solvents, and radiation has been documented as high as 1.0 mil.[ENICO-1131 @ 15] This represents a reduction of the original steel in addition to the more vulnerable welds at the seams. The welds were a large concern, after testing showed high corrosion rates at the welds.

"Three welds were cut from welded coupons which were prepared at the fabrication site using the process that was used to fabricate the tanks. In the as-welded condition, these specimens suffered high corrosion rates at the end of the third cycle; and average corrosion rate of 0.0211 inches per month being observed."... "The corrosion resistance of these welds was revealed by Heuy test rates indicates extremely poor resistance. Further, these tests indicate that the actual tank welds are susceptible to intergranular attack."... "In order to prolong the life of the tanks, type 316 ELC stainless steel plates were welded over the inside surface of the original welds by the fabricator. The cover plate dimensions were 4 inch wide strips cut from 1/4 inch sheet." ... "Huey tests were conducted on five metal-arc process fillet deposits cut with a grinding disk from the cover plate edges." "... specimens Y-80 and Y-83 exceeded (0.0096 & 0.0087) the rate of 0.003 inches per month average of five 48 hour periods which is the specification allowance." [IDO 14364 @ 49]

The tanks "largest compressive stress is the longitudinal stress in element 1 and has a value of 2163 psi. The ASME Code, Section VIII, Division 2, however, allows a compressive stress of only 2117 psi (for 347 and 304L [steel]) because of potential for buckling. This suggests that the tank is slightly over stressed." [Additionally, the tanks will only sustain an earthquake] "with a ground acceleration slightly less than 0.24 g, providing that no corrosion is assumed." [RE-A-80-102 @ 6] Connecting systems to the tanks can only sustain a 0.18 g ground acceleration. [DOE/EA-0831] A 1977 INL Environmental Impact Statement used the May 18, 1940 El Centro, CA earthquake to evaluate the ICPP's waste tanks. "Even when subjected to the 1940 El Centro earthquake record scaled to a peak ground acceleration of 0.5 g, the waste tanks were stressed only to 21,300 psi." [ERDA-1536@II-77] The unscaled 1940 El Centro earthquake record would generate a peak ground acceleration of 0.33 g. "This latter acceleration, 0.33 corresponds to the acceleration expected at the ICPP from a hypothetical earthquake of Richter magnitude 7-3/4 on the Arco fault at a point 15 miles from ICPP." [Ibid.]

Comparing the previous engineered stress analysis of the tanks (without the corrosion factor) to sustain less than 0.24 g with even the unscaled hypothetical earthquake of 0.33 g reveals a striking 38% over stressed tank scenario. The 1983 Borah Peak quake's epicenter, only 40 miles northwest of Arco, registered 7.3 on the Richter scale. The 1959 and 1975 Yellowstone quakes registered 7.5 and 6.1 respectively on the Richter scale. The combined risk of old over stressed and corroded tanks with earthquake hazard is significant. Moreover, DOE has negotiated a sweetheart Consent Order with the State to replace the tanks in the next 20 years. The design life of the tanks is 20 years. They have already been in use for nearly 40 years. When DOE complies with the Consent Order, they will be 60 years old, assuming they have not ruptured in the meantime. Should such an accident occur, it would be a catastrophic disaster with extensive impacts on the entire northwest because the Snake River is a tributary of the Columbia River.

The State of Idaho commissioned a limited study by Boise State University seismologist James Zollweg who found that "if a large earthquake struck, the biggest worry would be those tanks". Zallweg's assessment was endorsed by U.S. Geological Survey's Larry Mann who said, "that would be a catastrophic release. It couldn't be intercepted before reaching the aquifer". Zollweg calculated that, "if an earthquake of 7 on the Richter scale hit the fault closest to the tanks, a ground acceleration of about 0.24 G could hit the vaults". [Statesmen (b)] A catastrophic risk exists with these forty-year-old tanks which DOE refuses to address. The tanks are 400 feet above the Snake River Plain Aquifer that provides drinking water for over 275,000 Idahoans. Scientists also believe that if the tanks fail, then the acids in the tanks will react with the concrete in the vaults and release large amounts of radioactive gases into the atmosphere.

DOE contends that a spare tank is available in the event a problem arises; waste can be transferred to the spare tank. This contingency relies heavily on there being not more than one tank failure, that the service lines needed to pump out the failed tank remain intact, that the pump capacity is sufficient to remove the waste in minutes, and that operators can respond quickly in a multiple event accident scenario. DOE's 1993 assessment shows that the tank service lines could not survive greater than 0.18 g and the pumps to transfer the waste to another tank can only deliver 50 gallons/minute. [DOE/EA-0831] That means it would take 100 hours to transfer 300,000 gallons assuming the transfer lines survive. This does not qualify as a credible rapid emergency response to prevent tank contents from leaking into the ground..

Of particular concern is the long-term reliability of tanks WM-185, 187, and 188, whose corrosion rate is "definitely increasing". [ENICO-1131 @ 19] The 9,000 feet of underground piping used in transfer of radioactive waste does not meet RCRA standards for continuous secondary containment. Some lines are encased in concrete. "The concrete encasement is found in the immediate vicinity of valve boxes and around about 5% of the underground piping." [Ibid. @ 2] According to the General Accounting Office these underground pipes have leaked substantial quantities of high-level waste to the ground. [GAO/RCED/91-56] Also in March 1962, two tanks discharged to their vaults due to poorly designed service lines. Twelve INL tank or waste line leaks are documented through 1976. [ERDA-1536@II-79] DOE is currently replacing some of these service lines.

The tanks also do not meet Resource Conservation Recovery Act (RCRA) requirements for secondary containment of hazardous wastes. "A Notice of Noncompliance was issued on January 29, 1990 by the EPA because the secondary containment (concrete vaults) is subject to attack by the acidic solutions stored in the tanks", and "the pillar and panel construction style of the vaults has insufficient seismic resistance." [Spent Fuel Plan @ 8&11] Indeed, the 30,000 gal. tanks do not even have any vaults or secondary containment. In 1995, these unvaulted tanks were emptied and taken out of service.

The vaulted tanks also support 10 feet of earth plus a 12,000 pound concrete structure for radiation shielding of the vent pipes. That puts the bottom of the tank over 32 feet in the ground generating considerable earth loads. In an earthquake scenario, a collapsing vault would compound the stresses on the weak tanks and add to the likelihood of a total tank failure. The integrity of the vaults and their ability to hold the tank contents if it ruptured are further challenged because five of the 11 (300,000 gal.) tanks get water "in-leakage" that must be periodically pumped out. [ERDA-1536@II-79]

The State Oversight Program recently disclosed that an average of more than 2,400 gallons per month was pumped from the concrete vaults enclosing the high-level waste tanks. This compares to a maximum of 100 gallons per year that normally would be expected to seep into the tank vaults. [Oversight 92 @ 17] Another uncertainty is how much of the 2,400 gallons pumped out of the vaults is tank leakage and how much is ground/surface water migration into the vaults.

"Major discrepancies were discovered between recorded volumes of water pumped from the aquifer for [ICPP] production use when compared with water used and disposed or lost from February 1990 to December 1990. Approximately 20 million gallons were unaccounted for in June 1990 alone."..."Since 1988, water level in a perched body of water approximately 370 feet below the tank farm rose nearly six feet. Measurements were taken in a well about 500 feet southwest of the tank farm." [Oversight 92 @ ERDA documents show a long history of tritium plume migration under the ICPP. In 1960 the plume registered 1,000,000 pCi/L and was expected to migrate 12 miles south of the boundary. [ERDA@III-69] Significant spills and leaks have frequently occurred over INL's history. "Most spills have been the result of line and tank failures, leaking valves, and equipment and tank overfilling. [Spill and/or leak] volumes range up to 45,000 gal.." [DOE/EH/OEV-22-P,p.3-166] DOE sources cite that high-level tank wastes can range in concentration between 12,000 Ci/gal or 5 million Ci per batch [IDO-14532 @18&23] to 25,000 Ci/gal. [IDO-14414] One gallon is equal to 3.79 liters. Converting the previous concentrations to metric would be 3,166.22 Ci/L and 6,596.3 Ci/L respectively. Plutonium concentrations can reach 30 millicurie of alpha activity per liter. [Ibid @ 13] There is no doubt that these figures characterize an extremely radioactive witch's brew which when released to the environment via leaks represents a significant hazard. Also see Section IV(H) for more discussion of groundwater contamination under the ICPP.

ICPP Tank Farm High-Level Sodium Bearing Liquid Waste [Spent Fuel Plan][BEMR(c)]

Tank Number	Size cubic meters	Vault Structure	Volume cm	Volume Gallons
WM-180	1100	Monolithic	1060	279,683
WM-181	1100	Monolithic	1060	279,683
WM-182	1100	Segmented	1060	279,683
WM-183	1100	Segmented	1060	279,683
WM-184	1100	Segmented	540	142,480
WM-185	1100	Segmented	1060	279,683
WM-186	1100	Segmented	1060	279,683
Totals			6900*	1,820,578

High-Level Non-Sodium Bearing Liquid Waste

Tank Number	Size cubic meters	Vault Structure	Volume cm	Volume gallons
WM-187	1100	Monolithic	230	60,686
WM-188	1100	Monolithic	300	79,155
WM-189	1100	Monolithic	670	124,010
WM-190	1100	Monolithic	Spare	0
WM-100	113	Pad No Vault	0	0
WM-101	113	Pad No Vault	0	0
WM-102	113	Pad No Vault	0	0
WM-103	113	Pad No Vault	0	0
Non-Sodium	Totals		1000*	263,851
Sodium plus	Non-Sodium	Totals	7900*	2,139,858

[BEMR @26] * By January 1998 the non-sodium liquid portion is to be calcined and the sodium bearing waste is to be reduced by 330,000 gallons (1250 cm) to comply with a court order. However, as of this writing the total volume is ~ 900,000 gallons.

The residuals from the incineration of the high-level liquid waste in the New Waste Calcine Facility (NWCF) are combined with a calcine material and stored in huge underground silos which must be mechanically cooled because of the heat generated by the radiation. Between 1992 and when the first Calciner (WCF) was built at the ICPP in 1962, more than 7.5 million gallons of high-level liquid waste have been incinerated in the Calciner. The 7.5 million gallons (28,000 cm) calcined plus 2.1 million gallons (8,100 cm) in the tanks makes a total of 9.6 million gallons (36,100 cm) of high-level liquid waste generated. The calcine volumes include 3 campaigns of the NWCF. 1993 calcine volumes in 5 silos are 123,000 cubic feet (3500 cm). Two additional silos are ready for additional calcine campaigns. [Spent Fuel Plan @ 49] As of 1995, the calcine volume is 3,700 cm.[BEMR© @26] Calcine entering the silos is over 200 degrees generated from the radioactive decay heat of the waste, and thus requires continuous cooling.

Due to process restrictions in the calcine process, only acid based high-level liquid (raffinate) waste from reactor fuel reprocessing is incinerated. Earlier high-level liquid sodium-bearing raffinate waste and system decontamination solutions are chemically not readily compatible for the Calciner without dilution. The sodium raffinate must be either blended with non-sodium raffinate or mixed with large quantities of aluminum nitrate nanohydrate before it can be calcined. In order to calcine the existing 1.8 million gallons of sodium-bearing high-level waste, the Department estimates it will have to dilute it with about 5.4 million gallons of aluminum nitrate. The Calcine plant can process about 3,000 gallons per day. [Times News(g) 7/27/92] Therefore, this waste has remained in the holding tanks since the ICPP first started operations in 1952. DOE, in a particularly misguided attempt to write off high-level liquid waste volumes, now states that: "... sodium-bearing waste, which has been primarily generated from decontamination chemicals used to clean tank farm piping, is not legally considered to be HLW, so it will be considered separately." [EMSSAB @ 7][BEMR© @26] Review of the ICPP early reactor fuel reprocessing, "... involved dissolution of [Materials Test Reactor] MTR assemblies in a sodium hydroxide-sodium nitrate solution, leaving a precipitate of sodium diuranate [sic] and fission products." [IDO-14445 @ 14][IDO-14300@5][IDO-14307@8][IDO-14362@5][IDO-14295@27][IDO-14567@4&15] These Phillips Petroleum Co. (ICPP operating contractor) documents show without a doubt that ICPP sodium-bearing waste in the Tank Farm includes appropriately designated high-level waste from reprocessing reactor fuel and any recent attempt by DOE to delist this waste as "not high-level waste," is illegal. The nine year RaLa program (1954-1963) focused on the recovery of Barium-140 from reactor fuel, and required different chemical processes from highly enriched uranium reprocessing programs. Some RaLa runs involved four cycles. The first two cycles were for Barium-140 extraction and the third and fourth were for uranium extraction. Even more outrageous is the fact that State and EPA, as regulators, are willing to go along with DOE on this delisting initiative.

"In order to cut costs in the early years of the Cold War, the US Government built carbon steel tanks for the wastes, which were first made alkaline by adding sodium hydroxide. This has had a number of consequences. First of all, as soon as a solution is no longer acidic, many of the substances which were dissolved in the acid precipitate out (settle to the bottom) as sludge. Thus, instead of a well-mixed liquid, the waste becomes a combination of liquid and sludge, this can lead to uneven distribution of materials, resulting in hot spots (if radioactive materials build up in one area) and introducing the risk of criticality (if plutonium materials build up in one area). It also makes it more difficult to determine the actual contents of the tanks, because samples are less representative of the whole than in the case of an evenly mixed liquid solution. Also, ... alkaline wastes are more difficult to solidify into glass than are acidic wastes. Acidic wastes tend to pose fewer problems since they can more easily be solidified for long-term management and the potential hazards introduced by making the waste alkaline are avoided. However, acidic wastes also can pose dangers. For example, since the stainless steel tanks necessary for storing acidic wastes are very expensive, there are strong economic incentives to minimize waste volumes. This means that the concentration of radioactivity tends to be much higher, and consequently the wastes also generated much more heat. Continuous cooling of the waste is crucial. The importance of the tank cooling system is illustrated by an accident at the French reprocessing plant at La Hague in 1980. La Hague experienced a plant-wide electrical failure in April 1980, when a fire and subsequent complications at the reprocessing plant knocked out both the regular and the emergency power supplies. Among the systems affected was of course the cooling system for the waste tanks, which contain radioactive wastes that are typically orders of magnitude more radioactive and therefore generate more heat than the average wastes stored in the US Tanks. A cooling failure of three to ten hours could result in these wastes boiling at which point they would begin releasing cesium-137 and ruthenium-106. The releases would contaminate the site and possibly the environment. The uncooled tanks could boil completely dry in a few days, possibly resulting in an explosion." [IEER(e);Plutonium: Deadly Gold of the Nuclear Age @ 96]

DOE acknowledges 13 pounds of plutonium and 1,000 pounds of uranium are in the INL tank farm wastes. [Times News(g) 7/27/92] US Senate Government Affairs Committee investigative team warned DOE that a nuclear waste tank at the INL could explode like the April 1993 Russian Tonsk-7 tank explosion that spewed radioactivity over a 47-square-mile area. [Times(b) 12/10/93] Hydrogen build-up in the tanks has been of particular concern with the high-level waste tanks at Hanford. The explosive nature of hydrogen coupled with the potential criticality of tank constituents poses a significant risk. This is in addition to the previously mentioned structural and seismic risks of INL tanks. Collectively, these present a formidable and unacceptable hazard. The magnitude of the hazard warrants a comprehensive, independent, engineering, structural, and seismic analysis of the tanks that includes a full assessment of the current and projected corrosion factors. These studies must identify a priority sequence for decommissioning and decontamination (D&D) starting with the worst tanks. An integral part of this study also must fully characterize the waste constituent composition of each tank. A time table of not more than five years must be imposed on DOE to decommission and decontaminate these high-level waste tanks.

The Notice of Non-compliance issued by EPA on January 28, 1990 and the resulting Notice of Non-compliance Consent Order signed April 3, 1992 outlines a schedule that will result in the permanent cession of use of the ICPP five pillar and panel (segmented) high-level tanks before March 31, 2009 and the remaining six cast in place (monolithic) tank vaults before June 30, 2015. This time line for the ICPP high-level waste tanks WM-182 through 186 fails to prioritize this project based on the significant risk these old tanks pose. Seventeen years to D&D the first five tanks and twenty-three years for the other six 300,000 gal tanks makes a mockery of hazard prioritization and the Federal Facility Compliance Act. Admittedly, the State is partially at fault for accepting that time line. Had the State provided the appropriate documentation to the US District Court, the time line would have been appreciably shorter. Additionally, the enforceable time line and the project description in the INL EIS provide no action on the three 70 cm tanks WM-100, 101, and 102 that had high-level liquid wastes and no containment vaults.

These engineering studies by definition also must include the tank concrete vaults. DOE has been fully aware of the problem for decades and has chosen to maintain its spending priorities with nuclear materials production projects as opposed to spending on immediate environmental and safety hazards. DOE's new INL Spent Fuels Plan will only increase the load on the tanks thereby increasing the risk of catastrophic contamination of Idaho's sole source aquifer underlying the site. DOE plans (in the next 20 years) to replace five of the 300,000 gallon high-level tanks with four new 500,000 gallon tanks, which will result in a net increase in storage capacity of 500,000 gallons. Presumably, the five tanks slated for replacement are the ones with segmented vaults which do not meet seismic or containment standards. This investment is the best indicator of DOE's intentions to expand production capacity at INL. Given that existing tank capacity, coupled with calcine campaigns, has been able to meet full scale ICPP production needs for four decades, it begs the question of why is additional capacity needed?

The unstated hidden agenda is to build new production capacity under the guise of waste management programs designed to process spent fuel for final disposal in a repository. Again, as former Governor Andrus has correctly stated, spent fuel requires no processing prior to internment in a nuclear waste repository. Approximately, 20,000 metric tons of commercial spent fuel from 112 reactors must be disposed. DOE has agreed to take possession of this spent fuel by 1998. By the year 2030, there will be four times more spent fuel to be disposed. This issue is more fully discussed in the Spent Fuel Plan Section II(A).

ICPP Waste Tank Incidents

Date	Site	Description	Activity Released
December 1958		service line leak	?
March 3, 1959		leak to vault	?
August 1960	CPP-25	transfer line rupture to CPP-604	7 cubic meters soil contaminated
March 1962		2 tanks leaked into vaults	?
May 10, 1964	CPP-26	service line leak	10 acres contaminated
April 1974	CPP-27	tank vent failure	1,000 Ci
October 1974	CPP-28	Transfer Line leak	120 gal. & 46 cubic meters soil contam.
October 1974	CPP-33	service line leak	6,000 Ci
June 1975	CPP-30	valve box leak	12 cubic meters soil contaminated
September 1975	CPP-31	14,000 gal service line leak	30,000 Ci
January 16, 1976		12 gal leak in diversion valve	1,130 Ci

September 1976	CPP-79	20,000 gal service line leak	.06 Ci
December 1976	CPP-32	service valve leak	8 cubic meters soil contaminated
July 1989		Condenser Transfer Pipe Leak	
March 1992		2 tanks discharged to vaults	?

Other DOE documents cite that, "Most spills have been the result of line and tank failures, leaking valves, and equipment and tank overfilling. [Spill and/or leak] volumes range up to 45,000 gal.." [DOE/EH/OEV-22-P @3-116] N.S. Nokkentved reports a 30,000 gal. leak plus a 20 year leak starting in 1955 and discovered in 1975 which contaminated 1,800 yards of soil. [Times News, 8/29/89] The ICPP Remedial Investigation Feasibility Study lists 13 release sites related to the tank farm out of 100 total chemical and radiological release sites at the ICPP. This study estimates that 23,041 curies (decayed to 1992 values) were released to the soil at the ICPP, and 22,200 curies (decayed to 1992 values) were dumped down the ICPP injection well. [INL-95/0056 @ 2-139; 2-13] See ICPP cleanup section IV part H for more details.

"And as Carroll Wilson, the first general manager of the Atomic Energy Commission, acknowledged in 1979: Chemists and chemical engineers were not interested in dealing with waste. It was not glamorous; there were no careers; its was messy; nobody got brownie points for caring about nuclear waste. The Atomic Energy Commission neglected the problem .... The central point is that there was no real interest or profit in dealing with the back end of the fuel cycle." [IEER(e) @ 111] Also see Section IV(I)(1) ICPP Tank Remediation.

I.E. 4. INL Plutonium Vulnerabilities

DOE’s Office of Environmental, Safety, and Health convened a Plutonium Working Group to evaluate plutonium vulnerabilities associated with the Department’s plutonium storage. This group’s report noted that; “Most Argonne National Laboratory-West (ANL-W) [at INL] vulnerabilities stem from packages of scrap/residues shipped to this site from Argonne-East and Lawrence Livermore National Laboratory as a result of their consolidation activities. In decreasing order of priority, the most significant ANL-W vulnerabilities are:

- “ZPPR and Fuel Manufacturing Facility (FMF) vaults hold 193 packages of plutonium metal that are susceptible to oxidation, container failure and plutonium release.”
- “The FMF vault has canisters of decontamination rags containing plutonium metal particles (fines) that might pose a fire hazard.”
- “Current safety analyses do not fully consider plutonium accidents in the ZPPR [reactor] and FMF faults.” [DOE/EH-0415 p.45]

“These vulnerabilities are associated with plutonium metal, oxide, and scrap/residues packages stored in the FMF and ZPPR vaults. Consequences would mainly be limited to worker exposures. The majority of the ANL-W plutonium is in the form of ZPPR stainless steel clad fuel; no vulnerabilities were identified for this rugged fuel. The Mark III sodium test loops in the Transient Reactor Test Facility at ANL-W have not been inspected in over five years. However, the loops represent an insignificant potential for worker exposure.” [DOE/EH-0415 p.45-46]

”ZPPR and FMF vaults contain plutonium metal in 193 food pack cans. Plutonium in 49 of these cans has oxidized and could rupture the cans. Oxidation has occurred due to packaging failures and in leakage of air. Packaging involved placing plutonium metal inside food pack cans, the cans inside plastic bags, and the bags inside larger food pack cans. This packaging configuration is similar to those that have failed or bulged at LANL and Hanford. Oxides and ash are also stored in this manner and pose hazards for workers involved in routine inspections or repackaging.” [DOE/EH-0415 p.46]

“Oxide removed from the surface of plutonium metal during repackaging is collected on synthetic ‘tack cloths’. These cloths are then placed into storage containers and held in the FMF vault pending disposal in

Transuranic waste drums. The radio lyric decomposition of organic cloth in contact with plutonium metal particles (fines) and resultant hydrogen generation could lead to fires or explosions within drums. The plutonium metal particles could also ignite combustibles within the waste drums. The consequences could be worker injuries and exposures." [DOE/EH-0415 p.46] See Section IV Part J more discussion on ANL-W.

INL Facility Storing Plutonium		Quantity
ANL-W ZPPR fuel Metal Feed Stock Other	 4,000.00 kilograms 200.00 kilograms 29.02 kilograms	4,229.0200 kilograms
Naval Reactors Facility		0.2720 kilograms
Test Reactor Area/ ID Chemical Processing Plant		0.7836 kilograms
Plutonium in EBR-II fuel		?
Plutonium in Transuranic Waste		1,800.0000 kilograms
Total Pu at INL		6,030.0756 kilograms

[Hull][DOE/EH-0415 p.A-22][DOE-2/6/96@52

More recent reports by the Defense Nuclear Facilities Safety Board (3/10/05) "Recommendation 2005-1 Nuclear Packaging" confirms that DOE's ability to deal with these major plutonium storage vulnerabilities remain unresolved and continue to threaten site workers and the general public. [www.dnfsb.gov/pub_docs/dnfsb/rec_2005.html]

Argonne National Laboratory-West (ANL-W) has a solid high-level waste site called the Radioactive Scrap and Waste Facility (RSWF) that is seldom acknowledged. It has 12-foot-deep steel walled underground repositories (27 rows on 12 ft centers and 40 rows on 6 ft. centers for a total of 1200). According to DOE, the existence of severely corroded storage wells coupled with the lack of a monitoring program for soil contamination was identified as a vulnerability. RSWF had, as of 1981, 81 cubic meters containing 9,823,000 Ci of radioactive materials, including 40.73 grams of plutonium. [ID-10054-81@19] Responding to pressure, ANL-W upgraded 1,016 of the RSWF vaults in 1995 and plan on upgrading another 350 in the next three years.[RSWF] Even the new upgrades do not meet regulatory requirements for spent fuel storage because the contents cannot be inspected due to the welded cap on the top of the vault. However the regulators granted ANL-W a variance.

ANL-W radioactive airborne releases for the 1952-81 period were 44,580 Ci. [ID-10054-81@19] The 1977 radioactive content of ANL-W's annual waste generation sent to the RSWF or RWMC was 1,300,126 curies. [ERDA-1552 @V-23] DOE claims that ANL-W dumped 1.1 million curies at the RWMC between 1952 and 1983. [EG&G-WM-10903] ANL-W's Zero Power Physics Reactor fuel is releasing fission product because the uranium has oxidized and hydrided on approximately 25% of the plates, causing stainless steel cladding to bulge. In a few isolated cases, the cladding is breached. A total of 83,276 spent fuel elements/assemblies are stored at ANL-W. [DOE Spent Fuel Working Group Report, p.25]

I.E. 5. Highly Enriched Uranium Vulnerabilities

In December 1996, DOE released a Highly Enriched Uranium Vulnerability Assessment Report [DOE/EH-0525] that identified problem areas within the Complex were unsafe conditions exist. The report acknowledged 11 sites at the INL that pose significant safety hazards.

ICPP-604/SAT/01; "A few large volume vessels of unsafe geometry in the Mechanical Handling Cave and in cells 3 and 4 of the ROVER Facility contain large amounts of uranium. While dry, these vessels are critically safe. The addition of moderator [i.e. water] to a vessel, however, could create a critical system. Also, the addition of moderator into a process cell, combined with a spill of material from one of the vessels, could result in a criticality on the cell floor. Tight control of the amount of moderator present is essential for critically safety. The roof of the facility leaks. Water exists in the lower level of the fire sprinkler system but the system is isolated from the upper level."[DOE/EH-0525@3]

ICPP-604/SAT/02; "CPP-604, which houses the ROVER process system is not seismically qualified to current standards (built in 1961). The ROVER process cells have thick, reinforced concrete shielding walls that appear to be structurally sound. A severe earthquake could cause structural damage, compromising the process vessels and other confinement features, and resulting in a localized spread of contamination. The CPP-640 roof is not qualified to withstand extreme winds, and wind failure of the roof could cause damage to confinement features in the Mechanical Handling Cave, resulting in a localized spread of contamination and loss of strict moderator control."[DOE/EH-0525@3] Another CPP-640 vulnerability is criticality, spread of radioactive contamination under fire. Fire is related to two vulnerabilities because water used to fight a fire would spread contamination and could contribute to a criticality by moderating and reflecting the fissile material in the ROVER cells. In 1997 DOE launched the Rover Deactivation Project to collect, package and transfer the HEU in CPP-640 to the Irradiated Fuel Storage Facility (CPP-603). Unfortunately, CPP-603 is not a compliant storage facility because of other safety deficiencies. The ROVER burn cell was grouted to stabilize the residual HEU that was not removed. Some 800 entries into the highly contaminated areas through the course of the project and one of which resulted in a contamination incident.

ICPP-651/SAT/03; "Fuel storage racks containing LANL material in Room 102 do not meet design requirements of KEFF <0.95 for cans fully flooded and containing the maximum U-235 allowable."[DOE/EH-0525]

ICPP-651/SAT/04; "Seismic qualifications of the inner building (north and south vaults) and the south vault fuel storage racks have not been verified. A seismic event could cause a failure of the inner building, which supports all fuel storage racks. Damage to the fuel storage racks and rack supports and a consequent loss of geometry could result in criticality." [DOE/EH-0525]

INL/Site/SAT/05; "Numerous aging facilities throughout the INEL contain small amounts of inactive HEU that collectively enhance the probability of an HEU incident and a consequent increase in contamination within the next 5-10 years." [DOE/EH-0525]

RWMC/SAT/06; "Drums of U-233 are currently stored inside cargo shipping containers and located in a concrete shielded storage arrangement on the ILTSF Pan. Since the containers are in the open yard, corrosion and potential compromise of container spacing is possible, potentially resulting in a criticality."[DOE/EH-0525]

RWMC/TSA/SAT/07; "U-233 containers stored under earthen cover at the TSA Pad are subject to corrosion and loss of integrity due to age and storage conditions. This can potentially lead to a loss of drum spacing and a criticality."[DOE/EH-0525]

ICPP-640/WGAT/01; "Fire is possible on the operating floor area of the ROVER Fuel Processing Facility. The operating floor contains a significant combustible loading, the sprinkler system has been disabled in this area, and housekeeping is very poor. An operating floor fire could breach confinement barriers and release contamination to the environment. The emergency fire response procedure does not reflect the correct facility mission as it does not identify the potential for criticality and does not prohibit the use of water for manual fire suppression. Inadvertent criticality is possible."[DOE/EH-0525]

INEL/SITE/WGAT/02; " Inconsistent or incomplete implementation of the INEL Fire Protection Program increases as the potential for a fire involving HEU holdings and the severity of the consequences of such a fire. Typical of the problems in CPP facilities are deficient controls on the fire protection equipment, housekeeping, facility modifications, and the storage of combustible material."[DOE/EH-0525]

RWMC/WGAT/03; "Drums of U-233 are collected with thousands of drums of TRU waste in the RWMC. Over 200 drums (containing more than 40 kilograms of material) of U-233/232 waste from the Bettis Atomic Power Laboratory Light Water Breeder Reactor are in storage in the RWMC. This material did not originate from a typical waste stream, but is being stored and handled in the RWMC as waste in compliance with a DOE declaration. Owning to the high-level gamma field created by the U-232 contaminates, these materials pose severe radiological hazards uncommon for materials declared as waste."[DOE/EH-0525]

RWMC/WGAT/04; “In ASB-II, U-233 drums are collocated with TRU waste drums and stacked five high with no restraints. Many of the drums show signs of corrosion that could compromise their structural integrity. In the event of drum mishandling, a forklift accident, or a seismic event, drums containing TRU waste and U-233 could fall from the stack and rupture, thereby releasing and exposing workers to radiological and hazardous materials.”[DOE/EH-0525] There is a radical difference in the HEU inventories at INL noted in the Vulnerability Study (2,797 kilo grams) because the exact inventory was “classified.” However, then DOE Secretary O’Leary‘s 1996 Openness Press Conference Fact Sheets acknowledges HEU at INL at 23,400 kilo grams (23.4 metric tons). [DOE-2/6/96] In March 1996 the Idaho Department of Environmental Quality issued 135 individual counts of environmental violations and a fine of $892,725. The violations were based on September 1995 and January-February 1996 investigations. [Star 9/2/97]

I.F. Snake River Aquifer Contamination

The Snake River Plain Aquifer (SRPA) underlies the INL, and is a valuable regional resource in southeastern Idaho extending approximately 320 km (200 mi) from Ashton, Idaho in the northeast to Hagerman, Idaho on the southwest where it empties into the Snake River at Thousand Springs. The aquifer consists of a series of basalt flows with inter-bedded sedimentary deposits and pyro-classic materials. The SRPA was designated as a sole source aquifer by the EPA (56 FR 50634, October 7, 1991) because it is the only viable source of drinking water for most communities on the Snake River Plain.

"Radioactive, inorganic, and organic wastes releases from active and inactive waste sites have resulted in contamination of the Snake River Aquifer." [DOE/EH/OEV-22-P,p.3-166] "Some of the injection wells, such as at Test Reactor Area, Power Burst Facility, Test Area North, and ICPP, disposed of the wastes directly into the Snake River Aquifer." [ibid p.3-115] Significant spills and leaks have frequently occurred over INL's history. "Most spills have been the result of line and tank failures, leaking valves, and equipment and tank overfilling. [Spill and/or leak] volumes range up to 45,000 gal.." [Ibid. @3-116] "It should be noted that rather large quantities of chemicals were routinely disposed of via the ICPP disposal well." AEC documents acknowledge discharging on average “4.5 times the maximum permissible concentrations as given in Handbook 52". [IDO-14334 @12] “The average level of activity discharged to the water table by the approximate 30 million gallons of water per month is on the order of 10^{-5} micro curies/milliliter [10,000 Pico curies per liter]. Ordinarily, the radionuclides which approach [1960] drinking water tolerance in the disposal well are iodine-131 and strontium-90. Radioactive decay is relied upon to reduce the iodine-131 to permissible levels and adsorption to reduce the concentration of strontium-90 should either of these radionuclides momentarily exceed drinking water tolerances during discharge.” [IDO-14502 @10-11] Other INL documents acknowledge ICPP injection well discharges exceeding 0.22 beta except for 7 curies of I-131 per million gallons. [IDO-14532 @13] "Chemicals used at ICPP such as metallic sodium and metallic potassium were disposed of by "pumping the solution on the desert." [ERDA-1536@II-102] Idaho Division of Environmental Quality as recently as April 1998, acknowledged that the ICPP drinking water wells were contaminated with the chemical TCE requiring DOE to install special treatment process before it went into the system. During a tour of the RWMC in 1996, the author found all the restroom sinks with signs warning not to drink the water.

INL Radioactive and Chemical Waste Injection Wells

Injection Well	History	Contamination	Status
Test Area North			
Technical Support Facility (TSF-05)	Drilled 1953 305 feet	Radioactive and Volatile Organic	Now used as extraction well for groundwater remediation
Initial Engine Test (IET-06)	Drilled 1953 329 feet Nuclear Engine coolant and fuel	Radionuclides and chemicals	Converted to a monitoring well 1982
WRRTF well (WRRTF-05)	Drilled 1957 313 feet	50 mCi Cobalt-60 212 liter (56 gal) Turbine Oil	Abandoned 1984
Test Reactor Area (TRA-05)	Drilled 1964	Radionuclides and chemicals + Chromium	Converted to monitoring well 1982
Test Reactor Area (USGS-53)	Drilled 1960	Radionuclides and chemicals + Chromium	Converted to monitoring well 1964
ICPP (INTEC)			
(CPP-23)	Drilled 1952 580 feet	21,302 Curies of Rad. And chemicals	Pressure grouted closed 1989
(USGS-50)	Used 1970 to present	Radionuclides and chemicals	Currently used for emergency disposal and as monitoring well
Auxiliary Reactor Area			
(PBF-15)	Used 1972 to 1978	Sulfuric acid, Sodium Hydroxide & chromium	Capped in 1979
(PBF-05)	Used 1973 to 1984 Discharge reactor coolant	Radionuclides and chemicals	Capped in 1984
Argonne-West			
ANL-10 ANL-15 ANL-17			

[ICPP RI/FS] [USGS Report 00-4222, DOE/ID-22168]

The State of Idaho in the late 1980s persuaded INL to stop injecting radioactive and chemical wastes into the aquifer. Currently, the wastes including plutonium, are dumped into unlined ponds. Waste discharged to these ponds continues to percolate into the aquifer. [Statesman/3/79] ICPP discharge rates range from 1 to 2.6 million gallons per day. [DOE/EH/OEV-22-P,p. 4-188] The large volumes are a deliberate attempt to dilute the contamination. The State is now trying to convince DOE to phase out the use of percolation ponds, but only at the slow rate that DOE considers building new lined evaporation ponds.

"Major discrepancies were discovered between recorded volumes of water pumped from the aquifer for [ICPP] production use when compared with water used and disposed or lost from February 1990 to December 1990. Approximately 20 million gallons were unaccounted for in June 1990 alone." "Since 1988, water level in a perched body of water approximately 370 feet below the tank farm rose nearly six feet. Measurements were taken in a well about 500 feet southwest of the tank farm." [Oversight 92 @17] Also see Section IV(H) for more discussion on ICPP groundwater contamination.

"The service waste activity is allowed to average no more than three times drinking water tolerance in any isotope with the exception of very short-lived ones like iodine-131."[IDO-14532,p.49] Plutonium-239,240, and Pu-238 in Test Reactor Area leaching ponds were found in net plankton in concentration ranges (CRs) from 40,000 to 400,000. [DOE/ID-12111,P.39] Plants and animals concentrate these contaminants within their systems. Current monitoring of the Snake River Aquifer by the USGS indicates the presence of tritium, sodium, strontium-90, chloride, nitrate, and iodine-129 contamination plumes". [DOE/EH/OEV-22-P,p.3-167]

"One test well emitted organic gas levels 30 times the safe worker exposure limit and had to be sealed. Samples from the Waste Management Complex show the presence of tetrachloride and other organic compounds." [DOE/EH/OEV-22-P,p.3-166] An on-site drinking water well became so contaminated that it had to be shut down. [DOE/EH/OEV-22-P,p.ES-3] Purgable organic exist in concentrations 200-800 times maximum safety levels in perched aquifers. [Olsen Notes,7/31/89] Test Area North's (TAN) waste injection wells contaminated their own drinking water wells with trichloroethylene (TCE) at levels three times the drinking water standards. Other contaminates injected into the aquifer were PCE's, plutonium 238, 239, 240, Americium 241, cesium 137, cobalt 60, strontium 90 and tritium. [INL Oversight 7/91] The LOFT reactor at TAN alone contributed 150 Ci/yr to the peculation pond. [ERDA-1536@II-120]

Test Reactor Area (TRA) contains the Materials Test Reactor, Engineering Test Reactor, Advanced Test Reactor, ATR Critical Facility, TRA Hot Cell Facility, Advanced Reactivity Facility (2 reactors), and three other research labs. TRA leads all other INL areas for radioactive waste discharges. Between 1952 and 1981 50,840 curies were released through percolation ponds or injection wells, or 83% of INL's total liquid discharges for the period. [ID-10054-81] Beta-Gamma radioactivity concentrations in wastes dumped in the ponds was 1.1 x 10^{-2} uCi/ml [11,000,000 pCi/L]. [ERDA-1536@II-147]

The soils at INL are very porous. DOE studies on the transmissivity of contaminates in INL soils show that tests in the vicinity of TRA showed transmissivity as high as 18,000,000 gal/day/ft and porosity of the aquifer as high as 15%. [EGG-ER-8644 @ 35] A February 1999 USGS study put the aquifer transmissivity under INL in a range as high as 32,000 feet per day (6.06 miles/day). [DOE-ID-22155] This means contaminate in the aquifer can move rapidly down gradient in the direction of the Snake River.

Four TRA percolation ponds, received 80.39 billion gallons of waste. [TRA ROD @ 5] Between 1952 and 1974 these ponds alone received 41,049 Ci of radioactivity. [ERDA-1536@II-109,150,III-61] The reason for the high volumes of water was the once through cooling for the reactors requiring dilution. TRA pond algae registered 100 mR/hr. Migrating ducks (usually 25 at any one time) using the pond registered radionuclide concentrations in tissue samples. [Ibid. @ III-75-76] Also see Section IV(B) Test Reactor Cleanup Plans for the Warm Waste Pond. Chromium used to retard corrosion in the reactors was dumped in concentrations of 500 ppm when the standard in 1974 was 0.05 ppm, or 10,000 times over regulatory standards.[Ibid. @III-79] Also see Section IV(B). TRA radioactive dumping migrated to the perched water under the site in the following Pico curie per liter (pCi/L) concentrations: [Administrative Record Analytica-ID-12782-1][Also see TRA Cleanup Section for a full listing]

Contaminates in TRA Perched Water

Nuclide	Concentration	Nuclide	Concentration
Cobalt-60	12,200,000 pCi/l	Cesium-137	21,000,000 pCi/l
Americium-241	16,700 pCi/l	Strontium-90	18,000 pCi/l
Tritium	3,940,000 pCi/l	Cesium-134	62,400 pCi/l

[Administrative Record Analytica-ID-12782-1]

Between these TRA reactors there are 15 radioactive waste tanks, some of which have leaked. Two injection wells were also used to dispose of radioactive coolant water which contained hazardous chemicals. Injection well No. 53 received 3.89 x 10^{+9} (3.89 billion) gallons containing 31,131 lbs of hexavalent chromium. Well No. 05 received 2.2 x 10^{+8} (220 million) gallons between 1964 and 1982. Between 1952 and 1972 the three TRA reactors discharged 55,353 lbs of Cr(VI) [Anilititcia @F-4-25&6] The high water volume was due to once through coolant for the reactors and the fuel storage canal. Collective TRA waste water disposal volumes to ponds and injection wells are 84.5 billion gallons. [TRA ROD@5] Currently the injection wells are not used, but the percolation ponds are in use. INL dumped huge quantities of chemicals into pits and in sub-surface leach fields. 600 tons of sulfuric acid, 300 tons of sodium hydroxide, and 50 tons of sodium chloride were dumped in the TRA waste ponds. [ERDA.@II-79&80] The following representative figures show that chemical contamination is equally a significant part of the problem at INL. Chemicals included tributyl phosphate, Hexone Methyl Isobutyl ketene. [Ibid.@E-8]

Hazardous Chemicals Dumped at INL (1975-76)

	1975	**1976**
Surface Chemicals Disposed	3,053,000 gal.	2,989,000 gal.
Sub-Surface Chemicals Disposed	1,550,000 gal.	1,508,000 gal.

[ERDA -1536 @ E-8]

DOE and the commercial nuclear industry have consistently discounted the health impacts of tritium contamination. However, a growing body of independent research has challenged this position. Dr. Charles Huver, a retired University of Minnesota biology professor who studies tritium for the Minnesota Pollution Control Agency, says the 20 Pico-curies per milliliter tritium standard is at least 1,000 times too high because of tritium's "chromosome-breaking ability". [Spokesman (a)] Tritium from INL dumping has migrated the 50-miles via the aquifer to the Snake River. USGS 1994 to 1999 spring discharges to the Snake River sampling data show significant tritium concentrations near Twin Falls and Hagerman areas. [DOE/ID-22180] Also, 1993 USGS monitoring found Iodine-129 from the ICPP 3.4 square mile ground water plume, with concentrations of 0.25 pCi/l, in two wells eight miles south of the INL boundary near Big Southern Butte. [Environmental Science Foundation July 1997] The INL DEIS also acknowledges the tritium and I-129 plumes have migrated off-site. Iodine-129 , a byproduct of the fission of uranium, is of concern because of its 15.7-million-year half-life. Because of this it is considered by EPA to be a permanent environmental pollutant and the drinking water standard for I-129 is set at one pCi/l.

Government estimates do not consider the effect of irrigation when predicting the speed with which contaminates migrate. Agriculture in the INL region is expanding rapidly. As a warm desert ecology, farming relies solely on irrigation to produce high yield products. Idaho uses 22 million gallons per day - second highest amount of water used for agriculture in the nation.[UIWR]

On a total per capita water usage basis, Idaho ranks first in the nation with 22,000 gallons/person/day - with second place going to Wyoming at 13,052 gal/person/day. [UI WR # 887] So much water is being drawn from the aquifer that the water table has dropped three feet in the late 1980's. [AP(a),1/1/89] Municipal water for 41 communities also adds to the drain on this aquifer. [UI WR # 887] Three years of drought have exacerbated these conditions requiring even greater demands on the aquifer. [AP(a),1/1/89] Drought conditions continue with June 1992 Snake River average flow of 3.7 billion gallons per day. The previous low was in 1977 at 5.2 billion gallons per day. [Times-News(d)] USGS studies show Snake River Plain Aquifer draw-down in excess of recharge is 410,000 acre feet/yr. [Times News (f) 7/19/92] Recharge from the 1996-1997 winter show pack run off halted this trend but it is unclear whether previous loses were completely made up.

Snake River Aquifer springs feeding the Snake River provide the entire river flow west of Twin Falls. The river flow east of Twin Falls is almost entirely diverted for irrigation. Irrigation of over 3 million acres of farm land is drawn from the Snake River Aquifer. [UI WR # 887] Rapidly growing agriculture and municipal water needs may pull INL's pollution back to the surface much faster than predicted. Reduced recharge and aquifer lower volume may increase the concentration level of INL contaminates.

A six member ground water study team commissioned by EG&G, an INL contractor, was canceled after its preliminary results showed that contamination "could move from INL to the Magic Valley within months." [Aley, 1980] Their findings revealed the presence of lava tubes that move water rapidly through the aquifer and exit at Thousand Springs on the Snake River. The Big Lost River that flows onto the north end of the Snake River Plain totally disappears into the underlying soils.

Other DOE studies of aquifer contamination plume movement from ICPP to CFA between 1953 to 1958 document a seven foot/day or one-half mile/yr. Contaminate travel time from surface disposal to the aquifer is approximately 4-6 weeks or 10 feet/day. [ERDA-5316@II-120&III-81] Because the aquifer is not a homogenous geologic structure, but rather a very heterogeneous mix of different strata, and therefore, no generalized characterization about water movement within the aquifer is valid. For instance, the entire volume of the Big Lost River literally disappears into the porous Snake River Plain. The significant gradient change from 200 feet in the north east to 600 feet in the south west aids the water movement through the aquifer.

As previously noted, a 1993 US Geologic Survey water sampling has disclosed Iodine-129 in wells south of the INL boundary. [AP(e) 2/13/93] Well number 11 located 4 miles south of INL and 3.5 miles west of Big Southern Butte contained concentrations of I-129 of 1 x 10^{-5}. Well number 14 located 8 miles south of INL and 6 miles southeast of Big South Butte has I-129 concentrations of 3 x 10^{-5}. [Phone conversation with Oversight 2/18/93] DOE announced in 1990 that radioactive chlorine-36 from the ICPP has also been detected off-site in concentrations of 0.2% of the drinking water standard. [Environmental Science and Research Foundation, July 1997] "Our computer modeling has predicted for years that these contaminants would be detected off-site," according to Brad Bugger, INL spokesman. [AP (e)Daily News 2/14/93] These are significant DOE admissions which contrast decades of denials that INL contamination would migrate off-site.

In a 1994 study of sorption of radionuclides in basalt and interbed materials of the Snake River Plain found breakthrough of Sr-90 of 43%; Cs-137 of 94%; U-233 of 89%; Pu-239 of 33.5%; Am-241 of 9%; and Co-90 of 0.9%. [Goff] This study contradicts DOE's contention that the basalt underlying the INL is a good filter for radionuclides and the aquifer is not at risk from migration of contaminates dumped into percolation ponds and injection wells. INL's Health and Safety Division found:

"A tracer study using fluorescein dye and a 'slug' amount (10 tons) of common salt was initiated during October [1958] for the purpose of determining the rate of movement of the underground water. The dye was detected in four wells at distances up to 900 feet. A maximum rate of movement of approximately 100 feet per day was indicated."..."On December 9, 1958, an unidentified source at the CPP began discharging liquid waste at levels which averaged ten times the maximum permissible concentration for Strontium 90, in addition to other fission products. Traces of this material began to appear in the monitoring wells at a distance of 700 to 800 feet on December 15 which substantiated the flow rate as determined by the tracer." [IDO-12082(58)@60]

A 2001 USGS report confirms the above contaminate migration prediction. Plutonium-238, 239/240, Americium-241, and Cesium-137 were detected in wells 20 miles south of the INL boundary. The report shows Plutonium concentrations of 0.01 pCi/l in Grazing Well # 2, and Grazing Service CCC # 3. [DOE/ID-22175]

The Snake River flows into northern Idaho where it turns west at Lewiston, Idaho and joins the Columbia near the Tri-Cities, Washington. Any radioactive and chemical wastes which INL puts into the Snake River Aquifer may eventually reach northern Idaho, southern Washington, and northern Oregon. The affected water pathway populations studied may need to be extended beyond the immediate vicinity of the INL site with special emphasis on down-gradient populations of the Snake River Aquifer. Oregon's Health Division found in studies of the State's surface waters that after the Hanford reactors were shut down and ended direct reactor coolant dumping into the Columbia, that the Snake River contributed the highest levels of radioactivity to the Columbia River. [Oregon @ 1]

Snake River Aquifer Water Sampling

INL's southern boundary is about 53 miles from the Rupert area and about 110 miles from the Hagerman area (see map below). INL over the past five decades has dumped vast quantities of radioactive waste into shallow pits, trenches, and unlined percolation ponds. Billions of gallons of radioactive waste water was also injected directly into the aquifer until the early 1980's when then Governor Cecil Andrus forced the federal government to end the practice. A 1995 U.S. Geological Survey report notes:

"In the past, wastewater containing chemical and radio chemical wastes generated at the INEL was discharged mostly to ponds and wells. Since 1983, most aqueous wastes have been discharged to infiltration ponds. Many of the constituents in the wastewater enter the aquifer indirectly following percolation through the unsaturated zone." [DOE/ID-22130,p.3]

The following table shows U. S. Geologic Survey (USGS) 1989-1996 water sample data from 33 of the 55 monitoring wells in the Snake River Aquifer south of INL between Rupert on the east and Hagerman on the west. These monitoring wells are in the Magic Valley group of wells checked by USGS in three sampling campaigns (1989, 1990-92, and 1994-96). The sample data show gross beta and alpha radioactivity over the period and is used as a screening method to determine if additional testing is needed.

The comparative water sample data is a means of identifying trends in the migration of radioactive contaminates. The USGS emphasizes that the Magic Valley monitoring wells remain below the Environmental Protection Agency maximum concentration level (MCL) standard for drinking water. If increasing trends are confirmed, then additional isotope specific tests may be needed to identify the source of the contamination.

The following two tables compare gross beta and gross alpha particle radioactivity, which is a measure of the total radioactivity given off as beta or alpha particles during the radioactive decay process. USGS instruments were calibrated for dissolved cesium-137 (gross beta) and dissolved thorium-230 (gross alpha). The concentrations of gross beta/alpha particle activity are for reference only and do not imply that the radioactivity is attributed to these specific isotopes. The numbers in the table are the mean or middle number between an analytic plus or minus (±) uncertainty range published in USGS reports.

Snake River Aquifer Water Sample Data

Gross Beta (dissolved Cesium-137)(pCi/L)

Well #	1989	1990-92	1994-95	1996-98	1999-00
MV-01	7.8 ±1.21	7.3 ±1.65		6.86 ±1.76	10.7±2.4
MV-02	10.65 ±1.65	7.57 ±2.01	7.64 ±1.58	11.1±4.3	8.09 ±2.68
MV-03	4.88 ±0.77	4.33 ±1.28	4.58 ±2.91	5.84 ±1.36	
MV-04	6.54 ±1.2	7.38 ±1.67		5.83 ±3.11	7.43± 2.6
MV-05	7.36 ± 1.29	6.69 ± 1.51	12.0 ± 5.38	6.99 ± 1.89	
MV-06	6.12 ± 1.02	8.01 ± 1.63	7.93 .. ± 4.86	6.12 ± 1.61	
MV-07	4.62 ± 0.77	4.00 ± 1.26	6.49 ± 4.24	7.1 ± 4.2	
MV-09	10.6 ±2.0	8.96 ±2.31		10.2±4.2	17.34 ±5.36
MV-10	10.60 ± 1.7	9.67 ± 2.23	9.93 ± 1.96		8.31 ±3.43
MV-11	11.50 ± 1.90	13.40 ± 2.85	8.20 ± 3.5	8.2 ± 3.5	9.67 ±5.18
MV-12	7.26 ±1.25	7.34 ±1.78		7.22 ±1.89	3.72 ±4.68
MV-13	9.31 ± 1.5	7.50 ± 1.54	10.1 ± 5.9	8.24 ± 1.72	
MV-14	5.36 ±1.17	3.56 ±1.12		5.78 ±1.89	5.79 ±2.6
MV-15	8.25 ± 1.39	10.60 ± 2.22	8.12 ± 2.07	8.12±2.07	4.65 ±4.85
MV-16	4.39 ± 0.73	3.99 ± 1.26	4.66 ± 1.15	7.6 ± 4.1	5.06 ±2.46
MV-17	4.64 ± 0.79	4.15 ± 1.24	7.01 ± 4.14	5.10 ± 2.84	
MV-18	7.73 ±1.38	7.51 ±1.86		6.24±2.6	8.5 ±4.93
MV-19	6.8 ±1.07	4.7 ±1.4	6.5 ±1.44	3.2±3.9	4.61 ±2.42

MV-20	6.17 ± 1.01	4.51 ± 1.14	5.48 ± 1.27	7.4 ± 4.1	5.36 ±2.05
MV-21	4.98 ±0.8	4.6 ±1.29		4.43±1.13	5.01 ±1.39
MV-23	9.37 ± 1.53	8.41 ± 1.89	4.39 ± 1.04	8.83±3.45	7.69 ±2.65
MV-24			11.0 ±2.39		
MV-24-A				8.38±3.62	11.4 ±3.65
MV-25	22.21 ±2.85	9.13 ±2.08	10.5 ±2.2	11.5± 4.4	
MV-26	5.99 ± 0.92	5.40 ± 1.26	9.02 ± 4.63	4.44 ± 1.47	7.81 ±2.63
MV-27	6.81 ± 1.04	6.73 ± 1.51	9.57 ± 5.18	6.06 ± 1.54	
MV-29	5.43 ±0.9	3.96 ±1.2	4.68 ±1.36	4.11±1.12	1.13 ±4.3
MV-30	7.16 ±1.22	6.25 ±1.62		6.59±3.19	7.93 ±4.93
MV-31	6.80 ± 1.22	7.32 ± 1.55	13.1 ± 4.37	9.53 ± 1.64	8.02 ±3.39
MV-32	8.38 ± 1.38	8.15 ± 1.91	9.45 ± 1.9	7.5 ± 4.2	
MV-33	4.82 ± 0.78	3.27 ± 1.06	4.39 ± 1.04	4.39 ±1.04	5.74 ±1.79
MV-36	5.44 ± 0.91	4.80 ± 1.18	7.03 ± 4.22	4.2 ± 1.05	
MV-37	6.83 ±1.07	4.75 ±1.45		3.75±1.21	2.93 ±4.36
MV-38	3.65 ± 0.69	3.87 ± 1.21	4.71 ± 3.85	3.93 ± 1.06	
MV-39	8.56 ±1.52	7.81 ±1.88		5.26 ±3.08	7.34 ±2.73
MV-40	5.93 ±0.9	4.11 ±1.19	4.13 ±1.18	5.4±4.0	4.67 ±4.44
MV-41	6.39 ± 1.04	7.33 ± 1.89	7.24 ± 1.81	7.0 ± 4.2	6.89±2.41
MV-42	6.00 ± 0.94	0.71 ± 0.58	8.65 ± 4.36	6.03 ± 1.18	
MV-43	10.1 ±1.71	9.17 ±2.13		6.68 ±3.32	8.91±5.06
MV-45	4.69 ± 0.78	4.45 ± 1.30	6.10 ± 4.19	4.0 ± 3.9	
MV-46	4.49 ±0.73	4.17 ±1.25	4.21 ±1.24	4.08 ± 1.03	3.49 ±1.67
MV-47	4.82 ± 0.76	4.07 ± 1.06		3.6 ± 3.9	5.06 ±1.8
MV-49	3.62 ± 0.7	2.52 ± 0.87	3.15 ± 0.95	4.2 ± 3.9	4.79 ±2.43
MV-50	7.51 ± 1.25	8.75 ± 1.77	9.43 ± 1.87	4.95 ±3.1	8.96 ±3.39
MV-51	8.06 ± 1.53	7.22 ± 1.83		11.2 ± 4.4	3.96±4.7
MV-52	9.56 ± 1.44	8.93 ± 1.88	8.44 ± 1.68	8.4 ± 4.2	8.81 ±3.42
MV-53	9.43 ± 1.58	9.94 ± 2.06	9.57 ± 5.4	10.7 ± 2.23	
MV-54	8.82 ± 1.52	9.19 ± 2.12	9.40 ± 2.05	8.4 ± 4.3	10.37 ±4.88
MV-55	4.80 ± 0.92	3.55 ± 1.10	8.46 ± 4.25	6.04 ± 1.37	
MV-56	4.89 ± 0.86	4.73 ± 1.32	5.21 ± 1.24	3.8 ± 3.9	0.48±4.33

MV-57	4.11 ± 0.67	2.81 ± 0.85	3.48 ± 1.06	3.25 ± 1.03	
MV-59	5.35 ± 0.83	4.37 ± 1.24	6.13 ± 2.37	8.44 ±2.75	2.78±4.53
MV-61	4.65 ±0.85	4.70 ±1.35		6.13 ±2.37	-.55±4.28

Gross Alpha (as dissolved thorium-230) (pCi/L)

Well #	**1989**	**1990-92**	**1994-96**	**1997-1998**	**1999-2000**
MV-03	2.62 ±0.65	2.0 ±0.76	0.218 ±1.2	4.48 ± 2.89	
MV-05	4.65 ± 0.85	2.22 ±0.8	3.56 ± 2.96	5.26 ± 3.39	
MV-06	1.88 ± 0.5	1.67 ± 0.65	4.22 ± 3.11	6.23 ± 3.36	
MV-07	2.46 ± 0.62	1.51 ±0.63	3.36 ± 2.71	2.17 ± 2.48	
MV-10	2.87 ± 0.65	3.35 ± 0.97	3.22 ± 2.14	2.3 ± 2.7	0.62 ±0.85
MV-11	3.05 ± 0.65	3.91 ± 1.04	5.79 ± 3.79		1.88 ±2.59
MV-12	2.7 ±0.66	2.28 ±0.79	2.56 ±1.98		6.08 ±3.62
MV-13	5.12 ± 0.97	2.15 ± 0.72	4.20 ± 3.09	4.55 ± 3.07	
MV-15	2.30 ± 0.54	2.58 ± 0.82	4.84 ± 2.86		3.39 ±3.24
MV-16	2.32 ± 0.66	1.95 ± 0.73	1.42 ± 0.95	1.1 ± 2.1	1.33 ±1.47
MV-17	1.07 ± 0.59	1.31 ± 0.06	0.103 ± 1.82	5.1 ±2.84	
MV-20	1.08 ± 0.52	1.92 ± 0.074	3.02 ± 1.62	5.5 ± 3.0	1.19 ±0.78
MV-23	1.85 ± 0.48	2.39 ± 0.79	3.54 ± 2.77		-.21 ±2.43
MV-26	2.32 ± 0.62	1.59 ± 0.65	2.22 ± 2.36	0.96 ±2.35	0.81 ±1.26
MV-27	4.09 ± 0.8	2.62 ± 0.82	2.56 ± 2.73	4.83 ±3.12	
MV-31	3.04 ± 0.72	2.31 ± 0.77	10.9 ± 4.65	9.22 ±3.8	1.42 ±1.73
MV-32	6.00 ± 1.04	3.75 ± 1.05	2.85 ± 2.06	3.9 ± 3.1	
MV-33	0.68 ± 0.46	2.29 ± 0.81	1.19 ± 1.3		0.72 ±0.52
MV-36	5.12 ± 1.0	2.10 ± 0.70	4.54 ± 3.08	2.64 ±2.34	
MV-37	4.75 ±0.99	4.15 ±1.06	1.94 ±1.61		4.05 ±3.37
MV-38	1.86 ± 0.51	1.19 ± 0.58	1.62 ± 2.26	4.58 ±2.73	
MV-41	4.76 ± 0.98	5.24 ± 1.15	7.21 ± 3.16	4.3 ± 3.2	3.13 ±3.2
MV-42	2.08 ± 0.55	3.18 ± 0.93	3.21 ± 2.72	2.76 ±2.46	
MV-43	5.01 ±0.92	4.58 ±1.13	4.49 ±3.01		4.64 ±3.25
MV-46	1.82 ±0.53	1.10 ±0.54	0.73 ±0.79	4.4 ± 2.62	1.23 ±0.66
MV-45	18.70 ± 2.4	1.27 ± 0.54	3.96 ± 2.85	2.1 ± 2.2	

MV-47	1.66 ± 0.51	2.02 ± 0.73	0.8 ±1.9		0.3 ±0.54
MV-49	0.00 ± 0.7	1.56 ± 0.63	3.04 ± 1.49	2.8 ± 2.4	1.36 ±1.51
MV-50	7.74 ± 1.33	3.09 ± 0.87	2.12 ± 2.09		1.95 ±1.35
MV-51	2.92 ± 0.67	3.15 ± 0.93	3.2 ±3.0	3.2 ± 3.0	5.15 ±3.45
MV-52	3.80 ± 0.73	4.00 ± 1.02	4.15 ± 2.2	2.8 ± 2.8	2.16 ±1.92
MV-53	3.25 ± 0.69	2.89 ± 0.87	1.55 ± 1.27	8.95 ± 4.2	
MV-54	3.87 ± 0.75	2.38 ± 0.84	4.51 ± 2.6	4.4 ± 3.5	2.18 ±2.97
MV-55	2.38 ± 0.65	1.57 ± 0.63	0.80 ± 1.44	3.33 ± 2.79	
MV-56	1.97 ± 0.59	1.48 ± 0.66	1.11 ± 1.01	2.1 ± 2.3	2.05 ±2.83
MV-57	0.03 ±0.29	1.34 ± 0.058	1.71 ± 0.93	-.12 ±1.78	
MV-58	2.08 ±0.54	1.02 ±0.5	0.58 ±1.03	-.12 ± 1.83	
MV-59	0.31 ± 0.26	1.76 ± .67	2.19 ± 2.0		2.56 ±2.91
MV-61	11.2 ±1.6	2.97 ±0.95	3.68 ±2.43		

Sources from USGS: DOE/ID-22124, DOE/ID-22130, DOE/ID-22133, DOE/ID-22141; DOE-IDO-22161; DOE/ID-22152; DOE/ID-22169; DOE-ID-22176

The above table unit's abbreviation - pCi/L - stands for pico curies per liter or one trillionth of one curie per liter. The maximum contaminate levels (MCL) for selected radioactivity and selected radionuclides in drinking water are established by the Environmental Protection Agency. For comparison, the MCL for the beta emitter strontium-90 is 8 pCi/L, and the MCL for cesium-137 it is 120 pCi/L based on an average concentration assumed to produce a total body or organ dose of 4 millirem per year. The MCL for gross alpha particulate radioactivity is 15 pCi/L.

As with all water sampling techniques, there is a range of uncertainty from instrument and sampling procedure variation. So the sample concentration is stated as the mean or middle of the uncertainty range which in turn is stated as plus or minus(±). A slight increase or decrease in different samples from the same well may be a result of this analytic uncertainty or variation. A major component of uncertainty is the standard deviation which varies with each sample. USGS uses a factor of two times the sample's standard deviation to identify the uncertainty range which is noted as a plus or minus number after the mean concentration number. The USGS uncertainty range appears to vary widely between sampling periods. For instance the average uncertainty in 1989 and 1990-92 sample campaigns was about 21 percent where as the average uncertainty in 1994-95 was nearly 60 percent. More detailed testing of a broad range of isotopes may be needed to identify the sources of this well contamination. The State INL Oversight Program, Idaho State University, and the Environmental Research Foundation are also doing testing, however their instruments are according to USGS, a thousand times less sensitive than the USGS's National Water Quality Laboratory. The usefulness of the above tables is to demonstrate trends in contaminate levels in the Snake River Aquifer south of the INL and factor this information into waste management decisions.

I.G. INL Stack Emissions Hazard

Four incinerators, Waste Experimental Reduction Facility (WERF), the Process Experimental Pilot Plant (PREPP), ICPP Denigration Facility, and the New Waste Calcining Facility (NWCF) have been built at INL as part of DOE's national nuclear waste volume reduction program. Additionally, several high-temperature waste "evaporators" have been added at INTEC in recent years. Stack emissions from these INL facilities should be considered in evaluations of health risk assessments due to their radioactive and toxic nature and lack of independent monitoring. Between 1952 and 1989, an estimated 18,564,868 Curies (Ci) were released from INL facilities. [ID-10054-81 @13][ID-10087-85&7 @6][DOE/ID-12119]

The WERF and PREPP incinerators have operated at INL without an Environmental Impact Statement being filed. Resource Conservation Recovery Act (RCRA) interim permits were grand-fathered in, and final permits are being reviewed. None of the INL incinerators/waste process plants have had "trial burns" that is currently required to demonstrate that emissions meet regulatory requirements. After considerable public pressure on the regulators, DOE finally, after decades of operating WERF, conducted a trial burn May of 1997. On May 12 DOE reported that the May 8 trial burn resulted in exceeding regulatory limits for chlorine emissions (hydrogen chloride). WERF operators ignored the monitoring instruments and failed to shut the incinerator down. In March 1997, a 14 inch crack was discovered in the transition area between the primary combustion chamber and the ash ram that allowed waste to run out onto the floor. The crack was a failure to an earlier weld repair. The chlorine emissions resulted in a violation of state regulations. Only non-radioactive emissions are regulated since radioactive materials are not considered a hazardous material under RCRA. But, when hazardous materials are commingled, RCRA covers it as "mixed waste". Radionuclides are virtually always in INL's waste streams. The state is currently enforcing RCRA for EPA and is not monitoring for radioactive emissions. RCRA is up this year for reauthorization and a concerted effort is being made to have radionuclides listed as RCRA controlled.

Incineration of mixed radioactive and hazardous waste has been utilized by DOE for decades as a means of avoiding RCRA regulation. Lax state and EPA enforcement have allowed DOE, through incineration, to separate RCRA listed materials from radioactive materials. The process of incineration burns off the volatile hazardous constituents. The radioactive ash then falls into a non-regulated category and can be buried in shallow trenches at RWMC as "low-level" waste.

In January 1988, the White House issued Executive Order #12580 which blocked the EPA and affected states from having the authority to determine pollution abatement projects for federal agencies under the Superfund Reauthorization Act of 1986. Under intense pressure from these states Congress passed, in 1991, the Federal Facilities Compliance Act (FFCA). This bill removes the federal government's sovereign immunity from compliance with state and federal environmental laws, and gives more state and EPA oversight authority to enforce laws at federal facilities.

As part of the compliance with the FFCA, DOE awarded in December 1996 one of the largest privatization contracts to British Nuclear Fuels (BNFL) Inc. to incinerate waste at the INL. This $1.18 billion facility will incinerate mixed transuranic (TRU) waste. DOE claims it "shifts the operational liability and risk to the contractor through a fixed-priced contract and only makes payment for waste actually treated."... "Privatization of waste treatment is cheaper than the government making a large investment in owning and operating its own treatment facilities." [DOE This Month 1/97] One need go no further than the INL Pit-9 privatization project to see how the original contract has already been vacated and now DOE is faced with a new contract for twice the original amount. As for shifting liability, the Pit-9 process shows clearly that regardless what they try to call it, the DOE still pays the full costs and ultimately is left holding the bag.

The broad variety of operations at INL results in a proportional variety of radioactive emissions from these plants. Few are benign - otherwise they would have been built in urban areas close to research centers. Normally radioactive gasses are released to the atmosphere via the Main Stack of the Idaho Chemical Processing Plant (ICPP). Between 1952 and 1981, ICPP released 7,512,000 Curies (Ci) of radioactivity to the atmosphere. [ID-10054-81@13] "Until 1975 all ventilation from process areas was discharged to the stack without treatment."...

"Twenty-two individual stacks at ICPP that release radionuclides do not go through the filter system." [ERDA-1536@II-67&70]

Between 1957 and 1977 acknowledged ICPP airborne releases averaged 150,000 Ci/yr which included 85,000 Ci of Krypton-85 and 2,600 Ci tritium. [ERDA-1536,p.I-2] In later years these gas emissions ran 2,000 curies/day krypton [IDO-14532,p.46], tritium, cesium, strontium-90 and other transuranic. [DOE/EH/OEV-22-P,p.3-20] For krypton alone, the 0.3 micro curie/L at the stack is 100 times maximum permissible level for air. In 1974 ICPP main stack released 259,955 curies that included 8 curies of cesium, 6,036 curies of tritium, and 0.0071 curies of plutonium. [ERDA-1536@II-64] As previously discussed, these figures are believed to be understated.

ICPP's solvent burner off-gases containing plutonium are not filtered. [IDO-14532.p.26] This incinerator burns solvents with plutonium concentrations of 5.7 ugPu/gal [5.7 micro grams Plutonium/gallon] or [1,540,540 Pico grams/liter]. "When solvent is burned at 15 liters per hour the stack gas at stack top is only 3 times maximum air tolerance ..." [IDO-14532,p.46] Background readings outside the ICPP perimeter fence "generally do not exceed 1 mR/hr." [IDO-14532,p.61] Depending on how long the burner runs, the 1 mRem/hr could add up to a considerable dose (24 mRem/day)(480 mRem/mo) to workers at the ICPP. Later ICPP reports put the plutonium concentration in the solvent burner feed at 150 micrograms per liter. "A program was developed to sample the burner off-gas for plutonium and to burn the solvent during appropriate intervals when atmospheric diffusion conditions were suitable and when there were no personnel working in the adjacent construction area." [IDO-14509 @18]

Partially filtered air from the ICPP's 603 Fuel Element Cutting Facility (FECF) is released through a 50-foot stack and travels only a short distance before falling to the ground. "Thus, air-born particulate material from the FECF would not travel past the site boundary, and most probably would not spread beyond the immediate area of the FECF."[IDO-14532,p.47] This admission that radioactive particulates are escaping does not preclude re-suspension every time the wind kicks up the dust. A FECF HEPA filter failure released 1,200 curies of long-lived fission products causing 131,302 square feet area around CPP-603 to be contaminated in 1958 and causing excessive background readings around the Fuel Element Cutting Facility. [IDO-14532,p.61][INL-95/0056,p.2-129] Failures of CPP-601 Vessel off-gas (VOG) filter, the dissolver off-gas (DOG), the hydrocarbon solvent burner system were found by Site Survey Branch during the second and third quarter of 1958. [IDO-14471,p.13] The ICPP was evacuated on April 2, 1992 because of radioactive particulate releases. [DOB , 4/3/92]

Idaho Department of Environmental Quality is aware that the INL is burning material contaminated with radioactive isotopes but is reluctant to take a stand and regulate radioactive emissions under Resource Conservation Recovery Act (RCRA). "We have no regulatory authority over high-level waste. No one in the state has looked at it in the past."[Times-News(c)] Emissions from these incinerators pose a serious health hazard and deserve independent monitoring for radioactive emissions by State and EPA regulators.

"The primary objective of the PREPP [incinerator] is to process select Transuranic-contaminated waste [radioactive elements heavier than uranium] that has been generated in national defense programs. The process is designed to convert the waste into a form acceptable for disposal at the Waste Isolation Pilot Plant (WIPP). During the initial years of operation, the principal PREPP activity will be the incineration of hazardous waste. Although the facility has the potential to release toxic air pollutants, its current application for the IDHW air permit does not specify hazardous waste incineration." [DOE/EH/OEV-22-P,p.3-13] PREPP completed TRU waste test burns in 1992 and it is expected to be supplemented by a newer incinerator called the Idaho Waste Processing Facility (IWPF).

"Identified radionuclides that will be released during incineration of transuranic waste include plutonium-239, 240, 241, and 242; americium-241; curium 241; and uranium-233." [DOE/EH/OEV-22-P,p.3-13] Of particular public concern is the effectiveness of the high efficiency particulate arresters (HEPA) filters which are the final stage of INL's three incinerators, Fluorinel and Fuel Storage Facility (FAST), Fuel Processing Facility (FPF), and other ICPP emissions control system. [ENI-217,p.33] The effectiveness of the HEPA filters to control toxic emissions to the environment has been challenged by independent researchers. [Goldfield,p.1] Failure of these filters to actually provide the emission control claimed by DOE would result in additional unplanned toxic releases to the environment. DOE acknowledges, in accident scenarios, that failure of these HEPA filters are the most serious potential release of radioactivity to the general public. [ERDA-1536,p.I-5]

"A radioisotope of antimony, Sb-125, was determined to be escaping ICPP's Fluorinel and Fuel Storage Facility (FAST) ventilation exhaust particulate filters, due to its presence as a stilbene (SbH3) gas. Stilbene gas is unstable and rapidly undergoes chemical decomposition into a particulate form (Sb2O3) in an oxidizing environment."... "Antimony-125 was detected in air at both on-site and off-site monitoring stations in the fourth quarter of 1986 and continues to be detected in 1987. Unlike previous years, in which the isotopes of the noble gases comprised the majority of hypothetical dose to an off-site person from INL, 78% of the calculated dose (0.11 mRem) to a maximally exposed individual in 1986 from routine operations was due to Sb-125." [1986:DOE/INL-12082(86),NTIS] Approximately one curie of Sb-125 was released in 1986, and the annual 1987 release was expected to be at least 10 times higher. [DOE/ID-12111@37]

Two successful law suits against DOE incinerators forced the closure of Rocky Flats and Lawrence Livermore facilities for radioactive and chemical emissions violations. A third lawsuit was been filed April 2, 1996 against DOE's Los Alamos site for radioactive emissions violating the Clean Air Act.[CCNS v. USDOE] Exhaustive and highly credible scientific reviews have independently cast light on the hazard of DOE's HEPA filter control systems at these other sites. Institute for Energy and Environmental Research's (IEER) Radioactive and Mixed Waste Incineration report cites the findings of Lawrence Livermore National Laboratory internal review panel recommendations against a proposed mixed waste incinerator in California.

"We have never been comfortable with the EPA's position that incineration of mixed waste to eliminate its chemical toxicity should be the first procedural step and burial of its radioactive residuals the second step. This approach commits to the volatilization of important radionuclides, including tritium, carbon-14, and several isotopes of iodine. Furthermore, the incineration of non-volatile nuclides, including those of uranium and plutonium, leads to a finite, although exceedingly small, probability of radioactivity is emitted from the incinerator's stack. We view incineration as a violation of the cardinal principle of radioactive waste management; namely, containing radioactivity rather than spreading it." [IEER(b) @1]

IEER's report also cites an EPA study of DOE mixed waste incinerators that showed that exposure of the public to tritium and plutonium-239 from this incinerator's emissions could exceed the federal standards for off-site radiation doses, in the latter case by more than 10 times. [IEER(b)]

"The most difficult elements to contain are the highly volatile radioactive elements, namely tritium, carbon-14, and several isotopes of iodine. Pollution control systems typical of most incinerators have no effect on these radionuclides, allowing the total input to the incinerator to exit out the stack, unless special filters are employed."... "The vast majority of less volatile radionuclides such as plutonium and cesium-137, which tend to condense onto particles remain in the ash or filters following combustion. Radioactive particles that do escape filters, however, are small in diameter and can be carried by winds over long distances. Due to their small size, fine particles (radioactive or otherwise) can more easily be inhaled and lodge in the sensitive inner lining of the lungs than larger particles. Since incineration can disperse radioactive elements, especially those not amenable t filtering it can increase near-term population doses compared to securely storing the wastes." [IEER(b) @21]

Denitration Facility's (ICPP-602) heated fluidized bed burns off the unwanted liquid from dissolved fuel solutions leaving granular uranium trioxide. "Off-gases, after preliminary treatment within the Denitration system, pass through the atmospheric protection system (APS) and are then released to the atmosphere through the ICPP plant stack."... "Gaseous wastes such as process off-gas NOx and ventilation flows are filtered to remove radioactive particles before being handled by the ICPP atmospheric protection system." [EA @ 12] DOE's FY-92 budget request for INL includes a $40,600,000 Nitrogen Oxides Abatement Facility for the ICPP. This money has been appropriated yet questions remain whether this off-gas system does meet RCRA standards. "At the ICPP, the major source of alpha activity is the solvent burner, which burns the exhausted tri-butyl phosphate and dilute used to extract uranium from spent nuclear fuel elements. This solvent is contaminated with small amounts of plutonium, uranium and mixed fission product nuclide. The off-gas from this combustion process is not cleaned before emission to the atmosphere via the stack." [ENICO-1054 @ 1] Off-gas sampling during solvent burner operation revealed Pu-238 concentrations as high as 27 pCi/cu meter. [Ibid. @ 30] The 40 hr. occupational limit is 2 pCi/cu meter. [Ibid. @ 32] This represents a significant plutonium emission to the atmosphere of nearly 15 fold.

The ICPP Waste Calcine Facility (WCF) and its replacement, the New Waste Calcine Facility (NWCF) are also incinerators that use a fluidized-bed to burn off liquid and combustible solids from reactor fuel reprocessing waste. ICPP reports acknowledge WCF off-gas system was “found to be 83% efficient for the removal of entrained particulates.” [IDO-14430@69] The incineration process releases numerous radionuclides in gaseous and liquid aerosol forms. Major gaseous components of the ICPP off-gas stream include Carbon-14, Krypton-85, Tritium, Iodine-129, Ruthenium-106, Antimony-125, and Tin-119. [ICPP-1187 @ 1] Monitoring at the WCF found Ru-106 in vegetation as far as 16,000 meters from the stack, with a maximum of 2.2 x 10 E-03 uCi/g (2,200 pCi/g) at 1600 meters. [IDO-14661@48] ICPP off-gas sampling results of the Calcine Facility to determine the effectiveness of the filtration systems resulted in the following conclusions:

a. "The total removal efficiency of the silica gel absorbers, High Efficiency Particulate Arresters (HEPA), and the Atmospheric Protection System (APS) for Iodine-129 is less than 30%;"
b. "The low efficiency of the HEPA's and analysis of the sample pre-filter indicate the emitted I-129 is predominately gaseous;"
c. "Less than 31% of the I-129 charged to the Calciner vessel as blended feed is emitted to the atmosphere; and 40-60% of the I-129 charged to the vessel is recycled in the scrub solution." [ICPP-1187 @ 19]

Another ICPP off-gas sampling conducted three years later by another contractor produced the same results with the additional conclusion that increased concentrations of I-129 in recycled scrub solutions explain the increased release rate to the atmosphere as a Calciner run progresses. [ENICO-1108@21] A third analysis of the Calciner emission system found that, “during the shake-down run of the large Calciner the off-gas system was evaluated and found to be 83% percent efficient for the removal of entrained particulates.” [IDO-14430 @ 69] At this stage of evaluation (1958), the Calciner off-gas system consisted of: 1) a scalp cyclone, 2) venturi scrubber and knock-out cyclone, 3) condenser, and 4) and AEC positive filter in series. The Calciner’s off-gas efficiency “lower limit is reached when atomization is excessive and a large volume of fine particles escapes through the off-gas system.” [IDO-14430 @ 64&62] These 1958 Calciner scrubber efficiencies are less than September 18, 1957 data collected that showed 84.8 % efficiency. [IDO-14422 @ 122] The reason for focusing on this efficiency data is because the publicly acknowledged radioactive releases to the environment are based on emission control efficiencies that are not supported by their own internal sampling data. Therefore, it is believed that the radioactive releases are grossly understated.

"Iodine-129 is one of the most environmentally significant radioisotopes emitted from nuclear fuel reprocessing and waste solidification facilities, and all facilities subject to EPA regulations must isolate at least 99.75% of the I-129 in the spent fuel from the environment. The results of an I-129 process distribution study at the ICPP indicated that a significant fraction of the I-129, not volatilized during fuel dissolution, eventually reached the Intermediate Level Waste Evaporator." [WINCO-1001 @ 1] Unfortunately, the evaporator does not have the control mechanism to retain the I-129 [Ibid] nor do the filtration systems have the ability to filter out the I-129. Clearly, this facility is not meeting EPA's 99.75% standard. Other species of iodine which have been volatilized into gaseous aerosols would also likely be escaping at the same rates.

"The discharge of radioiodine to the environment from nuclear fuel reprocessing plants is of particular interest due to the ability of iodine to enter the food chain and subsequently concentrate in the human thyroid. Iodine-129 is the isotope of interest during fuel dissolution and waste solidification since its 17-million-yr half-life makes I-129 a permanent contaminant of the environment."... "Stack monitoring at the ICPP has not detected significant I-129 releases during fuel dissolution, but detectable amounts were released during waste solidification." [ICPP-1187 @16]

Test Area North's Support Facility (TSF) Hot Shop has "no provisions for either the removal of radioactive Iodine or for monitoring of gaseous wastes (e.g. xenon, krypton, and argon)." [ERDA-1536@II-106] TAN's waste evaporator coils leaked and allowed contaminates to get sucked into the steam system. This leak reportedly was never fixed. The Aircraft Nuclear Propulsion (ANP) and the Initial Engine Test at TAN released over

4,635,724 Ci. during its 59 tests. [DOE/ID-12119@A-55][ERDA-1536] Also see Section I(C)(1). The Loss of Fluid Tests (LOFT) Reactors at TAN released up to the year 1977, over 940,225 Ci/yr to the atmosphere and sent 27,100 Ci/yr solid rad waste to RWMC. [ERDA-1536@II-118 &II-124] Aerial Surveys for Gamma radiation were conducted in 1976 to determine radioactive concentrations around INL facilities and are presented below.

INL 1976 Aerial Surveys for Gamma radiation

Facility	**Concentration in uR/hr**
Test Reactor Area	5,000
ICPP	2,500
ERB-I Reactor	90
Borax Reactor	200
ERB-II	150
OMRE/EORC	3,000
Test Area North / TSF	150
Auxiliary Reactor Area	5,000
Central Facilities Area	1,000
CFA Drain Field	800
Radioactive Waste Management Complex	3,000
Health Physics Laboratory	3,000
Naval Reactors Facility	1,800

[ERDA-1536 @ III-15 to 34]

Exposure rates in the above survey for Cobalt-60 and Cesium-137 were calculated to be 22,118.4 and 10,444.8 uR/hr respectively. [ERDA-1536 @ III-15 to 34] Also the above aerial survey listing clearly identifies Test Area North and the Auxiliary Reactor Area as the highest radiation emitters. The survey does not state whether the ICPP was processing fuel or whether the ICPP Calciner was operating at the time of the survey, so it is possible that they were temporarily not releasing much radiation. Also, it should be noted that the Central Facilities Area emissions were mainly due to the laundry that washes contaminated (10 mR/hr) worker clothing and respirators. [ERDA-1536@II-161] The second highest reading for the Health Physics Lab is particularly curious. One might expect this lab to be the most conscientious about its emissions.

The Test Reactor Area (TRA) contains the Materials Test Reactor (MTR), Engineering Test Reactor (ETR), and Advanced Test Reactor (ATR), and ranks second behind the ICPP for radioactive atmospheric releases. Between 1952 and 1981 TRA released 5,400,000 Ci to the atmosphere. [ID-10054-81@13] Test Reactor Area (TRA) also has a hot cell facility for handling very radioactive materials. Fuel element end sections that are cut off in the hot cell and filter element resins containing 500 Ci/cf are sent to RWMC for burial. [ERDA-1536 @ III-76] None of the reactors have the required Nuclear Regulatory Commission (NRC) full containment buildings - in fact they look like sheds. Nor are these, or any other INL reactors permitted or regulated by the NRC. Only a federal facility, insulated from the normal regulatory oversight, could get away with such practices.

Mismanagement of the Advanced Test Reactor by operation contractor, EG&G, was cited in an independent safety review released 12/93. The report cited a January 5 automatic reactor shutdown occurred when operators conducted experiment steps out of order; a January 29 planned shutdown for maintenance was extended by two days because workers discovered some pumps had been incorrectly mounted; a June 13 mishap closed the reactor for four days -workers had displaced a safety rod accidentally while removing a tool and subsequently reinstalled it incorrectly; and in September workers found smashed flashlight parts that were dropped by a worker - more parts showed up in later inspections. OCAW Union charged EG&G with 10 safety violations during this period that put workers at risk. [AP(h), 12/14/93]

Radiological Monitoring Data in INL Region [ERDA-1552-D @E-3 to 13]

Monitor Site	Date	Concentration	Isotope
ID Falls	2/65	24 pCi/L	Sr-90
Butte, MT	7/66	15 "	Sr-90
Butte, MT	3/65	125 "	Cs-137
ID Falls	3/66	45 "	Cs-137
Preston, ID	8/65	88 "	Gross Beta
Preston, ID	7/66	6 "	Gross Alpha
La Barge, WY	10/71	5 "	Gross Alpha
ID Falls	5/65	29 pCi/Kgm	Sr-90
ID Falls	2/65	140 pCi/Kgm	Cs-137

As a part of DOE's INL monitoring activities, milk samples were taken and tested primarily for Iodine-131. The current MCL for I-131 is 3 pCi/L, Sr-90 is 8 pCi/L, Cs-137 is 200 pCi/L. Milk sampling around INL in 1958 notes that the I-131 activity was below the, then, permissible level of I-131 in water which was 3 x 10^{-5} uc/ml (30,000 pCi/L). [IDO-12082(58)@76] Compared to current standards, the preceding milk iodine concentrations represent extremely high numbers. The following are acknowledged contamination concentrations in milk sampled from dairies and farms around the INL region. [DOE/ID-12119@E-34-48]

Iodine-131 Milk Samples in INL Region

Year	Month	Amount pCi/L	Month	Amount pCi/L
1958	Feb.	980	Mar.	2,250
	May	1,780	Oct.	5,600
1959		1,500		
1960	Jan.	1,400	Aug.	188
	Mar.	700	Oct.	400
1961	Jan.	200		
1962	Sept.	200	Oct.	140
	Nov.	320	Dec.	200

[DOE/ID-12119@E-34-48]

Monitoring Data on Food Stuffs in INL Region

Year	Food Stuff	Concentration
1960	Milk I-131	2 x 10^{-6} uCi/ml [2,000 pCi/L]
1961	Milk I-131	1 x 10^{-7} uCi/ml [100 pCi/L]
1963	Milk Sr-90	230 uuCi/L [230 pCi/L]

1963	Wheat Sr-90	170 uuCi/Kgm [170 pCi/Kgm]
1963	Wheat Cs-137	800 uuCi/Kgm [800 pCi/Kgm]
1963	Wheat Manganese-54	560 uuCi/Kgm [560 pCi/Kgm]

[Monitoring Reports 9,10,11,12 and 13; Environmental Monitoring Data Annual Guides][Cited by Blain @ 22 to 25]

I.G.1 Summary of INL Radioactive Releases to Atmosphere as of 1998

Facility	Date	Curies Released	Source
Naval Reactor Facility*	6/18/55	305	A @ A-203
ICPP*	10/58	1,200	B @ C-3
ICPP*	10/16/59	367,717	A @ A-99
ICPP*	1/25/61	5,200	B @ C-5
SL-1*	1/3/61	1,128	A @ A-196
BORAX-1*	7/22/54	714	A @ A-203
Aircraft Nuclear Propulsion*	1956-66	4,635,724	see ANP table
Other INL Operational Release	1952-89	13,552,880	A @ A-189
Total Air Release	1952-98	18,564,868	

Sources: (A) DOE/ID-12119; (B) ERDA-1536

* Significant episodic releases not included in general INL operational releases to the atmosphere. Curie releases less than 0.1 were not added in this summary and are considered understated due to lack of information.

I.H. Earthquake & Volcanic Hazard

DOE continues to understate the geologic risks at the INL. The Arco and Howe seismic faults shown in the 1991 New Production Reactor Draft Environmental Impact Statement (DEIS) maps are not constant between maps. (DEIS(a)Vol. 2, 4-59 and 4-60) The faults shown seem to mysteriously disappear under the INL site and then reappear on the other side of the site. Moreover, if the DEIS 4-59 and 4-60 seismic maps are superimposed on the 4-57 Volcanic Rift Zone map one can easily see that the faults match the rift zones.

A rift, as defined by the American Geologic Institute dictionary is: "a long, narrow continental trough that is bounded by normal faults; a graben of regional extent. It marks a zone along which the entire thickness of the lithosphere has ruptured under extension." This dictionary also states that rift zones have associated volcanic activity. Therefore, a rift zone by definition contains faults, very deep seated ones that have the potential to erupt lava. [Schlak] A 1977 EIS of INL found that, "Faults near Arco and Howe extend south and southeast toward the INL. The Arco Fault is 30 miles from ANL-W and the Howe Fault is 20 miles distant. Other INL studies postulate subsurface extensions of these faults to within six miles southeast of ANL-W." [ERDA-1552 @ I-56]

Idaho's former Governor Andrus criticized the Department of Energy's (DOE) seismic risk assessment process. "To provide the state of Idaho with a better understanding of the seismic risk assessment process, we have repeatedly requested technical observer status on the panels that are determining seismic hazard assessments. To date, the state has been denied access to the assessment process. We believe that impartial state representation would promote greater confidence in seismic findings." [Andrus(a)]

INL had an earthquake zone 3 rating prior to a 1982 gerrymandering of the site to a zone 2 (See Idaho Earth Quake Risk Figure). Zone 3 is the same seismic category as San Francisco. The strongest earthquake in United States recorded history, the Yellowstone quake, occurred in 1959. This quake had its epicenter only 137 miles from INL. The largest earthquake on the Centennial Tectonic Belt in Idaho (7.3) occurred in 1983 along the western flank of Borah Peak (Lost River Range) approximately 40 miles northwest of Arco. The largest earthquake within the Inter-mountain Seismic Belt (7.5) occurred in 1959 near Habgen Lake, 90 miles from the site. As a result, a new seismic zone of 4 was created adjacent to the INL site. In January through June 1994 a swarm of earthquakes hit Soda Springs, ID 60 miles south-east of the site - the largest reached 5.8 on the Richter Scale according to USGS. Among the 1994 quakes included the Draney Peak earthquake of 3 February 1994 (5.9) and Challis earthquake of 7 June 1994 (5.1) on the Richter scale.

A limited review of INL's 1979 to 1981 Quarterly Seismic Reports revealed that DOE contention in INL Environmental Impact Statement that the Snake River Plain is "aseismic" is unjustified. The following quakes were registered on or originated on the Snake River Plain: [RE-P-79 to 82 series]

Seismic Activity on Snake River Plain 1979-81

Year	**Number of Quakes**	**Magnitude Richter Scale**
1979 2nd Quarter	100	(5) greater than 3.0
1979 4th Quarter	68	0.1 to 1.1
1980 2nd Quarter	2	1.0
1980 4th Quarter	116	0.5 to 3.3
1981 1st Quarter	91	0.1 to 2.8
1981 4th Quarter	120	0.4 to 3.5

[RE-P-79 to 82 series]

The four rift zones and their related faults underlying INL from southwest to northeast are:

Rift Zone	**Fault**
Arco	Lost River Range
Howe East Butte	Lemhi Range
Lava Ridge/Hells Half Acre Circular Butte/Kettle Butte	Beaverhead Range

The 1988 Final Environmental Impact Statement for the Special Isotope Separator (SIS) did a seismic analysis of the INL site. "Based on the proximity to the INL and the likelihood of generating sizable earthquakes, the faults considered to be of most significance to the proposed SIS are the range front faults located along the western flanks of the Lost River, Lemhi, and Beaverhead Ranges." ... "It is apparent from extensive geologic investigations as well as historic evidence that the Lost River, Lemhi, and Beaverhead Faults are capable of producing large Magnitude 7 - 7.5 earthquakes in the future." [SIS@3-19]

"Detailed work on the Arco segment of the Lost River Fault indicates an average slip rate of 0.1 - 0.12 meters per 1000 years during the past 160,000 years. The fault has not ruptured in the past 30,000 years."... "If the slip rate has been constant, the fault has a potential strain accumulation of 3 meters (9.8 feet). Since characteristic earthquakes along the Lost River Fault produced less offset than this, it could be concluded that the Arco Segment is overdue and should have ruptured 10,000 - 20,000 years ago." [SIS@3-21]

"If an earthquake does occur, it seems most likely that it will be epicentered approximately as far away from the INL as was the Borah Peak Earthquake, and that it will have approximately the same magnitude." ... "In the less likely event that an earthquake would occur on the Arco or Howe Segments during the lifetime of the SIS, ground motion would be stronger."... "Predicted peak ground accelerations were calculated assuming a 7.25 magnitude earthquake on either the Arco or Howe Segments approximately 30 kilometers (18 miles) from the proposed SIS site. Utilizing attenuation curves calculated for the INL by Tera Corp .... a peak horizontal ground acceleration of 0.22 g is predicted." [SIS@3-19] [ERDA-1552@I-57]

If DOE's geologists had applied an equivalent earthquake magnitude of the Borah Peak (7.3) to their calculations, the ground acceleration might well approach or exceed the structural strength of the ICPP high-level waste tanks of .24 g. (See Sec.I(E)(3) "Five of them [tanks] are considered especially vulnerable. This is because their containment vaults consist of several concrete panels, grouted at the seams that are more likely to leak or breach in a major earthquake than the six other tanks."[GAO (b) @4-5] The State of Idaho commissioned a limited study by Boise State University seismologist James Zollweg, and University of Idaho seismologist Kenneth Sprenke, who found that "if a large earthquake struck, the biggest worry would be those tanks". Zallweg's assessment was endorsed by U.S. Geological Survey's Larry Mann who said, "that would be a catastrophic release. It could not be intercepted before reaching the aquifer". Zollweg calculated that, "if an earthquake of 7 on the Richter scale hit the fault closest to the tanks, a ground acceleration of about 0.24 g could hit the vaults". [Statesmen (b)] A catastrophic risk exists with these forty-year-old tanks which DOE refuses to address. The tanks are 400 feet above the Snake River Plain Aquifer that provides drinking water for over 275,000 Idahoans. Scientists also believe that if the tanks fail, then the acids in the tanks will react with the concrete in the vaults, releasing large amounts of radioactive gases into the atmosphere.

Zollweg and Sprenke's 1995 report titled *Review of INEL Seismographic Networks and Seismic Hazard Program*, also challenged DOE's seismic monitoring and characterization. DOE's seismic instruments are set so high that only two earth quakes were registered in the last 20 years. Zollweg notes that in 1994 alone there were five earthquakes with magnitude greater than 5 within 150 km of INL that were not recorded on DOE instruments yet were felt on INEL. These unregistered quakes include the 5.9 Draney Peak earthquake of 3 February 1994 and the 5.1 Challis earthquake of 7 June 1994. [OPTR 95-01@52] Consequently the available data understates the seismic activity in the region and draws into question DOE's claim that the INL lies in an aseismic zone. The report further criticizes DOE for not including multiple fractures within a given seismic event as is more common. The researchers emphasize the current knowledge gained from "surprises" such as the 1994 Los Angles and the 1995 Kobe, Japan quakes because these cities sit on alluvial sediments (like INL) which earlier were thought to attenuate or cushion shocks from underlying ruptures, but which actually magnify the shocks at the surface. Zollweg further challenges DOE censure of their own seismologist Ivan Wong's subsequent work for political reasons, because the department did not like Wong's findings. Zolweg and Sprinke's conclusions list the following safety issues:

"1.) Characterization of the maximum credible earth quake (MCE) on the southern Lemhi and Lost River faults. It is our opinion that the Mw 7.0 MCE chosen in [DOE's] Wong et al. (1992) is not sufficiently conservative in view of the faulting behavior of typical large Basin and Range province earthquakes. We recommend the Lemhi fault MCE be chosen on the basis of simultaneous rupture of three to four segments, and the Lost River fault MCE be chosen on the basis of rupture of the entire length of the Lost River fault south of the southern terminus of the faulting in the 1983 Borah Peak earthquake. Directivity effects should be considered as part of the analysis, since rupture propagation on these faults in the general direction of INEL could potentially produce larger ground motions at INEL than bilateral rupture or unilateral rupture away from the INEL.

"2.) Amplification characteristics of the basalt-sediment inter-beds underlying the northern part of the INEL. Theoretical modeling suggests that the inter-beds may attenuate surface motion, but this work has largely been based on 1-dimensional calculations and we believe that 3-D effects have not been adequately modeled. We recommend that the inter-bed effects on seismic waves be directly measured, taking advantage of an existing deep borehole which is known to penetrate into the rocks below the inter-bedded stratigraphy." [OPTR 95-01@69-70]

Complete seismic monitoring, documentation and analysis must be independently developed by the State in addition to a study that addresses the recurrence rates of these large earthquakes and the impact on INL facilities such as the high-level waste tanks. Seismic analysis of INL reactors also documents non-compliance with current codes. The Advanced Test Reactor (ATR) vessel "spacer bolt loads and support skirt radial bolt loads exceeded allowable values." Loads on the support skirt bolts were calculated at 76 kips and the yield load of the bolts was 43 kips. [RE-A-78-038 @ 16&18] The ATR's Emergency Firewater Injection System (EFIS) would be inoperable during a design basis earthquake. The purpose of the EFIS is to inject firewater into the reactor core to prevent irradiated fuel elements from being uncovered in the event of a loss-of-coolant accident or a complete loss of coolant flow during reactor operation or shutdown. The ATR was built in 1963 in accordance with national building code standards applicable at that time, but it was not built to earthquake standards. Because the EFIS does not meet current seismic codes and because of the potential firewater piping hanger failure, engineers declared the system technically inoperable. This means the system is functional but documentation does not support operability for the full range of intended safety functions (i.e. earthquakes). [OE-95-35] The ATR also has no containment building currently required around nuclear reactors to contain radioactive releases in the event of an accident. The ATR continues to operate today - primarily conducting materials testing for the Nuclear Navy.

"The Engineering Test Reactor (ETR) primary coolant system was designed in the late 1950's with no consideration for seismic loading. The system was designed according to standard piping practices of that time and presently does not meet certain criteria in the ASME Boiler and Pressure Vessel Code." [ER-E-77-102 @ 1] The Materials Test Reactor (MTR) spent fuel storage facility has been cited by DOE investigators as extremely vulnerable to seismic activity. [Spent Fuel Working Group 11/93]

Analysis of the ETR building revealed that it also does not meet structural code. Among many violations was a concrete block wall that was over-stressed by a factor of 2.5. [RE-A-77-027@21] None of INL's reactor buildings can contain radiation in the event of an accident. Current standards require a sealed reinforced concrete containment building with the structural capacity to withstand explosions and contain radiation emissions from the reactor vessel and/or related equipment. Both the ETR and the MTR are in cold shutdown but no decision has been made to permanently close these reactors.

The ICPP Calcine silos are also at risk according to a 1977 INEL Environmental Impact Statement. "The occurrence of an earthquake of magnitude near 7.75 (Richter Scale) with an epicenter at the Arco Scrap fault, about 20 mi. west of the ICPP, would produce a maximum credible ground acceleration at the storage area of above 0.33 g (the design basis earthquake)." ... "The bin anchor bolts possibly might shear, and with anchor bolt failure some damage may be inflicted on bin vent piping above the bins." ... "No damage would be anticipated- if the ground acceleration was 0.18 g." [ERDA-1536@II-95] These bins must be continuously cooled due to the heat generated by the radiation which the cooling coils keep at 480^0. Bin Set # 1 is in the worst shape and must be prioritized for D&D.

An October 1992 DOE report prepared by Westinghouse Nuclear has generated an investigation about the safety of key facilities used to store high-level radioactive waste at INL. The report questions the ability of the ICPP-603 Underwater Fuel Storage Facility to withstand an earthquake. In the event of a quake, heavy corrosion in the facility could create leaks into the environment, the report said. Corrosion on the fuel storage baskets and the yokes they hang from may cause a criticality (an accidental uncontrolled nuclear chain reaction). Because the facility has outlived its design life, equipment failures are frequent and costly. WINCO's Standing Root Cause Committee Report 6/14/93 compiled by S.P. Gearhart outlines over 20 years of knowledge of ICPP-603 safety/criticality SNF storage problems. The report even documents many remediation projects to correct the same problems that were funded but the work was never done; and the government never followed up to confirm completion of the work. "Even when the operating contractor was able to secure funding, the funds were spent on FDP startup and other fuel reprocessing facilities, and fuel storage did not receive much priority." [SPG-31-93 @ 15] Though DOE is moving the spent fuel out of the CPP-603 pools, the Irradiated Fuel Storage Facility in CPP-603 remains in use as a dry fuel storage area. Public pressure forced DOE in 1998 to construct a concrete sheer wall tin CPP-603 along with some modifications to the overhead cranes that move the fuel from trucks to the storage space but there is no mention of any modification to the inadequate ventilation or fire suppression systems.

DOE's 1995 seismic analysis of existing facilities postulates an earthquake magnitude of 7 on the Richter scale generating an acceleration of 0.24 g. However, a DOE’s 1995 Natural Phenomena Hazards Mitigation Conference in Denver generated a contradictory report by Ivan Wong titled *Microzonation for Earthquake Ground Shaking at the INL* which shows accelerations as high as 0.30 g on their probabilistic seismic hazard map contour through the RWMC, TRA, and NRF. [Wong @ 27] These findings are more in line with the previously discussed Zollweg and Sprenke conclusions. These differences in interpretations are not just an academic exercise when catastrophic radioactive releases into the environment are at stake.

Building 607 at INL's Test Area North holds the core debris from the wrecked TMI reactor in pools of water yet the building does not meet current standards for seismic performance, compliance with electrical code, ventilation and filtration systems, and other requirements which would be applicable to the storage of nuclear fuels. The pool, built in 1954, is also unlined and has no leak detection system. Because of these deficiencies, it was stipulated in the 1995 court settlement that the Three Mile Island fuel in the pool be moved out by 2001.[DOE/EA-1050@4-5]

The Naval Reactors Facility Expended Core Facility built in 1957 does not meet current seismic building standards. Water Pits 1, 2, and 3 were only constructed to "Zone 2 earthquake requirements which were judged to be appropriate under the USGS's classification of the area at the time [1957] of their construction." [INL DEIS @ B-18] Subsequent (1979) USGS requirements for INL raised that standard to zone 3, then in 1982 INL was gerrymandered back to a zone two. As previously discussed, it is a open debate as to whether the zone three should be reinstated. Since the superstructure of ECF was built in 1957, it too does not meet code requirements.

Earthquakes in INL Region between 1900 and 1973*

Distance in Miles from INL Site

Magnitude Richter Scale	50 - 60 Miles	60 - 70 Miles	70 - 80 Miles	80 - 100 Miles
5.8 to 4.9	0	0	0	3
4.8 to 3.8	1	2	3	15

*** 1983 Borah Peak quake with its epicenter 40 miles from INL registered 7.3, the 1994 Draney Peak of 5.9 and the 1994 Challis with 5.1 on the Richter Scale within 60 miles.**

There are also volcanic hazards. Craters of the Moon, a large volcanic flow, next to the INL site was formed 2,000 years ago - a mere blink of an eye in geologic time. Volcanic cones also exist on the INL site. A complete analysis of the potential for silicic ash-flow sheet volcanism in the INL region was not incorporated in 1995 INL EIS studies. Silicic ash-flow sheets represent a sizable portion of the geologic history of the Snake River Plain and are characterized by the most violent eruption histories. INL is in the middle of the Snake River Plain (SRP). Flying over the SRP, the volcanic flows dominate hundreds of square miles making it look like a moonscape.

To put these seismic and volcanic hazards into perspective, two time frames and facility categories should be analyzed: short-term earthquake hazards on structurally deficient reactors and high-level radioactive waste storage facilities; and long-term hazards of volcanic activity on buried radioactive waste some of which have a half-life of 24,000 years. The eruption of Mt. St. Helens in the 1980's along the Oregon/Washington border along with the Borah and more recent Challis earthquakes would give any reasonable person concern over the wisdom of leaving such radioactive hazards at INL. A National Park Service and US Geological Survey sponsored a study conducted by John Byrd and Bob Smith who said " It looks like the Teton Fault is either on schedule or considerably overdue for a major ground-rupturing earthquake.” The quake would measure at least 7.0 and not more than 7.6 on the Richter Scale. [Idaho State Journal(b),AP 12/7/93]

I.I. General Accounting Office Report

The Idaho Chemical Processing Plant (ICPP) was temporally shut down in 1989 for Resource Conservation Recovery Act (RCRA) violations. Despite the loss of its mission of extracting highly enriched uranium from spent reactor fuel, DOE plans to rebuild the ICPP to current standards so that it can maintain its nuclear materials production capacity. See Section II(A). Responding to public concerns, Senator John Glenn (D-OH) requested that the Congressional General Accounting Office (GAO) conduct a study on INL. *Environmental Problems at DOE's Idaho National Engineering Laboratory* (GAO-RCED-91-56) was released April 15, 1991. "The Energy Department faces immense cleanup and environmental compliance problems at INL," stated Glenn. "Although DOE and its contractors recognize the scope of this problem, their continued failure to meet compliance deadlines could harm the health and environment of our citizens as well as our national security." [Glenn(a), 4/15/91] According to the GAO report: “there are releases of radioactive and hazardous contaminates into the soil, groundwater and drinking water at INL. Tons of hazardous substances, such as chromium, were directly injected into the Snake River Plain Aquifer - an important fresh-water source for the region. [Ibid.]

"The Idaho Chemical Procession Plant [ICPP], which manages spent nuclear navy reactor fuel, has been shut down since July of 1989 due to costly replacement of 6,000 feet of radioactive waste pipes and 11 large-scale underground waste tanks. The shut-down was triggered after INL officials discovered that an underground pipe had corroded through -- leaking unknown quantities of high-level radioactive waste to the environment. According to GAO, the pipe failed because it was `incompatible with corrosive waste it carried' and lacked a secondary containment as required by federal environmental law." [Glenn (a)]

"Currently, DOE has identified over 200 inactive waste sites at INL, which, according to the GAO, `could be a continuing source of contamination to the Snake River Plain Aquifer.' Large quantities of plutonium wastes were dumped at INL that have migrated as far as 110 feet toward groundwater. Four injection wells disposed large quantities of trichloroethylene that have contaminated drinking water wells above federal and state limits." [Glenn (a)]

"Another major [Resource Conservation Recovery Act] RCRA-related containment problem involves waste storage tanks. Of most concern are eleven 300,000 gallon underground waste storage tanks at the chemical processing plant's tank farm. These stainless steel tanks are used to store the highly radioactive acidic wastes resulting from the nuclear fuel reprocessing operation before the wastes are calcined into a solidified granular form. The tanks were cited for incompatible secondary containment because of a June 1989 EPA inspection at the plant. The tanks have a form of secondary containment because they are encased in individual concrete vaults designed to contain leaks. Yet, EPA determined that the vaults do not meet secondary containment standards because of material incompatibility with liquids stored in the tanks." "...five of them [tanks] are considered especially vulnerable. This is because their containment vaults consist of several concrete panels, grouted at the seams that are more likely to leak or breach in a major earthquake than the six other tanks.”

"At both the Chemical Processing Plant and the Radioactive Waste Management Complex, as well as at other INL locations, DOE has identified problems associated with storing its mixed wastes. The problems involve, among other matters, the storage of (1) mixed wastes without having EPA-approved treatment technologies available, (2) stored nuclear fuels that may qualify as mixed wastes subject to RCRA requirements, and (3) mixed transuranic wastes in configurations that do not meet RCRA storage requirements. According to several DOE officials, these issues could ultimately result in RCRA related lawsuits and/or shutdowns of other INL facilities if they are not resolved." [GAO (b) @ 5-6] "A second RCRA-related storage issue at INL involves nuclear fuels that may contain hazardous constituents. Under RCRA, DOE was required to seek permits to continue various operation involving the handling, treatment, storage, and disposal of hazardous wastes. DOE did not include the nuclear fuel storage operation at INL in its permit applications because it did not identify the fuels as mixed wastes subject to RCRA -- these fuels are classifiable as special nuclear materials under the Atomic Energy Act. In this regard, DOE did not originally consider any of the materials in the fuels to be subject to RCRA, even though some of the fuels stored at INL contain hazardous constituents such as cadmium, silver, metallic sodium, or metal carbides." [GAO(b) @ 6-7]

"DOE has not estimated the total costs that would be involved in cleaning up all of INL's inactive waste sites, but partial estimates indicate the cost will be substantial." [GAO @ 9] "Included in the [GAO] report are 113 environmental findings related to air and water protection, waste management activities, cleanup of inactive hazardous waste sites, protection against toxic and chemical materials, National Environmental Policy issues, quality assurance, and other issues ... including an additional 317 safety and health findings." [GAO (b)@ 19]

Then Idaho Governor Andrus stated that, "Nationally, the DOE's waste management practices remind me of a credit card consumer who is nearing the $1000 limit on his charge card. DOE has charged $999, but now wants to make another purchase. Unfortunately, we have reached the limit on waste and it's time to pay the bill. We must, as a nation, come to grips with the problem, address it honestly and solve it. Unless and until the waste dilemma is solved all new projects are in jeopardy and DOE will encounter increasing reluctance on the part of the public and public officials to support open ended assurances that waste management is really being addressed."[Andrus(b)] Idaho Health and Welfare has identified 27 violations of State environmental laws at INL. Although unenforceable, the fines would add up to $115,000. Violations included air, water, hazardous materials handling, waste tanks, waste percolation ponds and trenches. [IDH&W Notice 6/5/91] In a more recent notice of violation (3/21/96), the State Division of Environmental Quality levied enforceable fines on INL totaling $317,300 for 61 violations of the Hazardous Waste Management Act.

I.J. Tiger Team Report on INL

Former DOE Secretary Watkins established a special investigative "Tiger Team" comprised of environmental, health and safety experts to evaluate the DOE sites. The Tiger Team investigated INL in July 1991 and characterized the site as an extremely complex entity with a diverse multi-program mission. This diversity of organizations/contractors and the fact that programs at the INL are sponsored by several offices at DOE Headquarters, has contributed substantially to the overall complexity of the Tiger Team assessment. The following deficiencies were cited in 1991:

1. “The programs required to achieve full compliance with current Environmental, Safety, and Health (ES&H) requirements and to ensure progress towards excellence have not been developed and implemented at the INL.
2. Of particular concern is the lack of oversight of construction, EG&G Idaho's semi-autonomous departments and a particularly deficient radiation protection program, and a pervasive lack of attention to detail at the Chem Plant.
3. No environmental expertise was on staff within the Argonne Area at INL and that several deficiencies that related to the validity of data produced or used by the Radiological and Environmental Sciences Lab for the calculation of dose to members of the public from radiological releases.
4. There is doubt about the ability to accurately measure emissions and calculate dose as a result of unplanned releases.
5. Staff and management training and experience in the recognition of OSHA hazards are severely lacking at the INL.
6. INL has a lack of a comprehensive, cohesive management approach, and virtually no independent ES&H oversight program.
7. INL operations office lacks an arms length relationship with the contractors resulting in ineffective management of the process of awarding of fees which are several areas fundamental to successful operations at the INL but for which the performance level is deficient.
8. Both the large number and the significance of the non-compliance found throughout INL and its contractors are particularly troubling considering that the overall Tiger Team initiative has been underway for more than two years.” [Tiger Team]

I.K. Inspector General's Audit of INL

DOE's Inspector General conducted an audit of INL's construction projects in October 1995 which revealed that $26.4 million in construction projects were unneeded. The audit report states that, "[INL] continued to pursue and budget for these projects because it did not (1) consistently verify the need for these projects; (2) independently identify and evaluate alternatives; (3) reassess the need for these projects in light of the Laboratory's current and foreseeable mission requirements." [WR-B-96-03 @ 5]

The auditors randomly selected 52 projects out of a total of 290 projects at the INL. Seven of those 52 randomly selected projects were found not to be needed due to downsizing at the site. The 52 projects represent a high (18%) random sample rate that is statistically more reliable than a lower sample rate. Those seven projects represent a 13% problem rate that is statistically significant. The auditors do not acknowledge this important fact and recommend a more extensive review be conducted on the other 238 projects. Is there an unstated basis for not recommending a complete construction audit?

The report specifically cites DOE/ID and Lockheed Martin reassessment deficiencies as the cause of $26.4 million in unneeded construction spending. If DOE/ID is not conducting adequate independent verification of need in the construction projects, it stands to reason that problems in other areas of operations may also exist. The report fails to recommend any additional audits in other operational areas.

The auditors recommended canceling the $1.3 million parking lot upgrade project at the Naval Reactors Facility because it was not needed. Why is funding for these Defense Programs coming out of DOE's Environmental Management (EM) budget in the first place, is the real question that needs to be asked. Also see Section III(A).

While it is indeed heartening to see the Department continuing to exercise management control over its field operations, one need only review the August 1991 Tiger Team Assessment of INL to see that little has changed. Clearly, the Department needs to develop a new and effective management process, otherwise the old culture will continue to thumb their noses at headquarters. To his credit, former DOE Secretary Admiral Watkins understood that the field offices were out of control and initiated a more centralized management structure. Secretary O'Leary appears not to understand the mistakes of the past and is attempting to decentralize again (back to the DOE Secretary Harrington era) before the old culture is changed. This is a fundamental mistake in our view.

The audit also found that the Department's Project Management System (Order 4700.1) was violated when a $3.3 million construction project was split into three separate projects in an attempt to circumvent line item budget requirements. Field offices "...are responsible for ensuring the proper classification of all construction projects. Specifically, this Order requires the Department's field elements to classify all projects exceeding $2.0 million as line item construction projects, and to obtain approval from Congress before initiating these types of projects." [WR-B-96-03 @ 13] The audit found, however that a Westinghouse Idaho Nuclear Company official split into three other projects a $3.3 million voice paging and evacuation system upgrade project "...because he believed the Department would not approve the entire project as a single line item." ... "The Office of Inspector General believes that Idaho's internal controls are weak in detecting and preventing future instances of project splitting. Accordingly, the Idaho Operations Office should also consider this condition when preparing its year end assurance memorandum on internal controls." [WR-B-96-03 @ 13, 14] Despite the Inspector General's audit, DOE headquarters awarded Lockheed Martin a bonus of $14.15 million on top of operating costs for a job well done in 1995. [AP(d), 1/4/96]

II. New Plans for Supersite INL

A. ICPP Spent Reactor Fuel Plan

DOE's 1992 *Draft ICPP Spent Fuel and Waste Management Technology Development Plan* (SFP) presented to then Governor Andrus by DOE Undersecretary Leo Duffy generated considerable public concern because it showed DOE's long-term intent to continue spent fuel reprocessing. Processing spent fuel generates large quantities of high-level liquid wastes. These wastes are then incinerated in the ICPP Calcine Facility. This plan outlines an elaborate program for expanding the ICPP into a mass incinerator for foreign, domestic commercial, Navy, and DOE's complex wide spent reactor fuel. [SFP @16&53] Research and development costs, not including any construction, are projected over six years to be $467.7 million. [SFP @4]

Ostensibly, a primary driver for the ICPP Spent Fuel Plan is the Nuclear Waste Policy Act's Land Disposal Restrictions listed in 40 CFR 268. As of May 8, 1992, DOE was violating the law by continued production of high-level radioactive liquid waste and calcine (residuals after incineration). DOE received an extension of the deadline by demonstrating that they are processing waste for ultimate disposal. Between 15,000 and 20,000 metric tons of foreign and domestic spent fuel is slated for the program. The timing of the shipments is controlled by the 1995 Settlement Agreement between Governor Batt and DOE.

Another driver for the Plan is waste volume reduction to minimize the high cost of future permanent repository space. DOE claims that calcine/incineration offers a volume reduction of seven times [SFP@7], but Jim Werner, former Senior Engineer for the Natural Resources Defense Council disputes that claim. Werner states that:

"DOE operating records indicate that the ICPP produced 132 gallons of high-level liquid waste per kilogram of [spent fuel] uranium feed. Operating the [ICPP] Fuel Processing Facility, now under construction, to replace the current facility [CPP-601], will generate approximately 380 gal. of high-level liquid radioactive waste for each kilogram of U-235 processed - almost three times the rate documented in 1963. Based on specific gravity of the U-235 of 10.96, approximately 5,000 cubic meters of high-level waste is produced from each cubic meter of U-235 processed. If the calcining process reduces the volume of this high-level waste by a factor of six, then the increase in volume of the U-235 before reprocessing in the ICPP is still more than 900 times. Processing INL's current inventory of 109,198 kilograms of uranium in spent fuel will generate 41,495,350 gallons of high-level liquid waste." [Werner, NRDC Memo, 1/21/92]

EDI concurs with former Governor Andrus that the most appropriate management of DOE, Navy, and foreign spent fuel is to keep it at its current location in dry storage. At some future time if/when a safe permanent high-level nuclear waste repository is developed, the spent fuel could then be shipped to that site. EDI considers the new Spent Fuel Plan for processing huge amounts of reactor spent fuel an unacceptable hazard for the residents of Idaho and neighboring states. Andrus's comments on the Plan bring up other important and unaddressed issues.

"The Plan proposes to process the spent nuclear fuels and high-level radioactive wastes into forms that are acceptable for permanent disposal in a geological repository. However, the criteria for determining what forms of waste are acceptable for such disposal have not been established pursuant to the Nuclear Waste Policy Act of 1982."... "The absence of those criteria means that neither the Department [DOE] nor the state of Idaho can be assured at this juncture that the technologies to be developed and applied will process the spent nuclear fuels and high-level radioactive wastes into forms that are acceptable for permanent disposal in a geological repository." [Andrus(b) 6/10/92]

Andrus further challenges that should the acceptance criteria allow spent fuel in "as-is" condition, it makes little sense to process it. "I believe the Department has more than enough graphite spent fuels in storage at INL to develop technologies for processing them for disposal. The Plan does not establish that the Department requires additional spent fuels from [Ft. St. Vrain] FSV or any other source to conduct this program." [Andrus(b) 6/10/92 @3] "The Department also must provide binding assurances that the Plan will not be used to turn INL into either an interim or permanent nuclear waste repository. Idaho already has assumed its share of nuclear wastes; hence, it should not be required to accept any additional wastes." [Andrus(b) 6/10/92.@5]

A possible explanation for what appears on the surface as an illogical Plan, is that DOE's hidden agenda in this Plan is to rebuild its nuclear weapons materials production capacity under the guise of waste processing. Currently, DOE's old production facilities including the ICPP are violating environmental laws and must be either shut-down or extensively upgraded. Congressional funding and public acceptance will be radically different if DOE was candid about its true mission for the ICPP. Therefore, DOE's subterfuge might be a well planned ploy to build new nuclear materials production capacity while publicly they claim it is a waste management project.

A clear indication of DOE's hidden agenda can be seen in the Spent Fuel Plan's replacement of high-level waste storage tanks. Four new 500,000 gallon tanks are planned to replace five existing 300,000 gallon tanks. Current storage capacity with eleven 300,000 gallon tanks is 3,300,000 gallons. Removing five old tanks yields a net old tank capacity of 1,800,000 gallons. Four new tanks (2,000,000 gallons) will generate a new capacity of 3,800,000 gallons. This gives a net increase of 500,000 gallon capacity over existing capacity. Existing capacity was adequate for full scale ICPP fuel reprocessing and facility decontamination for nearly fifty years. As of 1997, DOE has put this plan on hold, however the Department retains this option for future production capacity.

Former Governor Andrus, seeing no other options, filed a suit in US District Court against DOE in June 1993. The safety of spent nuclear fuel storage facilities at INL was seriously undermined by DOE documents that surfaced during litigation between the agency and the State. IT Corp's Spent Fuel Background report [Ryan citing][Sept. 18, 1992 @3-24] cited the Underwater Fuel Storage Facility went into service in 1951 with a design life of 30 years and is not in compliance with current DOE Orders. Its design life has already been exceeded by 12 years. Consequently, pools are not an appropriate location for the long-term storage of spent fuel while a high-level repository is being developed. Another report [Ryan citing][WINCO Oct. 1992 @ 100-01] ,Nuclear Fuel Reprocessing Phase-out Plan for the ICPP, cites that the Underwater Fuel Storage Facility at INL lacks an impermeable liner underneath the storage basins, has no leak detection systems, nor any ventilation of air conditioning systems in the basin area. This report also expresses concern over potential leakage through the basin walls into the environment. [Ryan, Ex. B @ 101] Additionally, the report cites that "recent inspections have revealed gross corrosion of the fuel, baskets, and yokes. The potential for a severe seismic event to cause a criticality has not been fully evaluated yet but is a concern." [Ryan @ 50] In his summary judgment against DOE, Judge Ryan cites a March 4, 1993 letter from John Conway, Chairman of the Defense Nuclear Facilities Safety Board that cites the following concerns:

“1.) several unusual occurrence reports issued in 1992 arising from improper fuel storage configurations and degradation of a criticality safety barrier; 2.) safety standards at INL are set too low; 3.) ineffective and/or inadequate inspection practices; 4.) existing detection equipment in some storage pools is inadequate and probably would not recognize a criticality if one were to occur; 5.) independent validation of criticality safety evaluations are not being done; and 6.) the ability of the existing storage facilities to withstand seismic events.” [Ryan @ 51]

Ryan also cites that DOE recently discovered in one of the storage areas 25 highly radioactive fuel elements being stored adjacent to each other, and in the same area, corrosion caused a carbon steel hanger to fail that resulted in a bucket containing spent fuel to drop to the floor. These events occurring in the same area violated the "double contingency" rule (two independent, unlikely and concurrent changes must occur before an accidental criticality is possible). In other words, these events came dangerously close to causing an accidental criticality or nuclear chain reaction at the facility. [Ryan @ 54]

"The Office of Nuclear Safety also expressed significant concern over the Underwater Fuel Storage Basin at the ICPP. In particular, the Office noted that conditions at the facility have degraded to such an extent that the potential for a criticality accident has increased significantly. Particular problems cited in the report included corrosion of fuel storage devices, non-functioning safety devices, storage of spent fuel in unapproved locations, inadequate safety analyses based on inappropriate standards, and failure to follow facility operations procedures." [Ryan @ 53]

DOE's plan to shift spent fuel to the Underground Storage Facility (CPP-749) in order to make room for the Fort St. Vrain spent fuel was challenged by the court because the Environmental Assessment failed to address the fact that the dry wells in the underground facility are nearing the end of their 20-year design life. Furthermore, the most recent annual dry well atmosphere samples from the underground facility showed corrosion occurring in the dry wells, and Westinghouse had expressed concerns about its ability to continue to store spent fuel there safely. [Ryan @ 29]

Judge Ryan concluded that "despite DOE's desire to characterize serious safety concerns as irrelevant, the court finds that the documents are in fact relevant in light of the court's holding that DOE must thoroughly study all of the cumulative effects of the receipt and storage of spent nuclear fuel at INL in a single site-wide EIS. Furthermore, this latest affidavit shows DOE's persistence in down-playing risks and promoting corrective action. The record reveals that significant safety problems have arisen and continue to arise at INL; that DOE has been advised of these problems; and that DOE has failed to take adequate remedial measures. In addition, the record shows that the risks of serious environmental contamination and loss of life increase as additional spent nuclear fuel is brought to INL under these conditions." [Ryan @ 55] Phil Batt succeeded Cecil Andrus as Governor of Idaho in 1994 and, like Andrus, he was forced to continue the legal battle with DOE over INL waste.

In May 1995, DOE released its Record of Decision (ROD) on its Programmatic Spent Nuclear Fuel Management and INEL Environmental Restoration and Waste Management Programs Environmental Impact Statement ordered by Judge Ryan. This ROD articulates DOE's plan to consolidate its inventory of spent nuclear fuel by fuel type. Aluminum clad fuel goes to the Savannah River Site and non-aluminum fuel goes to INL. This allows "the Department to efficiently stabilize spent fuel for safe interim storage if necessary, or initiate new research and development for stabilization and ultimate disposition." [ROD(1995)@30] Stabilizing fuel is a euphemism for processing. Future spent nuclear fuel disposal scenarios in the ROD include "direct geologic repository disposal (in suitable containers) or processing followed by disposal." [ROD(1995)@30]
DOE, for the time being, appears to have backed away from building new high-level waste tanks described in the EIS, however processing start up will mandate it unless the State and EPA give DOE more extensions on the non-compliant existing tanks. The ROD leaves no doubt that DOE remains committed to rebuilding its nuclear fuel processing capability and that INL is one of its two designated supersites.

II. B. New Nuclear Waste Agreement

On October 17,1995 the long legal struggle between the State of Idaho and the Departments of Energy and Navy came to an end. The new agreement on nuclear waste shipments to the Idaho National Engineering Laboratory (INL) lacks the substance that most Idahoans hoped Governor Batt would have held out for.

Even former Governor Cecil Andrus weighed in with the critics, because the final agreement was significantly different from Batt's original offer that Andrus supported. Andrus' main concern was in the area of enforcement. He expressed serious reservations about whether those provisions in the Agreement would actually be enough to make the government keep its word after a generation of breaking it. The $60,000/day penalties stipulated in the agreement are "subject to the availability of the [Congressional] appropriations." [Batt(b)] Idahoans must remember that it is the present Congress that is trying to reinstate sovereign immunity back into the laws. The Republicans in Congress are writing language into the Superfund Reauthorization Act that exempt federal officials from fines and penalties for violating the law.

Andrus' main criticism was directed at Idaho's Congressional delegation, more specifically its senior Senator Larry Craig who left Batt with no choice but to cut what Andrus indicated was an unacceptable deal for the resumption of radioactive dumping in Idaho.

According to an Associated Press interview, Andrus stated that "I'm not going to second guess Governor Batt." ... "But, I think what we have to do is look at how he found himself in the position of having to negotiate; and that was because Larry Craig did not give Idaho the support he should have." Andrus went so far as to say he believed Craig conspired with others wanting shipments to resume to make sure they did.

The most troubling part of the agreement is the State's requirement that, "DOE designate INL as the Department's lead laboratory for spent nuclear fuel." [Batt(b)] The agreement encourages and places no limits on the amount of spent fuel that can be sent to Idaho for processing. Specific expansion projects at the Naval Reactor

Facility at INL are mandated " . . . to accommodate the removal of excess material and examination of Naval spent fuel in a dry condition." These "excess materials" are spent fuel parts that are removed to reduce the volume prior to storage/disposal. The Navy alone has dumped more than eight million curies of this excess material at the INL's Radioactive Waste Management Complex in shallow pits and trenches that would not meet municipal garbage landfill requirements. Since this material is part of the spent fuel element, it is extremely radioactive and requires remote handling and special shielded bottom dump shipping containers that allow the waste to be dropped into the burial ground without direct contact with workers. The recent agreement signed by Governor Batt will in fact increase INL's spent fuel processing volumes and proportionally the fuel element parts that are buried above the Snake River Aquifer. Nuclear Regulatory Commission regulations should be imposed on DOE and the Navy and require the entire spent fuel assembly to go to the repository.

In true pork-barrel style, the INL Agreement mandates " . . . for the fiscal 1997 no less than $7 million for the Navy to construct a Ships Model Engineering and Support Facility at the Naval Surface Warfare Center, Acoustic Research Detachment at Bayview, Idaho." Lake Pend Oreille residents have long fought that facility because of the restricted access to the lake. This appears to be a trade between a military instillation in the north and nuclear waste dump in the south of Idaho.

An equally troubling part of the Agreement is the statement that, "In any administrative or judicial proceeding, Idaho shall support the adequacy of the INL Environmental Impact Statement (EIS) and Record of Decision against any challenges by third parties." The State's previous success in court during the litigation phase was because it demonstrated that the EIS was fundamentally flawed. Yet there is no mention in the agreement to correcting those flaws. In fact, the State is now prepared to defend DOE against the Snake River Alliance suit that challenges the adequacy of the EIS. The Land and Water Fund of the Rockies is representing the Alliance in their suit.

The importance of the EIS cannot be overstated, because it is the only detailed plan that lays out what the government is going to do with its nuclear waste and how it is going to do it. The EIS is also an open process that allows for public participation and comment on its adequacy.

The waste agreement calls for DOE to "ship all Transuranic waste now located at INL, currently estimated at 65,000 cubic meters in volume to the Waste Isolation Pilot Plant no later than 2018." The stated waste volume suggests that the state is only requiring DOE to ship Transuranic waste that is in storage and not the Transuranic waste in the burial grounds. This is a serious shortcoming because it is the buried waste that is migrating into the aquifer and should be prioritized for being exhumed and prepared for shipment. The TRU waste buried and stored at INL's RWMC prior to 1984 that falls between the 10 and 99 curies per gram is currently and technically not TRU waste and therefore falls through a huge crack in the Governor's Agreement. DOE will likely take full advantage of this loophole and rebury this former TRU waste at a new dump site at INL or simply put it back into the pit as is planned for Pit-9 remediation.

DOE is allowed under the agreement to ship foreign reactor fuel to INL under a national security and non-proliferation policy. On the surface, it is logical to keep this material out of the hands of rogue countries that have a history of terrorist activities. However, closer analysis of the countries shipping spent fuel to the US under this non-proliferation policy shows quite another picture. In descending order based on volume of spent fuel shipped, Canada, France, Japan, Netherlands, and Sweden rank as the top five. These top five countries represent nearly 75% of the total foreign shipment volumes. [AR-RF-1158] Idaho is faced with very serious problems just dealing with the waste already on the INL site. As a state, Idaho has shouldered more than its share of the Cold War legacy. Therefore, it is reasonable to expect that the above listed countries take responsibility for resolving their own nuclear waste problems.

The waste agreement also allows DOE to bring off-site nuclear waste to INL for treatment prior to shipment to a non-Idaho waste repository. The same fundamental principles apply to off-site waste treatment as to accepting foreign waste. Generically speaking, waste treatment plants are incinerators that by definition will release volatilized radionuclides and chemicals out the stack. This may be unavoidable to get the on-site waste into a stable form that will not continue to migrate into the environment. However, Idahoans should not have to bear the burden of process emissions from other states or foreign country's waste. INL released more than 18.5

million curies of radioactivity into Idaho's air over the past 50 years. There are limits to the amount of a radioactive biological burden a given population can endure. On October 24, 1995 the Shoshone-Bannock Tribes blocked a shipment of Navy nuclear waste to the INL when they attempted to cross Indian lands. Tribal Chairman Dealbert Farmer stated:

"The State of Idaho and Governor Batt do not represent nor speak for the Shoshone-Bannock Tribes." ... "The State of Idaho had no authority to agree that any nuclear waste shipments would cross the Fort Hall Indian Reservation."... "The Navy and the Department of Energy have never communicated with the Tribes to obtain permission to cross the Reservation."... "The Shoshone-Bannock Tribes are very concerned about the stockpiling of nuclear waste at the INL, the aboriginal lands of the Shoshone-Bannock Tribes, and the 40-year period that the federal government has to remove the high level waste from Idaho." ... " All of the waste, in and out of INL, will cross the Fort Hall Reservation."... "When our ancestors signed the Fort Bridger Treaty of 1868, they reserved the Fort Hall Reservation as the permanent homeland of the Shoshone and Bannock people."... "We are entrusted with the continuing obligation to uphold the Treaty and protect and preserve our lands and people."... "The federal government, which has an Indian policy, must understand that we are here to stay and our concerns must be addressed." [Shoshone]

On October 26, the Tribes agreed to ten shipments crossing the reservation while negotiations proceed with DOE, Nuclear Navy, Department of Transportation, and Department of Justice.

The waste Agreement also gives DOE another 17 years to complete calcining (solidifying) the high-level liquid wastes at INL's Idaho Chemical Processing Plant tank farm. This is an unnecessary and unsupportable delay. These single wall tanks are over 43 years old and pose the most serious health and safety hazard on the site. Over two million gallons in eleven tanks represent a potential radioactivity content of 155.8 million curies. INL's tank waste problem is similar to DOE's Hanford Nuclear Reservation tank problem. By DOE's deadline of 2012 the tanks will be sixty years old. Their original design life was less than 30 years. If DOE was forced to prioritize the high-level liquid waste processing, the job could be completed in less than five years.

Also giving DOE forty years to remove all high-level waste only shifts these burdens on to future generations. The federal government broke every promise and contract it has ever made on nuclear waste. This includes the contract with the commercial nuclear utilities to take possession of their spent reactor fuel by 1998.

The agreement mandates [Section F(1)] the designation of "INL as the DOE's lead laboratory for spent fuel". This lays the policy/ infrastructure ground work that initially will be research and development but later will be a national nuclear waste processing center. This designation is also consistent with the Spent Nuclear Fuel Programmatic Environmental Impact Statement Record of Decision, which the agreement also specifically supports. [Section J(1)]

The Argonne-West (ANL-W) Electrometallurgical / Pyroprocessing Technology project, currently funded by Congress, is the first step in the direction in establishing this spent nuclear fuel processing capacity. Despite its official designation as a demonstration project, the pyroprocessor is being built to full production scale. [See Section II(C)]

The agreement [Section D(2)(b)] sets no limits on importing spent nuclear fuel (SNF) to Idaho, "after a permanent repository or interim storage facility is operating and accepting shipments of spent nuclear fuel from INL". Legislation introduced in Congress [HR-1020; S-1271][Craig's bill] promise to overrule regulatory requirements and State of Nevada objections in order to open the Yucca Mt. high-level repository and Monitored Retrievable Storage (MRS) facilities. This legislation mandates an MRS at Yucca Mt. by the end of 1998. Therefore, if these bills pass, there will be no impediments to waste shipments to INL.

The need to process spent nuclear fuel to prepare it to meet yet to be determined waste repository acceptance criteria has no credible policy or technical basis. Former Governor Andrus was correct when he stated that spent fuel could be sent directly from the generator to the repository and it required no processing. Spent fuel processing also includes the removal of excess materials to reduce the volume prior to storage/disposal. The agreement, because it encourages increased spent fuel processing, will increase the volume of these spent fuel parts to be dumped in Idaho.

Unlimited processing of off-site Transuranic waste is also provided for in the Agreement [E(2)(a)]. "Any

Transuranic waste received from another site for treatment at the INL shall be shipped outside of Idaho for storage or disposal within six months following treatment." The Agreement only mandates the removal/off-site disposal of **stored** Transuranic (TRU) waste at INL. The State and DOE are quick to say that the **buried** TRU waste is covered by the Federal Facility Agreement/ Consent Order (FFA/CO). This is true, however, the FFA/CO only specifies that the burial grounds will be evaluated for re-mediation. There is nothing in the FFA/CO that requires that the buried waste be exhumed and shipped to a repository despite the fact that it is the buried waste that is contaminating the soil and groundwater. Recent Superfund Record of Decisions (SL-1 and BORAX-1 burial sites at INL) stipulate no re-mediation except for a thin soil/rock radiation shielding cover. This is indicative of DOE's unwillingness to dig up buried waste and the State/EPA's unwillingness to press for real cleanup. Notwithstanding the Pit-9 demonstration project that will exhume the contents of this one pit, there is no certainty that other pits, trenches and waste holes will be dug up. Indeed, the Congressional cuts to DOE's environmental restoration budget strongly indicate that no money will be available to fully remediate this dump site. The Pit-9 treatment facility will likely only be used later to treat off-site waste for future disposal in a repository.

An even more troubling problem is the complete reliance by our public officials on the Waste Isolation Pilot Plant (WIPP) to solve all of the TRU waste disposal needs. The WIPP Land Withdrawal Act (Public Law 102-579-Oct. 30, 1992) and the subsequent 1998 Record of Decision specifically limits WIPP capacity to 6.2 million cubic feet (175,637 cm). DOE's 1994 Integrated Data Base Report [DOE/RW-0006.Rev.11] shows the following TRU waste inventories.

Commercial & DOE Complex TRU totals	141,000 cm	Buried
	104,000 cm	Stored
	137 cm	Stored remote handled
	245,137 cm	
WIPP Capacity	175,637 cm	
	69,500 cm	WIPP Capacity Short fall
INL TRU totals	57,100 cm	Buried
	64,800 cm	Stored Contact Handled
	80 cm	Stored Remote Handled
	690,000 cm	TRU Contaminated Soil*
	811,980 cm	INL TRU Total Inventory
WIPP Capacity	175,637 cm	
	636,343 cm	WIPP Capacity Short fall
DOE Complex TRU Estimate Inventories in the year 2020		
	105,000 cm	Current Stored Inventory
	154,000 cm	Newly Generated
	259,000 cm	TRU total in 2020

The above figures show that even if WIPP opens, there is not adequate capacity to take INL's TRU waste let alone the rest of the DOE complex volumes. If the contaminated soil is not included INL's TRU waste would dominate 70% of WIPP's capacity. The situation is even more serious when the estimated TRU inventories in the year 2020 are compared to the WIPP legally mandated capacity. Moreover, there is no national discussion to initiate the siting process for another TRU waste repository. The same capacity issues exist for the Yucca Mt. high-level waste repository in Nevada where the total commercial and DOE inventories are far greater than the design capacity.

II. C. Integral Fast Breeder Reactor Program

by Daniel Hirsch, Committee to Bridge the Gap

Argonne-West's Integral Fast Reactor (IFR) project at INL is the most recent application of DOE's Advanced Liquid Metal Reactor (ALMR) program. The Experimental Breeder Reactor-II is also part of the ALMR program. The IFR represents a grave safety, environmental, and proliferation threat. The reactor "breeds" new plutonium as it operates, uses sodium coolant that can burn or explode if it comes in contact with air or water, and depends on exotic new technologies for separating plutonium, exacerbating already serious nuclear weapons proliferation and waste disposal problems.

Earlier in 1993, President Clinton had announced that the IFR program was to be phased out. This was due, in part, to "significant proliferation policy concerns," as well as its failure to generate commercial interest, according to Budget Director Leon Panetta. In a March 8 letter to Idaho Governor Cecil Andrus, Panetta said, "The IFR reactor consumes as well as produces a wide array of transuranic isotopes, including plutonium-239. This administration plans to continue the bipartisan policy of discouraging support for reactor programs that are based on a transuranic fuel cycle." IFR work is conducted largely at the Department of Energy's Idaho nuclear facility and its Argonne, Illinois laboratory. Idaho and Illinois officials have been lobbying hard to revive the program, and succeeded in getting the Clinton Administration to restore IFR funding it had previously pledged to cut. Fiscal year 1993 funding level for ALMR was $130 million. Argonne's budget is $425 million. President Clinton and Secretary O'Leary were successful in cutting the ALMR program in the 1994 Budget, however nearly $30 million was put into the 1996 budget for the IFR’s spent fuel Pyroprocessing facility.

In the 1970s, the U.S. established a national nonproliferation policy opposing the "plutonium economy" -- nuclear fuel cycles dependent upon separating plutonium from spent nuclear fuel and using that plutonium in reactors that produce more plutonium as they consume it. Plutonium separation is known as "reprocessing," and reactors that both use and produce plutonium are known as "breeders." In the early 1980s, President Reagan quietly abrogated that policy and pushed work on new reprocessing and breeder technologies. The centerpiece of that work is the IFR.

By way of background, the IFR breeder is a "fast" reactor. Current commercial reactors utilize fuel based on low-enriched uranium as fuel and water as a coolant/"moderator" to slow the neutrons down to make fission more efficient. Fast reactors, by contrast, use plutonium for fuel, so powerful a material that no moderator is needed to slow the neutrons to make the reaction more efficient. These reactors run, therefore, on "fast" neutrons; hence the name, "fast" reactor.

Because of its use of sodium as a "liquid metal" coolant, the IFR is particularly dangerous because sodium, in the presence of air or water, can explode and/or burn, causing the whole reactor to catch fire. Additionally, the reactor uses plutonium- based metallic fuel, which itself is flammable. Neither risk - coolant or fuel catching fire -- exists with traditional reactors, which use water as the coolant and uranium oxide rather than plutonium metal as fuel.

Furthermore, because of the use of plutonium as fuel, a meltdown in such a reactor is especially dangerous. If the molten plutonium forms a critical configuration, a small-scale nuclear explosion can occur, releasing the radioactivity into the environment. Such an event cannot occur in a normal reactor using low enriched uranium and no added plutonium.

But the central concern about the IFR is that it is a "breeder" reactor. The IFR is designed to produce new plutonium constantly as it consumes old plutonium. This produces major nuclear weapons proliferation risks. If that plutonium were diverted or stolen, the results could be grave.

Finally, an important component of the IFR is a new reprocessing technology called "Pyroprocessing" or "electro- refining." Traditional techniques for separating plutonium from spent nuclear fuel involve dissolving it in acid and using solvent extraction, a process known as PUREX (Plutonium URanium EXtraction). IFR advocates are attempting to develop a far cheaper technique, in which spent nuclear fuel is dissolved into a molten salt at high temperature ("Pyroprocessing") and an electric current is passed through it, with the plutonium and other Transuranic elements "plating out" on one of the electric poles ("electro-refining"), with the remaining fission products (90+% of the waste) staying behind in the salt. The remaining high level waste would, in some proposals, be disposed of in surface low-level dump sites rather than more expensive deep geological repositories as currently planned, a very dangerous outcome.

The IFR reprocessing technique would, thus, vastly increase the volume of radioactive waste; put it in a far worse chemical form, far more difficult to dispose of properly (soluble salt); involve large environmental releases during routine operations; and pose major accident risks. Most importantly, it would provide a new, cheaper, easier technique for separating plutonium from spent fuel, creating a major proliferation problem. And it would lead to a kind of plutonium economy, with large amounts of plutonium available for theft or diversion for weapons purposes. (Claims by IFR advocates that the plutonium would be mixed with other actinide elements such as americium and neptunium are misleading; these are readily removed.)

Proponents of the IFR are now trying to call it an "actinide burner" rather than a breeder reactor, and call its plutonium separation technology "Pyroprocessing" rather than reprocessing. However, a name change cannot alter the fact that the IFR is simply the long-discredited breeder reactor and plutonium reprocessing system in new clothes.

Because the IFR produces more plutonium as it consumes other plutonium, studies by the National Academy of Sciences, Livermore National Laboratory, and the American Physical Society have concluded that one would have to run numerous IFR's for a thousand years to even reduce plutonium inventories to 1% of current levels -- and that would still be a ten-fold poorer result than the IFR design goals. Every time some plutonium would be consumed in such a reactor, a good deal of additional plutonium is produced, plus a huge quantity of other high level radioactive wastes. Orwell would be bemused by an industry that calls such a scheme the "solution" to the problem of radioactive wastes.

Because of concerns that a "plutonium economy" would radically increase proliferation risks, the U.S. government in the 1970s forbade commercial reprocessing of plutonium from spent nuclear fuels and its subsequent "recycling" in breeder reactors. What is not widely recognized is that this policy was quietly reversed in the 1980s by the Reagan Administration, and that a far-flung DOE program was quietly undertaken to develop new technologies for plutonium reprocessing and breeder reactors. These projects have advanced with little public attention to date, yet pose a major unaddressed proliferation risk. This program, under the general rubric of "partitioning and transmutation" or "actinide burning" is actually a very dangerous effort to develop exotic new nuclear technologies for plutonium separation and recycle. It is imperative that there be a serious review of and effort to expose to public scrutiny this program that could so severely exacerbate proliferation problems.

The new partitioning and transmutation (PT) projects have two major components: (a) new methods of separating plutonium and the minor actinides from spent fuel, particularly using pyro-processing or electro-refining techniques, and (b) recycling those actinide elements, primarily as fuel in a new generation of reactors called "actinide burners." These new reactors are essentially breeder reactors modified so that the breeding ratio is below 1.0, i.e., so that they produce somewhat less plutonium than they consume. Because they do produce substantial amounts of new plutonium as they fission the old, they are very inefficient "transmuters." It has been estimated that one would have to run such reactors for 1000 years to reduce plutonium inventories in spent nuclear fuel by a factor of 100.

The IFR project is designed to be a self-contained full cycle facility where the reactor fuel is fabricated, burned up in the reactor, reprocessed, and finally full cycle back to new fuel fabrication. All these functions occur within the same facility. Reprocessing of high plutonium content spent fuel by melting the fuel elements is a hazardous business due to the volatilized nuclides that go out the stack. This issue is particularly problematic if the spent fuel is not put in cooling ponds for a year or more to allow the short lived isotopes to decay prior to reprocessing. Emission control system technology simply has not yet evolved to adequately filter/scrub out volatilized nuclides such as iodine and krypton species.

Credible challenges have been raised by Jim Smith, a metallurgical engineer who worked on the IFR fuel design. Smith uncovered flawed ANL-W scientific data on IFR fuel's ability to sustain temperatures that will be generated in the reactor. ANL-W harassed Smith for exposing the flawed data and ultimately fired him. Smith petitioned DOE's Inspector General to review his harassment/dismissal case. DOE responded with a 1991 report from the Office of Nuclear Safety, authored by Steve Blush. The report understated Smith's allegations as a result of ANL-W's pressure on DOE, but was extremely critical of ANL-W's handling of Smith's termination. Recent Congressional legislation that extends "whistle blower" protection to DOE and DOE contractor employees mandated that the agency challenge ANL-W's actions. Smith however has yet to be reinstated, and reportedly is extremely concerned that IFR fuel designs have not been independently reviewed.

A coalition of organizations - Nuclear Control Institute, Friends of the Earth, Greenpeace International, INL Research Bureau, Natural Resources Defense Council, Public Citizen, Safe Energy Communication Council, Snake River Alliance, and US Public Interest Research Group, threatened to file suit against DOE and Argonne National Laboratory (ANL) for violation of the National Environmental Policy Act (NEPA). DOE and Argonne tried to proceed with the IFR electro refining/pyroprocessing without conducting an Environmental Impact Statement (EIS) required under NEPA. Selected text of the coalition letter to DOE (8/25/95) written by Dan Horner follows in section D. In December 1995, DOE agreed to only conduct an Environmental Assessment which is an abbreviated form of an EIS.

II.D. Pyroprocessing of Spent Reactor Fuel [by Daniel Horner, Nuclear Control Institute]

Electro-refining (often used interchangeably with the terms “Pyroprocessing” and “Electrometallurgical technology”) is summarized as follows in a recent report by the National Academy of Sciences: ”The Electrometallurgical technology under development at ANL is derived from many years of R&D on molten salt systems for the production of materials for nuclear reactors and weapons....The heart of the process is the electro refining step, which employs a metallic feed, molten alkali metal salts as the reaction medium, and two cathodes, one steel and the other an immiscible pool of molten cadmium, to separate actinides from fission products and other nuclear reactor fuel materials.”

The electro refiner was originally designed to serve as the reprocessing component of DOE’s Advanced Liquid Metal Reactor (ALMR) program. Reprocessing is the general term for separation of actinides, including uranium and plutonium, from fission products in spent nuclear fuel. The ALMR, also known as the Integral Fast Reactor or IFR is a special type of nuclear reactor known as a “breeder” capable of producing more plutonium than it consumes. In conjunction with the electro refiner, it formed a so-called closed fuel cycle. The spent fuel produced by operation of the ALMR was to be reprocessed in the electro refiner, and the resulting uranium and actinides were then to be fabricated into fresh fuel, and returned to the ALMR to continue the cycle.

In 1994 Congress, with the support of DOE terminated the ALMR program. A paramount reason, along with the budgetary one, for terminating the program was its inconsistency with US non-proliferation policy - a point that the Department emphasized in its communications with Congress.

At the same time ANL began to suggest other applications for the electro refiner. A key current mission of the DOE is to reduce the environmental hazards of certain types of its spent nuclear fuel (SNF). DOE contends that the electro refiner could be applied to this mission. That application is the basis for DOE’s seeking to start up the electro refiner.

Start-up of the electro refiner clearly falls into the category of “major Federal actions significantly affecting the quality of the human environment,” the criterion established by NEPA for determining whether an EIS is required. The initial application of the electro refiner will involve the processing of the more than 20 metric tons (100 EBR-II spent fuel driver assemblies and 25 irradiated blanket assemblies). This amount, while clearly significant enough in itself to justify an EIS, represents only a small fraction of the thousands of tons of DOE SNF that is planned or contemplated for Pyroprocessing.

Among the effluent streams are metallic waste forms that have not been characterized and are likely to be unsuitable for emplacement in Yucca Mountain or a similar repository environment. Because they are metallic, they will tend to be more reactive in such an environment than alternative waste forms. This factor would delay, complicate, and raise the cost of ultimate disposition, as well creating difficulties for interim storage. Therefore, these uncharacterized waste forms clearly would have significant environmental impacts.

Disposition of the other effluent streams, those containing uranium and transuranic, respectively - is uncertain, and DOE's plans even for the interim storage have not been well articulated. Neither of the streams is amenable to direct geologic disposal. Under the most likely processing scenarios, at least one, and very possibly both, of these streams would consist of nuclear-weapons usable material. Therefore, the uranium and Transuranic streams would have significant environmental and non-proliferation impacts.

Use of the electro refiner also raises broader environmental and nuclear-proliferation issues. For example, Pyroprocessing of spent fuel produces a net increase in the amount of radioactive waste, a fact that calls into question its utility as a tool of environmental management. Indeed, since DOE's enormous spent-fuel management problems were largely caused by reprocessing, with little thought for the long-term consequences, claims that a reprocessing technique will solve these problems deserve to be treated with skepticism. Furthermore, if the environmental-management mission, at least with regard to the EBR-II spent fuel, is to remove sodium, it is not at all clear why that mission requires separation of the spent fuel into various streams - particularly when this separation would result in nuclear-weapons-usable material.

DOE's claim that it has fulfilled its NEPA obligations rests primarily on a 1990 Environmental Assessment (EA) and Finding of No Significant Impact and secondarily on a very limited treatment in a 1995 programmatic EIS. Reliance on the 1990 document is plainly unacceptable. In light of the significant environmental impacts presented by the proposed action, the Department cannot rely on an EA to satisfy its NEPA obligations here. Start-up and operation of the electro refiner demands the detailed environmental analysis and opportunities for public participation afforded by the EIS. Moreover, DOE's own NEPA regulations require preparation of an EIS as opposed to an EA, for proposals to start-up and operate reprocessing facilities.

Even if an EA could satisfy DOE's NEPA obligations here (a notion we vigorously contest), the 1990 EA is so outdated that it cannot possibly support the proposed agency action. First, the mission for which the electro refiner originally was designed (the ALMR program) was fundamentally different in 1990 from what it is today (treatment of EBR-II spent fuel and other DOE SNF). Second, analyses in the intervening period have raised important environmental questions about the storage and disposition of the electro refiner's effluent streams - questions that arise in large part because of the change in the electro refiner's mission. Third, US non-proliferation policy has changed significantly since 1990; indeed, President Clinton's non-proliferation policy, announced on September 27,1993, constituted one of the key reasons for cancellation of the ALMR, the electro refiner's parent program in 1994. None of these crucial factors were (or could have been) analyzed in the 1990 EA. Nor are they analyzed in the 1995 PEIS. Moreover, the discussion of electro refiner operation contained in the PEIS is general and cursory. The document was not intended as a site-specific NEPA analysis of electro refiner operation, and it does not function as such. Thus, the Department cannot rely on it.

But even if nothing had changed since 1990, the existing documentation fails to meet the requirements of the law. The documents fall far short of the NEPA requirement to "rigorously explore and objectively evaluate all reasonable alternatives," including the No Action Alternative. Indeed, the two key sets of alternatives, storage of the EBR-II spent fuel, as has been done for the past 30 years, and exploration of alternative processing techniques are addressed only in the most cursory and dismissive fashion. This omission is particularly striking in light of DOE's acknowledgment that the EBR-II spent fuel, as presently managed, presents no compelling environmental, safety, or health concern.

Given the shortcomings in the analyses contained in the existing DOE documents, the fundamental changes in the program that are not addressed in those documents, and the critical environmental and non-proliferation implications of start-up of the electro refiner for its new proposed mission, we find it astonishing that DOE deems it unnecessary to prepare an EIS. In its failure to consider the environmental impacts of the course it has chosen, to analyze alternatives to that course, and to obtain input from the public, DOE has exhibited precisely the type of decision making that NEPA was designed to prevent.

Operation of the electro refiner would produce effluent streams about which there are many uncertainties. An EIS, incorporating the latest information from recent analyses much as those conducted by the National

Academy of Sciences (NAS), would have been an appropriate way to address key issues to the extent possible on the basis of the available information, and to indicate what uncertainties remain. But DOE has done none of that.

The environmental problems arise from both of the two basic groups of effluent streams that would, or could, be produced by the electro refiner. The first of these is the metallic waste forms. In terms of the geologic disposal problems, these waste forms differ in important ways from those with which DOE is most familiar. In its NEPA documents, DOE has not addressed the implications of these differences, much less proposed a credible solution to the problem.

In a recent study on plutonium disposition - another application of Pyroprocessing that its backers at ANL and DOE had advocated - a panel of the NAS rejected Pyroprocessing, in large part because "it would produce a waste form that has not been characterized at all for long-term disposition and would probably be unsuitable for emplacement in Yucca Mountain."

Another NAS report, requested by DOE specifically to examine the utility of Pyroprocessing for spent fuel treatment, expressed similar concerns. It said, "The major limitation of the electro-metallurgical process (whether applied to [Hanford] N-Reactor fuels or other SNF) is its present inability to produce waste forms with behavior that is well understood (in comparison, for example, to the degree to which glass forms have been studied)...The time and cost for qualifying any waste form are expected to be large, and the qualification process is fraught with technical and political pitfalls. To date, no waste forms have been licensed or qualified for geologic disposal, although a large body of knowledge has been accumulated on borosilicate glass, which is the leading candidate waste form for high-level waste and is favored over other waste types."

DOE's NEPA analysis does not in any way address this key drawback of Pyroprocessing. Nor does it address the problem with the second set of effluent streams. In this set are one stream consisting of uranium and another consisting largely of Transuranic elements, including plutonium. Again, the comments of the Barolo [NAS] report are instructive. "According to the ANL's proposal, the first two output streams would be directed to interim storage rather than to final geologic disposal. Nonetheless, there are attendant safety and proliferation issues with respect to the surface storage of such materials for an unspecified duration." ... "If [spent fuel treatment] processes and waste streams were to yield separated uranium and plutonium, the storage problems would be significantly increased, as would the need to safeguard these separated materials from theft and diversion. Above all, product streams from this development program must be of a nature that their later treatment for ultimate disposal after interim storage is not precluded." And in its concluding list of the disadvantages of Pyroprocessing, the NAS said, "Uranium and TRU [Transuranic] products might be considered waste, destined for TRU waste storage or permanent disposal. Disposal would probably require oxidation of the uranium metal and TRU metal streams to oxides. If the uranium product were to be a waste stream but not acceptable for geologic disposal, the additional processing steps (e.g. oxidation) would bring into question the usefulness of the proposed electro-metallurgical technology."

This last paragraph indicates a key dilemma posed by Pyroprocessing. If the uranium ultimately is to be disposed of as a waste, then additional time and costs will be required. At lease as important, the figures for the amount of waste produced by the process and, consequently, its environmental impact, would increase dramatically. If, on the other hand, the uranium is stored in the form in which it was produced - up to 68 percent enrichment according to DOE - either in Idaho or at the Oak Ridge National Laboratory in Tennessee, or blended down to a lower enrichment level, then there are a host of environmental and non-proliferation issues concerning the processing, transportation, use, and physical security of this material.

DOE avoids addressing the troublesome realities of either of these options by failing to consider anything beyond interim storage (and even that phase, as noted above, is addressed only in the most cursory way). The failure to address long-term consequences as a result of alleged near-term needs is precisely the type of situations in which an EIS is most needed. The far-reaching environmental implications of start-up of the electro refiner, in both the short term and the long term, plainly warrant detailed analysis in an EIS.

Proliferation consequences arise from both the Transuranic stream and the uranium stream. The uranium stream contains nearly pure uranium at the enrichment level of the fuel from which it is derived. EBR-II driver fuel, on of the principal components of the initial application of the electro refiner, is highly enriched - at levels up to 68%, according to DOE. As noted in the previous section, a recent National Academy of Sciences study highlighted the “attendant safety and proliferation issues with respect to the surface storage of such materials for an unspecified duration”.

In addition, there are important policy considerations that would be raised by the separation of highly enriched uranium (HEU). The US government led by DOE has made the ending of the production and use of HEU a central element of US non-proliferation policy. What then, would be the impact of going forward with a process that would separate HEU - particularly when the plans for its ultimate destination are so poorly articulated.

Plutonium, the other weapons-usable material, is contained in the Transuranic stream, which raises equally serious concerns. While Pyroprocessing advocates have disputed the proliferation implications of their process, the NAS for all practical purposes, settled this point when it said, “Although the developers of the electro-metallurgical technique argue that the technology is proliferation resistant, any SNF processing that is capable of separating fissionable materials from associated fission products and Transuranic elements could be redirected to produce material with nuclear detonation capability.”

The nuclear proliferation concerns raised by this fact create a serious drawback to the whole ALMR Pyroprocessing program. These concerns are, in at least one important respect, exacerbated under the new mission for Pyroprocessing because the Transuranic stream will not, as planned under the original ALMR concept, be recycled back into a reactor. Since its principal radiological self-protection comes from Cerium-144 (the much longer-lived Cesium-137 is removed by Pyroprocessing), this protection tapers off to such an extent that after several years it no longer meets the “spent fuel standard”. Cerium’s short half-life (284 days, in contrast to the 30 year half-life of Cesium-137) was not considered a serious problem when the Transuranic were intended to be recycled quite promptly into the ALMR. But with the longer storage times now contemplated, the problem could be far more serious. This issue provides an important example of the way in which the change in missions since the 1990 EA renders that EA completely inadequate.

Similarly, on a broader policy level, a crucial development that has taken place since 1990 is the enunciation of the Clinton administration’s non-proliferation policy on September 27, 1993. This policy statement committed the US “to seek to eliminate where possible the accumulation of stockpiles of highly-enriched uranium or plutonium” and further stated, “The US does not encourage the civil use of plutonium and, accordingly, does not itself engage in reprocessing for either nuclear power or nuclear explosive purposes.” This policy, and the specific actions the administration has taken to implement it, would be directly contradicted by proceeding with Pyroprocessing.

We emphasize that we strongly support the Department’s stated goal of expediting the safe shutdown and defueling of the EBR-II. The EIS we seek should not interfere with that goal, and it may serve to expedite it. First, it is clear that use of the pyroprocessor is not the only option for dealing with the EBR-II fuel. The spent fuel from this reactor has been stored for 30 years, apparently without ill effects. Proponents of start-up in DOE’s Office of Nuclear Energy, have argued that storage is politically untenable, because of anticipated objections from the State of Idaho. It should go without saying that political circumstances should not allow one option to prevail when other technically acceptable alternatives, including storage, are available - particularly when those alternatives are more environmentally benign and more supportive of US non-proliferation efforts than the proposed option.

Second, in the context of this letter, the alleged political difficulties of an alternative most assuredly do not relieve DOE of the responsibility of carrying out the analysis of that alternative (and others) as required by NEPA. Nor do they relieve DOE of its obligation under NEPA to provide an analysis of the environmental impacts of the alternative it has chosen.

Finally, it must be emphasized that the 1995 PEIS covers not just EBR-II blanket treatment, but also “Electro-metallurgical Process Demonstration”. As noted above, the EBR-II spent fuel represents only a small fraction of the vast amounts of material that could be treated by Pyroprocessing. DOE has not given any indication that it plans to conduct any NEPA analysis beyond that contained in the 1995 PEIS. Therefore, we are asked to accept the superficial and grossly deficient analysis in that PEIS as the basis for processing at least tens of tons - perhaps eventually thousands of tons - of highly radioactive material.[NAS]

II.E. Environmental Assessment on ANL-W (Now Called Materials and Fuels Complex) Pyroprocessing

DOE released a Draft Environmental Assessment Electrometallurgical Treatment Research and Demonstration Project in Fuel Conditioning Facility at Argonne National Laboratory-West in January 1996. DOE is continuing to violate the National Environmental Policy Act (NEPA) by not conducting the required Environmental Impact Statement (EIS). The Environmental Assessment (EA) does not legally fulfill NEPA requirements. Without prejudicing the Environmental Defense Institute's (EDI) finding the EA inadequate, EDI supports the third alternative; "taking no action, placing all the EBR-II SNF in interim storage, and not demonstrating the electrometallurgical treatment technology".

Idahoans are outraged at DOE's subterfuge of using waste management as a guise to rebuild its special nuclear materials production capacity. No credible scientific analysis has been offered by DOE to show that EBR-II spent nuclear fuel (SNF) cannot be safely stored in interim monitored storage facilities or in long-term repositories.

DOE's own Spent Nuclear Fuel Vulnerability study shows no hazards related to EBR-II fuel storage other than decrepit facilities that are operating beyond their design life. Long-term underwater storage of **any** SNF will result in cladding failure. Even after DOE knew that a geologic repository was not going to be available for decades, the Department failed to move SNF from the wet storage to dry storage. Fuel cladding failure in inadequate storage facilities like CPP-603 was not unique to EBR-II fuel. SNF cladding failures are an indictment of DOE's own mismanagement of its wastes.

ANL-W has a twenty year history of safe dry storage of EBR-II fuel at Hot Fuel Examination Facility (HFEF). ANL-W claims that "only a few" elements are stored at HFEF and that they do **not** represent a "statistically significant sample". DOE's Spent Fuel Working Group Report cites 90 EBR-II assemblies in storage at HFEF which **is** a statistically significant sample. This same report states that EBR-II stainless steel clad fuel stored at the Radioactive Scrap and Waste Facility (RSWF) "are not breached". Vulnerabilities cited in the report were related to inadequate storage areas including the RSWF. Idaho Division of Environmental Quality issued a Notice of Violation on the RSWF October 20, 1995. ANL-W has cut corners with its underground fuel storage. The RSWF is a crude soil vault that lacks the corrosion control and essential monitoring features of above ground dry casks. Therefore, DOE's claims of EBR-II SNF vulnerabilities that are greater than many other fuel types is unsubstantiated. The EA claims an inventory of only 330 blanket assemblies whereas the Spent Nuclear Fuel Working Group Report acknowledges 500 currently being stored. This is a significant discrepancy.

The EA fails to fully characterize the ongoing project's waste streams. With decades of operating experience and presumably continuous data collection and record keeping, ANL-W is remiss in not fully disclosing this information. The EA acknowledges reprocessing over 570 EBR-II assemblies since 1964 [DOE/EA-1148@36]. For instance, a breakdown of air emissions would show significant volatilized radionuclides that HEPA filters are not designed to control. ANL-W's unwillingness to provide wet caustic scrubbers to reduce volatilized nuclide releases is unacceptable. With the potential of 203,000 curies available for release in any single process batch this represents a significant hazard.

ANL-W deserves due credit for initiating for the first time in the history of the AEC/ERDA/DOE the classification of SNF parts and assemblies as Greater Than Class C waste requiring final disposal in a geologic repository. Unfortunately, this change follows EDI's exposing DOE's practice of shallow land burial and showing the public DOE's own shocking data gained through a Freedom of Information Act request. This policy represents a significant move toward responsible waste management that hopefully will be adopted throughout the DOE Complex.

The EA inadequately addresses the non-proliferation compliance issues. Indeed, ANL-W's comparison of PUREX type SNF reprocessing “footprints” (600,000 sq. ft.) with the pyroprocessing (16,000 sq. ft.) “small footprint” literally clinches the argument. This proliferation prone technology is so compact that it would be extremely difficult if not impossible to detect in a non-compliant country. Moreover, diversion of throughput after the “cathode processing” stage would be undetectable even in this country. Therefore, even the American public would have no assurance that DOE itself was not producing weapons grade material at this facility.

The EA’s environmental impact calculations assumed a low 10% burnup. [DOE/EA-1148@73] Yet when trying to justify EBR-II SNF vulnerabilities, the EA characterizes EBR-II SNF as high burnup [DOE/EA-1148@122] which means high quantities of fission products that will be released during reprocessing. If the high burnup characterization is correct then the source term assumptions are wrong and the environmental releases may be grossly understated.

This EA further violates NEPA by its own admittance because it is retrospective. The Department has committed funds for many years (acknowledged in the EA) toward construction of the pyroprocessing facility at ANL-W.

The whole thrust of NEPA is to force agencies to conduct an EIS **prior to** committing resources so that expenditures will not prejudice the decision making process. The EA’s proposal to defer any EIS until after the “demonstration project” technology is proven ignores NEPA’s mandate that an EIS be prepared **in advance** of the stage where a program “has reached a stage of investment or commitment to implementation likely to determine subsequent development or restrict later alternatives”.

The fact that ANL-W’s pyroprocessor is already complete only highlights the need for an immediate EIS, and does not provide a rationale for deferral of full NEPA compliance. The pattern of “phased” EA’s improperly segments the NEPA process, and obfuscates the need to prepare an EIS prior to any irretrievable commitment of resources. The EA reflects that detailed planning and substantial federal resources have been advanced toward a full scale electrometallurgical processing facility.

In May 1996, DOE issued a Finding of No Significant Impact on the electrometallurgical plant which means that the Department believes that the Environmental Assessment was adequate and that no significant impacts were identified. The plant continues to receive full funding at $50 per year up through Fiscal Year 1998.

III. Environmental Cleanup vs. Nuclear Weapons Buildup

A. INL'S Environmental Management Plan

A number of events converged in the last five to seven years that conspired to fundamentally alter the DOE’s nuclear weapons complex. First, public outrage over environmental, safety, and health violations forced the closure of many of DOE’s production sites. Second, the end of the Cold-War meant that previous production levels of nuclear weapons could not be justified. Indeed, with the Salt Treaties, there is now a warhead surplus that poses its own disposal problems. Third, the mortgage payments on the environmental legacy of the Cold War could no longer be deferred. This mortgage, originally estimated to range between $360 and $500 billion. The last estimate (1996) dropped to a range between $189 and $265 billion still ranks as the largest public works project in the history of the country. These reduced cost estimates reflect DOE’s ability to cut corners on cleanup.

The bomb makers devised a series of new plans to restructure the DOE Complex. Complex-21, and Complex Reconfiguration are two such plans launched in the early 1990's. Basically what these plans envisioned was a smaller leaner nuclear production and testing complex using designated “Super-Sites”. INL and Savannah River were at the top of the Super-Site list. Even these sites were in bad shape with aging facilities that were many decades beyond their design life. The bomb makers desperately wanted modern nuclear production capacity that would meet current standards. So they shifted modernization projects from the Defense Program budget to the Environmental Management Budget in the early 1990s to ease passage through Congress, and avoid public scrutiny.

A detailed DOE budget analysis for FY-92 by Heart of America Northwest in *The Dirt in the USDOE's Nuclear Waste Clean-up Budget* further revealed how DOE diverted $547,859,000 from clean-up to subsidize Atomic Energy Defense Nuclear Materials Production programs. "Forty-four % of all `clean-up account' construction projects were found to be for weapons production and research missions, instead of clean-up."[Dirt @iii] "The 1992 cost of these projects that do not belong in the clean-up account is actually the tip of the iceberg. Over the course of the complete construction schedules for these projects, they will cost the Clean-up Account $821.484 million. (Based on the USDOE listed Total Estimated cost, or TEC, for each project) [Dirt @ 22] INL's "clean-up" construction projects supporting defense production missions for FY-92 is $12,995,000; and $91,600,000 over the complete multi-year construction schedules. [Dirt @ 33]

Funding, through 1998, for the ANL-W pyroprocessor for spent fuel is yet another project characterized as a waste management budget item when it should be a Defense Program item. See Section II(D). This is a back door attempt to modernize the nuclear materials production capacity under the guise of waste management. Spent fuel requires no processing to meet acceptance criteria at disposal repositories. Also see Section I Inspector General Report.

The first years of the Clinton Administration changed some of the old culture but not as much as DOE's critics had hoped. Funding for nuclear weapons was decreased and cleanup funding was increased. Unfortunately, the new 1994 Republican Congress reversed these changes. Now nuclear weapons funding is increasing by $40 billion and cleanup is decreased by $4.4 billion over five years. DOE's 1998 Defense Programs appropriations increased six percent over 1997 and again the budget request for these programs in 1999 increase 8.6 % over 1998. DOE's 1998 Environmental Management appropriations were down 2.5% from Fiscal Year 1997.

DOE's INL 1996 Baseline Environmental Management Report shows a change from $30 billion 1995 INL cleanup estimate reduced to a $19 billion 1996 cleanup estimate. [BEMR(d)] This is not surprising because previously DOE thought they would have to do serious cleanup at INL. However, the State and EPA allowed DOE get away with inexpensive cover-up caps over dump sites as opposed to exhuming the waste and properly disposing of it at a repository. Thus the cleanup cost estimates are nearly half of earlier projections.

III. B. INL Site-wide Environmental Impact Statement

The Environmental Defense Institute (EDI) supports the Department of Energy's (DOE) involuntary decision to conduct a site-wide Environmental Impact Statement (EIS) of the Idaho National Engineering Laboratory (INL). Responding to a citizen law suit, (EDI was a co-plaintiff) DOE initiated in 1991 two Programmatic Environmental Impact Statements (PEIS) of its nuclear weapons production complex. One PEIS covers Environmental Restoration and Waste Management (ER/WM PEIS) or "Cleanup", and the other PEIS covers Reconfiguration or "Modernization" of DOE's production Complex. In 1992 DOE decided to do a third PEIS or Spent Nuclear Fuel PEIS. These three PEIS's do not meet the complex wide programmatic National Environmental Policy Act (NEPA) requirements. DOE failed to comply with the Court's Stipulation by not producing the ER/WM PEIS but only generated a WM PEIS. The citizens groups went back to Court in May 1997 to force the Department to meet its legal obligations on the remaining ER PEIS. As of January 1998, DOE has been found in contempt of court. The importance of this ER PEIS lies in a number of the following issues.

- DOE would be obliged to establish complex wide cleanup standards.
- DOE would have to articulate where and how much of the waste is going to be disposed.
- Define the impact of workers from intersite transport
- Institutional controls and land usability/long term stewardship
- Priority for complex wide cleanup

DOE is also responding to a June 28, 1993 Summary Judgment from US District Court, District of

Idaho. Judge Harold Ryan found in favor of the State of Idaho and the Shoshone-Bannock Tribes. He issued an injunction on additional DOE waste shipments to INL until a comprehensive EIS was conducted and a Finding of No Significant Impact was determined. Ryan found that; "In light of all of these changes and new proposals, the court strongly believes that DOE must prepare a comprehensive, site-wide EIS addressing all nuclear waste activities at INL." [Ryan @35]

"On December 22, 1993, Senior US District Judge Harold L. Ryan issued an Order ratifying proposed modifications to the US District Court's Opinion and Order of June 28, 1993. Subsequently, the Notice of Non compliance Consent Order between the Idaho Department of Health and Welfare (IDHW) and DOE, signed April 3, 1992, was amended on March 22, 1994, to include mixed waste management stipulations outlined in the ratification Order dated December 22, 1993. The amended Consent Order requires DOE to take the following actions:" [WINCO-1216]

* "Calcine all high-level liquid radioactive waste that does not contain sodium on or before January 1, 1998."
* "Calcine or otherwise process as much sodium-bearing high-level liquid radioactive waste (sodium-bearing waste) as DOE and the IDHW mutually agree is practicable by January 1, 1998."
* "...evaluate and test Freeze Crystallization, Radionuclide Partitioning, and Precipitation, the sodium-bearing treatment technologies identified by DOE in a November 15, 1993 letter."
* " Select the sodium-bearing waste pre-treatment technology, if necessary, and calcine or processing technology by June 1, 1995."
* "within ninety (90) days following the selection of ... technologies for sodium-bearing waste calcination and calcine conversion, ... enter into negotiations [with IDHW] on the construction schedule for any necessary facilities to implement the technologies."
* "On or before March 31, 2009 ... permanently cease use of [tank farm tanks with pillar and panel vault construction] and all associated vaults; or .... achieve compliance with all secondary containment requirements set forth in IDAPA ss 16.01.5009 (40 CFR ss 265.193)."
* "On or before June 30, 2015 ... permanently cease use of [all remaining tank farm tanks] and all associated vaults; or ... achieve compliance with all secondary containment requirements set forth in IDAPA ss 16.01.5009 (40 CFR ss 265.193)."

[WINCO-1216]

The Environmental Impact Statement (EIS) is over 4,200 pages, yet it offers less definitive information and waste stream characterization than the 1977 INL Waste Management EIS that was one eighth the size. The 1977 EIS at least offered some historical data on radioactive releases so that the reader could evaluate to some degree the cumulative environmental impact of future activities. This EIS offers little or none of this essential information. In order to satisfy NEPA, the INL ER/WM EIS must comprehensively assess the cumulative environmental impact of past and proposed government activities at INL, which it did not.

Summary of Issues in the Draft INL Environmental Impact Statement (EIS)

* The EIS lacks sufficient detail to be considered a comprehensive programmatic site-wide Environmental Impact Statement.
* The EIS fails to be conducted within the context of DOE's Reconfiguration PEIS, ER/WM-PEIS, and implementation plan for compliance with the Federal Facilities Compliance Act.
* <u>All</u> public testimony at Idaho hearings on the two PEIS's must be included in a the EIS comments.

* EIS fails to consider all INL operating facilities and their related operating systems from 1947 to the present and fully assess and characterize their waste streams, (i.e.. reactors, fuel processing, incinerators, Calciner, evaporators, etc.).
* All activities within the boundaries of INL must be included in the EIS. By definition, this must include all facilities listed on Tabulation of Facilities at the INL, and the New Integral Fast Reactor (IFR).
* The EIS fails to fully characterize Navy waste streams for NRC disposal criteria compliance.
* All current and planned non-INL activities upon which successful implementation of INL activities depend, must be fully characterized and the potential environmental impacts of such activities not coming on line as anticipated identified, (i.e.. WIPP and Yucca Mt. dumps).
* The EIS fails to consider fully all planned INL facilities, their related operating systems and characterize their waste streams.
* The use of radioactive waste percolation ponds must be suspended.
* Radioactive and chemical waste must be disposed in fully compliant and permitted RCRA hazardous waste and/or EPA/NRC permitted radioactive waste disposal sites.
* Decontamination and Decommissioning waste volumes and toxicity must be fully characterized.
* EIS fails to fully assess the ICPP high-level waste tanks and vaults to include structural, constituents, seismic, leakage into/out-of vaults, and service line leaks.
* A full mass balance assessment of water pumped from aquifer and waste discharge volumes over INL's history.
* Compilation of Snake River Aquifer information into a single data base and a development of a new model to analyze contaminate dispersion.
* Declassification of all environmental, health and safety documentation relevant to establish historical INL source terms (radioactive releases).
* Analysis of the seismic and volcanic hazard that is fully peer reviewed by ID Geologic Survey and other qualified experts.

III. C. DOE’s High-Level Waste Environmental Impact Statement

The Department of Energy Idaho Operations Office (DOE) announced in 1998 its intent to prepare a High-Level Waste and Facilities Disposition Environmental Impact Statement (EIS). This is a requirement of the National Environmental Policy Act for all federal agencies. The scoping phase of this process is intended to give the public an opportunity to comment on the what issues must be addressed in the EIS. Unfortunately DOE refuses to provide the required hearings where citizens can be assured that their comments will become a part of the public record. Instead, DOE is offering feel-good focus group meetings and butcher paper pads.

Primarily, the EIS focus is the legacy of reactor irradiated fuel reprocessing at the Idaho Chemical Processing Plant (ICPP). Reactor fuel was reprocessed to extract highly enriched uranium and other isotopes for military nuclear programs. The high-level radioactive waste left behind after reprocessing includes both 1.7 million gallons of liquid waste in eleven underground tanks as well as 3,800 cubic meters (134,140 cubic feet) of solidified liquid waste known as calcine. The Calciner is basically an incinerator that took some of the liquid waste and burned off the liquid portion and mixed the residual ash with a granular calcine material so it could be more easily moved to underground storage silos at the ICPP.

DOE offers three alternative actions in their EIS scoping literature; 1.) no-action; 2.) proposed action; and 3.) non-separations action.

The EIS no-action alternative would continue the solidification of the liquid high-level waste into calcine and indefinitely store it in underground silos at the ICPP. Tank sediments and liquid portions (30-40,000 gallons) that cannot be removed using existing transfer pumps will also remain in the tanks permanently.

The EIS proposed action, preferred by DOE, would include building a pretreatment plant to separate the transuranic (heavier than uranium) or “high-activity” waste portions from the “low-activity” portions. This separations process would be applied to both the liquid and the calcine waste. The "high-activity" portion would then be vitrified into a glass-like form and shipped to a geologic repository. The "low-activity" portion would be mixed with cement (grout) and dumped back into the ground at INL or back into the old waste tanks on top of the remaining liquid and sediments.

The EIS non-separation alternative would treat both the liquid tank waste and the calcine for permanent disposal in-place at the INL or at an out of state geologic repository. Residual liquid and tank sediments would be mixed with cement and left in the old tanks.

DOE is legally obliged to offer EIS alternatives that meet all regulatory and legal requirements. However, none of the above three alternatives meet this basic test. Among the regulations that would be violated are the Resource Conservation Recovery Act, the Nuclear Regulatory Commission regulations on radioactive waste disposal, the U.S. District Court Settlement Agreement between the State of Idaho, Navy, and DOE, and finally DOE's own Record of Decision on Spent Nuclear Fuel Management and INL Environmental Restoration and Waste Management EIS.

Why don't the EIS alternatives meet regulatory and legal requirements? The Nuclear Regulatory Commission (NRC) defines high-level waste by the process that created it as opposed to specific characteristics. High-level is, (1) irradiated reactor fuel, (2) the waste generated by the processing of irradiated reactor fuel, (3) the solids into which the liquid wastes were converted. There is no question that the entire contents (liquid and sediment) of ICPP waste tanks and the calcine are high-level wastes. As such NRC disposal regulations require a permanent geologic repository and waste shipped to the repository must meet acceptance criteria. Anything less than total extraction of all the tank contents and vitrification of the waste will meet these requirements.

Additionally, the Resource Conservation Recovery Act (RCRA) classifies the ICPP tank waste as a mixed hazardous radioactive waste. RCRA requires vitrification treatment of this waste prior to disposal. Land Disposal Restrictions in RCRA will not allow the tanks or silos to be used as a disposal site. Therefore, DOE could not get a RCRA closure permit for the tanks or silos without first decontaminating them.

The separations technology DOE is pushing in Idaho is reminiscent of the Hanford grout scenario. DOE is trying to pull the same high-level low-level nonsense at INL apparently thinking Idahoans are not aware of the Hanford escapade. The radionuclide partitioning technology is an unproven process of separating out the transuranic elements (heavier than uranium) from the rest of the waste and calling it "high-activity."

The driver to this treatment approach is volume reduction. The separations approach minimizes the volume shipped to a geologic repository and maximizes the volume dumped back into the ground. The Department also thinks that it can ship the smaller volume of high activity waste to another site to be vitrified, thereby avoid building a plant at INL. Since DOE is building a vitrification plant at Hanford, the Department wants to ship the high-activity portion of INL's high-level waste there for treatment thereby saving the $3 billion cost of the Idaho vitrification plant.

DOE's attempt to use grout (cement) to stabilize the "low-activity" waste is a Hanford rerun that generated so much public opposition that DOE was forced to cancel the project. The question of waste classification played a crucial role in ending the Hanford grouting program. DOE tried in 1990 to delist much of its high-level liquid waste saying it was not really high-level and therefore could be mixed with cement (grout) and dumped back into the ground. The Oregon and Washington State regulator's position is that all the tank farm waste is high-level and therefore regardless what DOE's separations treatment produced, it must be managed and disposed as high-level wastes.

Hanford now is planning to vitrify both the high and low activity parts of its high-level wastes. The low-activity parts are to be stored on-site in a retrievable form. Thomas Tebbs with the Washington Department of Ecology and Dirk Dunning with the Oregon Department of Energy believe this is a step in the right direction; but that it is a waste of resources to separate the high and low wastes; best just vitrify the whole volume together in one operation and ship it to a permanent repository.

Another very troubling part of DOE's INL plan is to leave the high-level tank farm sediments (heels) in the tanks. "The ICPP Tank Farm heels will not be removed and the Tank Farm will be closed under RCRA [Resource Conservation Recovery Act]." "The closed Tank Farm would probably meet the subtitle D landfill standards for industrial waste." Subtitle D is a municipal garbage dump classification. It is obvious, even to the most pedestrian observer, that garbage and high-level radioactive waste are different. If DOE is allowed to implement any of its EIS options it will literally translate into INL becoming a permanent high-level waste dump site.

The tank heels can be removed by conventional dredging techniques currently being used at Oak Ridge or use the Hanford Tank Sluicer Mechanism. DOE believes: "However, it is not practical to remove all of the heels from the INL tanks, decontaminate the equipment, and remove all surrounding soils due to technological, economic, and health and safety factors involved." In a technical journal called *Initiatives in Environmental Technology Investment* the history of tank heel removal equipment is explained along with the most recent application with Oak Ridge's Bethel Valley high-level tanks.

"Power Fluidic devices have been used in nuclear installations in the United Kingdom for the past 20 years, and more than 400 systems have been installed with no failures, to date. They offer an alternative to mechanical pumps, which are generally more expensive, produce large volumes of secondary waste, and tend to fail frequently, increasing the risk to maintenance workers. Steam jets require less maintenance but have limited ability to pump solid/liquid mixtures, operate on one fixed flow rate, and heat and dilute tank contents." [Initiatives]

The Environmental Defense Institute (EDI) suggests that the best approach is to directly vitrify the whole volume of the tank liquid, the tank heels, and the calcine wastes without any partitioning or separation of high-activity and low-activity wastes. This vitrified "road-ready" waste would then be put into an on-site monitored retrievable storage facility until a safe permanent disposal site is developed. The State of Idaho must fully review the failed Hanford grout program before committing to a similar project at INL. DOE's continued efforts to run the evaporator to reduce the liquid volume in the ICPP high-level tanks though on the surface appear to minimize the risks of leaks, could ultimately exacerbate any heal removal program and increase the amount of waste left in the tanks if proceed with the preferred alternative of grouting the heals in place.

The Final Report from the Hanford Tank Waste Task Force got it right by recommending: "The high cost and uncertainty of high-tech pretreatment and R&D threatens funding for higher performance low-level waste form, vitrification, and cleanup. Put wastes in an environmentally safe form, using retrievable waste forms when potential hazards from the waste may require future retrieval and when retrievability does not cause inordinate delays in getting on with cleanup. Let the ultimate best form for the waste drive decisions, not the size nor timing of a national repository. Accept the fact that interim storage, at least, of the waste in an environmentally-safe form will occur for some time at Hanford. Select a waste form that will ensure safe interim storage of this waste." The Institute for Energy and Environmental Research's 1997 report Containing the Cold War Mess discussion of the Hanford tank problems are applicable to the INL situation.

"However, the current predisposition in the DOE seems to be to pour cement into the tanks over the residual waste volume as a method of closure. This is being done on the one tank that has been emptied of sludge at the Savannah River Site, pursuant to an Environmental Assessment. This closure method could leave tens of thousands to millions of curies of long-lived radionuclides in each tank at the time of closure. It would put these wastes in forms that would be very difficult to retrieve, because they would be hardened cement. This method of closure is converting on of the few programs actually reducing risks a weapons site (i.e., vitrification of high-level waste in the Defense Waste Processing Facility) into a potential long-term liability, in a manner analogous to examples that we have discussed where short-term waste management 'solutions' are converted into long-term environmental problems.

Pouring cement into the tanks should be ruled out as a method of closure, especially as there is insufficient understanding of the long-term risks to soil and groundwater from residual waste and there has been insufficient retrieval technology development. If hardened wastes cannot be retrieved, then the focus for such waste should be on technology development, because they do not pose risks that would be mitigated by cementation in the near-term. Cementing would also make remediation of the vadose zone far more difficult than it already is. Cementing the tanks appears to be DOE's way of washing its hands of the environmental problem of tank decommissioning." [IEER(g)@212]

In summary, the repeated mantra "get on with cleanup" in the Hanford Waste Tank Task Force is repeated in public interest group reports. DOE is wasting precious resources by refusing to recognize the public's demand for real solutions to the radioactive waste problem. DOE must get on with cleanup and apply proven technologies that will put all radioactive waste into a stable vitrified form for on-site storage for the near-term because there are no guarantees on any repositories coming on line soon.

IV. INL Cleanup Plans

A. How Clean is Clean

Conscientious environmental restoration of the INL site where massive quantities of radioactive and chemical wastes have been recklessly dumped will not occur unless clear quantitative environmental standards are established. "How clean is clean." The Environmental Protection Agency's (EPA) last promulgated ruling on maximum concentrations limits (MCL)for radionuclides in drinking water was issued in the Federal Register (28404) July 9, 1976, The agency also issued National Interim Primary Drinking Water Regulations (EPA-570/9-76-003) that went into effect in June 24,1977. EPA tried to promulgate new standards for high level and Transuranic radioactive wastes in 1985 that offered inadequate protection of human health. These standards were challenged by the Natural Resources Defense Council and were overturned by the First District Court of Appeals in 1987. In 1991, EPA announced National Primary Drinking Water Regulations; Radionuclides; Proposed Rule, published in the Federal Register, July 18, 1991. As of this writing, EPA has yet to promulgate these new standards. The table titled EPA Drinking Water Standards- Current and Proposed compares the two standards. See Appendix G for a complete listing of both the current and proposed rules.

EPA Drinking Water Standards - Current and Proposed

Nuclide	Symbol	EPA 1976 Standard pCi/L	EPA Proposed Standard pCi/L
Beryllium-7	Be	6,000	43,500
Carbon-14	C	2,000	3,200
Sodium-22	Na	400	466
Phosphorus-32	P	30	641
Sulfur-35	S	500	12,900
Chlorine-36	Cl	700	1,850
Calcium-45	Ca	10	1,730
Calcium-47	Ca	80	846
Scandium-46	Sc	1,000	863
Scandium-47	Sc	300	2,440
Scandium-48	Sc	80	766
Vanadium-48	V	90	644
Chromium-51	Cr	6,000	38,400
Manganese-52	Mn	90	733
Manganese-54	Mn	300	2,010
Iron-55	Fe	2,000	9,250

Iron-59	Fe	200	844
Cobalt-57	Co	1,000	4,870
Cobalt-58	Co	9,000	1,590
Cobalt-60	Co	100	218.00
Nickel-59	Ni	300	27,000
Nickel-63	Ni	50	9,910
Zink-65	Zn	300	396
Germanium-71	Ge	6,000	436,000
Arsenic-73	As	1,000	7,850
Arsenic-74	As	100	1,410
Arsenic-76	As	60	1,060
Arsenic-77	As	200	4,330
Selenium-75	Se	900	574
Bromine-82	Br	100	3,150
Rubidium-86	Rb	600	485
Rubidium-87	Rb	300	501
Strontium-85	Sr	21,000	2,830
Strontium-89	Sr	20	599
Strontium-90	Sr	8	42
Yttrium-90	Y	60	510
Yttrium-91	Y	90	576
Zirconium-93	Zr	2,000	5,090
Zirconium-95	Zr	200	1,460
Niobium-93	Nb	1,000	10,500
Niobium-95	Nb	300	1,250
Molybdenum-99	Mo	600	1,830
Technetium-96	Tc	300	2,050
Technetium-97m	Tc	1,000	4,450
Technetium-97	Tc	6,000	32,500
Technetium-99	Tc	900	3,790
Ruthenium-97	Ru	1,000	7,960
Ruthenium-103	Ru	200	1,810
Ruthenium-106	Ru	30	203
Ruthenium-105	Ru	300	3,720
Palladium-103	Pd	900	6,940

Palladium-109	Pd	300	2,120
Silver-105	Ag	300	2,700
Silver-110	Ag	90	512
Silver-111	Ag	100	1,080
Cadmium-109	Cd	600	227
Cadmium-115m	Cd	90	339
Cadmium-115	Cd	90	958
Indium-115	In	300	35.1
Tin-113	Sn	300	1,740
Tin-125	Sn	60	446
Antimony-122	Sb	90	810
Antimony-124	Sb	60	563
Antimony-125	Sb	300	1,940
Tellurium-125m	Te	600	1,490
Tellurium-127m	Te	200	663
Tellurium-127	Te	900	7,920
Tellurium-129m	Te	90	524
Tellurium-129	Te	2,000	27,200
Tellurium-131m	Te	200	971
Tellurium-132	Te	90	580
Iodine-126	I	3	81
Iodine-129	I	1	21
Iodine-131	I	3	108
Cesium-131	Cs	20,000	22,800
Cesium-134	Cs	20,000	81.3
Cesium-135	Cs	900	794
Cesium-137	Cs	200	119
Barium-131	Ba	600	2,950
Barium-140	Ba	90	582
Lanthanum-140	La	60	652
Cerium-141	Ce	300	1,890
Cerium-143	Ce	100	1,210
Praseodymium-143	Pr	100	1,170
Promethium-149	Pm	100	1,380
Samarium-151	Sm	1,000	14,100

Samarium-153	Sm	200	1,830
Emporium-152	Eu	60	814.00
Emporium-154	Eu	200	573.00
Emporium-155	Eu	600	3,590.00
Gadolinium-153	Gd	600	4,680
Terbium-160	Tb	100	815
Dysprosium-166	Dy	100	830
Holmium-166	Ho	90	981
Erbium-169	Er	300	3,640
Thulium-170	Tm	100	1,030
Thulium-171	Tm	1,000	12,700
Ytterbium-175	Yb	300	3,110
Lutetium-177	Lu	300	2,550
Hafnium-181	Hf	200	1,170
Tantalum-182	Ta	100	842
Wolfram-181	W	1,000	19,000
Wolfram-185	W	300	3,440
Rhenium-183	Re	2,000	5,400
Rhenium-186	Re	300	1,880
Rhenium-187	Re	9,000	520,000
Osmium-185	Os	200	2,460
Osmium-191	Os	600	2,380
Osmium-193	Os	200	1,690
Iridium-190	Ir	600	1,010
Iridium-192	Ir	100	957
Platinum-191	Pt	300	3,810
Platinum-193m	Pt	3,000	3,020
Platinum-193	Pt	3,000	46,100
Platinum-197	Pt	300	3,400
Gold-196	Au	600	3,660
Gold-198	Au	100	1,310
Thallium-204	Ti	300	1,680
Lead-203	Pb	1,000	5,060
Bismuth-206	Bi	100	656
Bismuth-207	Bi	200	1,010

Radium-226/228	Ra	5	15.7
Protactinium-233	Pa	300	1,510
Gross Alpha		15	15
Tritium		20,000	60,900.00

[EPA-570/9-76-003] [FR-7/18/91-Part-II]

The current and proposed comparative table shows the obvious trend to raise the allowable limits of radionuclides in drinking water. The current 1976 regulations are based on whole body or critical organ dose limit of 4 mrem/year. Whereas the proposed 1991 regulations are based only on whole body effective dose equivalent of 4 mrem/yr. Thus, any nuclides that were limited by their dose (4 mrem being the limit) to a critical organ (e.g. Sr-90 to bone) are now limited by that same (4 mrem) dose, but calculated on the effective whole body equivalent basis, thus the allowable uptake of these nuclides go up. EPA rationale has been severely challenged to the extent that seven years later the agency has not promulgated the rule to avoid the anticipated litigation. This is an attempt by EPA to legitimize federally generated contaminates dumped by a sister federal agency - DOE, the primary radioactive polluter. EPA's rule making is in direct contradiction to the independent research which document the risks to exposure to low-level radiation, and the need to lower the allowable radioactive contaminates in the environment. And once again, it will be the public interest groups that must generate the resources to challenge these rules in court in order to protect the public health.

A Congressional Office of Technology Assessment report states that: "The existing Federal guidance for protection of the public against radiation is outdated, and the development of new guidance is uncertain." ... "It is uncertain when and whether EPA would revise their standards to reflect: 1.) recent findings by the National Research Council's Committee on Biological Effects of Ionizing Radiation (BEIR V report) that the risks of low-level ionizing radiation are two to three times more serious than it previously anticipated and 2.) the draft recommendation by the International Commission on Radiological Protection that the current radiation limit for workers be reduced by 60 percent." [OTA @ 41]

The Nuclear Regulatory Commission’s definition of transuranic waste was also changed from 10 nano curies per gram to 100 nano curies per gram, which effectively wrote off large quantities of waste that must go to permanent repositories as opposed to going to low-level landfill dumps like the RWMC burial ground at INL.

The federal government continues to violate its obligation to clean up its environmental disasters by setting standards that will minimize clean up costs - not maximize restoration. Risk minimization dictates that the establishment of environmental standards be guided by considerations of health affects on current and future residents. DOE must assume that currently sparsely populated areas will not remain so. Declaring large areas of land as "nuclear sacrifice zones” into perpetuity is unacceptable - if not grossly unconscionable. The National Academy of Sciences (NAS) offered standards in “A Study of the Isolation System for Geologic Disposal of Radioactive Wastes.” This study used risk based approach for standards setting. The NAS panel recommended that there be a limit on the dose to the maximally exposed individual at <u>any</u> future time from wastes buried in a repository. The NSA's risk based approach is the most sensible and scientifically supportable approach to standards. However the 10 millirem limit NSA recommended is far too high. Recent epidemiological studies are revealing that exposures at that level can cause serious health effects. [IEER(c)] The recent (May 1997) NRC standards are set at 25 millirem for unrestricted access and 500 millirem for restricted access. EPA advises for a 15 millirem/year limit for lifetime exposure.

Congressional action on the Resource Conservation Recovery Act (RCRA) which is up for reauthorization, will have far reaching impact on INL cleanup. Currently, RCRA excludes radionuclides, in their pure form, from regulation. However, if radionuclides are mixed with other RCRA listed hazardous materials, then the laws apply. DOE has for decades, hidden behind this exemption. Hopefully, Congress, now having to appropriate hundreds of billions of dollars to cleanup DOE's mess, will finally recognize that federal agencies must be held to the same standard as corporate America. Continuing the RCRA exemption will surely continue the past abuses and exacerbate the cleanup process.

The public must be involved and able to fully participate in developing clean up standards. This issue must be specifically addressed and ample opportunity for public comment. The question of "How Clean is Clean" is a question that the public, not government agencies, must decide. Therefore, Congressional hearings are needed not only to address standards, but also the fundamental structural issues concerning the funding of cleanup programs under a permanent trust fund that would not be subject to annual Congressional and Administrative raids.

As is true with all things government, regulation is only as good as the political will of those in power to protect the general public's interest. The current struggle between federal agencies to generate nuclear site cleanup standards is a high stakes game because of the hundreds of billions of dollars required for cleanup and decommissioning. A strict standard that protects the public health will cost more than a lax standard that only protects the polluter. As the first commercial nuclear power plants end their design life and the utilities move toward decommissioning, the Nuclear Regulatory Commission (NRC) is determining "how clean is clean." Michael Mariette, Director of the Washington, DC based Nuclear Information and Research Service (NIRS) reported May 23, 1997 in his "Radiation Crisis Alert" the following:

"The Nuclear Regulatory Commission's (NRC) FINAL Rulemaking in a process that began as ERORR (Enhanced Rulemaking on Residual Radioactivity-- and before that BRC) has a three part deal -- 25 millirem/year for unrestricted, and 100 or 500 millirem/year for 'restricted' license termination at nuclear sites. This new rule currently applies to civilian sites under NRC or state agreement agencies, (thousands of sites in the US) and may be applied to DOE sites, if prospective external regulation of DOE by NRC is approved. NRC's rule provides no special protection for groundwater, and indeed assumes that if public water supplies are available, that water contamination does not have to be factored as an exposure pathway, in some cases creating permanent sacrifice of water resources."

"To qualify a site for unrestricted use, licensees must 'clean' contamination of the site to a level 'As Low as Reasonably Achievable' (ALARA) below a 25 mrem/yr dose to the average member of the 'critical group.' The 25 mrem/yr dose is in addition to the NRC's estimated background dose of 300 mrem/yr which, by itself, results (according to NRC) in a little more than one fatal cancer per hundred people. Unrestricted use includes farming, homes, day care centers and other uses--i.e. anything. Both dose and critical group are based on many assumptions made by NRC that may not represent actual radiation exposure that will result from activities on any given site. Again, using NRC calculations, the 25 mrem/yr incremental dose above background, over a lifetime will result in 1 fatal cancer for every 1144 people exposed. Not only are there thousands of sites, but much of the radiation will persist for decades, centuries, millennia. It is not possible to calculate the cumulative death toll."

"A dose of 25 mrem/yr for unrestricted sites is clearly inadequate to protect public health and safety even by EPA standards. EPA drafted a clean-up rule that would have limited the site dose to 15 mrem/year and would have enforced the Safe Drinking Water Act limit of 4 mrem/yr on ground water. EPA has tabled the rule for now after DOE announced it did not want this rule. EPA could still issue the rule, and has made a rare display of standing tough, by suggesting to NRC that EPA would declare sites released under the NRC rule to be Superfund sites, requiring a more stringent clean-up."

"NRC proposes even laxer standards for "restricted" sites. Although "restricted" sites will have higher contamination levels, NRC claims these sites can still be used for certain activities, as long as licensees "guarantee" no one at these sites receives more than a 25 mrem/yr dose. Exemptions may be granted by NRC, on licensee request based on factors such as prohibitive cleanup costs, and arguments that further clean-up may cause greater harm than the residual dose. The rule allows contamination levels that will cause doses of 100 mrem/year and as high as a 500 mrem/yr to those who use the site, if restrictions fail. The NRC claims exceptions will only be made in 'unusual circumstances,' such as perceived loss of institutional control of the contaminated site, sites that have contaminated soil, or SDMP sites. Since many site operations have resulted in contaminated soil, and SDMP (Site Decommissioning Management Plan) is composed of the current major nuclear license terminations, NRC's definition of 'unusual circumstances' verges on criminal."

"Licensee proof of compliance with the regulations required by the rule is not stringent and NRC has left many loopholes by using non-specific language and definitions. It appears that almost any site contaminated with radionuclides could apply for cleanup standards at the 500 mrem/yr level and be considered as long as it was 'restricted' use. 'Restricted' use could mean simply fencing in the area or planting obstructing bushes. This is clearly unacceptable since 500 mrem/yr over 'background' translates into a citizen cancer fatality of approximately 1 in every 57 people exposed to this radiation dose for a lifetime. Those are NRC numbers for the rate of cancer. Independent analysts have made findings that the rate could in fact be 10 times higher. Further, other health impacts that NRC's rule ignores altogether include non-fatal cancer, infertility, genetic and birth defects and lowered immunity. The rule does not account for Hot Spots, which could allow certain individuals to get a double dose of radiation (or more), while others receive none. Since the projected radiation doses are averaged, this effectively assumes the dose is spread evenly among all individuals in the critical group, while in reality, those receiving the largest doses (and the higher risk), are effectively ignored and unprotected."

"This devastating departure from the NRC's mandate to protect the public health and safety is one more piece in a long history of placing industry economic interests ahead of citizen health and citizen's economic interests, not to mention all the other species that are affected, and in affect us indirectly. This process of deregulation of radiation has been ongoing at NRC, but in 1986 the agency formalized it as a policy called "Below Regulatory Concern" or BRC. Citizens across the country did a phenomenal organizing effort, including passage of over a dozen state laws prohibiting deregulation and in 1992, Congress directed NRC to revoke the BRC Policy."

"In 1993, in the wake of this industry defeat, NRC put together the ERORR (Enhanced Rulemaking on Residual Radioactivity) process and citizens from across the country attended "stakeholder" meetings. Again and again we told NRC that in order to release the polluter from liability; it is their job to require that the site be returned to naturally occurring levels of background radiation. Indeed, the NRC draft rule of August 22, 1994 was more stringent than this final rule. The proposed rule did not mention a 500 mrem/year dose cap, only a 100 mrem/yr cap, and the level of 15 mrem/yr was given for unrestricted sites. The final rule also drops mandatory Site Specific Advisory Boards (SSABs). There are other forms of public in-put in decommissioning, but the implication is clear: NRC does not wish to create any more opportunities for public participation."[NIRS]

EPA's proposed standards for nuclear waste sites [by Margret Carde]

The Environmental Protection Agency (EPA) proposes environmental standards for the disposal of spent nuclear fuel, high-level and transuranic radioactive wastes (40 CFR 191) but specifically limits EPA's consideration of public comment on these proposed standards. Questions on the adequacy of the proposed standards include:

a. Are there reasons for adopting a different regulatory time frame for the individual and ground-water protection requirements than the 10,000-year period of analysis associated with the containment requirements in 191.13? EDI believes that a regulatory time frame of at least 100,000 years is appropriate and necessary. The Transuranic wastes to be regulated, for instance at the Waste Isolation Pilot Plant (WIPP), remain hazardous for longer than 240,000 years. The 10,000 year time frame proposed in the standards is an arbitrary time frame that cannot be justified given the hazard of these wastes and the length of time they remain hazardous. A 100,000 year time frame would allow for the degeneration of a significant proportion of these wastes, thus reducing the danger of radioactivity to the public after the control period.

b. Should the Agency adopt non-degradation requirements for especially valuable ground water? If so, what types of ground water warrant this extra level of protection?

EDI believes that all ground water warrants a no-degradation protection requirement. Particularly in the West where surface water is scarce, ground water is frequently used, even today, for human and livestock drinking water and irrigation. When considering 10,000 to 100,000 year time frames and given the projected exponential growth predicted for future populations, it will be important to protect all ground water from endangerment. In addition, because it is difficult to predict future hydrologic flows over the period of time contemplated for this standard, there is a possibility that water not currently classified as Class I that is an “underground source of drinking water could, in the future, be used for human consumption.

Strict limits will discourage siting nuclear disposal facilities near ground water that people depend on for personal use. Stringent requirements also will limit the cost of future remediation of this ground water that is limited in quantity and necessary for human survival. Not only have ground water remediation techniques thus far not been 100% successful in reversing contamination, but these processes are also expensive. Current technology relies on two processes: containment and extraction. Containment involves expensive engineered barriers, and extraction is an equally costly process of pumping, treating, and reinjecting water into the water table. By requiring a no-degradation standard for irreplaceable ground water today, EPA can save future dollars, preserve our valuable natural resource, and prevent the future need for bulky and expensive remediation programs.

c. Is it reasonable for the Agency to adopt a standard (15-millirem) that allows a slightly higher level of risk when the dose is being received through all exposure pathways, e.g., direct exposure, food ingestion, water ingestion, and inhalation and all environmental media, e.g., air and water, than when regulating doses received through a single environmental medium, e.g., a 10-millirem committed- effective-dose (CED) per year standard for air emissions (40 CFR Part 61). EDI believes that the CED limit for nuclear waste disposal facilities should be much lower than 15-millirem per year. As early as 1983 in A Study of the Isolation System for Geologic Disposal of Radioactive Wastes, the National Academy of Sciences (NAS) recommended a "lifetime radiation-dose commitment to the maximally exposed individual at any future time" to be "10-4 sieverts per year (Sv/yr)," which is equivalent to a CED limit of 10-millirem. [BRWM] In 1990 the NAS Board on Radiation Effects Research Commission on Life Sciences Committee on the Biological Effects of Ionizing Radiation (BEIR) published Health Effects of Exposure to Low Levels of Ionizing Radiation BEIR V. The BEIR V committee concluded: "The cancer risk estimates derived with the preferred models used in this report are about 3 times larger for solid cancers (relative risk projection) and about 4 times larger for leukemia than the risk estimates presented in the BEIR III report." The BEIR III report was published in 1980. (National Academy Press, 1990, page 6)

Because the most recent research into the biological effects of ionizing radiation indicates a greater risk to the public than was previously thought, EDI believes that EPA standards minimally must limit the CED to the 1983 NAS's recommendation of 10-millirem per year. The direction of the current research, however, argues for an even more conservative limit.

d. Does the public have comments on how, if at all, implementation of Subpart C, in lieu of direct compliance with the SDWA regulations, to the extent that statute applies for a particular disposal system, if at all, would not be equivalent to direct application of the SDWA. EPA standards must not take away a state's right to permit underground injection wells under the Safe Drinking Water Act (SDWA 1421(b) (3) (C). EPA's Federal Register publication (58 Fed. Reg. 7931) states that "compliance with the new Subpart C will provide an equivalent level of protection as would compliance with SDWA regulations. Thus ... compliance with Subpart C will constitute compliance with the SDWA to the extent -- if at all -- such compliance would otherwise be required for a particular disposal system." EDI believes that this section of the standard must be eliminated so that each state's right to regulate Underground Injection Controls (UICs) within its boundaries is preserved. A state's right under SDWA to permit underground injection wells must not be preempted by this standard. Procedures for issuing UIC permits are different from those of Subpart C, so compliance with Subpart C is not "equivalent" to a UIC permit.

The Environmental Protection Agency (EPA) arbitrarily limits the scope of public comment

EDI believes that EPA must consider public comment on all parts of 40 CFR 191. In 1987, the 1st Circuit Court remanded the entire 1985 EPA nuclear waste disposal standards, not just the specifically cited subsections that concerned individual and ground water protection requirements. Subsequent to the 1987 court ruling, EPA reviewed all aspects of the 1985 standards, producing four drafts of the standards which were never published in the Federal Register. These drafts clearly show that EPA has its own concerns with other parts of the 1985 standards.

In October, 1992, Congress passed Public Law (PL) 102-579 that directs EPA to "issue ... final disposal regulations." Section 8 of the law reinstates "the disposal regulations issued by the Administrator on September 19, 1985, and contained in Subpart B of part 191 of title 40 Code of Federal Regulations" and excepts " (A) the 3 aspects of sections 191.15 and 191.16 of such regulations that were the subject of the remand ordered in Natural Resources Defense Council, Inc. v. United States Environmental Protection Agency, 824 F.2d 1258 (1st Cir. 1987); and (B)the characterization, licensing, construction, operation, or closure of any site required to be characterized under section 113(a) of Public Law 97-425." Thus, PL 102-579 intended the reinstatement of EPA's 1985 nuclear waste disposal standard (with the above exceptions) to be a temporary measure until EPA issued a new standard. EPA's promulgation of only revised sections of its 1985 standard does not address the mandate of PL 102-579, which expressly directs EPA to "issue ... final disposal regulations." EPA's limited promulgation not only fails to satisfy PL 102-579, but it denies the public right to comment on the whole, final standard.

EPA has repeatedly said that rather than revising the whole disposal standard at this time, it will postpone review of issues other than those mentioned above, taking up these issues when it proposes EPA disposal standards compliance criteria. EDI believes that the PL 102-579 deadline of 1994 for publishing final compliance criteria will be too late for consideration of problems in the 1985 standards. EPA will find it difficult to impose added restrictions on WIPP in 1994, given that this facility is already sited and built. Any increased requirements for this facility must be considered at this time. Delay will encourage yet more exemptions or variances for a facility which has never adequately been tested for compliance with federal and state requirements.

Response to EPA's proposed nuclear waste disposal standards:

a. EPA must revise the standards to require isolation of the alpha-emitting TRU radionuclides with the same degree of effectiveness as for high-level waste. EPA has stated its intention that the radioactivity from either high-level or TRU wastes would be "isolated with about the same degree of effectiveness ... so that about the same fraction of TRU radionuclides would be retained for either high-level or TRU-wastes (Numark, Presentation to BRWM, 9/24/92)." Reissuing the 1985 standard without revising the TRU-waste unit ignores EPA's own stated concerns. EDI recommends that EPA revise its TRU-waste unit to be between 3 and 11 million curies in accordance with the conclusions and the recommendations of the Environmental Evaluation Group (EEG) report by James Channell, February 5, 1992, and the September 1992 presentation by Neil J. Numark, Associate, and S. Cohen & Associates.

b. EPA must revise the standards' assurance requirements to prohibit waste disposal in areas with large deposits of valuable natural resources. EPA and DOE are in agreement that future human intrusion is probably inevitable at the WIPP site because of the presence of valuable natural resources. The proposed standard does not, but should, give clear guidelines for acceptable limits to human intrusion from petroleum drilling, innocent intrusions or intrusions from exploration for solid mineral deposits or salt bed storage areas. EPA's language, "Such places [with valuable water or other natural resources] shall not be used for disposal of the wastes covered by this part unless the favorable characteristics of such places compensate for their greater likelihood of being disturbed in the future," does not insist on a scientific limit either to the frequency of future intrusion or to the releases allowed by that intrusion. Rather, EPA's language allows this requirement to be ignored for political or policy considerations.

c. EPA disposal standards should include performance standards for engineered barriers such as TRU-waste containers, backfill, plugs and seals at repositories which are not licensed by the Nuclear Regulatory Commission (NRC). PL 102-579 (Section 8(g) directs DOE to "use both engineered and natural barriers, and waste form modifications, at WIPP to isolate Transuranic waste after disposal to the extent necessary to comply with the final disposal regulations." Thus Congress directed EPA to set guidelines in its disposal standards for engineered barriers. Indeed, the EPA 1985 standard explicitly recommends that "[D]isposal systems shall use different types of barriers to isolate the wastes from the accessible environment. Both engineered and natural barriers shall be included." However, disposal facilities not regulated by NRC do not have the benefit of NRC guidelines for these engineered barriers. Therefore, EPA must provide specific performance standards to be met for engineered barriers at non-NRC regulated disposal facilities. d. EPA must review all public comment on all of the proposed standard, rewriting all sections which need to be strengthened. EPA should then issue these rewritten standards, ask for additional public comment, and review the public comment. Then and only then should EPA attempt to publish final standards. Should deadlines contained in PL 102-579 prove to be counter productive to the process for writing and reviewing credible, scientific nuclear waste standards, EPA must ask Congress for an extension of the deadlines.

e. And finally, EDI objects to the fact that EPA is treating its proposed nuclear waste disposal standards as if they only apply to WIPP. In fact, the regulations could apply to several other Department of Energy (DOE) facilities around the nation where Transuranic or high-level waste is stored. Some of those facilities may be designated in the future as disposal sites, especially since DOE has no plans for developing repositories in addition to WIPP and Yucca Mountain, and these two repositories are not designed to hold all of the existing high-level and transuranic wastes.

Sites that currently have significant quantities of high-level or Transuranic wastes include: Hanford, Washington; Idaho National Engineering Laboratory, Idaho; Las Alamos, New Mexico; Mound Plant, Ohio; Nevada Test Site, Nevada; Oak Ridge, Tennessee; Savannah River Site, South Carolina; and West Valley, New York.

IV.B. Test Reactor Area [now called Reactor Technology Complex] Cleanup

The Test Reactor Area (TRA), now called the Reactor Technology Center (RTC) is one of the major - including the Navy - in on-site radioactive solid waste disposal relative to curie content. DOE summary data between 1952 and 1983 cite 5 million Ci of solid waste disposed. [EGG-WM-10903 @6-25][ID-10054-81] TRA supports the Advanced Test Reactor, Advanced Reactor Critical Facility Reactors, Hot Cell Facility, Nuclear Physics Research Program, Advanced Reactivity Measurement Facility, and Coupled Fast Reactivity Measurement Facility Reactors. The reactors used chromium (VI) in the coolant and discharged between (1952-72) 55,353 lbs. of Cr (VI). [Analytica ID-12782-1 @4-26] Accidental chemical spills have also contributed to site contamination. For instance recent disclosures by the Oil Chemical and Atomic Workers Union revealed a 680 gallon sulfuric acid spill. The union cited nine other worker health and safety violations at the Advanced Test Reactor.

The Test Reactor Area (TRA) has fifty-one Solid Waste Management Units. These include leaching ponds, underground tanks, rubble piles, cooling towers, waste injection wells, french drains, and assorted spills where hazardous and mixed radioactive/hazardous wastes exist. These waste sites have been in continuous use for over 40 years and have created ground water contamination under the TRA. The culture of secrecy and non-accountability made it possible to willfully allow problems to go unsolved. For instance, the TRA's reactor fuel cooling canal at the Materials Test Reactor had a severe leak that was not drained and repaired until a decade after it was discovered. This leak allowed large quantities of contaminated coolant water to escape to the soil below the TRA, and initially was not identified in the Cleanup Plan as a contamination source. The largest contributor to groundwater contamination under the TRA was the radioactive waste injection well that was not closed until 1984. Discontinuing the use of injection wells due to pressure from the State increased volumes of contamination in the leach ponds proportionally.

Test Reactor Area (TRA) Groundwater Liquid Waste Volumes Disposed at TRA

Disposel Site	Period Used	Total Discharge (gal)
Warm Waste Pond	1952 - 1996	5.35×10^{9}
Cold Waste Pond	1982- 1996	2.13×10^{9}
Chemical Waste Pond	1962 - 1996	726×10^{8}
Sanitary Waste Pond	1952- present	310×10^{6}
Injection Well -05	1964-1982	3.89×10^{9}
Injection Well - USGS-53	1960-1964	2.2×10^{8}
Totals		8.45×10^{10} or 84.5 billion gallons

[TRA Record of Decision [ROD] (a) pg. 5]

TRA also leads (volume and activity) the list of INL facility areas for radioactive liquid waste discharges - 84.5 billion gallons between 1952 and 1990.TRA [ROD @5] Between 1952 and 1981 TRA released 50,840 Ci to the soil or 83% of total INL liquid discharges. This figure does not include short-lived radioactivity with less than 2-3 day half-life. [Ibid. @14] Idaho State University monitoring found TRA highest in tritium concentrations. TRA injection well No.53 received waste containing 31,131 lbs. of hexavalent chromium between 1964-1982. In the same time period, TRA injection well No.05 got 55,353 lb. of Cr (VI). The size of the contamination plume under TRA is larger than DOE acknowledges. Well No. 65 south of [and beyond acknowledged plume] TRA had the highest results ranging from 43, 5000 to 48,200 pico curies per liter. [IDEQ Oversight (a) pg.21]

The State challenges DOE's characterization of the size of the perched water contamination plumes because of the location and depth of the monitoring wells. The State's "review strongly suggests that wells along the north and northeast margin of the network are too deep to intercept or represent water levels in the perched water zone."... "That is, the perched water zone may extend farther to the north and northeast than previously recognized" by DOE. [Oversight (a)@31] The volume of the perched water plume is estimated at 4.3 billion gallons. This plume is connected to the Big Lost River flood zone. Hydrology studies during flooding of the Big Lost River and TRA monitoring well static levels revealed that recharge to the TRA groundwater occurred at a rate of 30 - 35 feet per day. [EGG-WM-10002 @ 3-109] At this transmissivity rate, contaminates could move nearly 2 ½ miles per year. Other monitoring data supports these findings. “Chromium-51 was detected in monitoring well USGS-56 at a concentration of 0.33 pCi/mL [330 pCi/L]. Well USGS-56 is located in close proximity to the [TRA] Retention Basin where concentrations of up to 2,540 pCi/mL [2,540,000 pCi/L] of chromium-51 have been detected in the shallow perched zone wells. Thus, detection of chromium-51 is not considered unusual in USGS-56; however, this indicates rapid transport time from the shallow zone to the deep zone in this area.” [EGG-WM-10002 @ 4-129]

Selected TRA Perched Water Chemical Sample Data

[TRA, ROD, 12/92@13& Analytica ID-12782-1][40 CFR Sec. 141.61]

Chemical	Concentration ug/L	EPA Standard ug/L
Arsenic	42.8	50
Barium	10,300.0	2
Beryllium	136.0	1
Cadmium	177.0	0.005
Chromium	4,480.0	0.1

Copper	1,930.0	1,000
Iron	546,000.0	300
Lead	4,260.0	50
Manganese	92,000.0	50
Mercury	394.0	2
Sulfate	4,880,000.0	250,000
Zinc	10,700.9	5,000
Aluminum	430,000.0	?
Xylene	31,000.0	10
Magnesium	400,000.0	?

* The Asterisk (*) on the following TRA perched water sample data table indicates EPA's new proposed Drinking Water standards (40 CFR Part 141 and 142). These new proposed nuclide limits in drinking water, which EPA attempted to promulgate in 1991, are substantially higher than the 1976 limits. For instance, tritium MCL will be increased from 20,000 to 60,900 pCi/l. It should be noted that the federal government is the largest polluter of radionuclides so it is in their interest to raise the limits on their own waste sites. EPA attempted to raise the allowable limits in 1985, but the courts found that they were not protective of human health, and EPA was forced to withdraw the standard. As of this writing, the 1976 rule is still the only enforceable regulation.

Test Reactor Area Perched Ground Water Sample Data

Nuclide	**Concentration pCi/L**	**EPA 1976 Standard pCi/L**	**Number Times over EPA Std.**
Cobalt-58	601	1,590.0*	0
Cobalt-60	12,200,000	100.00	122,000.0
Zinc-65	105,000	300.00	350.0
Cesium-134	62,400	8.13*	7,675.0
Cesium-137	21,000,000	119.0*	176,470.0
Europium-152	108,000	60.00	1,800.0
Europium-154	130,000	200.00	650.0
Europium-155	20,400	600.00	34.0
Americium-241	16,700	6.34	2,634.0
Manganese-54	336	300.00	0
Chromium-51	2,540,000	6,000.00	423.0
Scandium-46	4,140	863.0*	4.7
Iron-59	2,600	200.00	13.0
Zirconium-95	11,500	200.00	57.0
Niobium-95	12,000	300.00	40.0
Ruthenium-103	3,970	200.00	19.8

Rhodium-106	4,980	30.00	166.0
Silver-108	14,400	90.00	160.0
Antimony-124	150	60.00	2.5
Cerium-141	6,140	300.00	20.4
Ytterbium-175	3,500	300.00	11.6
Hafnium-181	136,000	200.00	680.0
Tantalum-182	3,180	100.00	31.8
Lead-203	1,680	1,000.00	1.6
Plutonium-239	12	15.00	0
Uranium-234	520	13.9*	37.0
Strontium-90	18,000	8.00	2,250.0
Tritium	3,940,000	20,000.00	197.0

[Administrative Record, TRA Summary Tables of Chemical and Radiological Analysis, Appendix G-484 and 485, Analytica-ID-12782-1 @ D-615 to D-632] [EPA-570/9-76-003] *[FR-7/18/91 Proposed MCL] Expressed in Pico Curies per liter (pCi/L)

The decision by the Agencies (DOE, ID, EPA) to do nothing on interim actions on the TRA perched water is an affront to common sense and demonstrates blatant disregard for Idaho's most valuable resource - groundwater. Contaminated water in the perched zones must be pumped and treated to minimize further migration into the rest of the aquifer. The federal government must never again be allowed to foul our waters and just walk away. Monies currently being channeled into nuclear materials production would more than adequately fund environmental restoration such as pump and treat. It is unconscionable for Idaho & EPA to approve such a position. The Environmental Defense Institute recommends this pump and treat immediate action because as the Congressional Office of Technology Assessments states:

"Contaminates may also form or absorb onto colloidal particles, which allows them to move with, or faster than the average groundwater flow. Flow can result from an apparently unrelated force, such as the flow of water and contaminates due to a thermal or electrical gradient instead of the expected hydraulic gradient. Chemical reactions and biotransformation may occur, possibly changing the toxicity or mobility of contaminates. Some contaminates dissolve and move with the water; some are in the gas phase; others are non-aqueous phase liquids; some are more dense than water and may move in a direction different from groundwater; others may be less dense than water and float on top of it." [OTA (a) @ 38]

Test Reactor Area (TRA) Warm Waste Pond

A major contaminated area at TRA is the Warm Waste Pond which has three separate cells dug in 1952, 1957, and 1964 respectively. These are unlined percolation pits where contaminated waste water was dumped and allowed to absorb into the ground. Even though EPA determined that this percolation pond was in violation of federal law, DOE continued to use it up until 1995 when it was capped.

The "low levels of radioactivity" the DOE describes as going to the Warm Waste Pond are actually not so low. Three separate contractors sampled pond sediments. One found cesium-137 and cobalt-60 in concentrations of 55,750 and 50,292 pCi/g respectively. [EGG-ER-10610 @ 3-3][EGG-WM-10000@11] The second sample tests showed Cs-137 and CO-60 in concentrations of 110,000 and 100,000 pCi/g respectively in sediment fines. [NRT 910521-N/C @ 2-5] The third treatability samples showed Co-60 and Cs-137 at 50,292 and 113,497 pCi/g. [EGG-WM-10000 @11] Currently, “The service waste activity is allowed to average no more than three times drinking water tolerance in any isotope with the exception of very short-lived ones like Iodine-131." [IDO-14532 @ 49]

Continued use of the Warm Waste Pond up until 1995 clearly demonstrates DOE's misguided priorities and total disregard for environmental degradation. DOE continued to add radioactive contaminates to a site that has been identified for cleanup for over fifteen years. The continued use of the pond insures that water will continue leaching previous contaminates further down into the aquifer. Moreover the Environmental Protection Agency (EPA) and the State of Idaho are remiss in their respective enforcement responsibilities for not closing down the Test Reactor Area ponds. According to the TRA Warm Waste Pond Hazardous Conditions and Incidents Report, "After November 1980 it was in violation of RCRA since we had no interim status". [TRA Hazardous] EPA and the State have full justification to declare these ponds RCRA hazardous mixed waste sites as the following paragraph illustrates.

"EPA is authorized [under RCRA] to issue a corrective action order, which can suspend or revoke the authority to operate an interim status Treatment/Storage/Disposal facility or to seek appropriate relief (including an injunction) from a US District Court." [OTA (a) @ 28]

"Over the past 5 years, DOE has gradually been required to acknowledge that cleanup of the Nuclear Weapons Complex [including INL] is subject to regulation by EPA (or the States) to the extent that hazardous materials are involved or a site is placed on the Superfund's National Priority List (NPL). Until 1984, DOE claimed that it was exempted from regulation under hazardous waste laws such as RCRA because of its Atomic Energy Act authority relating to national security and sovereign immunity from State regulation. A 1984 Tennessee Federal court decision rejected this claim and ordered DOE to comply with all RCRA provisions." [OTA (a) @ 34] Congressional passage of the Federal Facility Compliance in 1992 further clarified the law removing sovereign immunity as a federal defense against compliance with environmental laws.

TRA Warm Waste percolation pond received (5.35×10^9) 5.35 billion gallons between 1952 and 1992 at a rate of 40 gallon/minute.[TRA ROD@5] The high volumes of water were due to the once through cooling for the reactors that were then diluted before discharge. This also accounts for the high chromium contamination in the groundwater because chromium was used to retard corrosion in the reactor cooling systems. Between 1961 and 1985 a total of 32,660 curies were released to the pond. [TRA Hazardous] Warm Waste Pond sediments at the two foot level contained 75.1 pCi/g of Plutonium-235-240. [Analytica ID-12782-1 @ 4-33] TRA pond algae registered 100 mR/hr. Ducks (usually 25 at anyone time) using the pond registered the following radionuclide concentrations. [ERDA-1536 @ III-75-76]

TRA Duck Tissue Samples

Nuclide	**Concentration**	**Nuclide**	**Concentration**
Cesium-137	890 pCi/g	Cerium-141	390 pCi/g
Cobalt-60	540 pCi/g	Iodine-131	18 pCi/g
Zinc	1,100 pCi/g	Cesium-134	38 pCi/g

[ERDA-1536 @ III-75-76]

DOE calculated in 1977 that an individual eating a duck would receive 20 mRem to the thyroid and 25 mRem (milli-rem) whole body exposure. [ERDA-1536 @ III-75-76] In a later 1988 study of TRA waterfowl, "Three thousand one hundred forty-one individuals representing 22 species of waterfowl were observed on the TRA ponds from January 1974 through 1978." "If each of the 3,141 waterfowl had transuranic concentrations equal to the averages in the experimental waterfowl, 1,300 nCi of transuranic [including plutonium-238/239/240] would have been removed during this period or an annual average of 305 nCi" and "... if one of the bone samples that was approximately 100 times the other samples was excluded from the average." Additionally, "...if the 3,141 individuals in the wild [duck] population had similar [Sr-90] activity, a total of 292 uCi of Sr-90 would have been exported in the 51 month period or an annual average of 68.7 uCi." The dose to a person eating a duck from the Sr-90 alone would be whole-body 12 mrem and thyroid 7 mrem. "The mean dose rate to experimental ducks on the TRA ponds was 69 mrad from Sr-90 and transuranic nuclides in body tissues."... "Water fowl at the TRA ponds potentially export greater quantities of transuranic from this area than do other species of wildlife.

The maximum yearly export of transuranic radionuclides by small mammals and coyotes at the TRA was 35 pCi (Haliford) and 70 nCi (Arthur and Markham)." [Markham @ 522] Pacific Northwest Laboratory studies on internal exposure of dogs found that there was no minimum amount of plutonium that did not cause death. [Parks] State radiation standard limit is 4 mRem/yr for beta emitters. Safe limits for cesium-137 are 10 pCi/g. [EG&G-WM-8804] Chromium released to TRA ponds was 500 ppb. The chromium standard at the time was .05 ppb or 10,000 times over regulatory standards. [ERDA-1536 @III-79]

Test Reactor Area (TRA) Summary of Site Risks

DOE remediation plan's listing of contaminants fails to list Iodine-129 and Plutonium-238, 239, and 240 which were found in TRA leach pond plankton in concentration ranges (CRs) from 40,000 to 400,000. Distribution coefficients for Pu isotopes in sediments ranged from 13,000 to 150,000. [DOE/ID-12111 @39] Due to I-129's 17-million year half-life, and Plutonium's 24 thousand-year half-life, these isotopes are considered permanent contaminates.

DOE's plan also fails to quantify the range of contamination in TRA perched water in its Community Relations Plan mailings. EDI concurs with the State's criticism of DOE for using only the MEAN (average) concentration levels. By only offering the mean, DOE dilutes the data and offers a lower average number as opposed to offering the highest concentration number which best characterizes the risk. Readers of the plan deserve more information than they "exceed federal safe drinking water standards" or a footnote stating a standard of 4 mRem/yr. The proposed EPA standard for Cesium-137 (not stated in the plan) is 119 pCi/L.

There is no justification for DOE to eliminate from consideration in the plan, radioactive isotopes that had half-lives of more than five years. [TRA Plan @ A-6] This also holds true for the non-inclusion of Cesium (half-life of 30 yrs) in the exposure assessment. The current cesium levels of 21 million pCi/L mean that by the year 2023, the concentration levels will be 10.5 million pCi/L. In other wards it will take 540 years before the cesium will decay to below proposed EPA drinking water standard of 119 pCi/L.

TRA lies immediately (less than 2 miles) up gradient to the Big Lost River. Considerable uncertainty exists as to contaminate transport time within the aquifer due to the existence of lava tubes etc. in a very non-homogenous geology of the Snake River Plain Aquifer. Moreover, DOE's contention that "there is no current use of the perched water or contaminated Snake River Aquifer in the vicinity of TRA" and the decision to consider the potential use of the area for only a 125 years period, is unjustified and unacceptable.

A six member ground water study team commissioned by EG&G, an INL contractor, was canceled after its preliminary results showed that contamination "could move from INL to the Magic Valley within months." [Aley, 1980] Their findings revealed the presence of lava tubes which move water rapidly through the aquifer and exit at Thousand Springs on the Snake River. Under normal conditions the entire volume of the Big Lost River literally disappears into the porous Snake River Plain. This is a very graphic example of the porosity of the ground under the INL. Also see Section I (F) on aquifer contamination.

TRA Risk Assessment

Human health risk information appears not to consider the combined cancer risks for non-radionuclide and radionuclide from inhalation. Since the radionuclide component already "approaches the upper National Contingency Plan (NCP) limit"[TRA Plan @3], the combined risks (synergistic effect) may push it over the limit.

"The carcinogenic risks due to the external exposure to radionuclides were found to be significantly above the recommended NCP target risk range."[TRA Plan] This statement, as with other vague un-quantified statements, deserves specific numbers attached to it due to their obvious significance. EPA's standards are nearly two decades old and do not reflect current knowledge about the health risks to exposure to low levels of radiation. Therefore, the conservative 1 chance in a million in getting cancer must be used, not the 1 in 10,000 industrial standard.

Human health risks assessments additionally do not consider migratory water fowl using the TRA waste ponds. I-129 and other gamma-emitting nuclide in tissues of ducks from the Test Reactor Area (TRA) leaching ponds have been known by INL at least since 1981. [Health Physics 40: 173-181, 1981] DOE acknowledges I-129 concentration AVERAGES of .3 pCi/gm. [TRA ROD (b)@35]

According to the Office of Technology Assessment (OTA), INL has not attempted extensive ecological site characterization. "Although selected studies have been done on effects with potential relevance to the cleanup, there appears to be no systematic attempt to inform the cleanup process through ecological studies at INL. The routine monitoring program there, is designed primarily to determine radionuclide pathways to human receptors and includes very little biological monitoring. Routine contaminant-level monitoring in animals is limited to game animals obtained from road kills." [OTA (a) @ 205]

Since the soil ingestion assessment for "cesium approached the upper limit of the recommended NCP target risk range" [TRA Plan @ 3] DOE must specify which "worst-case conditions" were used. Since, "It could take over 400 years for the cesium to naturally decay to an acceptable level," then cesium must be given appropriate consideration. [TRA Plan @ 7]

DOE's statement that any wastes generated or isolated during remediation activities "will be properly disposed of" is not only inadequate; it is based on credibility that DOE no longer can claim. Therefore, a full discussion must describe the required "cradle to grave" waste process. "DOE's current decisions lack credibility because of past failures by DOE and its predecessor agencies to deal effectively with environmental contamination and to make full public disclosure regarding the contamination and its impacts." [OTA (a) @ S-14]

The fact that DOE has known for decades that it was contaminating the environment and deliberately avoided compliance with environmental law, warrants challenges to its credibility. According to the Office of Technology Assessment of INL, "Characterization work is proceeding at a slow pace and is probably limited by funding. Investigation and testing of more conventional stabilization and containment techniques could be pursued more aggressively." [OTA (a) @ 34]

Test Reactor Area Warm Waste Pond Interim Action Record of Decision

The December 1991 TRA Warm Waste Pond Record of Decision (ROD) is deficient. The ROD did not include the immediate secession of use of the TRA leach ponds. EDI supports immediate secession of use of the leach ponds in combination with pumping contaminated perched water to a water treatment system for removal of ALL contaminates. EDI supported the physical separation and vitrification of pond sediment contaminates. These separated wastes must be safely stored in a monitored, retrievable form after vitrification. However, the remedy criteria for removal of sediments of 690 pCi/gm must be equal to or less than the State radiation exposure standard of 4 mRem/yr. Tragically, even the ROD plan to implement chemical extraction was revoked by a March 1993 notice of "Explanation of Significant Difference for the Warm Waste Pond Sediments Record of Decision." Treatability tests found that:

"the goal of reducing cesium activity to less than 690 pCi/gm activity for the treated sediment returned to the pond would result in a dramatic increase in the amount of treatment residuals that could not be returned to the pond cells, resulting in the need for long term storage, as no disposal location had been identified. This increase in the amount of sediments requiring long-term storage would, therefore, result in a decrease in the short-term effectiveness of this physical/ chemical treatment remedy. This increased storage would significantly elevate the project costs above the original estimates in the Proposed Plan. Further, the effectiveness of acid extraction was marginally achievable only under extremely rigorous (i.e., boiling acid and long retention times) conditions bringing into question the implementability of the project" [TRA ROD(c)]

In plain English, what this decision means is this. DOE is once again walking away from a cleanup site because they do not want to store the waste generated, and they do not want to pay the additional costs to cleanup the site to safe standards. The Significant Difference Notice also states that the State and EPA have agreed to a contingency plan to exhume contaminated sediments in one of three cells within the Warm Waste Pond and dump it in the other two cells. Then DOE plans to cover all the cells with soil - not an impermeable cap - just soil. "...The soil cover is to be placed over the Warm Waste Pond to reduce the radiation field and mitigate the potential for blowing dust. The need for an infiltration barrier is not demonstrated and therefore, no cap is needed to meet this objective." [INL Reporter 3/93 @4]

EG&G's 1993 treatability study of the Warm Waste Pond sediments showed extremely effective extraction results for Co-60 that ran as high as 9,270,000 pCi/L and Cesium-137 residuals that ran as high as 27,000,000 pCi/L. [EGG-ER-10616 @4-51] Of course there will be increased storage costs involved with these extracted wastes due to the extreme radioactivity that by definition will require similar management that highly radioactive spent reactor fuel requires. That is, theoretically, the whole idea of cleanup - safe isolation of contaminates from the environment. DOE's final solution supported by the State and EPA was, "transfer of contaminated sediment from the 1964 [Warm Waste Pond] cell and consolidation into the 1952 cell. Contaminated soil from the following INL sites was also dumped into the 1957 cell; 788 cubic yards (603 cm) from ANL-W containing Cs-137 @ 800 pCi/g; 1,178 cubic yards (901cm) from BORAX ditch containing Cs-137 @ 95.4 pCi/g; 1,279 cubic yards (978 cm) from EBR-I containing Cs-137 @ 364 pCi/g; 1,947 cubic yards (1,489 cm) from TRA-NSA containing Sr-90 @ 7,755, Eu-152 @ 913, Am-241 @ 684, Cs-137 @ 404, Eu-154 @ 146, Co-60 @ 74 pCi/g; 2,737 cubic yards (2,093 cm) from TAN Area B containing Cs-137 @ 75, Sr-90 @ 160 pCi/g; 2,208 cubic yards (1,88 cm) from TAN Technical Support Facility containing Cs-137 @ 39, Sr-90 @ 405 pCi/g. Contaminate soil from the ICPP was also dumped at the Warm Waste Pond. These percolation pond cells were then to be backfilled with six inches of soil to grade level. [DOE/ID-10531 @3-23] A reasonable observer would conclude that DOE has created another shallow radioactive dump site and nothing has been cleaned up.

If one accepts the agency's contention that the original plan to treat the sediments in a chemical extraction process is not feasible, then EDI proposes that the sediments must be exhumed and interned in a monitored retrievable storage (MRS) facility until the mixed waste treatment. The worst contaminates in the top three feet would thereby be isolated from the environment. At some future time when vitrification treatment technology is developed to handle the waste then the MRS can be opened up and the material removed for treatment. After the sediments are removed from the pond, a membrane could be laid to delineate contaminate zones from backfill should the need arise to exhume additional sediments. An impermeable cap must then be placed on top of the backfilled pond to eliminate infiltration of precipitation that could leach additional contaminates into the aquifer. Unfortunately, none of this was done.

None of the agencies dispute that the Warm Waste Pond posed a significant threat to health and safety, and they recognized the need to initiate an interim remedial action to mitigate the threat. The agency's action consolidating the sediments in one or two cells of the pond clearly did not isolate the threatening contaminates from the environment, and therefore is not acceptable. Moreover, now the volume of the waste is tripled due to commingling of backfill and cap soils over the contaminated sediments making later cleanup actions unlikely.

At Hanford, DOE was forced by the regulators to construct the Environmental Restoration Disposal Facility (ERDF) that is a fully compliant RCRA Subtitle C Hazardous waste and NRC compliant low-level waste dump. The ERDF has a double liner, leach monitoring and collection wells, and an impermeable cap. This approach would work for INL if an on-site location can be found that is not above the Snake River Plain Aquifer.

TRA Compliance with Applicable or Relevant and Appropriate Requirements (ARAR's)

Both the State and EPA have clearly turned a blind eye to enforcing ARAR's when they agreed to go along with DOE's refusal to cleanup the Warm Waste Pond. In this case the term enforcement agency is an oxymoron. Corporate America should be justifiably outraged at the double standard exercised by enforcement agencies. DOE acknowledges Cesium-137 concentrations of 110,000 pCi/gm in the sediments. [NRT-91052-NC@2-5] The standard for Cesium-137 is 10 pCi/gm. [EG&G-WM-8804] That represents 11,000 times over the standard that is established to protect human health and the environment. If DOE is allowed to walk away from this contaminated site like they did with the TRA perched water which contained Cesium-137 in excess of 176,470 times the standard, what will get cleaned up? What legacies do these actions leave for future generations 540 years from now when the cesium has decayed to "safe" levels?

EDI challenges the Plan's statement that, "The sediment is not hazardous waste as described in RCRA, based upon tests conducted in 1990." [TRA Plan @ 7] Clearly the sediment is a hazardous mixed waste as defined by court challenges to DOE's obfuscation of RCRA definitions. The agencies contend that even though there are RCRA listed contaminates DOE's tests show that they do not leach and therefore RCRA does not apply. No independent tests have been conducted to confirm DOE's claim to non-leachability. This begs the question as to how these contaminates got into the perched water zones in such high concentrations if it did not leach through the soil. DOE continues to circumvent RCRA requirements that specifically specify safe handling, treatment, disposal, and waste site closure standards. For instance, the Warm Waste Pond plan would not even pass EPA's Subtitle D municipal garbage landfill standards.

The TRA pilot study goals state: "minimize or eliminate any characteristic which makes the [warm waste pond] waste RCRA hazardous, including treatment if necessary." [TRA ROD@30] This is indisputable evidence that there are RCRA classified constituents in the pond, and DOE's goal is to avoid RCRA requirements. RCRA closure requirements are further circumvented by not providing a non-permeable cap on top of the pond after extraction operations. This is important to keep precipitation from leaching residual contaminates still suspended in the sub-soils.

The Plan brazenly proclaims - without protest from the State nor EPA - that, "the new lined evaporation pond must be operational before significant cleanup can begin on cells currently in use." This statement clearly and unequivocally identifies EPA and the State with complicity with DOE's highest priority being continued operation - not protection of human health and the environment.

The Congressional Office of Technology Assessment found that, "Doe's various priority systems have certain fundamental flaws and have yet to prove themselves useful in decision-making. The priority scheme used in the Five-Year Plan groups activities into four very broad categories. Most DOE activities fall into some portion of the first two categories primarily, ongoing activities ..."... "Yet, at present, the greatest uncertainty concerns the variables that should be given highest priority in these systems - reducing health and environmental risks." [OTA(a) @ 62-63]

The priority system developed by DOE's Office of Waste Operations provides the categories in descending order of importance for action and funding. In category number one, DOE puts "maintains ongoing activities." [DOE(b)] Again, DOE's priority system reflects the same misguided emphasis on continuing "operation" and "maintaining on-going activities" in priority number 1 over its legal obligations to comply with environmental regulations in priority number 3. INL's current crisis can be attributed to its historic failure to emphasize environmental compliance.

Other TRA Contamination Areas

Test Reactor Area had four separate groups of underground hot waste tanks (TRA-15, TRA-16, TRA-19, and TRA-603/605). TRA-15 has four tanks contained in two concrete basins that occupy about 624 square feet (58 square meters). Leaks in tanks 1 and 2 plus waste piping leaks resulted in extensive soil contamination that included the following pCi/g concentrations: alpha @ 40; beta @ 6,640; Sr-90 @ 2.280; U-234 @ 2,000. [DOE/ID-10531 @3-10] One of the tanks was removed in the 1960's after it leaked extensively.

TRA-16 is an underground hot waste storage tank. The contents of the tank were found to be ignitable waste contaminated with low levels of radionuclides, primarily uranium isotopes. The tank was emptied and excavated in 1993 and dumped at the RWMC.

TRA-19 has four Materials Test Reactor (MTR) underground rad tanks that had service line leaks including a significant incident in August 1985 that caused extensive soil contamination. Soil samples for gamma contamination (Co-60, Cs-134, Cs-137, and Eu-154) ran as high as 1,3000,000 pCi/g. [DOE/ID-10531 @3-14] TRA-603/605 tank was used for all the warm waste from the MTR

TRA-04; "Warm Waste Retention Basin is composed of one large rectangular underground concrete structure divided into two cells by a common concrete wall and holds 720,000 gallons (2,725,200 L). The basin received waste en route to the Warm Waste Pond, and was designed to delay passage of reactor system flush water to allow sufficient time for radionuclides with half-lives of less than a few hours to decay." "It is known that the Basin has been leaking since the 1970's. There have been a number of documented releases from the Retention Basin in the past, including pipeline leakage and leakage from the Basin at a estimated rate of 86,000 gallons (325,526 L) per day. Contamination from the Basin enters the perched water zone beneath TRA." [DOE/ID-10531 @3-24] The Basin was not removed from service until August of 1993 despite the known leaks. Soil contamination around the Basin in pCi/g include: Cs-137 @ 9,150; Co-60 @ 1,320; Sr-90 @ 416: Pu-238 @ 5.08; Pu-230-240 @ 3.79. [DOE/ID-10531 @3-25] "Well USGS-56 is located in close proximity to the retention basin where concentrations of up to 2,540 pCi/mL (2,540,000 pCi/L) of chromium-51 have been detected in the shallow perched zone wells. Thus, detection of chromium-51 is not considered unusual in USGS-56; however, this indicates rapid transport time from the shallow zone to the deep zone in this area." [EGG-WM-10002 @ 4-129] Other contaminates in the deep perched zone are Co-60 at 800 pCi/L; Sr-90 at 180 pCi/L; and U-234 at 14.2 pCi/L. [Ibid @ 4-115/4-116/4-129]

The Materials Test Reactor Canal (OU-2-8/ TRA-37) is located in the basement of the MTR. "The canal installed in 1952 leaked significant quantities of water contaminated with radionuclides for approximately eight years." [INL-94-0026 @a-8]

Test Reactor Area (TRA) Cleanup Cost

EPA's comments on the costs challenge DOE's estimates. "Several of the most significant costs are not adequately backed up by the cost summary and calculations." EPA lists twelve items as inflated, unsupported, or not needed [EPA(b)]

DOE contractors that knowingly violate the law and create the polluted sites requiring Superfund cleanup are now being paid to cleanup their own mess. Former Congressman Mike Synar (D-OH) has stated that these contractors are "being paid at a profit to pollute."... "In any other Superfund situation, a private firm would be penalized for its pollution - by footing the bill itself for the cleanup." [Environmental Magazine 3/93 @42] The cost of actual cleanup is only part of the pork offered these polluters. Costs for remedial investigations, sampling programs, pilot studies, and community involvement put additional millions of dollars into DOE contractor profits.

Congressional Office of Technology Assessment (OTA) recommended that Congress "authorize an institution other than DOE to regulate those aspects of radioactive waste management activities not subject to DOE authority, and over which no other agency has authority, in order to enhance the credibility and effectiveness of those programs." "By limiting DOE self-regulation and providing appropriate independent regulation of radioactive waste management at the [DOE] Weapons Complex, Congress could provide a credible and effective mechanism for addressing the issues, problems, and prospective solutions related to the safe treatment, storage, and disposal of existing and future radioactive waste." [OTA(a) @141-142]

IV.C. Test Area North Cleanup Proposals

Ground Water Contamination at TAN

The self-serving language in DOE's Test Area North (TAN) Fact Sheets persists as with all previous publications on INL. A consistent effort to minimalize the risks and hazards is pervasive. "The DOE believes the current risk of exposure to groundwater contaminants is minimal. At this time, only contaminated wells are located within a few miles of the TAN and all the drinking water at the facility is treated before use, so no human health exposures exist." [TAN Fact @ 3] EDI considers this an incredulous statement when DOE later states that: "none of the [treatment] alternatives [in the interim actions] would meet drinking water standards for the groundwater under TAN." [TAN Plan @ 8] Either the TAN potable water is not safe; or, DOE can treat the ground water for TAN production facilities but not for the cleanup of the TAN ground water contaminated by TAN facilities.

DOE's solicitous statement that the plume has only migrated a few miles challenges any public confidence that it is capable of objective characterization of its own mess. The following list of contaminates was not on DOE's Community Relations Plan (CRP) Fact Sheets: [TAN Fact]

List of Contaminates of Concern in the TAN Ground Water 1987-1998

Contaminate	Concentration	Drinking Water Standard
TCE	35,000 ug/L	5.0 ug/L
PCE	170 ug/L	5.0 ug/L
DCE	9,300 ug/L	5.0 ug/L
Strontium-90	1,930 Ci/L	8.0 pCi/L
Tritium	43,200 pCi/L	20,000.0 pCi/L
Cesium-137	7,500 pCi/L	119.0 pCi/L
Plutonium-238	1.22 pCi/L	7.02 pCi/L
Plutonium-239-240	5.0 pCi/L	62.0 pCi/L
Cobalt-60	890 pCi/L	100.0 pCi/L
Uranium-234	17 pCi/L	13.9 pCi/L
Europium-154	6.62 pCi/L	200.0 pCi/L
Americium-241	23.6 pCi/L	6.34 pCi/L

[TAN ROD @ 17][EGG-10802][EGG-10643]

Of particular concern is the high tritium contamination at TAN and the public and worker risks from tritium exposure. For instance, huge tritium releases from INL facilities have been largely ignored despite the known risks. A cursory review of the literature by EDI reveled a significant body of research challenging DOE and the nuclear industry's public contentions that tritium is of little public health concern. Two studies by DOE's Battelle NW Labs in 1972 and 1982 found that rainbow trout exposed to tritium only 0.4 rad above background levels resulted in permanent immune suppression in all the fish.[Strand] Numerous other studies on animals have proven significant genetic damage and other biological dysfunction as a result of tritium exposure. Also see references on tritium studies.

Maximum contaminant in TAN TSF-05 injection well sludge

[OU 1-07B TAN groundwater RI/FS work plan, Appendix B and G]

Substance	Concentration	EPA Standard
1,1 trichloroethylene	24 ug/gm	7 ug/L
methylene chloride	290 ug/l	?
trans-1,2-dichloroethylene	410 ug/gm	5 ug/gm
trichloroethylene	30,000 ug/gm	5 ug/gm
tetrachloroethylene	2,800 ug/gm	5 ug/gm
2-butanone(methyl ethylketone)	180 ug/gm	?
Barium	326 ug/gm	1,000 ug/gm
Lead	180 ug/gm	50 ug/gm
Chromium	91 ug/gm	50 ug/gm
Mercury	101 ug/gm	2 ug/gm

Gross Beta	4,900,000 pCi/l	8 pCi/l
Gross Alpha	6,000 pCi/l	15 pCi/l
cobalt-60	812 pCi/gm	
cesium-137	2,340 pCi/gm	
emporium-154	6.62 pCi/gm	
americium-241	23.6 pCi/l	6.34 pCi/l
Tritium	1,000,000 pCi/l	20,000 pCi/l
plutonium-241	123.6 pCi/l	62.6 pCi/l
plutonium-239	12.2 pCi/gm	

[TAN Sludge] [TAN ROD @18][EGG-ER-10643][INL-95/0056@5-25]

Groundwater Pump and Treat Interim Action at Test Area North (TAN)

DOE only identifies trichloroethylene, tetrachloroethylene, lead and strontium as contaminates at TAN. [TAN Fact @ 3] The State INL Oversight list additionally identifies cesium, cobalt, plutonium, americium and tritium also have been detected at high activity levels in the [TAN] injection well. [Oversight(b)] Though the State's list which is more complete, neither agency is telling the whole story in their public literature. The State cites migration of tritium and strontium-90 (Sr-90) in the ground water. [Oversight (b) @ 29] Sr-90 levels of 10 pCi/L in TAN-1 well, 12 pCi/L in TAN-2 well, and 27 pCi/L in APN-9 are also acknowledged by the State. [Ibid] The maximum Sr-90 contaminate level for drinking water standard is 8 pCi/L. DOE has an obligation to state the data presented in the previous tables in their fact-sheets, and the other agencies clearly are remiss by not ensuring that appropriate data reaches the public. Additionally, Test Area North 616 Tank area, trench soil has readings of 54,120 pico curies/gram in the soil which indicates additional contaminate sources than currently acknowledged. [RE-P-80-090, p.6]

DOE's contention that the contaminate plume has not migrated more than 1/4 mile [TAN Plan @ 4] is in direct contradiction to its own fact-sheet stating contaminated wells located within a few miles of TAN [TAN Fact@ 3] and the State's report. [Oversight(b)@ 29] Additionally, DOE's claim that "trichloroethylene plume is not expected to reach existing supply or drinking water wells in areas outside of TAN for over 100 years" [TAN Fact@ 4] is currently being challenged. Knowledgeable hydrologists not related to DOE argue with justification that the aquifer is not homogenous and indeed, the existence of lava tubes can provide for speedy dispersion of contaminates. Even if the public were to accept the questionable 100-year migration time, the identified TAN contaminates have a half-life of thousands of years, a fact which dominates the discussion. This claim also contrasts to DOE's recent admission that Iodine-129 migrated eight miles south of the site and that "Our computer modeling has predicted for years that these contaminates would be detected off-site." [AP 2/13/93]

The groundwater pump and treat action will discharge partially treated water into the old leach pit. Any continued use of the existing TAN percolation pond (leach pit) - whether divided or not - is unacceptable. DOE's contention that "contaminates already in the pond would not be pushed deeper into the soil by water coming from the interim action" [TAN Plan @ 6] is totally unfounded. Sample data of the percolation pond show gross alpha at 53 pCi/g, and gross beta at 28 pCi/g. [TAN--5171 @ 17] EDI proposes that a new fully- lined evaporation pond, meeting Subtitle C requirements, must be built some distance from the present one to receive the processed TAN ground water. Even if the new lined pond had some minimal leakage, the water would not be flushing subsurface contamination downward as would be the case in the existing TAN percolation pond.

DOE acknowledges that: "The treatment facility built under these alternatives would be expected to remove a minimum of 90% of the contaminates in the groundwater before the treated water is discharged to the TAN disposal pond." And that: "none of the [treatment] alternatives [in the interim actions] would meet drinking water standards for the groundwater under TAN." [TAN Plan @ 8] The June 9, 1994 Moscow hearing presentation by EG&G project spokespersons acknowledged that the treated water discharged to the percolation pond contains greater than 300 pCi/l strontium-90. [Also see TAN ROD] This violates the Clean Water Act, Idaho Hazardous Waste Management Act and therefore does not meet the Applicable or Relevant and Appropriate Requirements (ARAR) rule. Discharging Sr-90 three hundred times the EPA's maximum concentration level of 8 pCi/l so that it can migrate back into the aquifer is unconscionable.

Environmental Defense Institute (EDI) suggests that technologies do exist to treat the groundwater to drinking water standards. No public acceptance should be expected for reintroducing contaminates back into the aquifer because DOE does not want to spend the money on appropriate resin filter technologies. If the agencies proceed with the identified treatment processes, the bottom line is: do not use the existing TAN percolation pond. Therefore, the "treated" groundwater must be categorized as a hazardous waste; and the new EDI proposed lined evaporation pond must be permitted by the State as a RCRA waste site. Because EDI raised this issue of re-dumping contaminated water, the agencies agreed to conduct more extensive treatability studies using commercially available resin filter columns. Despite success with these studies it is uncertain whether DOE will agree to pay the additional costs for the resins and appropriately dispose of the filters.

DOE's claim is unfounded that; "The only acceptable disposal option for this mixed waste [filter] carbon would be complete destruction in a special incinerator that also could capture the radionuclides." [TAN Plan @ 10] Any plan that incorporates the use of the aging industrial Waste Experimental Reduction Facility (WERF) incinerator is unacceptable. EDI supports the Hanford approach recently negotiated with the State, EPA, and the stakeholders. The technology chosen is vitrification of all low-level, mixed, and high-level (except for spent fuel) into a stable glass/ceramic form. This approach will meet RCRA requirements and also put the waste in a stable form that can be safely stored until a permanent repository is developed. An important issue yet to be resolved is DOE's insistence on pre-treatment which the stakeholders justifiably consider a waste of money.

Additionally, delisting TAN waste treatment residuals from the hazardous waste classification subject to RCRA Subtitle C hazardous waste disposal and closure requirements; and classifying the waste in the same category (Subtitle D) as municipal garbage, is illegal. This arbitrary switch in waste classification by the stroke of DOE's pen must not go unchallenged by the State or EPA. Little public confidence exists for EPA's Best Demonstrated Available Technology (BDAT) requirements. For a detailed discussion on these inadequate and controversial regulations see the Natural Resources Defense Council's comments on "Land Disposal Restrictions for Newly Listed Wastes and Contaminated Debris." "Although EPA acknowledges that technology is available, has been demonstrated and meets all of the relevant standards for NWW constituents, the agency improperly based its BDAT determination on less effective incineration and solvent extraction technologies." Moreover, "incineration technologies often cause an irreconcilable conflict due to the need to operate at a high enough combustion temperatures to destroy organic wastes without also volatilizing the radionuclide constituents." [NRDC(c), 2/24/92 @ 4]

Another monumental problem faced at INL is the strangle hold contractors have on the site. What cleanup money does finally make it to Idaho, is eaten up by these site contractors who charge excessive overhead for doing the work. Cleanup contracts at other DOE sites allow only 30% overhead charges, and consequently get three times the work accomplished. DOE Headquarters is now attempting to reign in these excesses by awarding the INL Maintenance and Operations contract to Lockheed Martin, however recent Inspector General Audit suggests that little has changed. See Section I(K).

Comprehensive TAN Cleanup Plan

DOE’s Proposed Comprehensive Plan for Waste Area Group 1 (Test Area North TAN) dated February 1998 fails to provide remedial solutions that meet Applicable or Relevant and Appropriate Requirements (ARAR). The Plan offers no substantive information about the maximum contamination levels related to individual Operational Units (OU). Consequently, the general public is effectively denied essential information upon which to make their own determination of whether the preferred alternatives were appropriate.

The Plan claims to be “the comprehensive” CERCLA investigation into TAN. This is not a “comprehensive” Plan because the ANP Cask Storage Pad, the Area 10 HTRE Reactor Vessel Burial Site, and the TAN Pool have been excluded. The disposition of the contaminated Tan Pool water into unlined pits and the dumping of the “hardware” and “reactor fuel support structures “in the Pool as low-level waste is particularly egregious. [DOE/EA-1050@ 17&a-4] If the hardware and fuel element parts were properly classified as greater than class C low-level waste (GCC), DOE would legally be blocked from dumping it at the RWMC although that never stopped the Department from dumping GCC there in the past.

The apparent absence of lessons learned between the Hanford Environmental Restoration (ER) process and the INL ER process is regrettable and a serious threat to Idaho. DOE is taking advantage of its position as the single largest employer in Idaho to float ER actions at INL that the Department was not allowed to do at Hanford because public and regulatory pressure blocked shortcuts. Specifically, at Hanford DOE was required to build the Environmental Restoration Disposal Facility (ERDF) which is a fully compliant Resource Conservation Recovery Act (RCRA)/ Nuclear Regulatory Commission (NRC) mixed hazardous/radioactive dump with double liner, leachate collection and monitoring wells and an impermeable cap. ERDF was completed in the Spring of 1996 at the farthest location on Hanford away from the Columbia River and will receive contaminated soil and decontamination/decommissioning (D&D) waste. At INL, DOE refuses to build such a repository because the Department is not being pressured by the state and EPA regulators to comply with the law. The need for the INL equivalent to the ERDF is discussed in the INL Environmental Impact Statement and the INL Site Treatment Plan but DOE has yet to initiate construction because the regulators are allowing short cut ER proposals to go through. DOE’s own “off-aquifer siting analysis identified two areas off the Snake River Plain Aquifer (Spent Fuel Storage at the INEL Yet off the Aquifer). [DOE/EA-1050@B-5] Another option would be for DOE to purchase additional adjacent land at the northwest of the site for an ERDF type dump off the aquifer.

The contamination the TAN Plan addresses is mixed hazardous / radioactive low-level waste (MLLW) and is listed in DOE’s own Site Treatment Plan (STP) which the Department was required to generate to comply with the Federal Facilities Compliance Act. This MLLW designation is supported by the TAN Remedial Investigation/Feasibility Study (RI/FS) sample data that clearly shows Resource Conservation Recovery Act (RCRA) Toxicity Characteristic Leaching Procedure (TCLP) extraction analysis results exceeding the regulatory limit in 40 CFR ss 261.23. Therefore RCRA Land Disposal Restrictions (LDR) in 40 Code of Federal Regulations (CFR) Parts 148 and Parts 268 for MLLW and Nuclear Regulatory Commission 10 CFR-Subpart D ss 61.50 must be applied. Unfortunately, the State of Idaho Division of Environmental Quality (DEQ) and the Environmental Protection Agency as regulators refuse to force DOE to comply with the legal requirements of the most basic of environmental laws. The Plan proposes disposal of this MLLW in a manner that would not even comply with municipal garbage landfill requirements let alone the more stringent MLLW regulations. For those TAN hazardous waste release sites, the LDR’s in 40 CFR 148 & 268 still apply.

Adding to the list of lessons NOT learned we must add dumping radioactive and chemical waste in unlined shallow pits and trenches over top of the regions sole source Snake River Plain Aquifer. This misguided dumping practice at the INL Radioactive Waste Management Complex Subsurface Disposal Area has resulted in extensive contamination of the aquifer. The proposed TAN Plan intends to repeat this dumping practice despite undeniable examples of failure of this approach. DOE has already gotten away with this illegal dumping in the Test Reactor Area Warm Waste Pond Environmental Restoration project completed in 1997. The Department proposes to repeat this type of dumping at the Naval Reactor Facility, Argonne-West and again at Test Area North. Still another lesson NOT learned at INL is the public and regulators rejection of grouting of MLLW and shallow land burial at Hanford. DOE proposes grouting the TAN tank wastes and leaving it in place in the existing waste tank. Grouting did not meet treatment and disposal requirements of MLLW at Hanford or INL. The State of Idaho simply will not force INL to comply with the relevant laws.

Below Table A lists the Operable Units (contaminate release sites) and the proposed decisions remedial actions or no actions. Table B lists the Operable Units and selected sampling data and the source of the data. This information is the result of weeks of review of the voluminous Administrative Record. The Environmental Defense Institute believes that this information is essential to making an informed decision as to whether DOE preferred alternative is appropriate and therefore should have been included in the Plan that was mailed out to the general public.

DOE has never in any of its INL Environmental Restoration Record of Decisions (ROD) been forced by the regulators to specify what institutional control constitutes. Only through that legally binding document can DOE be held liable for specific actions. For instance, 100 years of institutional control (the amount DOE has committed to) could be interpreted as retaining ownership and annual flybys to monitor the site. In view of the toxicity of the waste being hazardous for hundreds of thousands of years, this is a crucial issue. The length of time the waste will pose a risk to any intruder must determine the duration of institutional control and barriers adequate to keep intruders out must be maintained for the duration. Monitoring must include soil and ground water sampling to ensure the waste is not migrating. A trust fund must also be established so that if the federal government again decides to ignore the law, that state or local government will have the resources to do the job.

Table A and B

Ignored sites: ANP Cask Storage Pad; Area 10 Reactor Vessel Burial Site
TAN Pool contaminated soil

Table B

TAN Site	Contaminate	Concentration	Reference *
ANP Cask Storage Pad	Gross Alpha	330 pCi/g	(a) Table A-5-5
	Gross Beta	25,600 pCi/g	"
	Cs-137	30,400 pCi/g	
TSF-3 Burn Pit			
	Lead	2,830 mg/kg (a)	(a) Table A-2-3
TSF-06			
Contaminated Soil	Cs-137	30,400	(a)4-24
	Mercury	80,500 mg/kg	(a) Table A-5-6
	Gross Beta	1,880 pCi/g	(a) Table A-5-7
TSF-07 TAN Disposal Pond	Sight Treatment Plan	lists as MLLW	STP @ 6-3
	aluminum	25,400 mg/kg	(a)4-29
	barium	9,740 mg/kg	(b) 4-110
	mercury	4,040 mg/kg	"
	sulfide	4,270 mg/kg	"
	Cobalt-60	87.7 pCi/g	"
	Cesium-137	135 pCi/g	"
Drainage Pool TSF-10			
	aluminum	30,400 mg/kg	(a)4-26
TSF-09/18			
V-1 Tank Liquid	Cobalt-60	101,000 pCi/l	(a) Table A-6-10

	Cs-134	16,900 pCi/l	(a) Table A-6-10
	Cs-137	12,500,000 pCi/l	(a) Table A-6-10
	Europium-152	83,800 pCi/l	(a) Table A-6-10
	Europium-154	93,800 pCi/l	(a) Table A-6-10
	Plutonium-238	7,010 pCi/l	(a) Table A-6-10
	Plutonium-239	3,220 pCi/l	(a) Table A-6-10
	Gross Beta	16,100,000 pCi/l	(c) 59
	Gross Gamma	24,300,000 pCi/l	(c)59
	Gross Alpha	19,800 pCi/l	(c) 59
	Tritium	11,800,000 pCi/l	(a) Table A-6-10
	Total Strontium	1,840,000 pCi/l	(a) Table A-6-10
	Lead	842 ug/l	(a) Table A-6-10
	Tetrachloroethene	1,800,000 ug/kg	(a) Table A-6-11
	Trichloroethene Tetrachloroethene Vinyl Chloride	All three chemicals/metals Exceed TCLP	(c) 8 through 12
Tank V-2	Gross Beta	6,340,000 pCi/l	(c) 59
	Gross Gamma	38,500,000 pCi/l	(c)59
	Gross Alpha	84.9 pCi/l	(c) 59
	Trichloroethene Tetrachloroethene Cadmium Vinyl Chloride	All four chemicals/metals Exceed TCLP	(c) 8 through 12
V-3 Tank	Uranium-233/234	13,300 pCi/l	(b) A-83
	Strontium-90	12,300,000 pCi/l	“
	Cobalt-60	14,800 pCi/l	“
	Cesium-137	4,230,000 pCi/l	“
	Ruthenium-103	13,600 pCi/l	“
	Tritium	6,090,000 pCi/l	“
	Nickel-63	205,000 pCi/l	“
	Gross Beta	28,300,000 pCi/l	(c) 59
	Gross Gamma	2,230,000 pCi/l	(c) 59
	Trichloroethene Tetrachloroethene Vinyl Chloride	All three chemicals/metals Exceed TCLP	(c) 8 through 12

V-1, 2, 3 & 9 Tanks	STP lists waste as	MLLW	
V-9 Tank	Americium-241	40,200 pCi/l	(b) A-91
	Plutonium-238	170,000 pCi/l	(b) A-91
	Plutonium-239/240	45,300 pCi/l	(b) A-91
	Uranium-233	12,400 pCi/l	(b) A-91
	Uranium-234	211,000 pCi/l	(b) A-91
	Uranium-235	6,900 pCi/l	(b) A-91
	Uranium-236	3,260 pCi/l	(b) A-91
	Uranium-238	972 pCi/l	(b) A-91
	Cesium-137	6,370,000 pC/g	(b) A-91
	Tritium	353,000,000 pCi/l	(b) A-91
	Total Strontium	250,000,000 pCi/l	(b) A-91
	37 hazardous chemicals/metals		(b) 10-44
PMA-2M TSF-26 V-13 Tank	Cobalt-60	45,900,000 pCi/l	(c) 31
	Europium-154	93,000,000 pCi/l	(C)31
	Cesium-137	2,900,000,000 pCi/l	(c) 31
	Strontium-90	2,850,000,000 pCi/l	(c) 31
	Cesium-134	18,100,000 pCi/l	(c) 31
PMA-2M TSF-26 V-14 Tank	Cobalt-60	191,000,000 pCi/l	(c) 31
	Cesium-134	2,000,000 pCi/l	(C) 31
	Cesium-137	9,420,000,000 pCi/l	(c) 31
	Europium-154	17,200,000 pCi/l	(c) 31
	Strontium-90	9,260,000,000 pCi/l	(c) 31
	32 hazardous chemicals/metals		(b) 10-28
V Tank soil	STP lists as MLLW	54,120 pCi/g	RE-P-80-090 @6
V-13 & V-14 Tanks	STP lists liquid/sludge	MLLW	STP @ 6-3

IET Valve Pit TSF-21			
	Cs-137	602,000 pCi/l	(a)Table A-9-2
	Lead	9,350 ug/l	(a) Table A-9-2
	Trichloroethene	22,000 ug/l	“
Loft-02 Disposal Pond	aluminum	23,900 mg/kg	(b) 7-43
	manganese	1,080 mg/kg	“
	gross alpha	8,400 pCi/kg 8.4 pCi/g	“
	gross beta	6,500 pCi/kg 6.5 pCi/g	“
WRRTF-01 Burn Pit	Xylene	6,600 ug/kg	(a) Table A-3-3
	Acetone	4,200 ug/kg	(a) Table A-3-5
	Naphthalene	7,800 ug/kg	(a) Table A-3-5
	2-methylnapthalene	10,300 ug/kg	(a) Table A-3-5
	Lead	2,350 ug/kg	(a) Table A-3-6
Diesel Fuel Tank WRRTF-13	TPH	35,700 mg/kg	(b) 4-140

*See Reference Section for the following table references: (a) DOE-ID-10527; (b) DOE-ID-10557; (c) TAN(d)

IV.D. Radioactive Waste Management Complex Cleanup Proposal

Site Description

The Radioactive Waste Management Complex (RWMC) is the largest of the numerous INL radioactive waste burial grounds. This site's first trench was opened on July 8, 1952 for on-site mixed fission product waste, but soon started accepting waste from around the country. "During the 1950's, the rate of radioactive waste generated by private industry [Atomic Energy Commission] AEC licensees was increasing. Since no commercially operated burial ground existed for these wastes, most of the licensees used commercial sea disposal services provided by seven firms that disposed of packaged solid waste in AEC approved areas off the US Coast." "In late 1959, the AEC decided that land burial had definite advantages, particularly economic, over sea disposal." [PR-W-79-038 @27]

Between 1946 and 1970, the AEC supervised the disposal of about 107,000 drums of low-level radioactive wastes at sites off the Atlantic and Pacific coasts, according to the history of the commission and a report by Daniel P. Finn for the Senate Intelligence Committee. Ocean dumping of low-level radioactive wastes by the USA ended about 1970 with the passage of the Marine Protection, Research and Sanctuaries Act, referred to as the ocean dumping act.

The RWMC is divided into primarily two areas, the Subsurface Disposal Area (SDA), and the

Transuranic Storage Area (TSA). The SDA was expanded from the original 13 acres to its current 96.8 acres, and as of 1992 contained 20 pits, an acid pit, 58 trenches, and after 1977 more than 20 rows of soil "vaults" for small volume highly radioactive waste requiring remote handling and shielding. Soil vault is a euphemism for a plain old hole in the ground. Prior to 1977, remote handled waste was dumped in pits and trenches with other waste. The ANL-W Hot Fuel Examination Facility, ICPP, and the Navy's ECF remote handled hot waste is buried here in these 600+ holes. [INEL-94/0241] A thermal analysis of ANL-W waste notes 1,150 soil vaults at the SDA and container temperatures of 392 degrees (F). [RE-A-80-062 @2] See Section I(E) Navy waste characterization. A 1992 plot plan [RWMC # 416511] shows the 20 rows of soil vaults between the pits and trenches. Additionally, a more recent large concrete lined soil vault array has been added to the SW corner of Pit 20.

The SDA also contains the Transuranic Disposal Area (TDA) that originally was designed for two large pads (A & B) where the waste was stacked and later covered with ground to act as shielding, however only Pad A was used. Current DOE documentation acknowledges Pad-A with dimensions of 73.2 x 102.1 meters (240 x 335 feet) by 5.6 to 6.1 meters (20 feet) high and with a total volume of 10,200 cubic meters. [Pad-A ROD] However, if these dimensions are multiplied (minus soil cover) the volume would be 45,514 cubic meters. The discrepancy may in part be due to the Pad being somewhat larger than the waste stack but not likely to be four times larger. This volume discrepancy is not just an academic question but an important issue related to characterizing the actual volume of mixed alpha low-level waste dumped at this site.

The Transuranic Storage Area (TSA) covers 57.5 acres, and is divided into four areas. TSA Pad-1 opened in 1970 and has Cells 1 through 9, TSA-R Pad immediately south of Pad-1 has 3 cells. These two above ground pads are covered with plastic wood and soil. Pad-1 and Pad-R measure 150 x 1,100 x 15 feet. Pad-2 measures about 150 x 730 x 15 feet high. A containment building is currently being built over both pads for the planned exhumation of the waste. Pad-2 opened in 1975 contains an Air Support Building that stores barrels of TRU waste and has 3 earth covered cells behind it. TSA Pad 3 has the SWEEP building that assesses the contents of incoming waste barrels, and has another large air support storage building attached to it on the east. The fourth TSA section is the Intermediate Level Transuranic Storage Facility (ILTSF) that is divided up into two pads (Pads 1 & 2). The ILTSF contained 57 "concrete lined soil vaults" in 1979 and is used for remote handled waste in excess of 4,500 R/h three feet from the container surface.

Responding to warnings by the US Geologic Survey, the National Academy of Sciences Committee on Geologic Aspects of Radioactive Waste Disposal visited (June-July 1960) both Hanford and National Reactor Testing Station (NRTS) (now called INL) and submitted a report to the Atomic Energy Commission in which they stated:

"The protection afforded by aridity can lead to overconfidence: at both sites it seemed to be assumed that no water from surface precipitation percolates downward to the water table, whereas there appears to be as yet no conclusive evidence that this is the case, especially during periods of low evapotranspiration and heavier-than-average precipitation, as when winter snows are melted. At the NRTS pipes were laid underground without ordinary safeguards against corrosion on the assumption that the pipes would not corrode in the dry soil, but they did. At NRTS plutonium wastes (plutonium half-life 24,000 years) are given shallow burial in ordinary steel (not stainless) drums on the same assumption. Corrosion of the drums and ultimate leakage is inevitable .... The movement of fluids through the vadose (aeration) zone and the consequent movement of the radioisotopes are not sufficiently understood to ensure safety."[IDO-22056 @ 3]

Five years later (1965) the National Academy of Sciences revisited NRTS and concluded that "1.) considerations of long-range safety are in some instances subordinated to regard for economy or operation, and 2.) that some disposal practices are conditioned on over-confidence in the capacity of the local environment to contain vast quantities of radionuclides for indefinite periods without danger to the biosphere."[IDO-22056 @ 3]

These scientific observations by the National Academy of Sciences were made over forty five years ago and were ignored by the Atomic Energy Commission, Energy Research Development Agency (ERDA), and finally by DOE. Even in 1960, the scientists recognized what the consequences would be and offered specific criticism for subordinating safety to economic expediency. No claim to ignorance can be made by the federal agencies. This is outright gross negligence on the part of the federal government.

The cleanup proposal for the Radioactive Waste Management Complex (RWMC) unfortunately is characteristic of DOE's shell game with its nuclear waste. Observers also call DOE's process “radioactive relocation” - scoffing at the term "cleanup". Despite the fact that the RWMC is a Superfund cleanup site due to contamination from previous radioactive dumping, INL continues to bury radioactive waste at RWMC. The waste is dumped in unlined pits that would not even pass municipal garbage landfill regulations under Subtitle D. Neither the State nor EPA has demanded permitting of the RWMC under the Resource Conservation Recovery Act (RCRA). DOE claims that RCRA does not apply because radioactive waste is not covered by the law. Court decisions in 1987 over-threw that argument whenever radioactive and hazardous chemical wastes are mixed (mixed waste). The RWMC has mixed waste and therefore must be held in compliance with RCRA. EPA's inability to promulgate radioactive waste disposal standards has further exacerbated the enforcement problem. The Nuclear Regulatory Commission and DOE have effectively kept previous administration pressures on EPA to shelve the standards.

DOE's public literature (fact sheets) on cleanup actions inaccurately identifies only Rocky Flats transuranic (TRU) as the only off-site waste dumped at the Radioactive Waste Management Complex (RWMC). [RWMC Fact @ 2] Also on page 3 the fact sheet states that " The Subsurface Disposal Area which is dedicated to permanent disposal of low-level waste generated at the INL", [RWMC Fact @ 3] is not supported by the literature. A 1976 USGS document that has an RWMC plot plan of the location of the pits and trenches notes that "Trench 55 is still available for high-level waste." [IDO-22056 @9]

"In May 1960, the INL was designated as one of two national burial grounds for disposal of waste from any ERDA [predecessor of DOE] source. Consequently, a great deal of beta-gamma contaminated waste was received from various experimental operations around the country, and was buried together with the transuranic waste from Rocky Flats. This waste material included: reactor shielding weighing 16,329 Kg (36,000 lbs) from Kelly Air Force base, San Antonio, Texas, contaminated with Co-60; an aluminum heat exchanger 8.2 meters long and 1.5 meters in diameter weighing 20,000 lbs from Nuclear Engineering Company, Pleasanton, CA, contaminated with radionuclides of Co, Fe, and Al; drums containing old compasses, metascopes, switchboards, electron tubes, contaminated with Ra-226, Po-210, Sr-90, Co-60 from US Army Chemical Center, Dugway, UT; drums containing animal carcasses from US Nuclear Co., Burbank, CA; concrete blocks 1.5 x 1.5 x 2 meters contaminated with mixed fission products from Lawrence Livermore, CA." [WMP 77-3 @ 8-9]

Also US Nuclear Corp., General Atomics Corp., dumped at INL. [WMP 77-3 @ 14] In later years, DOE facilities at Mound, Battelle-Columbus, Argonne-east, and Bettis also dumped at INL. "Soon general 'low-level' and 'high-level' wastes were buried here. High level wastes in shielded containers continued to be buried there at least until 1957. Some readings were as high as 12,000 rads per hour. ‘Low-level' waste was buried in everything from cardboard boxes to steel drums and wooden crates. [Deadly Defense @ 50] Attempts were made to bury the most radioactive materials at the bottom of the trenches "to reduce the radiation level at the top of the trench to <25 R/hr. " [IDO-12085 @4] Reactors and/or cores from the on-site Aircraft Nuclear Propulsion, SNAPTRAN, SL-1, Low-Power Reactor (ML-1), Portable Medium Nuclear Power Plant (PM-2A), and LOFT tests were also buried at the RWMC. Spent reactor fuel from the INL Aircraft Nuclear Propulsion (ANP) and other projects went to the burial grounds. “Information about the disposal of the insert material is uncertain based on discussions with personnel previously employed with the ANP Program. A check with personnel at ICPP indicated that no records available at ICPP existed to show that ceramic fuels had been received or were being stored at ICPP. In addition, the only fuel to be processed at ICPP, other than metallic fuel, was the graphite ROVER (nuclear rocket propulsion program) fuel. To date, no ceramic fuel has been processed at ICPP.”[EGG-WM-10903 @2-14 & 2-21] Basically, there were three options, reprocess, storage, or dumping. If the spent reactor fuel was neither reprocessed or stored, then it was likely dumped at the RWMC.

Modifications to the EBR-II reactor at ANL-W in 1981 generated considerable radioactive waste that was buried at the RWMC. The large waste items included the old reactor vessel (16 tons), large reactor rotating plug (65 tons), and small reactor rotating plug (50 tons). The reactor-vessel cover contained about 270,000 curies of cobalt-60. This activity level results from activation of Stellite sleeves required for rod-drive shafts and gripper mechanisms. The reactor-vessel cover is filled with 263 individual graphite-filled cans. [ERDA-1552 @IV-16]

Considerable confusion exists in the public and DOE literature regarding waste classifications. The public cannot be faulted by combining all highly radioactive waste in the high-level category, as opposed to the arbitrary DOE definition of high-level being reactor fuel and fuel process waste. The term Transuranic is a relatively new term which earlier was called mixed fission products (MFP). High-level, Transuranic (TRU), and low-level are the currently used technical classifications.

Additionally, the public is not served by the DOE's deficient and inaccurate public literature that characterizes the waste at the RWMC. No mention is made of radionuclides in the aquifer, only "organic compounds are present in groundwater monitoring wells at RWMC." [RWMC Fact@ 3] DOE's internal documents reviewed by independent analysis show that, "Core sampling into the 88 acre [RWMC] burial ground site has disclosed plutonium contamination 110 feet and 230 feet below the Waste Management Complex. Floods in 1962 and 1969 are believed to have caused the plutonium migration. Another possible cause is transport by organic chemicals. One test well emitted organic gas levels 30 times safe worker exposure limit and had to be sealed." [Deadly Defense @ 51] In addition to hundreds of thousands of gallons of bulk chemicals dumped in the SDA Acid Pit, containerized chemicals were dumped in other pits and trenches such as Pit-9 where 23,600 gallons were dumped.[EGG-WM-9966 @Ap.A] More recent water sample data show radionuclides at a depth of 580 feet below the RWMC. [IDO-22056] Disposal trenches average about 6 feet wide, 12 feet deep and 900 feet long. Pits are large deep rectangular holes dug down to basalt, filled with waste and then covered over with soil.

Subsurface Disposal Area Pits and Trenches

Pit / Trench Number	Waste Type	Year Used	Number of drums	Number of Cartons/Boxes
Trenches 1-16	Non-TRU	1954-57	?	?
Trenches 17,19, 20, 26, 32, 34, 39, 45, 47-49, 51, 52, 55, and 56	TRU	1958-74	?	?
Trenches 18, 21-25, 27-31, 33, 35-38, 40,44, 46, 50, 53, 54, 57, and 58	Non-TRU			
Pit 1	Non-TRU	1957-61	7,551	2,526
Pit 2	TRU	1959-63	22,435	2,367
Pit 3	TRU	1961-63	5,511	100
Pit 4	TRU	1963-67	31,411	2,368
Pit 5	TRU	1965-66	18,486	1,350
Pit 6	TRU	1967-68	14,396	3,423
Pit 7	MFP	1966-68	?	?
Pit 8	MFP	1967-67	?	?
Pit 9	TRU	1968-69	3,921	2,029
Acid Pit	Rad/chemical Liquids	1954-61	?	160,000 gallons
Pit 10	TRU	1968-71	26,645	2,849
Pit 11 (later emptied)	TRU	1970-70	13,542	90
Pit 12 (part emptied)	TRU	1970-72	4,838	26
Pit 13 through 15	TRU	1971-	?	?
Pit 16	Non-TRU			

20 Rows Soil Vaults >600 w/2 drums each hole	>Class-C LLW shielding /remote handling		1,200	SW corner Pit-20 array concrete vaults >Class-C LLW
Pad - A	Mixed Alpha LLW	1972-78	18,232	2,020

[WMP-77-3 @2][IDO-22056 @9][Oversight(c), 1/6/96][INEL-94/0241][EGG-WM-10903@2-7]
MPF = Mixed Fission Products; TRU = Transuranic Waste (elements heavier than uranium >100 nCi/g);
Alpha Low-level = >10 nCi/g but <100 nCi/g TRU

Sub-soil sampling of the SDA burial ground showed Americium-241 at 66,000 pCi/gm, Plutonium-239 at 1,600,000 pCi/gm of soil, Cesium-137 at 2 pCi/gm, and Krypton-40 at 16 pCi/gm. [RE-P-81-016@2] Radiation being given off at 3 feet above Pit 13 and trench 55 were as high as 200 mR/ hr.[Tree-1013@8] SDA perimeter monitoring also at 3 foot height reached 7,261 mR/hr in 1975. [Ibid @ 11]

"High radiation level waste that would cause excess personnel exposure was handled and disposed by using special transfer vehicles and containers. A long tongue trailer, pulled behind a pickup truck, was used to haul material contained in 2x2x3 foot boxes or in 30 gal garbage cans. A shielded cask and a lead open-top box container were used to shield high-level waste."... "At least until 1957, no upper limit had been set on the level of radiation that could be handled; units of up to 12,000 R/hr were disposed." [PR-W-79-038 @19]

Limits of up to 400 grams of U-235, or 267 grams of Pu-239 that could be disposed in the same container were exceeded. [PR-W-79-038 @30] Two fires in Trench 42 occurred on September 8 and 9, 1966, and were caused by alkali metals being mixed with low-level waste. This was coupled with a 34% increase in "hot" waste in the trench. [Ibid] A third fire occurred on June 1, 1970 when sunlight on an exposed drum of uranium turnings ignited. The fire spread to other drums and "attempts failed to extinguish the fire in the waste stack." [Ibid @44] The fire was finally contained by a bulldozer operator who covered the stack with ground.

Pad-A within the SDA was the first attempt to comply with new regulations that required segregation of Mixed TRU waste from low-level. This crude storage approach consisted of a thin above ground asphalt pad (240 x 335 feet) upon which waste drums and boxes were stacked and later covered with soil to provide radiation shielding. Pad-A received over 87,500 kg of Uranium-234, 235, and 238 along with 4,600,000 kg of evaporator nitrates that the Code of Federal Regulations classifies as an ignitable oxide contaminated with plutonium, americium, thorium, uranium, and potassium-40. [Pad-A ROD@10] EPA and State regulators went along with DOE on a no-action (no cleanup) Record of Decision even though the risk assessment showed Pad-A would be contaminating ground water in excess of drinking water standards within 100 years. [EGG-WM-9967 @ 7-2] Corrosion / disintegration of waste containers with the resulting release of contaminates and the long term erosion (wind and rain) of the 3-4 feet of cover soil from the top of the 25-30 foot Pad-A mound does not appear to be considered. EG&G's Remedial Investigation Feasibility Study for Pad A found that erosion rates of 36 inches per hundred years can be expected. [EGG-WM-9967 @ 7-2] This means that the Pad-A waste will be exposed in a hundred years.

Understanding the extent of the waste problem at INL is necessary for putting any remedial cleanup actions into context. Additionally, the nature and radioactive content of these wastes must be understood in order to quantify the risks these wastes pose. Early waste burial practices were particularly egregious. The issue of contaminated soil, estimated at 60,000 cm under-burden and an additional 112,000 cm overburden, at the burial ground is very serious because environmental restoration efforts must include this contamination because it too will leach into the aquifer below if not removed with the waste. [IEER(g)@85] Soil samples five feet below Pit 2 in the Subsurface Disposal Area contained the following concentrations: [TREE-1171 @29]

RWMC Pit 2 Sub-surface Soil Samples [TREE-1171 @29]

Nuclide	Concentration
Strontium-90	41.0 pCi/gram
Plutonium-238	220.0 pCi/gram
Plutonium-239/240	11,000.0 pCi/gram
Cesium-137	10.9 pCi/gram
Americium-241	1,550.0 pCi/gram

See Section I Part E Onsite Waste Hazard for summaries of disposed and stored waste. Samples were taken of deer mice tissues that had access through burrowing to the waste in the SDA. "Much of the activity [on the mice] in this one set of samples was associated with the hides and GI tracts, total concentrations of 2,026 and 415 pCi/g respectively while the lungs and remainder of the carcasses had total concentrations of 86 and 145 pCi/g respectively."[IDO-12085 @ 9] This sample data brings up numerous questions as to the extent these animals were consumed up the food chain by other predators which in turn may have been consumed by humans. "Harvester ants (Pogonomyrmex salinus) are complicating waste disposal efforts by doing what ants do best: digging below and moving dirt above."... "The rigorous digging of the ants disturbs radioactive contaminates and paves vertical tunnels that can channel water into disposal areas." [Programs and People @ 10] Six-month exposures measured at the RWMC perimeter from November 1973 to November 1984 found 16,800 mrem at station 33. [EGG-2386 @ 35]

At a 11/2/92 briefing, Idaho Division of Environmental Quality representative Dean Nygard emphatically denied that radionuclides had migrated lower than the 150 foot level below the SDA. Again, this position by the State is not supported by the literature. Cesium-137, Plutonium-238,-239,-240 were all found at the 240 foot interbeds. [IDO-22056@74] Forty-one % of the samples from the 240 foot inter-beds contained radionuclides. [Ibid.@87] Other literature confirmation of plutonium at 240 feet includes: "Radionuclides (including Pu-238.-239.-240, Am-241, Cs-137, and Sr-90) have been detected in soils and in sedimentary inter-beds to a depth of 240 feet beneath the RWMC, (Hodge et al, 1989)." "Positive values for Pu-238,-239,-240 were detected in samples obtained from the 240 foot interbed in bore hole DO2."[DOE/ID-10183@134-145][DOE/ID/12082(88) @14-16]

Radionuclides are also confirmed in the aquifer under the RWMC. [EG&G-WTD-9438@25] USGS water sampling data at the 600 foot levels, expressed in pico curies per liter (pCi/l) show:

Groundwater Sampling Data at 600 Feet Under RWMC

Nuclide	Concentration pCi/L	Drinking Water Std. pCi/L
Tritium	10,000.00	20,000.00
Cobalt-57	48.00	1,000.00
Cobalt-60	100.00	100.00
Cesium-137	400.00	119.00
Plutonium-238	9.00	7.02
Plutonium-239-240	0.14	62.10
Americium-241	15.00	6.34
Strontium-90	10.00	8.00

[IDO-22056 @66] * The drinking water standard for gross alpha (total of all alpha emitters) is 15 pCi/l.

USGS report titled Hydrology of the Solid Waste Burial Ground as Related to the Potential Migration of Radionuclides Idaho National Engineering Laboratory , describes in detail the monitoring well drilling methodology. USGS hydrologists that drilled the wells went to considerable lengths to ensure surface or near-surface contamination did not compromise their 600 foot deep well samples listed in the table above. Analysis of the circumstances of the RWMC generated the following principal evidence supporting migration of radionuclides to the aquifer below.

"Sufficient water has come in contact with buried waste to cause initial leaching and mobilization. Sufficient quantities of wastes have been available for leaching to account for observed subsurface radionuclide concentrations. The lithologic column beneath the burial ground has sufficient permeability and appears to be at field moisture capacity; this would allow infiltrated water to have migrated downward. Sufficient water has percolated downward through the burial ground to have reached depths were significant concentrations of radionuclides were found. Most of the higher subsurface radionuclide concentrations tended to lie beneath the oldest buried waste or beneath the areas through which the most water has percolated. A greater percentage of samples analyzed from the 110 foot sedimentary layer contained waste isotopes than from the 240 foot or deeper layers in the six interior wells. Samples from wells 93 and 96 indicate greater concentrations of nuclides in the 110 layer than in the 240 foot layer. Many of the observed subsurface concentrations of radionuclides were greater than could be attributed to artificial sample contamination from any known ground-surface or other overlying sources." [IDO-22056@83]

DOE's own sampling of the USGS 600 foot wells at the RWMC between 1987 and 1997 show americium-241 contamination at levels shown in the following table. Americium-241 is a decay product (daughter) of plutonium-241. The maximum concentration level allowed in drinking water is 6.34 pCi/l. Though the DOE sample concentration levels for Am-241 are lower than those of USGS, the data contradicts DOE public statements for the past several decades that actinides (isotopes heavier than uranium) had migrated to the aquifer which is 580 feet below the RWMC.

Americium-241 at 600 foot level at RWMC

Well Number	Date of Sampling	Concentration (pCi/l)
88	1992	0.40 +/- 0.02
89	1990	0.04 +/- 0.02
90	1988	0.06 +/- 0.03
90	1991	0.40 +/- 0.02
117	1987	0.06 +/- 0.03
119	1991	0.06 +/- 0.03
M-1F	1997	1.03 +/- 0.27
M-10-S	1993	0.3 +/- 0.1
M-3F	1997	0.045 +/- 0.017

[Hain(a)]

US Geological Survey (USGS) hydrologist Barraclough estimates that 100 acre-feet (32,492,910 gallons) of direct precipitation landed on the RWMC between 1952 and 1970. Additionally, due to the low depression of the RWMC local run off has entered the burial ground adding to direct surface water introduction. The 1962 flood which inundated the SDA allowed 30 acre feet (10,000,000 gallons) into the SDA. The 1969 flood put 20 acre feet (6.4 million gallons) into the SDA. [IDO-22056@46] It is no wonder radionuclides are found in the Snake River Aquifer. "Adams and Fowler measured solubilities of plutonium in tap water and found a range of 46,000 to 130,000 pCi/l."... "These findings are also consistent with Hagan and Miners (1970)." [Ibid.@70] According to DOE sponsored studies, the presence of gamma radiation increases the permeability/leach-ability of contaminates in basalt by ten-fold. [EG&G-J-02083] Water samples taken in the flooded SDA pits during the 1969 flood contained 13,000 pCi/l gross beta and 2,700 pCi/l gross alpha. [IDO-22056@69-70] This data verifies the solubility of radionuclides and the water sample data from the deep monitoring wells verify the mobility of these contaminates. Additionally, USGS soil samples under Pit 10 showed plutonium at 400,000 pCi/g and under Pit 2 the Pu was at 320,000 pCi/g which confirms contaminate mobility.[IDO-22056@77]

Flooding of the RWMC and its Subsurface Disposal Area (SDA) from the Big Lost River has occurred at least three times (1962, 1969, and 1982) since 1950. In 1962, Trenches 24 and 25 plus Pits 2 and 3 were flooded. In 1969, Trenches 48 and 49 plus Pits 8, 9, and 10 were flooded. In 1982, Trenches 42 and 49 plus Pit 16 were flooded. [EG&G-WM-10090@3] According to topographical map (INC-B-15368) of the burial ground area and a part of the Big Lost River ponding areas, the burial ground lies 40 feet below the Big Lost River 2 miles north. [IDO-22056@8] A flood-control diversion dam was been built to mitigate flooding. A USGS 1976 "Analysis of historical stream-flow information indicate that floods in the Big Lost River would overtop the flood-control diversion dam about once in every 55 years on average; if the culverts in the dam are completely plugged, overtopping of the dam would occur about once every 16 years." [IDO-22052@iii] The 1982 flooding of the SDA was in fact caused by plugging of the culverts. [EG&G-WM-10090] Since the RWMC is the lowest point in the region, there is nowhere else for the water to go. Currently, sump pumps are required to remove water out of the RWMC due to its lack of drainage. [IDO-22056 @10] This drainage problem begs the question of long-term institutional control to prevent flooding after DOE is gone.

In 1984, the Big Lost River Diversion Dam height was raised several feet to prevent additional flooding of the RWMC and other INL facilities. These improvements are expected to divert a maximum of 9,300 cubic feet per second flow of the Big Lost River with the accuracy limits of the computational procedures in the order of plus or minus 10-15%. The theoretical capacity then could be as low as 7,905 (9,300 - 15%) cubic feet per second. “A sustained flow at or above this [9,300] discharge could damage or destroy the dike”. [DOE/ID-22071 @ 24] According to Larry Mann, former USGS Supervisory Hydrologist, “There is a USGS publication that is undergoing technical review which will update the 100-year flood for the Big Lost River and provide an estimate for the 500-year flood. Peak flows for the 100 and 500-year floods are estimated to be 7,260 and 9,680 cubic feet per second, respectively”. [Mann 12/12/95]

Winter of 1996-97 brought record (188%) snow pack that feeds the Big Lost River coupled with record high Spring temperatures that again raise the flooding risks. Brandon Lommis, Idaho Falls Post Register reporter, found that in addition to the RWMC flooding hazard, the ICPP high-level waste tanks are also at risk. Lommis reports that, “Mike Bennett, INL’s water resources coordinator, said ‘it would be foolish not to have some concerns,’ and that dike failure could allow water to seep into the underground storage tanks under a chemical processing plant and possibly contaminate the Snake River Plain Aquifer, according to a recent study. INL officials this year asked the Army Corps of Engineers to help inspect the dam and dikes before the water peaks. Bennett said dirt graders and trucks are standing by to shore up any unexpected weak spots.” [Post Register 5/7/97]
The May 20, 1997 LMICO Star noted that:

> “Under normal conditions, the diversion dam is adequate to control water flow. The dam is weakest above the diversion gate, and may need reinforcement if water flows become heavier than anticipated (flood waters could flow over the diversion dam and back into the Big Lost river bed). Dixon has identified a source of rip rap (large rocks) and gravel for reinforcement. Along with the rip rap and gravel, 9,000 sandbags are strategically stockpiled to expedite any reinforcement that becomes necessary. The sandbags include 4,000 in existing inventory with another 5,000 bags ordered and available if needed.” [Star (d)]

Geologic investigations are needed on the ground up stream of the INL diversion dam to see if there is evidence of flooding and related heights/volumes. This type of information may minimize the uncertainty of long-term maximum flood projections (i.e.. validate flow-rate assumptions). The life expectancy evaluations are also needed of the Big Lost River diversion dam and related channels, dams etc., after the 100 year institutional control and maintenance of the flood control infrastructure ends. Absent maintenance, could debris collect and block the interconnecting channels to the spreading areas facilitating the failure of the dams, and thus flood the

RWMC? The USGS believes this is a credible scenario in their 1976 report.

> "It would appear that a rare major flood of the [Big Lost] river could over-flow into the burial ground basin through the narrow wind-gaps in the basalt. Although this has not occurred in the INL history, evidence indicates it has occurred in the past 2,000 years and possibly within the past 200 years." "At regional scale, horizontal hydraulic conductivities of the Snake River Plain Aquifer generally range from 100 to 10,000 feet per day as determined from well pumping tests or flow net analysis. The high number is among the highest for any know aquifer."... "Although vertical hydraulic conductivity is generally much less than horizontal conductivity in basalt, significant vertical conductivity does exist, primarily through vertical fractures. This is demonstrated by the fact that surface water from the Big Lost River infiltrates from the channel and the INEL diversion area and produces measurable recharge to the aquifer. In addition, waste water recharged to the Test Reactor Area (TRA) disposal ponds eventually reaches the Snake River Aquifer, 450 feet below. There is no reason to believe that basalt beneath the burial ground have significantly less hydraulic conductivity than those beneath TRA or the diversion area." "Specified field tests...at Test Area North vicinity of the INL indicated an average horizontal permeability of about 55 feet per day and vertical permeability of about 15 feet per day." [IDO-22056@48]

A hypothesis is needed of Mackey Dam being overtopped and failing due to floods of not much greater recurrence interval than that of the maximum floods considered in the literature. The results of a failure of Macky Dam have not been investigated in this paper. The INL EIS acknowledges that Mackey Dam "was built without seismic design criteria" and "additionally, it is not clear how resistant the dam structure is to seismic events" and the fact that "a fault segment runs within 6 kilometers of the Mackay Dam" [DEIS @ B-17] is significant. One need only recall the catastrophic failure of the Teton Dam a few years ago northeast of Idaho Falls. The Teton Dam, also constructed by the Army Corps of Engineers, failed because of inadequate design and construction. A 1996 DOE Environmental Assessment (EA) for TAN Pool Stabilization noted that the maximum probable flood is considered conservative as the last flood (12,000 years ago) with the magnitude of 35,000 cubic feet per second.[DOE/EA-1050 @B-4] This flood would easily overflow the diversion dam capacity of 9,300 cubic feet per second.

Radioactivity of Waste Dumped at the Subsurface Disposal Area 1952-1983

Major Generator	RWMIS Shipping Record Roll up (curies)
Test Area North	63,000
Test Reactor Area Reactor Technology Center	460,000
ID Chemical Processing Plant Idaho Nuclear Technology & Engineering Center	690,000
Naval Reactors Facility	4,200,000
Argonne-West Materials &Fuels Complex	1,100,000
Rocky Flats Plant	57,000
Other	55,000
Total	11,000,000

[EGG-WM-10903 @ 6-25]

The above summary of radioactive content of waste dumped is considered understated. The Environmental Defense Institute analysis of the curie content of Navy shipments to the burial ground, for instance, adds up to 8,140,668 curies. However the above DOE data using annual summaries attributes the Navy to only 4.2 million curies or only half as much. DOE admits that the annual summaries are understated. [EGG-WM-10903 @ 6-26]

Selected Rocky Flats Waste Dumped at the Subsurface Disposal Area, 1954-1972

Radionuclide	Lower Bound Estimate	Upper Bound Estimate
Plutonium (all species)	1,102 kilo grams	1,455 kilo grams
Americium-241	44 kilo grams	58 kilo grams
Uranium-235	386 kilo grams	603 kilograms

[ER-BWP-82 @A-4]

RWMC Pit 9 Remedial Action

The EPA, State of Idaho and DOE released a Pit-9 cleanup Record of Decision in October 1993. Remediation of Pit-9 using alternative 4 would consist of exhuming the waste to include the following steps: (a) physical separation, (b) treatment, and © stabilization. The preferred alternative 4 remedial action presented in the "Revised Proposed Plan for a Cleanup of Pit 9 at the Radioactive Waste Management Complex" (RWMC) represents a flawed decision making process. A review of the available literature suggests that implementation of the preferred alternative 4 would not be protective of human health and the environment. Moreover, aspects of alternative 4 may be illegal under National Environmental Policy Act (NEPA) and Resource Conservation Recovery Act (RCRA).

DOE's statement that: "Because it is possible that some of the storage containers in Pit 9 have breached, the potential exists for subsurface soils to be contaminated with both radioactive and nonradioactive materials" is not supported by the literature. It is not just possible but a fact that contaminates have migrated. Additionally, DOE's Plan states: "The Pit 9 Interim Action will be used to expedite site cleanup and to potentially halt possible contamination of the vadose zone and groundwater." Plutonium has been found at 110 and 230 feet under RWMC and organic have contaminated the vadose zone. False and inaccurate statements like the above cited quotes challenge the very credibility of the document and indeed the whole cleanup process. Clearly, DOE, is not being honest with the public.

The Environmental Defense Institute (EDI) supports exhuming the buried waste from INL's Radioactive Waste Management Complex Pit 9 and the development and testing of waste treatment technologies at INL. Specifically, EDI endorses the Hanford approach, mandated by the State of Washington. Hanford is moving ahead with construction of a vitrification facility for all classes of waste except spent nuclear fuel which requires no treatment. Excavation and vitrification and storage actions are therefore supported. Waste treatment technologies are still in the developmental stage. As an interim action to mitigate additional contaminate migration from the buried waste, excavation is immediately necessary. The original treatment technology agreed to by the State of Washington, EPA, and DOE is to build a pre-treatment chemical separations process and one vitrification facility to stabilize low-level, mixed, TRU, and high-level waste into a glass/ceramic medium. Vitrification is the best approach and should be adopted at INL; however, the chemical pre-treatment is not supported. DOE's proposed Pit 9 technology is geared to listed RCRA organic contaminates and fails to provide a stable waste form for all contaminates. The goal is to get all waste forms into a stable medium as directly as possible.

The Pit-9 waste chemical separations (nitric acid leaching) process is now challenged by the State and EPA regulators as unworkable. Lockheed Martin finally in May 1996 admitted that the redesigned chemical treatment system did not work, and proposed replacing it with a physical soil separation process- abandoning the chemical leaching system. [IEER(g)@140]   Even DOE has locked horns with its contractor. “The retrieval and treatment of the waste was originally estimated to cost $50 million in the 1993 Record of Decision; Lockheed Martin Advanced Environmental Systems, the contractor for the Pit-9 project, has estimated its costs through June

30, 1997 to be 57 million. This increase has occurred without retrieval and treatment system design having even been finalized, never mind built, tested and completed. Major components that have been designed or built are not in compliance with the terms of the contract. In March 1997, the contractor indicated that its final costs would be over $400 million." [IEER(g)@132] The public expects and the regulators must advocate for the entire waste volumes to be directly vitrified into a stable form that can be safely stored onsite until a permanent repository is permitted. To their credit the regulators have levied $940,000 in fines against DOE for missing Pit-9 cleanup milestones.

The Pit 9 issues of reburial of the residuals of chemical separations approach does not enjoy public acceptance for many reasons. First, the classification of low-level waste has no connection with environmental, health and safety hazards; [IEER(c)] it is merely a catchall category for all waste not classified as high-level or transuranic. Secondly, the public demands that the entire volume waste be processed directly into a stable form so that the inevitable interim storage does not continue the migration of contaminates into the environment. Finally, the Final Report Hanford Tank Waste Task Force got it right by recommending:

"The high cost and uncertainty of high-tech pretreatment and R&D threaten funding for higher performance low-level waste form, vitrification, and cleanup."... "Put wastes in an environmentally- safe form, using retrievable waste forms when potential hazards from the waste may require future retrieval and when retrievability does not cause inordinate delays in getting on with cleanup."... "Let the ultimate best form for the waste drive decisions, not the size nor timing of a national repository."... "Accept the fact that interim storage, at least, of the waste in an environmentally-safe form will occur for some time at Hanford. Select a waste form that will ensure safe interim storage of this waste." [Hanford]

The mantra repeated over and over again "get on with cleanup" in the Hanford Waste Tank Task Force is repeated in public interest group reports. [HEAL] DOE is wasting precious resources by refusing to recognize the public's demand for solutions to the radioactive waste problem. DOE must "get on with cleanup" and apply R&D to technologies that will put the whole volume of waste into a stable form for on-site storage for the near-term because there are no guarantees on any repositories coming on line soon. Additionally, the DOE is remiss in not investing in the essential R&D on emission control that will be key to health and safety in all waste processing that cannot be avoided in stabilizing and preparing for the waste acceptance criteria for the future repositories.

Under no circumstances would EDI support reinternment of processed waste back into Pit 9. Pit 9 simply must not be considered independent of the collective impacts of the site-wide environmental restoration and waste management activities. The final disposal of all processed wastes must be in a fully permitted and compliant RCRA/NRC radioactive waste site. The Agency for Toxic Substances and Disease Registry, a federal public health agency found that:

"The [Pit-9]clean-up level for Transuranic wastes of <10 nCi/g will not be protective of public health for a future agriculture or commercial use scenario."... "The planned clean-up level for transuranic waste is 10 nCi/g. When compared to the proposed Annual Limits on Intake for Americium-241 by ingestion (40 nCi), an ingestion of only 4 grams of contaminated soil would exceed the proposed Annual Limit on Intake. Similarly, an inhalation of only 0.30 grams of contaminated soil within a one year period would exceed the proposed Annual Limits on Intake for Americium-241 by inhalation (0.25 nCi). In either an industrial or agricultural use scenario, the Annual Limits on Intake for Americium-241 by ingestion and inhalation would probably be exceeded." [ATSDR @ 10-11]

Former Governor Andrus, because of his long history of justified concerns over the mismanagement of INL's radioactive wastes, insisted that the State be the lead enforcement agency on the cleanup of the RWMC. Unfortunately, the ID Division of Environmental Quality and the INL Oversight Program have not provided a credible enforcement and oversight role in the process. EDI encourages current Governor Batt to reevaluate the positions his agencies have taken on INL cleanup.

Continued public pressure for the enforcement of environmental laws will be essential in coming years. Reauthorization of the Resource Conservation Recovery Act with stricter compliance standards that must also include radionuclides as a regulated hazardous material will also be key to environmental protection. The Clinton Administration, unfortunately, is not moving toward a new national environmental legislative priority.

A review of the DOE documents for Pit 9 reveals extremely disturbing assumptions made by J.J. King [EG&G-ERP-BWP-64] to determine the radiological inventory subsequently used in the risk evaluation. King acknowledges Rocky Flats radionuclide information on shipments to INL in 1968 contained the following:

Radionuclide	Quantity (grams)	Radionuclide	Quantity (grams)
U-238	33,373,000.00	U-235	1,210.00
Pu-238	4.18	Pu-239	43,543.44
Pu-240	2,720.83	Pu-241	210.11
Pu-242	7.44	Am-241	1,778.00

The above listed nuclides were contained in 345,377 cubic feet of waste shipped from Rocky Flats to INL in 1968. This represents an activity concentration of possibly 31,216 Curies. J.J. King cites Rhodes' determination that of the total 345,377 cubic feet shipped in 1968, 67,352 cubic feet (containing 203 g of Pu-239) went to Pit 10 and 102,103 cubic feet went to Pit 9. [EG&G-ERP-BWP-64] No accounting by King is offered as to what happened to the remaining 157,922 cubic feet of Rocky Flats waste shipped to INL during 1968. Generally, only one trench was open and received waste at any given time. In those early years, no attempt was made to segregate categories of waste. [EG&G-WTD-9438@23] It simply all was dumped in whatever trench or pit happened to be open at the time.

Another assumption King made in determining the radiological inventory was to assume that the Pu-239 was "distributed uniformly throughout the waste volume not associated with Pu-239 identified in Pit 10". [EG&G-ERP-BWP-64] There is no credible basis for these assumptions. The numbers King ended with are many orders of magnitude below the possible inventories available for deposition in Pit 9. Moreover, the use of Kings numbers in the risk evaluation are not conservative and greatly understates the probable hazard.

These issues of radionuclide inventory are extremely germane to determining the appropriate remediation for Pit 9. If DOE's presentation of inventories is extremely understated, and the Alternative 4 chemical separation design target for radionuclide removal is not met, a lot of radioactive waste could be returned to Pit 9. DOE's design treatment standards for "wastes and/or materials in Pit 9 containing [greater than] >10 nanocuries per gram transuranic would be treated to reduce the volume by >90% prior to returning to the Pit." [Plan@11] The returned 10% could still potentially have considerable radioactivity in the processed waste since no upper bounds are stated for this "stabilized" material.

The plan also calls for exhumed waste or soils that contain 10 nanocuries or less will be returned directly to Pit 9. This 10 nanocurie criteria is a DOE internally generated directive that has not been legally established as protective of the environment. No quality assurance mechanisms are offered to ensure that non-contaminated material is not mixed with contaminated waste to reach the 10 nanocurie/ gram criteria. The plan's criteria for residuals returned to Pit 9 uses industrial (1 in 10,000) carcinogenic risk performance criteria. Due to the long half-life of the radioactive contaminates and the probable inability to maintain institutional control over the sight, the residential performance criteria (1 in 1,000,000) should be used.

Another area of uncertainty is the radionuclide inventory of on-site waste in Pit 9. DOE acknowledges in the mailing that some Aircraft Nuclear Propulsion (ANP) wastes are in Pit 9. When asked at the Nov. 2 briefing if this may include ANP reactors, DOE emphatically denied that any ANP reactors were buried at INL yet the literature specifically acknowledges that jet engines are buried at the RWMC Subsurface Disposal Area (SDA). [EG&G-WM-10090@12] One of the ANP series involved three reactor assemblies that were constructed at INL for the ANP program. "These three assemblies were designated HTRE No. 1, HTRE No. 2, and HTRE No. 3." [DOE/ID-12119@A-87] Though two ANP nuclear jet engine shells are on display at the ERB-I, the disposition of all of the other engines and reactor cores for these engines were to the RWMC.

The HTRE-2 and 3 were disassembled in the IET hot shop where the highly radioactive plug shield and core assembly were removed and shipped intact to the RWMC. Radiation levels (300 R/h) were too high to allow further disassembly of the reactor vessel and its shielding. Then the reactor vessels were moved back out to the

IET test pad where the 200 ton HTRE-2 (with dollies) and the 90 ton HTRE-3 (w/o dollies) were jacked up off the rail tracks and a special 350 ton transporter was moved under for shipment to the RWMC. Bridges between the IET and the RWMC had to be blocked up to take the heavy transporter, and special ramps made into the trench where they were buried. [PR-W-79-001 @4-3] 106,000 pounds of radioactive mercury used in a tank for shielding around the HTRE-3 as well as considerable volumes of related radioactive parts were dumped at the RWMC.

Other reactor components including shielding weighing 36,000 pounds from Kelly Air Force Base, and a reactor heat exchanger 27 x 5 feet from Nuclear Engineering that were buried in Pit 2 in 1960 also may be part of the ANP program tests. The Hallam Nuclear Power Reactor from Lincoln Nebraska was also buried at the RWMC. [PG-WM-58-008 @2-3] Three SPERT experimental reactors tested at INL [ERDA-1536,@II-244] as where two SNAPTRAN reactors and, two Modular Cavity reactors from the ANP program were also dumped at the RWMC.

At the Pit 9 hearing in Moscow, (11/10/92) the State representative maintained his position that there was no radioactive contamination below the 150 foot level below the RWMC. One can only conclude that the State Division of Environmental Quality is grossly ill-informed. DOE's mailing only offers one waste volume number (110,000) cubic feet from Rocky Flats in Pit 9. [Plan@3] Why is the total volume to be exhumed not stated? DOE's Pit 9 estimated volumes are: [EG&G-WTD-9438@5]

Waste containers	150,690	cubic feet
Contaminated Soil	<u>191,726</u>	"
Total Volume	342,416	"

DOE's risk evaluation not stated in the public mailing states that the air pathway (respirable) exceeds the risk specific concentration for Am-241 and Pu-239 for both residential and occupational exposure. External pathway also exceeds risk specific concentrations for Am-241, Pu-239 and Cs-137 for both residential and occupational exposure. Soil ingestion exceeds residential exposure. [EG&G-WM-10090@10-11] This risk evaluation is based on understated (non-conservative) radionuclide inventories previously discussed. The risk evaluation also assumes 100-year institutional control over the site which is exceedingly presumptuous. Even if this control could be insured, the unlucky resident who tries to build a house with a basement over top of Pit 9, would be digging right into the buried wastes that will be toxic for 24,000 years. A future rancher who sinks a well through the burial ground also would be at extreme risk.

Another problem that the risk evaluation assumes is an underlying layer of soil to assist in filtering contaminates that may migrate. The underlying basalt at Pit 9 comes within 7.7 feet of the surface. [EG&G-ERP-BWP-67@6] "Some trenches and pits were excavated down to the basalt while others only have a thin layer of soil over the basalt. Therefore some older (pre 1970) buried waste has no soil between it and underlying basalt." [IDO-22056@8]

DOE's risk evaluation assumes non-conservative precipitation rates when calculating the leachate factors through the reinterred waste into Pit 9. "Heavy rainfall and melting snow within burial ground have also introduced water into the trenches and pits, especially where the soil cover has slumped or cracked." [IDO-22056@8] "Between 1950 to 1963 the yearly precipitation at INL varied from 5.25 to 14.4 inches." ... "Between 1950 and 1965 the greatest daily precipitation rate was 1.73 inches in June 1954." "The greatest monthly precipitation rate was 4.4 inches in May 1957." [Ibid.@45] This means that considerably more water can, and has, aided the migration of contaminates than DOE is acknowledging.. According to a RWMC worker currently employed at the Pit 9 project, 18 tons of pyrophoric zirconium cuttings (also see IDO-14532 @50) and a reactor emitting one billion rads make the remediation process extremely dangerous.

The selected waste treatment processes and the criteria for material returned to the burial pits must receive the full EIS evaluation within the context of existing site-wide contamination and anticipated site-wide "processed" waste returned to the ground. It is conceivable that existing contamination below Pit 9 poses sufficient risk that would preclude adding additional risk from reburial of partially treated waste.

DOE has legally binding Environmental Restoration milestones that must be meet under the Federal

Facility Agreement and Consent Order (FFACO). If the Department fails to meet a milestone the State of Idaho or the Environmental Protection Agency (EPA) can impose sizable fines on DOE or the contractor. Due to radical Congressional cuts in DOE's cleanup funding the Department was forced to turn to large contractors who could attract Wall Street's financial backing to provide the funding to build the waste treatment plants required by the FFACO. The sales pitch was that private industry could get the job done better, faster, and cheaper. Privatization is touted by its proponents as the wave of the future and fixed priced contracts would put an end to the proverbial cost overruns. Well, this simplistic approach is fine if the government wants to buy one thousand F-18 fighters planes. There are few uncertainties that the contractors face because of decades of experience manufacturing similar planes. The same cannot be said about cleaning up the Pit-9 radioactive waste dump at INL because no one knows for certain what is actually in the dump and the intensity of the radiation fields that may be encountered. This is the first time the government or anyone else has attempted cleaning up a highly radioactive dump site.

To further confound an already complicated situation, the DOE still has no permanent repositories for its nuclear waste. Even if the transuranic Waste Isolation Pilot Plant (WIPP) dump in New Mexico and the high-level waste dump at Yucca Mt. Nevada open, their capacity cannot handle the current volume in inventory. So there is this policy crunch to reduce the waste volume destined for the repositories. DOE puts unrealistic demands on its cleanup contractors to reduce waste volume and generate new treatment technologies that currently do not exist. The chemists are still struggling with the basic science and are not even close to developing an applied technology.

DOE gave the Pit-9 fixed price contract to Lockheed Martin Advanced Energy Systems for $179 million. Lockheed's cleanup record has been documented in a Public Broadcasting System program that featured the company's radioactive cleanup fiasco on Johnston Atoll in the Pacific. The technology was unable to meet criteria for discharge even after multiple recycling through the process. In a rerun, Lockheed Martin Pit-9 treatment technology failed forcing the contractor to delay facility construction for several years. This delay also resulted in a $750,000 fine imposed on Lockheed Martin by the State for missing a FFACO milestone. The fine was later negotiated in March 1997 where DOE/ID will pay $100,000 to EPA's Superfund account, submit new deadlines for the projects and provide $870,000 for additional environmental projects in Idaho. Now Lockheed Martin wants to double the original $179 million contract. The total cost to the government for Pit-9 including management and waste storage is estimated at $264 million; but the delays and change in technology are expected to double the price. Tom Brokow's NBC Nightly News (5/22/97) reported that Lockheed Martin is now asking DOE to raise the original $179 million "fixed" Pit-9 contract to $337 million.

Privatization is now seen by observers as something different than the faster, better, and cheaper alternative its proponents would like us to believe. Bill Weida, an economics professor at Colorado Collage and researcher for Economists Allied for Arms Reduction recently released a report on Privatization in DOE Cleanup Operations. This is a thorough analysis of the problem. Copies of the report are available by writing Bill Weida, c/o Department of Economics, Colorado College, Colorado Springs, CO 80903. The following is an excerpt from Weida's executive summary:

"Privatized nuclear cleanup operations will handle some of the world's most hazardous materials. Such high risk operations have many economic implications--most of them unfavorable. Because of this, and because of the general nature of nuclear waste cleanup, it is obvious that the cleanup of nuclear waste is a classic public good and that it is not an appropriate candidate for privatization. This fact has already been adequately demonstrated Department of Energy (DOE) cleanup privatization has only been possible when DOE assumed a majority of the risk in privatized operations. In fact, DOE has assumed so much risk in its current privatization contracts that there is no longer sufficient incentive for contractors to perform in an economically efficient manner. When these problems are added to the high capital costs created both by the use of private borrowers and by the appropriation of federal funds to the reserve account mandated by the Government Accounting Office (GAO), there remains no economic rationale for DOE privatization. Even DOE admits that privatization is fundamentally a budgeting ploy that trades short-term capital expenditures for delayed, and potentially higher, long-term reimbursements to a private contractor."

“DOE's privatization initiative could also be a very expensive experiment for those who live around sites where nuclear waste is stored or generated. As currently implemented, DOE privatization appears to be an attempt at union busting. If DOE cannot guarantee that members of the current local work force will be employed by privatized cleanup operations, the economic penalty levied on the regions that surround DOE sites will be substantial and the costs of privatization would need to be recalculated to include these negative economic impacts. Further, past experience with DOE contractors, and with the DOE itself, has shown that safety and health problems at DOE sites are only corrected when active citizen oversight is exercised. Privatization, as implemented by the DOE at the Portsmouth and Paducah gaseous diffusion plants, has been used to thwart citizen oversight by allowing the privatized operators to claim that most information about their operations is proprietary in nature and not subject to citizen oversight. At cleanup sites like Hanford and the INL, DOE has also limited public access to documents based on "procurement sensitive" document status. DOE's chosen successor as regulator of privatized operations, the Nuclear Regulatory Commission (NRC), has actively abetted this policy. These are the same short-sighted approaches to site management that created many of the nuclear problems now facing DOE and they have the potential to significantly increase the costs of cleanup now facing the US.” [Weida]

Another nuclear waste treatment plant called the Advanced Mixed Waste Treatment Project (AMWTP) was estimated by DOE in 1994 to cost $300 million. In January 1997, DOE awarded the AMWTF project, one of the largest privatization projects worth $1.18 billion, to British Nuclear Fuels Limited (BNFL) to treat mixed and transuranic waste at the INL. The team includes BNFL as the prime contractor with subcontracts with BNFL Engineering, CTS Duratek, Manufacturing Sciences, Morrison Knudsen, and Science Applications International. In the contract, BNFL has committed to treating at least 65,000 cm of waste at the INL, with the option to treat up to an additional 120,000 cm of waste generated by future INL cleanup and decontamination efforts, as well as some waste generated at other DOE sites. [Star 1/14/97] The AMWTP is another example of DOE’s violation of the National Environmental Policy Act (NEPA) that requires the government to conduct an Environmental Impact Statement (EIS) of all major projects prior to commitment of resources. DOE did conduct a 1995 INL site wide EIS but only committed seven pages discussing the AMWTP which at that time was called the Idaho Waste Processing Facility. In those seven pages only the most cursory descriptions of the planned mixed transuranic treatment plant are offered. There is little characterization of waste throughput, emission control systems, or anticipated radioactive and chemical releases to the environment. [DOE/EIS-0203F@C-4.4.3-1] If BNFL wanted to build a municipal garbage incinerator in Boise, they could not get away with a seven page plan let alone a mixed transuranic waste incinerator. Only after public interest organizations filed a law suit did DOE agree to comply with the legal requirements of NEPA. Even more incredible is the fact that the AMWTP is to be built only few hundred feet from the Pit-9 treatment facility. An analysis of DOE’s cleanup mess by the Institute for Energy and Environmental Research (IEER) found that duplication of comparable waste processing plants makes no sense.

“One of the remarkable indicators of a lack of coordination and disarray in DOE’s Environmental Management program is its failure to coordinate extraction and treatment of buried waste in Pit-9 with the Advanced Mixed Waste Treatment Project [AMTWP] that is supposed to treat the ‘retrievably stored’ TRU waste at the Idaho Lab; treatment of the ‘retrievably stored’ wastes is estimated to cost $880 million dollars. The buried and stored wastes contain similar kinds of wastes and it is likely that a large percentage will require similar treatment technologies. Whether or not they are stored under a few feet of dirt is relevant only to extraction and not to treatment technologies. Yet DOE is proceeding with the Advanced Mixed Waste Treatment Facility as a privatized project without yet having absorbed the issues of the pit-9 failure.” “Perhaps the only success of the Pit-9 has been the development of remote retrieval technologies that can reduce risk to workers from radionuclides, chemicals, and explosives. However, even this success has a major flaw in that Lockheed Martin AES did not build a double confined structure as required by the Record of Decision and as described in Lockheed Martin AES’ own Best and Final Offer.” [IEER(g)@145-146]

Privatization of waste treatment plants has produced an accountability barrier that state and EPA regulators find intolerable. Kathleen Trever, manager of the State of Idaho’s INL Oversight program testified at a 1997 Congressional hearing stating: “The nature of Pit-9 subcontract allowed DOE subcontractor Lockheed

Martin Advanced Environmental Systems (LMAES) to make design changes without consulting with the [regulatory] agencies, thus preventing the agencies from identifying and resolving concerns in a timely manner. In addition, EPA and Idaho were not even officially informed of the extent of cost overruns and schedule delays until October 1996, months after project deadlines had already been missed." [IEER(g)@146-147] As of this writing, LMAES's Pit-9 project is completely shut down because of contract disputes with DOE. LMAES contends that "subsequent inventories indicate that types and quantities of other radioactive and hazardous contents in Pit-9 are far greater than originally thought. Technology used on the project has been proven in laboratory testing, but never used before on a large scale to treat the types of materials now believed to be present in INL's Pit-9." [Star;7/15/97]

IV. E. Power Burst Facility (PBF) Cleanup

The PBF cleanup Plan considers only two alternatives, no action, and hot spot removal. [PBF Plan] Consequently, there is no credible comparative analysis when the only other option is no action - to which no one subscribes. EDI requests a third alternative be evaluated. That option would involve exhuming all contaminated material on top of the PBF evaporation pond Hypalon liner with the stipulation that if contamination exists below the liner due to its failure, then all contaminated materials be exhumed.

The basis for this third alternative request rests on three factors. First, spot removal will inevitably compromise the liner, thereby providing migration route to the other contamination in the pond. Secondly, the concentration levels in the whole pond are more than high enough to warrant complete removal. Thirdly, simple efficiency would dictate considerable cost savings with one comprehensive operation as opposed to numerous operational set-ups and tear-downs.

Considerable discrepancy exists between information offered to the public in the "Dear Citizen" publication and DOE contractor documents. For instance, the "Dear Citizen" cites: "The highest concentrations of cesium-137 (325 pCi/g) were at the pond inlet"[PBF Plan; where as DOE internal document (EG&G-WM-8804) cites: "Specific concentrations ranged from a high of 830 pCi/g for a surface sediment sample collected adjacent to the drip pan to a low of 15.2 pCi/g collected diagonally across the pond from the drip pan. Radiological Release Criteria specify a limit of 10 pCi/g for release of soils contaminated by cesium-137." [EG&G-WM-8804@ 5]

The "Dear Citizen" also does not offer important background on SPERT reactor tests. DOE internal documents have revealed that the 1954 SPERT-I reactor excursion released 240,000 curies of radiation including 500 curies of radioactive Iodine. The SPERT-II excursion in 1963 released 530 curies of radiation. SPERT-III released 1,900 curies. [ERDA-1536 @ II-244][IDO-12119@79]

Considerable public concern exists with this type of interim Plan. Specifically, if DOE is allowed to do only a spot removal to mitigate only the highest contaminate spot(s), there will more than likely be a later claim that the contaminate levels remaining do not warrant additional remedial action. The public may well be lulled into believing that the site was fully cleaned up during the earlier action. Public skepticism is further bolstered that this is not an interim but a permanent action by INL's statement that, "Both options [A&B] are permanent solutions and will reduce the risk for environmental and human exposure to the contaminants currently present in the pond." [PBF Plan @ 7] INL officials stated at a public briefing in Moscow 5/7/92 that once the hot-spots are removed, "the remaining concentrations of Chromium and Cesium will pose no risk." Again, these statements are not supported by data.

Public confidence levels in EPA, the lead agency on nine of the ten INL Waste Area Groups, are extremely low. This is particularly true after former President Bush's directive to all regulatory agencies to cease all new enforcement initiatives. As previously stated, OMB followed that up with a 1% cut to EPA's DOE/DOD oversight budget. Cuts in EPA budgets have continued into the Clinton administration which caused EPA to cut their Office of Federal Facility Enforcement. Moreover, the State has not protested these budget cuts to its enforcement partner in the INL cleanup process.

"EPA's FY 1993 budget requests identified ‘Federal Facilities Enforcement' as a 'Material Weakness' requiring ‘Corrective Actions'. According to EPA, ‘the Agency does not have sufficient resources to perform an adequate level of oversight of other agencies' environmental compliance and restoration plans and activities.' Moreover, the Agency noted that ‘[t]he sheer magnitude, impact, and political realities of the [DOD] base closures program could easily consume the entire Federal Facilities resources base during this period.' [NRDC(f) 3/30/92] [Citing EPA, FMFY!, Attachment D@1]

"Oversight costs are typically estimated at approximately 2 to 4% of the costs of the cleanup. Hence, based on FY 1993 DOD and DOE environmental restoration and waste management budget of more than $7.3 billion, the budget for oversight of the Energy Departments’ environmental restoration activities should be $150 to 300 million. Unfortunately, the EPA Federal Facilities Oversight Budget for FY93 is only $46.4 million - just 0.63 % of the DOE/DOD waste cleanup budgets. Moreover, while the DOE and DOD waste cleanup budgets increased from FY92 to FY93 by 26 and 44 percent, respectively, the EPA oversight budget declined by one percent." [NRDC (f)] "EPA is routinely reimbursed by private parties for the cost of overseeing the cleanup of commercial waste sites. During negotiations over some Interagency Agreements, the DOE has agreed to provide oversight funding to EPA and States. Unfortunately, the Office of Management and Budget (OMB) has opposed the transfer of DOE funds to EPA to cover oversight expenses." [NRDC(f) 3/30/92]

Public confidence is also extremely low with the State's enforcement role. In a recent meeting with the commenter, IDEQ's Dean Nygard stated that the State had adequate funding to fulfill its regulatory obligations. Indeed, he took issue with the Governor Andrus’ attorney Jonathan Carter's testimony to the Senate Commerce and Labor Committee that characterized State funding as inadequate. In response to Mr. Nygard, EDI showed him numerous falsifications in INL primary cleanup documentation that the State had not challenged. These falsifications are prima facie evidence that either the State does not have the resources to enforce; or it has the resources but is simply rubber stamping INL proposals. State oversight requires between 2 to 4% of INL's $428,313,000 ER/WM. At 2%, the State should be getting $8,566,000. In 1992 the State only got $3,500,600 from DOE for oversight of INL. Clearly, this is inadequate funding.

PBF Applicable or Relevant and Appropriate Requirements (ARAR)

The Plan does not cite RCRA hazardous waste, corrective action, or closure requirements in the listed ARARs. The INL Federal Facility Agreement and Consent Order (FFA) exempts INL only "... from the procedural requirements to obtain federal, state, or local permits, when such response action is selected and carried out in compliance with Section 121 of CERCLA, 42 USC 9621. Nonetheless, these actions shall satisfy, to the extent authorized by law, all the applicable or relevant and appropriate federal and state standards, requirements, criteria, or limitations that would have been included in any such permit. Accordingly, when USDOE proposes that a response action be conducted entirely on the INL Site which, in the absence of Section 121(e)(10) of CERCLA and the NCP, which, would require a federal or state permit, USDOE shall include in the appropriate documents submitted to the Lead and Support Agencies: (a) Identification of each permit which would otherwise be required; (b) Identification of the standards, requirements, criteria, or limitations which would have had to have been met to obtain each permit; and Explanation of how the response action proposed will meet the standards, requirements, criteria, or limitations of this Part." [FFA/CO @ 18]

Additionally, the Plan does not certify that exhumed contaminated materials from the PBF evaporation pond will be deposed at a RCRA permitted site which is in full and complete compliance with RCRA standards. Engineering study summaries by EG&G on using contaminated soil in a grout and injecting this grout into existing partially filled plywood waste containers are not supported by the studies testing results. Considerable air voids, lack of structural integrity, and extensive cracking was documented throughout the tests that were conducted at Oak Ridge National Laboratory. Additionally, the study stated that unless the outside as well as the inside of the containers were grouted the subsidence problem would not be mitigated.

Clearly, the use of old or even new plywood boxes in addition to a relatively unstable grout will result in yet another cleanup of the same waste some years hence. To rebury these wastes in wood boxes again over the aquifer is ridiculous. The misguided culture in DOE for the past four decades has regrettably not changed. Those previous waste management practices are today's cleanups. Clearly, today's waste management practices are sure to be tomorrow's cleanups as well, unless the DOE is brought under enforcement actions by the State.

The PBF evaporation pond is not a permitted RCRA land disposal site nor is it listed as an Idaho Hazardous Waste Management Act site. The big question is why? Why is the State not imposing federal and State enforcement regulations and closure requirements on this hazardous waste dump? The State claims that the PBF is not a permitted facility, because it is not does not generate wastes characteristically covered under RCRA. Yet there are clearly mixed hazardous chemical/radionuclide wastes that are covered under RCRA. Additionally, the State is not doing any split sampling of contaminates in the pond that means that they are taking DOE's word on the constituents and their concentrations. The Environmental Defense Institute (EDI) supports the construction of concrete surface bunkers similar to those used for munitions storage. This approach will accommodate regular monitoring of the contents of the facilities as well as ready retrieval for final shipping to the permanent repository. Current underground dumping in unlined pits or pads is a continuation of the failed waste management policies of the past, and therefore must end. Construction of vitrification waste treatment facilities is the best hope for putting these wastes into a stable form for interim storage until a permanent disposal site is built.

IV. F. Central Facilities Area

Motor Pool Percolation Pond

Agency plans to cleanup the Central Facilities (CFA) Motor Pool Pond fail to accurately acknowledge the source of, nor the quantities of significant radioactive contamination in the pond. DOE's plan states only that: "On several occasions, vehicles and equipment with small amounts of radioactive contamination were decontaminated at the station." In fact, washing vehicles is standard operating procedure to reduce the spread of on-site contamination picked up by vehicles - especially during the multitude of accidents the site experienced.

Internal DOE documents show concentrations of 8.41 pCi/l of cesium-137; americium-241 and plutonium-238 at 9.46 pCi/l; and plutonium-239 at 4.29 pCi/l that are not adequately accounted for in their public literature. Sampling data showed cadmium and lead concentrations were 25 times higher than background tolerance levels. Chromium levels were 3 times higher than background. [EGG-WM-9973 @4-1]

For those who are willing to read the administrative record, INL contractor (EG&G) documentation says that: "long-lived fission products such as cesium-137, cobalt-60, and strontium-90 may have been added to the waste stream during decontamination of vehicles." [EGG-WM-9973@13] Also potassium-40 concentrations of 8.73, lead-212, and radium-226 are not acknowledged. [EG&G 8792@36] Tritium contamination under CFA ranges as high as 24,800 pCi/l which means additional contamination loading from motor pool must not be allowed. [90 Oversight (a)] DOE's proposed plan also does not accurately state the volatile organic ranges. Oak Ridge Survey sampling found 2-butanone at 190 ug/kg; trichloroethane at 25 ug/kg; toluene at 23 ug/kg; methylene chloride at 460 ug/kg; acetone at 85 ug/kg; tetachloroethlene at 76 ug/kg; and 4-methyl 2-pentanone at greater than 8,300 ug/kg. [EGG-WM-9973.@4-6&11] EG&G sampling found organic such as bis (2 ethylhexyl) phthalate at 4,000 ug/kg. [EG&G-WM-9973 @1-7] The federal Primary Drinking Water Standards for most of these organic is 5 ug/L.

Over INL's history, many accidents and intentional releases made transport of contaminates off the site of significant concern. Washing all vehicles has always been standard operating procedure. Therefore, it is not surprising that those contaminates ended up in the Motor Pool Pond. Clearly, the instillation of motorized washing equipment made the process faster. The CFA Laundry washes 10 mrad/hr of contaminated clothing. [ERDA-1536 @II-161] Risk calculations for worker exposure only allow for inhalation at 5% and direct contact at 1%. This is grossly understated due to the close proximity of the pond to CFA. Both State and EPA review of the Plan challenge DOE statements that EPA risk assessment methodology guidance was followed and point out that heavy metals such as silver and selenium were not acknowledged. Additionally, EPA challenges DOE's dismissal of the soil to groundwater pathway for contaminates migration. EPA also challenges the use of average values that is inconsistent with EPA guidance requiring use of a 95% upper level confidence limit. Cesium is also not included in Exposure Assessment nor was alpha and beta emitters even tested for at the waste pit. [IDEQ]

The agency decision of "No Action" is not supportable, non-compliant with ARAR's, and therefore, unacceptable. The PCB aroclor-1260, in concentrations of 1,470 ug/kg, alone, would dictate enforceable remedial action of exhuming contaminates to prevent further migration to the aquifer.

IV. G. Auxiliary Reactor Area

ARA-1 Chemical Percolation Pond

Once again, DOE generates a "No Action" proposal without any substantive information to support the decision. The Auxiliary Reactor Area (ARA) Chemical Evaporation Pond is actually an unlined percolation waste pit for chemicals and radionuclides. Sampling did not include beta-emitting radionuclides. Alpha and gamma isotopes are listed without any quantitative contaminate values and drinking water standards upon which a reader could reasonably make an informed decision on the merits of the Agency decision.

This chemical percolation pit is located at ARA Area I, which is the site of the infamous SL-1 reactor explosion that spewed 1,100 Ci out and killed three operators (see next section on SL-1). The ARA has a long and sordid reactor destruct experimental history including Power Burst Reactor, Gas-Cooled Reactor Experiment, Mobil Power Plant #1, SPERT Reactors 1&2, Fast Spectrum Refractory Metals Reactor, Hot Critical Experiment, Fast Transient Reactor, and related support facilities.

In the Plan narrative, DOE commits nearly all discussion to trivializing the problem and offering little or no substantive information. The ARA facilities have extensively contaminated the ground in the area. DOE expects the public to accept background samples collected 100 feet from the pond. Given ARA released 361,632 curies over its history, this choice for background sampling is ludicrous. Adding insult to injury, DOE characterizes these background readings as "naturally occurring."

The ARA lies immediately up gradient of the Big Lost River. As previously cited, a six member ground water study team commissioned by EG&G, an INL contractor, was canceled after its preliminary results showed that contamination "could move from INL to the Magic Valley within months." [Aley, 1980] Their findings revealed the presence of lava tubes that move water rapidly through the aquifer and exit at Thousand Springs on the Snake River.

Other DOE studies of aquifer contamination plume movement from ICPP to CFA between 1953 to 1958 document a seven foot/day or one-half mile/yr. Contaminate travel time from surface disposal to the aquifer is approximately 4-6 weeks or 10 feet/day. [ERDA-5316@II-120&III-81] The fact is that the aquifer is not a homogenous geologic structure, but rather a very heterogeneous mix of different strata. Therefore no generalized characterization about water movement within the aquifer is valid. The entire volume of the Big Lost River literally disappears into the porous Snake River Plain. The Administrative Record lists the following contaminates in the ARA chemical "pond".

ARA Chemical Waste Pond Contaminates

Contaminate	Concentration	Contaminate	Concentration
Cesium-137*	297.00 pCi/gram	Barium	293.00 mg/kg
Cesium-134	11.40 pCi/gram	Methyl Chloride	26.00 ug/gram
Strontium-90	297.00 pCi/gram	Uranium-234	1.60 pCi/gram
Cobalt-60	8.14 pCi/gram	Gross Alpha	285.00 pCi/gram
Plutonium-239	2.60 pCi/gram		

* The Radiological Release Criteria for Cesium-137 is 10 pCi/gram. [EG&G-WM-8804] [EGG-WM-10001@4-16 to 4-20][EGG-2612(90)][ARA Rod]

IV.G.2 Auxiliary Reactor Area II - Stationary Low-Power Reactor 1

"The Stationary Low-Power Reactor 1 (SL-1) was a small [3 megawatt] nuclear power plant designed for the military to generate electric power and heat for remote arctic installations [defense early warning - DEW line]. The reactor was operated from August 1958 until January 3, 1961 as a test, demonstration, and training facility. On the evening of January 3, 1961, the SL-1 reactor accidentally achieved a prompt critical nuclear reaction [melt-down] that resulted in a steam explosion that destroyed the reactor. The accident resulted in the deaths of the three operators on duty. The reactor vessel and building were severely damaged and highly contaminated, and a massive cleanup operation ensued to dismantle and dispose of the reactor and building." [SL-1 Plan] Also see Guide section I(B) on INL accident history.

"A burial ground was constructed approximately 1,600 feet northeast of the original site of the reactor. This was done to minimize radiation exposure to the public and site workers that would have resulted from transport of contaminated debris from SL-1 to the Radioactive Waste Management Complex (RWMC) over 16 miles of public highway. Original cleanup of the site took about 18 months. The entire reactor building and contaminated materials from nearby buildings were disposed in the burial ground. The majority of contaminated materials consisted of soils and gravel that were contaminated during cleanup operations." [SL-1 Plan] Reactor core minus the remaining fuel not blown out during the explosion were sent to the RWMC for shallow burial in the Subsurface Disposal Area. "The SL-1 Burial ground consists of three excavations, in which a total volume of 99,000 cubic feet of contaminated material was disposed. The excavations were dug as close to basalt as the equipment used would allow, and range from 8 to 14 feet in depth." ... "During a survey of surface soil in June 1994, hot spots areas of higher radioactivity were found within the burial ground, with activities ranging from 0.1 to 50 mR/hr." [SL-1 Plan] Surface soil samples showed Cs-137 at 1,854.8 p/Ci/g and Sr-90 at 2,806 p/Ci/g. [INL-95/0027 @6-15] Other soil samples at SL-1 burial ground showed cesium-137 at 70,000 and Sr-90 at 27,000 pCi/g. [IT Corp]

"The initial [SL-1] core loading consisted of 14,007.5 grams of uranium-235, and 1022 grams of uranium-238". SL-1 heavy metal and fission product full core isotopic inventory was 221,507.13 curies. [EGG, 3/22/94] It is assumed that approximately 7 percent of the initial fuel load or 15,505.499 curies are buried at the SL-1 site. As a result of the explosion, this fuel is dispersed among reactor and building debris and contaminated soil primarily in the form of fission byproducts cesium-137 and strontium-90. The total exposure risk to a future resident in thirty years of getting cancer is 5 in 10 chances; or a 50/50 chance. "The risk due to cesium-137 falls below the EPA one in 10,000 [industrial] threshold in about 400 years". [INL Facts(b)] This high risk means that if institutional control cannot be ensured for over 400 years, then people or animals coming in contact with the waste will face serious hazards. EPA's one in 10,000 threshold is an industrial standard; the residential standard is one in a million. Despite this hazard, DOE, the State, and EPA concluded that the SL-1 burial ground environmental restoration was only to consist of adding a thin earth and rock cap. For a compelling documentary of the SL-1 accident see Beacher Films, 6810 Chabet Rd, Oakland, CA 94618.

IV. H. BORAX-1 Remediation

"The [Boiling Water Reactor Experiment Number 1] BORAX-1 reactor was a small experimental reactor used in the summer months of 1953 and 1954 for testing boiling water reactor technology. In 1954, the design mission of BORAX-1 was completed, and the decision was made to make one final test, which resulted in the intentional destruction of the reactor. The destruction of the reactor contaminated approximately 84,000 square feet of the surrounding terrain. Immediately following the final test of the BORAX-1 reactor, much of the radioactive debris including some fuel residue, was collected and buried on site in the reactor shield tank." "However the cleanup did not sufficiently reduce the radioactivity at the site; therefore, the 84,000 square foot contaminated area was covered with approximately 6 inches of gravel to reduce radiation levels at the ground surface."..."Buried materials at the site consist of unrecovered uranium fuel residue, irradiated metal scrap, and contaminated soil and debris. Part of the waste was buried in the bottom half of the shield tank; the top half of the tank was collapsed into the bottom and the void space was filled with debris." [SL-Plan]

"After 25 years, exposure rates as high as 45 R/hr were measured above the gravel covering of the BORAX-1 site."..."Radiation surveys around anthills on the gravel covering detected radioactive fuel fragments which were presumably transported to the surface by ants."..."Vegetation sampling indicated that mean cesium-137 concentrations in rabbit brush from the former reactor site was statistically greater than the control area samples."..."Uranium-235 was detected in two surface soil samples 100 to 140 meters to the southeast of the former reactor in concentrations about 3 times greater than background." [Dickson] Forty seven ant hills were observed in the BORAX-1 gravel area and a survey of the hills showed radiation counts ranging from 2,000 and 15,000 counts per minute. Sixteen grams of U-235 fragments were found on the surface after the explosion.[Dickson] Recent surface soil samples show Cs-137 at 7,334 pCi/g and U-235 at 144 pCi/g. [INL-95/0027 @6-15] Other soil sample data showed Cs-137 at 67,000 and Sr-90 at 27,000 pCi/g. [IT Corp]

Only 12% of the BORAX-1 reactor fuel was recovered leaving the remaining 88% released to the surrounding area. The reactor core consisted of 30 uranium aluminum alloy assemblies containing a total of 4.2 kg of 90% enriched U-235. The reactor tank had 3,4000 gallons of waste during operation. [Dickson] According to DOE's internal documents BORAX-1 fuel remaining at the reactor site burial ground contained 22,800,000 curies. This number is significantly understated because, "The total value includes total activity at the dates indicated while individually radionuclide entries include activity only if the curie value was greater than 0 after 40 years of decay". [ERD-93-002] Also not included in the remaining soil contamination is 714 curies released to the atmosphere. Atomic Energy Commission video footage of the intentional BORAX-1 explosion can be seen in the movie Dark Circles.

DOE, State of Idaho, and EPA concluded that the BORAX-1 site could be covered over with an additional thin layer of soil and rock as the final environmental remediation action despite the extreme hazard the site presents to future generations. The deterministic exposure risk of contracting cancer by a future resident in thirty years is 3 in 100. EPA's standard for residential exposure is one in a million. This is an example of a nuclear sacrifice zone.

IV. I. Idaho Chemical Processing Plant (ICPP) Now Called Idaho Nuclear Technology Complex (INTEC) Remediation

The ICPP mission since 1952 has been reprocessing spent reactor fuel to extract fissile material (primarily uranium) for military programs. Spills, leaks, and releases over the years resulted in significant contamination of the surface soils and underlying groundwater. A Remedial Investigation/ Feasibility Study Final Work Plan [INL-95/0056] for the ICPP was completed in August 1995. The following table show surface soil sample excerpts from this study.

ICPP Site	Contaminate *	Concentration (pCi/g)
CPP-34 Soil Storage Area	Sr-90 Cs-137	6,000 2,000

CPP-26 Soil in Tank Farm Steam Flush Operation	Sr-90 Cs-137	11,000 4,900
CPP-28 Soil in Tank Farm South of WM-181	Co-60 Sr-90 Ru-106 Cs-134 Cs-137 Ce-144 Eu-154 Pu-239 Pu-240 Pu-241 Am-241	23,000 57,000,000 54.1 76,000 100,000,000 14 570,000 13,000 12,000 1,100,000 1,500,000
CPP-31 Tank Farm South of WM-183	Co-60 Sr-90 Cs-137 Eu-154 U-235 Pu-239 Pu-240	120 140,000 900,000 1,500 6,400 1,100 1,100
CPP-79 Tank Farm Valve Box A-2	Sr-90 Cs-137 Am-241 Pu-238 Pu-239	5,410,000 33,700,000 16,600 276,000 89,900

CPP-04/05 Soil around CPP-603 Settling Tank	Cs-134 Cs-137 Ce-144 Co-60 Eu-152 Eu-154 Eu-155	1,450 26,500 2,390 2,390 35,000 35,000 7,600
CPP-19 CPP-603 to CPP-604 Line Leak	Cs-137 Co-60 Eu-152 Eu-154 Eu-155 Sr-90	408,000 21,600 87,600 53,500 9,620 125,000

* The Radiological Release Criteria for Cesium-137 is 10 pCi/gram. [EG&G-WM-8804]
INL-95/0056 pg. 2-115

The ICPP Remedial Investigation/Feasibility Study lists 100 chemical/radiological release sites. Of the 100 release sites, 13 are related to the tank farm. The estimate of radioactivity in decayed values in the surface soils within the ICPP compound is 50,000 curies plus 22,200 curies released to the aquifer. [EMSSAB @ 5] Contaminates migrating from the ICPP are found in the following perched water sample data.

ICPP Well Sample Data

ICPP Well	Gross Alpha (pCi/l)	Gross Beta (pCi/l)	Strontium-90 (pCi/l)
CPP-55-06	7,290	191,000	65,600
MW-2	4,700	925,000	516,000
MW-5	520	211,000	110,000

[INL-95/0056@2-162] EPA Maximum Concentration Limit (MCL) for gross alpha is 15 pCi/l; for gross beta 8 pCi/l; for Strontium-90 MCL is 8 pCi/l. [INL-95/0056 @ 5-25]

DOE, state, and EPA regulators are currently developing a cleanup plan for INL's Idaho Chemical Processing Plant (ICPP). For more than forty years this facility processed spent reactor fuel to reclaim enriched uranium for nuclear military programs. The legacy of these operations remains in the form of massive soil and groundwater contamination as well as stored high-level radioactive waste. Soil samples show radioactive contamination 10 million times higher than regulatory standards.

The most hazardous waste is the two million gallons of high-level liquid left in 11 underground tanks. This waste is the ultimate witch's brew of acids, solvents, and radioactive materials. Radiation emanating from these tanks is so intense that a lethal dose could be received just by standing beside a tank. Most of this liquid waste, as well as the tanks holding it, date back to the early 1950s. The design life of the tanks was 20-30 years. Dozens of tank service line leaks have contaminated the soil and groundwater. The Congressional General Accounting Office identified INL's tanks along with Hanford's tanks as having a significant explosive hazard due to gases that are generated in the tanks.

ICPP also stores the majority of the reactor spent fuel at INL. All but one of these storage facilities are recognized as having significant vulnerabilities. For instance, the CPP-603 water pool that keeps fuel elements under 20 feet of water to provide a radiation shield, is leaking more than a hundred gallons of contaminated water into the ground every day. Corrosion caused fuel support systems to fail, allowing the whole assemblies to fall to the bottom of the pool. This could cause a criticality or uncontrolled nuclear reaction to occur.

Trying to develop a cleanup plan for the ICPP while ongoing operations continue to contaminate the site is ludicrous. For example, millions of gallons of radioactive waste water every day are still being dumped in old unlined percolation ponds for "disposal". This waste water drives radioactive and chemical contaminates down to the Snake River Aquifer. Publicly, DOE claims it has no plans to restart ICPP fuel processing. Yet a 1/17/96 ID Division of Environmental Quality ICPP permit notice says that the ICPP "assigned objectives included .... recovery of highly enriched uranium from fuel elements discharged from Naval Nuclear Propulsion Reactors, Research and Test Reactors (foreign and domestic) as well as from other unique fuels that cannot be processed elsewhere." [DEQ@2]

One of the most discouraging policies currently being used by DOE to minimize cleanup expenditures is to assume that the federal government will maintain "institutional control" over the site and thereby restrict public access. Now DOE can claim that there is a minimal hazard because unauthorized persons cannot get near the pollution. Hundreds or thousands of years must pass before the radioactivity will burn off, yet DOE is confident that fences and guards can be maintained.

The Nuclear Regulatory Commission, which controls commercial nuclear facilities, assumes that "institutional control" cannot be assumed, and therefore requires deep geologic disposal to insure no one would be injured. Unfortunately, even these commercial standards are now under attack by vested interests wanting to cut disposal costs.

Congressional cuts to DOE cleanup requirements contrast to increased spending on military nuclear weapons and non-nuclear programs. According to the Center for Defense Information, Congress appropriated $27 billion for nuclear war in 1995 alone. Between 1940 and 1995 the U.S. spent an estimated $3.5 trillion to prepare for nuclear war.

High-level Tank Remediation

Since the beginning of the nuclear age, the unsolved problem of what to do with the radioactive waste has haunted the alchemists. The veil of secrecy let the problems go unnoticed thereby allowing the federal government to delay facing the inevitable waste problem. Only recently has the truth started to emerge and the awesome extent of the contamination problem revealed. The Department of Energy (DOE) is now obliged to comply with a number of Federal Court Orders and signed agreements with the State of Idaho and the Environmental Protection Agency. One of the many compliance areas is the treatment and disposition of its high-level liquid and solid radioactive waste at the Idaho Chemical Processing Plant (ICPP). This is the plant where the irradiated reactor fuel was dissolved and uranium, barium and other isotopes were extracted for the military. (See Section I(E)(3)).

Faced with legal deadlines, DOE is now generating plans on how to meet these court-ordered requirements. In October of 1996 DOE released a document called "Regulatory Analysis and Proposed Path Forward for the INEL High-level Waste Program." [DOE-ID-10544] This plan lays out in detail what the Department's intentions are for high-level waste disposition. From an environmental advocate's perspective, this plan is a shocking rerun of the terminated Hanford tank waste grouting program. This canceled program involved mixing Hanford's high-level liquid wastes in their tank farm with cement (grout) and dumping it back into the ground.

There are three main categories of radioactive waste, high-level, transuranic, and low-level. Under each of these main waste categories there are numerous subgroups. Different federal regulations apply to the disposal of different waste categories. Because of this regulatory framework, considerable emphasis is given to properly assigning the right category or class to a given waste. Unfortunately, the regulations are not as explicit in defining waste categories as one would hope.

The Nuclear Regulatory Commission defines high-level waste by the process that created it, as opposed to specific characteristics. High-level is, (1) irradiated reactor fuel, (2) the waste generated by the processing of irradiated reactor fuel, (3) the solids into which the liquid wastes were converted.

Another wild card in this process is the regulation on the characteristics of treated wastes. Each high-level repository must have what is called a waste acceptance criteria. This means all waste shipped to that repository must meet certain standards to ensure the contamination will not migrate and compromise the dump. Since DOE does not have a high-level dump yet there are no waste acceptance criteria. The Yucca Mt. Nevada site is still under evaluation. Currently, the collective wisdom is that waste vitrified into a glass form will meet any repository criteria.

Despite the uncertainty of not having high-level waste acceptance criteria, DOE must move forward in selecting treatment technologies and start building the treatment plants. Court ordered compliance agreements with enforceable deadlines are the current drivers. Had DOE followed through with its 1977 INEL Environmental Impact Statement commitments to vitrify the high-level wastes into a glass form, the Department would not be in its current bind. DOE's Record of Decision on its 1995 INEL Environmental Impact Statement (EIS) states that: "The technology selected [for high-level waste] is radionuclide partitioning for radioactive liquid and calcine waste treatment, grout for immobilizing the resulting low activity waste stream, and glass (vitrification) for immobilizing the resulting high-activity waste stream." [ROD(1995)] The EIS further acknowledges that:

"The removal of the final approximately 5,000 to 20,000 gallons of high-level liquid waste (that is, the heel) from the five tanks proposed for replacement (VES-WM-182 through WM-186) would be an existing normal Tank Farm Project."..."Since no materials were found that were completely compatible with the tank heels, and the mechanisms required to ensure mixing would be more complicated than simple removal. Also, one cannot ensure that the grout would prevent migration of hazardous elements (that is heavy metals) into the environment." [DOE/EIS-0203-F Vol.2 Part B C-4.3.1-3]

A similar high-level waste treatment program at the Hanford Nuclear Reservation in Washington State generated so much public opposition that DOE was forced to cancel the project. [HEAL(a)] The question of waste classification played a crucial role in ending the Hanford grouting program. DOE tried in 1990 to delist much of its high-level liquid waste saying it was not really high-level and therefore could be mixed with cement (grout) and dumped back into the ground in concrete cribs. The Oregon and Washington State regulator's position is that the tank farm waste is high-level and therefore, regardless of what DOE's separations treatment is, it must be managed and disposed as high-level wastes. [Dunning]

DOE is trying to pull the same high-level low-level nonsense at INL apparently thinking Idahoans are not aware of the Hanford escapade. The radionuclide partitioning technology is a process of separating out the transuranic elements (heavier than uranium) from the rest of the waste and calling it "high-activity." This "high-activity" waste would then be vitrified (made into glass) and eventually shipped to a geologic repository. The "low-activity" waste (everything else) would be mixed with cement and dumped back into the high-level tanks at the ICPP or into the ground at the INL Radioactive Waste Management Complex. The driver to this treatment approach is money. DOE says the separations approach is cheaper because the volume shipped to a geologic repository is small and the volume dumped back into the ground is large. The National Academy of Sciences' analysis of the comparative costs between vitrification and extensive separations suggests that direct vitrification is the least expensive. [NAS(1996)] The Department also thinks that it can ship the small volume of high activity waste to another site to be vitrified, thereby avoiding building a plant at INL. Since DOE is building a vitrification plant at Hanford, the Department likely will ship INL's high-activity waste there for treatment and avoid spending the $3 billion on vitrification plant in Idaho. If DOE follows through with this plan to ship to Hanford, Dirk Dunning of the Oregon Department of Energy says his state's jurisdiction over Hanford and transportation will kick in.

Another driver is waste repository capacity. Even if DOE can open Yucca Mt., its design capacity is not sufficient to hold the accumulated volume of commercial power reactor waste plus the military high-level waste

(HLW). INL's radioactive waste is considered military because it was generated in support of the nuclear weapons programs. DOE now acknowledges that ".. no [INL] HLW will be sent to the first repository by 2035. The second repository will take 30 years to license and open." [DOE-ID-10544@2]

Because of this waste constipation, DOE is looking for every excuse to reduce the volume of high-level waste requiring repository space. To complicate the problem further, DOE is not looking for another repository site that will be needed even if Yucca Mt. opens.

The show stopper of the Hanford grouting program occurred when the States of Washington and Oregon and the Yakima Indian Nation filed a petition with the Nuclear Regulatory Commission (NRC) for a rule making on the classification of the Hanford tank wastes. [Petition] DOE backed down when the grouting (mixing with Portland cement) of the tank wastes did not meet the disposal requirements for high-level waste in the NRC regulations. The NRC did subsequently release a vaguely worded discussion paper in an attempt to answer the Petitioner's request. [Fed.Reg.]

Hanford now is planning to vitrify both the high and low activity parts of its high-level wastes. The low-activity parts are to be stored on-site in a retrievable form. Thomas Tebbs with the Washington Department of Ecology believes this is a step in the right direction but is a waste of resources to separate the high and low wastes; it would be best to vitrify the whole volume together in one operation.

DOE's cleanup shortcuts at INL make it clear that the culture within the Department has not changed. Shortcuts taken over the last four decades are the reason we now see cleanup cost pushing $29 billion [BEMR(c)] to partially remediate the site under Superfund. Every year, every decade that passes, the costs only escalate. The worst part of delaying environmental restoration is that the pollution migrates away from the source every day. The further contaminates migrate the more unlikely any corrective action can be taken.

DOE's INL high-level waste (HLW) planning document perpetuates this shell game by stating: "The sodium-bearing and other mixed liquid wastes stored in the ICPP Tank Farm should not be classified and managed as HLW." [IDO-14362, IDO-14295, IDO-1414307, IDO-14300, IDO-14567] This sodium-bearing waste constitutes about three-quarters of the total high-level volume (~ 1.9 million gallons) in the ICPP tank farm. The Environmental Defense Institute's review of the quarterly report of the ICPP's former operator, Phillips Petroleum Co., shows clearly the chemicals used to dissolve the reactor fuel rods were sodium nitrate and sodium hydroxide. Wastes generated in the fuel dissolution process went to the tank farm. There is no question that this waste meets the Nuclear Regulatory Commission definition of high-level waste.

INL is unique from Hanford and other DOE sites because it used a calcining treatment process that converts most of the high-level liquid waste into a granular form stored in seven large underground silos at the ICPP. The Calciner is a incinerator that burns off the liquid portion and mixes the residual ash with granular calcine material so it can be pneumatically easily handled. Unfortunately, the sodium-bearing waste is not readily calcined unless it is diluted with aluminum nitrate. DOE put off calcining the sodium-bearing waste until it was faced with court-ordered deadlines.

The sodium-bearing waste volume in the ICPP tank farm is about 1,648,400 gallons.[DOE-ID-10544@6] DOE's recent attempt to reclassify or delist this high-level waste is illegal because it meets the Nuclear Regulatory Commission definition that includes the waste generated by reprocessing spent reactor fuel and the concentrated wastes from subsequent extraction cycles, or equivalent.

Between 1954 and 1963 the Idaho Chemical Processing Plant (ICPP) dissolved two-day cooled Materials Test Reactor (MTR) fuel. This fuel reprocessing program was known collectively as the RaLa runs, INL's equivalent to Hanford's Green Runs. Over this period, more than 113 separate process campaigns were run for the separation of barium-140 delivered to the Oak Ridge National Laboratory and Los Alamos for military programs. The RaLa campaigns used unique chemical separation processes from other ICPP nitric, sulfuric, or hydrofluoric acid uranium extraction campaigns. "This [RaLa] process involved the dissolution of MTR assemblies in a sodium hydroxide-sodium nitrate solution leaving a precipitate of sodium diuranate and fission products." [IDO-14445@14] Early Atomic Energy Commission documents leave no doubt that the sodium-bearing high-level waste in the ICPP tank farm is the result of spent nuclear fuel reprocessing and therefore appropriately designated as high-level. Admittedly, a certain amount of the sodium-bearing waste is from decontamination flushes. However, it is still a product of irradiated reactor fuel reprocessing containing all the characteristics of HLW. DOE's own characterization of the sodium-bearing waste acknowledges that it exceeds the low-level Class C definition because of its high alpha emitter constituents. [DOE-ID-10544@8] Uranium and plutonium are alpha emitters.

Even more troubling is DOE's attempt to use "cementitous [grouting] solidification for treatment" of this high-level waste. The discredited Hanford experience [Hanford] where hundreds of millions of dollars were wasted on a high-level waste grouting program appears to be conveniently forgotten at DOE Idaho Operations Office. Internal DOE Hanford contractor reports revealed that the physical integrity of the grout would not last long. When radionuclides decay, they give off heat and radiation.

"Under the expected disposal conditions...the grout will remain at elevated temperatures for many years. The high temperatures expected during the first few decades after disposal will increase the driving force for water vapor transport away from the grout; the loss of water may result in cracking ... as the grout cools... (it) may draw moisture back into the grout mass. The uptake of moisture may have detrimental impacts on the behavior of the grout." [HEAL(b)]

Additionally, DOE's attempt to reclassify the sodium-bearing waste may be a violation of the State Agreement with DOE that orders the Department to calcine all the waste in the ICPP tank farm. The order states that: "DOE shall commence calcination of sodium-bearing liquid high-level wastes by June 1, 2001. DOE shall complete calcination of sodium-bearing liquid high-level wastes by December 31, 2012." [Batt(a)] Even if DOE fulfills its commitment to calcine the sodium-bearing wastes the issue remains about the classification of the partitioned "low-activity" part that DOE wants to mix with concrete and dump back into the old waste tanks. All the calcine (~3,800 cubic meters) is slated for the same chemical separations process to divide the "high-activity" from the "low-activity" parts.

Another very troubling part of DOE's plan is to leave the high-level tank farm sediments (heels) in the tanks. "The ICPP Tank Farm heels will not be removed and the Tank Farm will be closed under RCRA [Resource Conservation Recovery Act]." [DOE-ID-10544@3] DOE thinks that: "The closed Tank Farm would probably meet the subtitle D landfill standards for industrial waste." [DOE-ID-10544@13] Subtitle D is a municipal garbage dump classification. It is obvious to the most pedestrian observer that garbage and radioactive waste are different. This literally translates into INL becoming a permanent high-level waste dump site.

The tank heels can be removed by conventional dredging techniques or use the Hanford Tank Sluicer Mechanism. DOE believes: "However, it is not practical to remove all of the heels from the INL tanks, decontaminate the equipment, and remove all surrounding soils due to technological, economic, and health and safety factors involved." [DOE-ID-10544@20]

The Environmental Defense Institute (EDI) believes that the best approach is directly to vitrify the whole volume of the sodium-bearing liquid and the calcine high-level wastes without any partitioning or separation of "high-activity and low-activity" wastes. Sediments and all tank heels must be included in the waste to be vitrified. The State of Idaho must fully review the failed Hanford grout program before committing to a similar project at INL.

A reasonable person may ask, "doesn't EPA Region 10 cover both Hanford and INL?" Why are these regulators, who are involved in all the decisions with both sites, not communicating with the Idaho State regulators? Are there no "lessons learned" at the EPA? Part of this problem revolves around the different regulatory authorities that are applied. The INL Tank Farm falls under the jurisdiction of the Resource Conservation Recovery Act (RCRA) the regulation of which Idaho has primacy. EPA granted Idaho this authority, however, EPA maintains review authority if the State does not appropriately enforce the regulation. So for the time being, EPA is sitting on the sidelines with respect to the INL Tank Farm wastes.

Another reason the Environmental Defense Institute disagrees with DOE's separating the high activity and low activity parts is the chemistry. Part of the problem is the complexity of the chemistry involved in separating or partitioning radionuclides from each other in this high-level witch's brew. INL scientists recently completed the first stage of a multi-year project called Efficient Separations and Processing Program that preprocesses high-level waste and is funded at a half million per year through DOE's Office of Science and

Technology. This project reportedly "separates highly radioactive elements from waste, reducing the volume of high-activity waste that must be disposed of at a repository." [STAR] This separations/ partitioning process is also called Transuranic Extraction (TRUEX). Despite the proliferation implications of this program, the grouted residual from this solvent extraction process is destined for low-level burial; or the preferred option is dumping it on top of the waste tank heels. A Science Program Symposium in Richland, Washington on June 26, 1996 sponsored by DOE showed that the Department is still struggling with the basic science of chemical separation and the applied technology is still in the hypothetical stage. This means that millions of additional R&D dollars will be required to test the technology.

The INL Pit 9 waste treatment plant could not get the chemical separations/ partitioning to work. DOE was forced recently to announce a two-year delay while the chemists and engineers go back to the drawing board. This Pit-9 reburial of the residuals of chemical separations approach does not enjoy public acceptance for many reasons. First, the classification of low-level waste has no connection with environmental, health and safety hazards. [IEER(c)@89] It is merely a catchall category for all waste not classified as high-level or transuranic. Secondly, the public demands that the entire volume of the waste be processed directly into a stable vitrified form so that the inevitable interim on-site storage does not continue the migration of contaminates into the environment. Remember, DOE thinks maybe a second repository will be available in forty years. The Final Report from the Hanford Tank Waste Task Force got it right by recommending:

"The high cost and uncertainty of high-tech pretreatment and R&D threatens funding for higher performance low-level waste form, vitrification, and cleanup."..."Put wastes in an environmentally safe form, using retrievable waste forms when potential hazards from the waste may require future retrieval and when retrievability does not cause inordinate delays in getting on with cleanup."..."Let the ultimate best form for the waste drive decisions, not the size nor timing of a national repository."..."Accept the fact that interim storage, at least, of the waste in an environmentally-safe form will occur for some time at Hanford. Select a waste form that will ensure safe interim storage of this waste." [Hanford@11]

Another reason why waste must not remain at the ICPP is the risk of flooding. A 1996 DOE Environmental Assessment (EA) for TAN Pool Stabilization noted that the maximum probable flood is considered conservative as the last flood (12,000 years ago) with the magnitude of 35,000 cubic feet per second.[DOE/EA-1050 @B-4] This flood would easily overflow the diversion dam capacity of 9,300 cubic feet per second. The EA predicted that the ICPP would be two feet under water during such a flood. However since the ICPP is 130 feet lower in elevation than the Big Lost River Channel, it is likely to be under more than two feet of water. [IDO-22056@8]

In summary, the repeated mantra "get on with cleanup" in the Hanford Waste Tank Task Force is repeated in public interest group reports. [HEAL(c)] DOE is wasting precious resources by refusing to recognize the public's demand for real solutions to the radioactive waste problem. DOE must "get on with cleanup" and apply research and development (R&D) to technologies that will put all radioactive waste into a stable vitrified form for on-site storage for the near-term because there are no guarantees on any repositories coming on line soon. Additionally, the DOE is remiss in not investing in the essential R&D on emissions control that will be key to health and safety issues in all waste processing.

Vitrification processing cannot be avoided in stabilizing and preparing the waste to meet future repository acceptance criteria. To ensure that the nuclear legacy mortgage is paid, the Department must make its case to Congress for specific funding for INL Waste Immobilization Vitrification Plant. Idaho State and Environmental Protection Agency regulators must aggressively challenge DOE's attempt to reclassify formerly high-level waste as low-level and learn from the Hanford debacle.

IV. J. Argonne National Laboratory – West (Now Called Materials and Fuels Complex)

Argonne National Laboratory-West (ANL-W) has a solid high-level waste site called the Radioactive Scrap and Waste Facility (RSWF) that is seldom acknowledged. It has 12-foot-deep steel walled underground repositories (27 rows on 12 ft centers and 40 rows on 6 ft. centers for a total of 1200). According to DOE, the existence of severely corroded storage wells coupled with the lack of a monitoring program for soil contamination was identified as a vulnerability. RSWF had as of 1981, 81 cubic meters containing 9,823,000 Ci of radioactive materials, including 40.73 grams of plutonium. [ID-10054-81@19] Responding to pressure, ANL-W upgraded 1,016 of the RSWF vaults in 1995 and plan on upgrading another 350 in the next three years.[RSWF] Even the new upgrades do not meet regulatory requirements for spent fuel storage because the contents cannot be inspected due to the welded cap on the top of the vault. However the regulators granted ANL-W a variance.

ANL-W radioactive airborne releases for the 1952-81 period were 44,580 Ci. [ID-10054-81@19] The 1977 radioactive content of ANL-W's annual waste generation sent to the RSWF or RWMC is 1,300,126 curies. [ERDA-1552 @V-23] DOE claims that ANL-W dumped 1.1 million curies at the RWMC between 1952 and 1983. [EG&G-WM-10903] ANL-W's Zero Power Physics Reactor fuel is releasing fission product because the uranium has oxidized and hydrided on approximately 25% of the plates, causing stainless steel cladding to bulge. In a few isolated cases, the cladding is breached. A total of 83,276 spent fuel elements/assemblies are stored at ANL-W. [DOE Spent Fuel Working Group Report, p.25]

ERB-II Leach Pit Sediment Sampling Data

Detected Radiochemical	Maximum Detected Value (pCi/g)
Yttrium-90	2,247
Americium-241	0.65
Cobalt-60	196
Cesium-134	1.8
Cesium-137	29,110
Uranium-234	35.64
Uranium-235	2.18
Uranium-238	3.54
Neptunium-237	329
Strontium-90	2,247
Iodine-129	124

[ANL-5277]

The Argonne National Laboratory -West (ANL-W) Plan suffers from the same misguided approach to environmental restoration that the DOE has applied at other INL sites. The apparent absence of lessons learned between the Hanford Environmental Restoration (ER) process and the INL ER process is regrettable and a serious threat to Idaho. DOE is taking advantage of its position as the single largest employer in Idaho to float ER actions at INL that it was not allowed to do at Hanford because public and regulatory pressure blocked shortcuts. Specifically, at Hanford DOE was required to build the Environmental Restoration Disposal Facility (ERDF) which is a fully compliant Resource Conservation Recovery Act (RCRA)/ Nuclear Regulatory Commission (NRC) mixed hazardous/radioactive dump with double liner, leachate collection and monitoring wells and an impermeable cap. ERDF was completed in the Spring of 1996 at the farthest location on Hanford away from the Columbia River and will receive contaminated soil and decontamination/decommissioning (D&D) waste. At INL, DOE refuses to build such a repository because the Department is not being pressured by the state and EPA regulators to comply with the law.

This must not be called a “comprehensive” plan because it does not include ANL-W’s underground high-level waste site (Radioactive Scrap and Waste Facility) which as of 1981 has 81 cubic meters of waste containing 9,823,000 curies of radioactive materials including 40.73 grams of plutonium.[ID-10054-81@19] DOE must not continue to postpone treatment and disposition of this waste.

The polluter's continue their criminal arrogance by thumbing their nose at the law and continuing to use leach pits that currently pose unacceptable hazards to environmental health and safety. Specifically, ANL-W intends to continue to use the contaminated Industrial Waste Pond (ANL-01) and the Sewage Lagoons (ANL-04) and the State and EPA regulators are silent. Continued waste water discharge perpetuates the leaching of contaminates into the soil column and eventually to the aquifer below. The Plan acknowledges that: "Human health risks from cesium-137 will be at acceptable levels within 130 years due to radiological decay." [Plan@14] Yet in the next paragraph, the plan states: "Institutional controls are assumed to remain in effect for at least 100 years." What about the remaining thirty years. Once the CERCLA process is wound up in a few years, there are uncertainties that DOE or any other federal agency is going to fulfill its questionably enforceable commitment to provide monitoring and institutional control to ensure no people gain access to the waste sites. Again, a trust fund is warranted and a requirement under the NRC 10 CFR ss 61.63 "Financial Assurances for Institutional Controls."

ANL-W's Plan, like the NRF deficient Plan, is to consolidate all the contaminated soil into the Industrial Waste Pit, and again, it does not meet Applicable or Relevant and Appropriate Requirements (ARAR's). The Plan offers no maximum contaminate levels of the waste planned for the Pit. This lack of full disclosure by the polluter and the regulators is unacceptable. The drawing offered in the Plan [Plan@15] of the Industrial Pit does not vaguely resemble the near 20 foot deep localized depression that the pit is in. The Plan drawing shows a flat terrain with the leach pit being the only depression. This is a major discrepancy. Continued pooling of surrounding precipitation runoff into the pit (covered or not) will provide water to leach contaminates toward the aquifer. Moreover, the cap does not include an impermeable seal to keep precipitation out. The Waste Pit currently receives drainage from a considerable area to the southeast in addition to storm water from the ANL-W site. A major flaw in the Plan is not providing drainage diversion away from the pit regardless of the alternative chosen. The fact that chromium, mercury, selenium, and zinc are in the pit sediments qualifies the waste as a mixed hazardous/radioactive and it must be disposed pursuant to RCRA land disposal restrictions.

The Plan states at page 8 that: "contaminates to the ground water show only arsenic and chromium exceeded the risk based screening levels." The ANL-W RI/FS well (M-13) 1993 sample data shows strontium-90 at 1,330 pCi/L at 642 feet. [RI/FS,Vol.III App. H pg. 3] EPA maximum concentration level for strontium-90 in drinking water is 8 pCi/L. The Plan does not acknowledge this strontium migration or propose remedies that will correct the problem.

Alternative 5 (phytoremediation) that would use plants, over five growing seasons, to absorb the contaminates in the leach pit, is so ludicrous in an arid environment that it does not deserve rebuttal. There are issues of plant density to prevent wind erosion (contaminate dispersion). What is ANL going to do after annual harvest and between growing seasons to prevent wind erosion? Bench scale tests in ANL's greenhouse will only reflect efficiencies in an artificial climate controlled environment, not the real desert thing.

The Sanitary Waste Lift Station (ANL-31) is listed as a no action site presumably because ANL wants to continue to use the pumps. The Plan offers no data to substantiate this no action decision. The Track 2 Investigation shows maximum concentrations of sludge collected from the Lift Station as follows: cesium-137 at 9,380 pCi/g, strontium-90 at 2,470 pCi/g, uranium at 4.8 pCi/g, neptunium-237 at 13 pCi/g, and cobalt-60 at 16.3 pCi/g.[Vol. III Track 2 App.-H pg.4] This contamination suggests that this Lift Station was inappropriately excluded from the cleanup. May 1995 Track 2 reflect continued high gross alpha and gross beta in the pump water and sludge. [Vol. III Appendix - E]

The EBR-II Leach Pit (ANL-08) underwent an interim "cleanup" action in 1993 when only "the majority of the sludge was removed "and the pit was backfilled. The Plan fails to acknowledge that the remaining sludge had the following pCi/g concentrations: cesium-137 at 29,110, iodine-129 at 124, neptunium-237 at 329, strontium-90 at 2,247, yttrium-90 at 2,247. [RI/FS Vol.II pg.59-60] Inadequate interim actions end up being permanent because of the additional volume of contaminated soil used as backfill is now part of the problem.

The public has demanded for many years that DOE treat its radioactive waste into a stable vitrified form so that it can be stored onsite until a safe permanent repository can be established. At the very legal minimum, all contaminated soil should be shipped off the INL site to a licensed and permitted RCRA hazardous/radioactive disposal site. A compromise would be if there is an area on the INL site that is not over the Snake River Plain Aquifer, use it to build a licensed and permitted RCRA hazardous/radioactive disposal site for INL low-level wastes only.

The ANL-W Plan makes it very clear that DOE and the regulators refuse to learn from past mistakes. So far three of the six U.S. commercial radioactive waste dumps are now closed and undergoing CERCLA cleanup. The Institute for Energy and Environmental Research's book High-Level Dollars Low-Level Sense notes the following about these dumps:

"At each of the three sites (located at West Valley, New York; Maxey Flats, Kentucky; Sheffield, Illinois), water has leaked into the burial trenches and in some cases caused extensive movement of radionuclides into the surrounding environment. Rather than being maintenance-free stabilized landfills, as was intended, these sites have ended up requiring active maintenance and remedial activities within ten years of closure. The problems at Maxey Flats which was first opened in 1962, provide an instructive example. A 1974 report by the state of Kentucky found that radioactive materials, including plutonium had moved hundreds of feet from where they had be buried. Although the operator of the site, U.S. Ecology had claimed that significant subsurface migration of plutonium was not possible, a 1975 report by the EPA found plutonium in core drilling samples, monitoring wells, and drainage streams. The EPA report noted that although Maxey Flats had been 'expected to retain the buried plutonium for its hazardous lifetime 'the plutonium had actually migrated from the site in less than ten years." [IEER(c)@69]

Even the fact that INL Subsurface Disposal Area (SDA) at the Radioactive Waste Management Complex is a CERCLA cleanup site seems to have been forgotten. Shallow burial of radioactive waste resulted in contaminate migration hundreds of feet below the SDA. See Section IV(D) Radioactive Waste Management Complex. DOE's continued use of Envirocare in Utah is unacceptable because it is being sued for permit violations by the Natural Resources Defense Council for RCRA non-compliance.

IV. K. Naval Reactor Facility Cleanup Plan

The apparent absence of lessons learned between the Hanford Environmental Restoration (ER) process and the INL ER process is regrettable and a serious threat to Idaho. DOE is taking advantage of its position as the single largest employer in Idaho to float ER actions at INL that it was not allowed to do at Hanford because public and regulatory pressure blocked shortcuts. Specifically, at Hanford DOE was required to build the Environmental Restoration Disposal Facility (ERDF) which is a fully compliant Resource Conservation Recovery Act (RCRA)/ Nuclear Regulatory Commission (NRC) mixed hazardous/radioactive dump with double liner, leachate collection and monitoring wells and an impermeable cap. ERDF was completed in the Spring of 1996 at the farthest location on Hanford away from the Columbia River and will receive contaminated soil and decontamination/decommissioning (D&D) waste. At INL, DOE refuses to build such a repository because the Department is not being pressured by the state and EPA regulators to comply with the law. DOE's own "off-aquifer siting analysis identified two areas off the Snake River Plain Aquifer (Spent Fuel Storage at the INEL Yet off the Aquifer). [DOE/EA-1050@B-5] Another option would be for DOE to purchase additional adjacent land at the northwest of the site for an ERDF type dump off the aquifer in Clark County.

The Plan (January 1998 publication) assumes that the DOE and the Naval Reactor Facility (NRF) enjoy credibility in the public's eye. This is an invalid assumption. These agencies have broken the law and are being forced via a Federal Facility Agreement and Consent Order to correct their illegal activities. As illegal polluters, no credibility can be assumed and therefore full and complete disclosure is demanded in all Plan publications. The Plan does not provide the reader with full disclosure or provide the essential information the reader needs in order to evaluate the appropriateness of the preferred remedial alternative. For instance, maximum contaminate levels for all contaminates of concern must be stated for each Operational Unit as well as the effective standard for that contaminate so that the reader can make up their own mind whether the cleanup actions or no actions are appropriate. Stating conclusions without providing definitive data to support the finding assumes credibility that the agencies do not have.

Another major assumption that is extensively evoked in the Plan is 100 years of DOE monitoring and institutional control of the contaminated sites. In real life, when entities brake the law, and are required to do major corrective actions in the future, they are generally required to establish a trust fund so that if they again decide to disregard their legal requirements, or are no longer in existence, the funding will be there for the state or local government to do the job. The state of Idaho should therefore, require DOE to establish a monitoring/institutional control trust fund to cover those costs at INL. An example of where this issue is important is the current designation that NRF is not in the Big Lost River (one mile away) 100 year flood plain. This current designation is due to Big Lost River dams that divert flood waters south into spreading areas. These dams and their related water channels require regular maintenance in order to provide that flood protection to NRF and other INL facilities. Spring 1997 runoff nearly topped the dams. Prior to construction of the diversion dam, NRF was in the Big Lost River 100 year flood plain. [RI/FS@5] Nuclear Regulatory Commission (NRC) radioactive waste disposal requirements state, "waste disposal shall not take place in a 100 year flood plain." [10 CFR ss 61.50] Institutional control must include diversion dam and water channel maintenance as well as monitoring and fencing of waste sites. The NRF Plan proposes consolidation of contaminated soil into one of the leach pits. The cesium alone will take over 420 years to decay to acceptable risk levels, or considerably longer than the planned 100 year institutional control.

The Environmental Protection Agency (EPA) and the Idaho Division of Environmental Quality (DEQ) also incorrectly assume credibility with the public. The presence of their logos on the Plan, their review of the document, and their endorsement of the preferred alternative make these agencies complicities in the Plan's inadequacies and flaws as well as a history of INL "cleanup" Plans that were more cover-up than cleanup.

The Plan states: "The Comprehensive RI/FS Waste Area Group 8 represents the last extensive Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) investigation for the Naval Reactors Facility." This Plan is not "comprehensive" because it excludes the Retention Basin (one of the most contaminated waste sites at NRF) from the CERCLA cleanup process. The Retention Basin (OU-8-08-17) is a large concrete tank that temporarily holds liquid radioactive and chemical wastes (presumably to allow short-lived isotopes to burn off) prior to discharge to the various leach pits. The Plan fails to state that the sludge in the basin contains cesium-137 at 192,700 pico curies per gram (pCi/g)(risk-based action level is 16.7 pCi/g) and Cobalt-60 at 20,410 pCi/g. [RI/FS@H8-8] A long history of Basin leaks assures significant soil contamination under the basin and therefore must be included in the Comprehensive Plan.

The Plan's exclusion of the NRF Expanded Core Facility (ECF) leaks additionally demonstrates the incompleteness of the so called "comprehensive" Plan. The ECF, built in 1958, does not meet current spent reactor fuel storage standards that require stainless steel liner, leak containment, and leak detection systems. The ECF should be shutdown for exactly the same reasons the Idaho Chemical Processing Plant (CPP-603) Underwater Fuel Storage Facility was shutdown - it was an unacceptable hazard and did not meet current standards. ECF has been leaking significantly >62,500 gallons of radioactive water over the past decade and the soil contamination around and underneath the basins must be included in the CERCLA cleanup process. [RI/FS@5-1] The Plan offers no soil sampling data to substantiate exclusion of the ECF from CERCLA action. A theoretical risk analysis assumed only one leak which does not reflect the actual ECF history and that is why the sampling data is essential.

The Plan's exclusion of the Sewage Lagoon (NRF-23) from its so called "comprehensive" CERCLA cleanup, again, demonstrates the incompleteness of the Plan. Contaminate levels of arsenic, mercury, and cesium-137 would normally require remedial action. In fact, the Track 1 investigations recommended inclusion of the lagoons into the comprehensive RI/FS primarily due to radionuclides and the risk assessment results showed increased cancer rate of 1 in 10,000 from exposure to the site. [Plan@25] The Plan offers no data to substantiate the "risk management decision" to exclude the lagoons. NRF intends to continue to use these unlined leach pits despite the fact that every gallon of waste water that flows into the pit, leaches more of the contaminates toward the aquifer below. NRF should be required to close the Sewage Lagoons, clean them up, and build new lined ponds that meet current regulations.

The preferred alternative 3 that DOE, the State, and EPA want the public to accept cannot be justifiably called a cleanup plan. A shell cover-up game, yes, but not a cleanup plan. Alternative 3 is a rerun of the misguided actions at the INL Test Reactor Area Warm Waste Pond. The NRF Plan calls for the consolidation of the contaminated soil from numerous sites into the bottom of one of the old leach pits (S1W Leach Pit), then cap it with rocks and gravel. It's quick, dirty and comparatively cheap; and that's why DOE likes it. With a slight of hand DOE wants to create a dump without calling it a dump because if they called it a dump then they would have to comply with hazardous and radioactive disposal regulations. If it looks like a duck, walks like a duck, and quacks like a duck then it is a duck. The very moment contaminated soil is moved from one site to another, a dump is created, and therefore the regulations apply regardless what DOE wants to call it.

The Plan offers inaccurate data to support the preferred alternative. The Plan states that the maximum soil concentration at all of the 8-08 Operable Units for cesium-137 is 7,323 pCi/g. [Plan@14] Appendix H of the RI/FS however credits the S1W Leach Pit with a maximum detected cesium-137 concentration of 149,759 pCi/g "decay corrected to obtain equivalent 1995 results." [RI/FS@H4-22] This contaminate concentration discrepancy is significant because the undisclosed higher amount qualifies under NRC radioactive waste Class B criteria in 10 CFR ss 61.55 and the "technical requirements for land disposal facilities" in ss 61.50. The preferred alternative does not meet NRC requirements. Actually, DOE's preferred alternative does not even meet municipal garbage landfill requirements under RCRA Subtitle D which require liner, leachate monitoring wells, impermeable cap, and location restrictions over sole source aquifers. The NRF Plan contains none of these essential features. This Plan effectively shifts the risks, hazards, and ultimate cleanup costs to future generations. The high levels of hazardous materials in the NRF waste qualify it as a mixed hazardous and radioactive waste under the 1992 Federal Facility Compliance and RCRA Land Disposal Restrictions. Hazardous contaminates in the soil include chromium at 2,090 mg/kg, lead at 1,140 mg/kg and mercury at 56.1 mg/kg. EPA's interim lead soil cleanup level is 400 mg/kg. The Plan offers no Toxic Concentration Leach Procedure (TCLP) data to support exclusion of this hazardous waste from regulatory disposal compliance. The transuranic contaminates (americium-241 and plutonium-238) at 20 pCi/g have half-lives of 432 and 87 years respectively guarantee the waste will be hazardous for a long time. Under the circumstances, it is difficult to see how the Plan's preferred alternative can claim to meet all the "Applicable or Relevant and Appropriate Requirements" (ARAR).

The INL Oversight Program's Kathleen Trever claims that the SIW data set containing the 149,759 pCi/g cesium-137 was not considered reliable by DOE and therefore it was not used in the Risk Assessment. When asked about this data-set discrepancy, EPA's Wayne Pierre said that DOE could not arbitrarily ignore data-set unless they had more than 10 data-sets, and then they could choose the most reliable 10 sets. Since DOE only had three data-sets, Pierre thought it unacceptable to rely completely on the 1991 and 1992 samples. It is possible that the earlier sampling grid identified hot spots that the later sampling grids could be planned to avoid.

1971 sampling data buried in the RI/FS show long-term waste mismanagement at the S1W Leach Pit with cesium-137 at 310,000 pCi/g, cesium-134 at 42,00 pCi/g, hafnium-181 at 20,000 pCi/g, and cobalt-60 at 1,300,000 pCi/g. [RI/FS@I-59] Algae (accessible to ducks using the pond) sampling show 667,447 pCi/g. [RI/FS@ pg H6-13] By comparison, the risk based soil concentration for cesium-137 applied to this Plan is 16.7 pCi/g. These high contamination levels were due primarily to once through reactor cooling water dumped in the leach pits which was discontinued by 1980. No explanation is offered why the remediation goal applied to Waste Area Group 3 of 0.02 pCi/g for cesium-137 was changed.

Alternative 4, Complete Excavation and "Off-site Disposal" is equally unacceptable because "Off-site" is defined as hauling the contaminated soil from NRF to another INL leach pit consolidation site at the Idaho Chemical Processing Plant, Test Reactor Area, or the Radioactive Waste Management Complex, none of which would qualify even as a garbage dump. Interestingly, DOE calls these "INL soil repositories." Therefore, alternative 4 also does not meet legal requirements in the ARAR's.

The cumulative risk assumptions that determine the exposures to future 100 year residential and occupational scenarios are not conservative (most protective of human health) and not supportable. The Plan states: “The ingestion of soil, the ingestion of food crop, and direct contact with soil through the dermal pathway is not included in the cumulative assessment because these involve exposures routes that are not likely to occur at more than one release site at a time.” [Plan@11] A possible future scenario of a pasture over the leach pit, a well over the Retention Basin, and dermal exposure from digging around the ECF is reasonable. Therefore, all these pathways must be considered to be cumulative. The risk assessment must also be recalculated using the above cited maximum cesium-137 contaminate level of 149,759 pCi/g which will produce radically different results from the 7,323 pCi/g used by DOE as the maximum contaminate level at NRF.

NRF and DOE representatives stated at a public meeting in Moscow that the groundwater and aquifer are not at risk because contaminates are absorbed by the soil column. Review of the historical deep well sampling data at NRF does not support the Navy’s conclusion. The NRF October 1995 Remedial Investigation / Feasibility Study (RI/FS) Appendix K shows Table III Deep Well Sample Results for Wells # 1, # 2, and # 3 at 60, 69, and 44 pico curies per liter respectively for gross beta. The federal drinking water standard for gross beta is 8 pico curies per liter. This deep well sample data confirm that the contaminates do migrate, contrary to the Navy’s claims.

The Plan’s “remediation goals” that set risk-based soil concentrations for contaminates of concern (cleanup goals) fail to include inhalation as an exposure pathway. This exclusion represents a major flaw in the Plan. Inhalation is the most biologically hazardous for alpha emitting contaminates of concern listed as americium-241, neptunium-237, plutonium-238, plutonium-244, and uranium-235, yet inhalation is not considered for these isotopes, nor for lead. The wide difference between ingestion of beta/gamma contaminated soil also appears out of balance. For instance cleanup goals for cesium-137 external exposure is set at 16.7 pico curies per gram (pCi/g) while ingestion of soil is set at 24,860 pCi/g. Additionally, the beta emitter strontium-90 is not considered for external or inhalation exposure but is considered for soil ingestion at 15,416 pCi/g and food crop ingestion at 45 pCi/g.

An integral factor in the Plan’s establishing a “remediation goal” is the maximum concentration of contaminates of concern. The Plan acknowledges (pg 14) that the maximum cesium-137 soil contamination detected at the NRF is 7,323 pCi/g which generated a risk based cleanup goal of 16.7 pCi/g. Again, as previously discussed, this must be recalculated using the above cited maximum detected cesium-137 at 149,759 pCi/g “decay corrected to obtain equivalent 1995 results.” This significant discrepancy begs the question as to the quality of regulatory review the State and EPA are bringing to the process and whether the “remediation goals” are supportable.

IV. L. Environmental Management Sight Specific Advisory Board

In May 1994, DOE/ID convened the first meeting of the Environmental Management Sight Specific Advisory Board - INL EMSSAB. Fifteen individuals were chosen to serve on the Board by a selection panel. Since the first meeting the Board has met semi-monthly. The structure that DOE headquarters chose to meet the requirements of the Federal Advisory Committee Act was a single large board composed of all members of each of the eight DOE sites that have advisory boards. The individual DOE sites would convene subcommittee meetings.

The dominate SSAB-INL composition of current or former site workers, and economic development interests is not balanced. This strategy ensured that environmental interests would be marginalized not only numerically but also through a perverse interpretation of the “consensus process”. For over a year, the SSAB refused to put INL CERCLA (Superfund cleanup) issues on the agenda. This precisely mirrors INL site manager John Wilcynski’s priorities presented numerous times to the SSAB. Wilcynski encouraged the SSAB to focus on the big picture and become advocates for new nuclear missions for the INL and not get “bogged down” in the multitude of Environmental Restoration (ER) projects.

Admittedly, the SSAB did eventually and grudgingly allow an ER Issue Committee to be formed - Brett Hayball, Shoshone-Bannock Tribal representative and this Guide’s author were co-chairs of this committee.

However this ER committee was shortly and summarily dissolved by the SSAB. New Waste Area Group issue committees were organized, but they are now dominated by individuals who are loath to allow substantive discussions concerning the details of specific INL remediation actions.

Environmental stakeholders are left with no other recourse than to pursue other venues within the CERCLA/Federal Facility Agreement mandates where INL environmental restoration actions can be fully discussed with the principal agencies. The departure of environmentalists from the SSAB in no way is an indication of a reduced interest in INL cleanup. Indeed, it represents a renewed commitment to the issues and a vigorous demonstration that environmental issues require full consideration by the policy makers. The SSAB effectively marginalized these environmental stakeholder interests yet claimed to accurately represent the diversity of Idahoans. Nothing could be further from the truth. The dominate SSAB opinion is to encourage DOE to build fences around contaminated sites and walk away from the problem. Continued participation on the SSAB by environmentally active individuals and organizations only lends unwarranted credibility to a failed process.

It is instructive to see that the two DOE site boards experiencing environmental flight are the two remaining production sites - INL and Savannah River. Expansion of their respective nuclear production missions remains the priority today as it did fifty years ago. Environmental restoration is perceived by the SSAB as damaging to future INL nuclear missions because it exposes the extent of past and present environmental contamination caused by mismanagement of the most toxic substances known to humankind. This is a tragic legacy to thrust on future generations - not only the health and safety hazards, but also the $29 billion mortgage costs that are now due. If at some future date Mr. Wilcynski chooses to redirect the SSAB toward substantive involvement in environmental restoration projects, then EDI will be ready and willing to participate on the board.

V. Independent Health Studies
Indicate Risk at INL

"Radioecological Effects on Animal and Human Populations Near the Idaho National Engineering Laboratory" by Michael Blain, Ph.D., et al. and presented to the American Association for the Advancement for Science annual meeting in May 1984 offers an evaluation of the radiological effects of INL operations.

Dr. Blain's 1984 study offered the first independent assessment of the health impact from INL operations. The Idaho Academy of Sciences as well as the State and DOE tried to discredit the analysis. American nuclear history is full of conscientious scientists who were subjected to pressure and discrimination by federal agencies because they told the truth. Dr. Blain's assessments are as true today as they were in 1984 and hopefully his work will receive the public credit it deserves. The following is the abstract in his report.

"Federal data on cancer mortality and state data on cancer incidence in the six counties near INL were analyzed. When the Idaho state population is employed as a control group, there was an excess number of deaths (1950-69) from cancer of the more radiosensitive organs (17 observed, 9.4 expected, $P<.05$) and minor excess of cancer cases (1971-80; 11 observed, 8.0 expected) in Clark county, Idaho downwind of INL. The minor excess is due to a lower than expected number of male cancers (2 observed, 2.8 expected) and a higher than expected number of female cancers (9 observed, 5.2 expected), particularly female breast tumors (6 observed, 2.8 expected). Mormons have a 23% lower rate of cancer than other populations and the six counties have large Mormon populations (range = 40% - 80%). When the cancer incidence in the counties is compared to a Mormon control population, there is an excess cancer incidence (1971-80) in Bannock (659 observed, 485.7 expected, $P=.001$), Bonneville (547 observed, 447.9 expected, $p=.001$), Butte (47 observed, 34.5 expected, $p=.05$), and Clark (11 observed, 6 expected) counties. There is a need for a comprehensive cohort study (1952-80) that considers membership in the Mormon Church." [Blain @I]

Due to the cancer latency period, which can be decades, a credible argument can be made to bring the study period to the present. Blain cites 1960 environmental monitoring data on milk samples of 2×10^{-7} mCi/cc for I-131 (cc=ml). The notation "m" in this sampling data appears to denote micro (10^{-6}) rather than the conventional m = mili (10^{-3}). This assumption is supported by the same reports citing the current standard at

100 x 10^{-9} mCi/ml (100 pCi/L). Proposed EPA Drinking Water Standard for I-131 is 108 pCi/L. The above sample of 2 x 10^{-6} mCi/ml converted would be 2,000 pCi/L. This represents 20 times more I-131 contamination than the current standard would allow. A 1961 Report cites I-131 in milk samples at 1 x 10^{-7} mCi/L [100 pCi/L]. Blain also cites 1963 reports that indicated Strontium-90 off-site milk samples of 230 mmc/L [230 pCi/L]. Wheat samples tested for Sr-90 for the same period were as high as 170 mmCi/kgm [170 pCi/kgm]; and for cesium-137 were 800 mmCi/kgm [800 pCi/kgm]. Gamma emitter manganese-54 samples were 560 mmc/kgm [560 pCi/kgm] [Blain @ 24 , citing Monitoring Report No. 12 1963:1]

Animal studies found the "highest ratio in rabbit thyroids occurred near the ICPP and was 9.1 x 10^{-4}. Ratios from thyroids of rabbits collected off-site and adjacent to the INL were higher than the control area ratios (<4 x 10^{-7})."..."During this same period mule deer thyroids collected at Craters of the Moon National Monument (54 km west of ICPP) had average I-129/I-127 ratios of 4.4 x 10^{-6} and were significantly ($P < 0.01$) higher than ratios in control animals (3.3 x 10^{-7}) [1983: Health Physics 45:31-38]."..."I-129/I-127 ratios in vegetation on-site ranged from 1.5 x 10^{-3} to 1.9 x 10^{-5}." "From these data it seems probable that the increase ratios obtained from samples NE and SW of the INL are due to the atmospheric releases from the ICPP."[DOE/ID-12111,P.38] [no units offered for data] Blain also cites on-site antelope muscle samples for Sr-90 taken in 1959 having 31.1 pCi/g and samples taken between 1972 and 1976 having 9.6 p/Ci/g. 1982 samples taken for Cs-137 in antelope showed 382 pCi/g. [Blain @ 35- 37]

1974 INL Regional Radioactive Air Monitoring

City	Iodine-131	Strontium-90	Gross Beta
Carey, ID	3.6 uCi/ml (or) 3,600,000,000 pCi/L	9.0 uCi/ml (or) 9,000,000,000 pCi/L	810 x 10-15 uCi/ml .00081 pCi/L
Idaho Falls	3.9 uCi/ml (or) 3,900,000,000 pCi/L		[ERDA-1536 @III-45]

Animal Tissue Samples Containing Cesium-137 On and Off-site

	Muscle	Liver
Sheep		
On-site	96 pCi/kg	81 pCi/kg*
Off-site	599 pCi/kg	286 pCi/kg
Antelope		
On-site	1,520 pCi/kg	2,660 pCi/kg
Off-site	92 pCi/kg	139 pCi/kg

* One kilogram (kg) = 1,000 grams [ERDA-1536 @ III-39&53]

Plutonium-239&241 in soil samples outside INL boundary registered 1500 nCi/sq meter and inside INL at 2,000 nCi/sq. meter.[ERDA-1536 @ III-36&37] Converting to pico curies, the readings are 1,500,000 pCi/sq meter and 2,000,000 pCi/sq meter respectively.

Idaho's Division of Health is conducting a cancer survey in counties around INL and the agency is finding excessively higher rates than national averages. The 1995 study analyzed a 17 county area comparison of cancer incidence rates and compared it to the other 27 Idaho counties. The study counties include Bannock, Bingham, Blaine, Bonneville, Butte, Caribou, Cassia, Clark, Custer, Fremont, Jefferson, Jerome, Lincoln, Madison, Minidoka, Power, and Twin Falls. The aggregate 17 county study found cancer incidents (observed) compared to the other 27 county control group (expected). The results include stomach cancer (observed 390 with 383 expected); brain cancer (observed 385 with 378 expected); and leukemia (observed 461 with 438.7

expected). [IDH&W(d)] This comparison is believed to be understating the problem because the counties in northern Idaho have high cancer rates possibly due to Hanford radioactivity.

In 1996 the state narrowed the previous study down to six counties south and east of INL including, Bingham, Bonneville, Butte, Clark, Jefferson, and Madison. The age-adjusted incidence rate for central nervous system cancers in the six country area was 8.1 per 100,000. The rest of Idaho had a rate of 7.0 per 100,000 compared with national rates of 6.7 per 100,000 (SEER) and 6.3 (CBTRUS). The observed number of central nervous system cancers for the six-county area was 110 (89 expected, based on the rest of Idaho). The analysis was then confined to brain cancer (other central nervous system cancers such as chordoma and optic tumors were excluded) 182 were observed when 151 would be statistically expected in the six country area for the years 1975 to 1994. A 1996 analysis of a reported cluster area around the town of Moreland in Bingham county revealed an increased rate of brain cancers, 4 observed with 1 expected between 1980 and 1995. [IDH&W(c)]

In Blaine county, a survey requested by a local physician found that the female population younger than 70 had significantly elevated rates of breast cancer. Epidemiologists are studying the same factors as in the ongoing eastern Idaho brain cancer study. In Clark County, the agency found eight cases of female breast cancer when only 3.2 cases were expected. In Minidoka County, the agency found 20 cases of stomach cancer when only 11.6 were expected. [Jackson]

Allen Benson also offers credible challenges to current dose estimate methodology in his book Hanford Radioactive Fallout. Dr. Benson's continued health research has unearthed an Atomic Energy Commission report titled "Radiation Standards, Including Fallout". This 1962 report focused on bone lesions which were characteristic of radiation exposure. "In summary, in 235 radium-bearing patients radio-graphed of the 264 measured for radium content, minimally significant radiographic lesions were seen with some degree of confidence when the radium level exceeded 0.01 micro curie." [AEC] This finding is significant not only in terms of the AEC's early knowledge of measurable radiation exposure but also that it can be reliably measured through simple X-rays. Dr. Benson is currently developing a new "holistic" approach to dose-reconstruction. Testifying before the INL Health Effects Subcommittee in 1996, Benson offered these recommendations:

"You look at the terrain. You look at the meteorology. You look at when they made their release. And then you go look and see if there is any clusters. What you do then is you bring in integrated science; meteorology...and start testing. You go with gene marking, for example. You choose who are the likely highest dose people, and you gene mark them.... You test the environment, depending upon what the pollutant is...depending if that particular nuclide could have stayed in the area, it can be stockpiled, for example, in trees. So you bio-marker different parts, artifacts in the living system, to see if you can trap the agent that credibly caused the cluster." [IHES(b)]

V. A. Radiation Exposure Standards

Current radiation exposure standards are being challenged by researchers studying the health effects - particularly low-level exposure. Historical standards were set based on Hiroshima bomb victim studies of high-level exposure. These early government studies considered low-level exposure of little significance. Recent studies have found that rather than killing a cell, low-level exposure can damage or mutate the genetic structure of a cell. This damage can, in time, result in a wide range of effects from cancer to multiple generational birth defects.

Karl Z. Morgan, M.D. is the founder of the science of health physics and was Director of the Health Physics Division of the Oak Ridge National Laboratory from 1943 to 1972. Dr. Morgan states that, "the most significant damage from low-level radiation results from the direct interaction of the stream of ions produced by radiation with the nucleus of one of the billions of irradiated cells. The cell may be killed, the radiation may produce no damage, or such damage as is caused may be repaired. But there is a fourth possibility that concerns us: that the cell nucleus may be damaged but the cell survives and multiplies producing over a period of years, a clone of cells that is diagnosed as a malignancy." [Morgan,(a)]

"From 1960 to the present, an overwhelming amount of data has been accumulated that show there is no safe level of exposure and there is no dose of radiation so low that the risk of a malignancy is zero. Therefore, the question is not: Is there a risk from low level exposure? Or, what is a safe level of exposure? The question is: How great is this risk." [Morgan (b)]

In 1990, EPA set the standard to 10 mrem/yr (0.01 rem/yr) effective dose equivalent. Idaho standard for gross beta is 4 mrem/yr. That means the accumulation of all beta-emitters to an individual cannot exceed 4 millirem (mrem) per year. In 1991 EPA released new proposed standards for maximum concentrations of radionuclides in drinking water (40-CFR-141-142) that will greatly increase the allowable limits contrary to the scientific literature. For instance, EPA wants to raise the current limit for tritium from 20,000 pCi/L to 60,000 pCi/L. Tritium contamination is the most common groundwater problem around commercial and DOE reactor facilities.

“Tritium, even in low levels, has been linked to developmental problems, reproductive problems, genetic abnormalities, and other health problems in laboratory animals. Additionally, there is evidence of adverse health effects on populations near facilities which utilize tritium (e.g. Darlington tritium extraction facility in Ontario, Canada). Tritium most commonly enters the environment in gaseous form (T_2) or as a replacement for one of the hydrogen atoms in water (HTO, called tritiated water), instead of ordinary, non-radioactive H_2O). Tritiated water can replace ordinary water in human cells (approximately 70% of the soft tissue in the human body is water). It can also enter fetuses through the placenta due to its similarities to ordinary water. Once in living cells, tritium can replace hydrogen in the organic molecules in the body. Thus, despite tritium’s low radio toxicity in gaseous form and its tendency to pass out of the body rather rapidly as water, its health effects are more severe by its property of being chemically identical to hydrogen.” [IEER(g)]

Dieudonne Mewissen, professor of radiology at the University of Chicago, believes the International Commission for Radiation Protection (ICRP) sets high tritium limits because it is generally assumed that tritium is evenly distributed into body tissues. "In fact", says Mewissen, "tritium becomes predominantly incorporated into DNA thus irradiating selectively the cell nucleus at a relatively high dose rate as a consequence of the cell's very small volume."[Quigg,]

Dr. Mewissen's extensive studies of the long-term (ten-generation) genetic damage to mice caused by tritium exposure make for shocking reading. Researchers at Japan's National Institute of Radiological Sciences and Poland's Central Laboratory for Radiological Protection also document shocking genetic effects from tritium exposure. See Tritium listing in Reference Section. There can be little doubt that the US government's analysis of inconsequential effect from tritium exposure is driven by the fact that they simply cannot control tritium releases. Therefore, standards have been adopted that insure continued operation of nuclear facilities that are not based on the actual health risk to exposed populations.

R. Lowry Dodson, a research scientist at the Lawrence Livermore National Laboratory, reported in 1974, "that chronic low levels of tritium in a range comparable to the [ICRP] Commission's then allowable limits can kill egg cells developing in the ovaries of mice. At levels commonly found in the environment, tritium beta radiation was about three times as destructive to developing egg cell as cobalt-60 gamma rays, an external radiation source widely used in human therapy." [Quigg,]

The current scientific trend is to dramatically reduce the exposure limits. The recent 1990 report by the International Commission of Radiological Protection recommends a reduction of radiation exposure by a factor of five. [Greenpeace(a),] The National Academy of Sciences also released a new report. This BEIR-5 study concludes that the risks have been underestimated. This report further states that the likelihood of getting cancer after being exposed to a low dose of radiation is three to four times higher than that given in the earlier Academy Report.

A British research team (Gardner, et al) studying England’s Sellafield nuclear plant found genetic prenatal damage which resulted in childhood diseases in succeeding generations. "Relative risks for leukemia and non-Hodgkin's lymphoma were higher in children born near Sellafield and in children of fathers employed at the plant, particularly those with high radiation dose readings before their child's conception." [British Medical Journal,vol.300,p.423] Gardner's finding suggests that fathers receiving as little as 1 rem exposure to radiation, (less than six months before conception) may be passing on a mutation to their offspring that increases the offspring's subsequent risk of cancer. Seascale, a village near Sellafield, had 12 times as many childhood cancers as expected. [Quiggley(a)] A dose-response relationship was observed, the association being strongest in the highest paternal dose group. Gardner demonstrated a case/control study that a high proportion of these cancers were linked to father's occupation at the Sellafield plant. [British Medical Journal, 2/90]

A study by Hatch and Susser of Columbia School of Public Health in New York just published in the International Journal of Epidemiology found a positive correlation between background gamma radiation and childhood cancers in census tracts within ten miles of the Three Mile Island Nuclear Facility. For childhood cancers, as a whole, incidence rates relate significantly to background radiation; the association is strongest in children ages 10-14 years. Their data indicate a 50% increase in risk of cancer of children under 15 with every 0.1 mgy increase in estimated annual background gamma ray dose rate. [Quigley(b)]

Inhalation of alpha emitting nuclides poses significant biological risk. Less than one microcurie of plutonium (the size of a grain of pollen) will cause lung cancer and death if inhaled or ingested. "Plutonium (Pu) is an alpha emitter, and no quantity inhaled has been found to be too small to induce lung cancer in animals." [Bertell,p.24] DOE-funded experiments with beagle dogs demonstrate that inhalation of less than one microcurie of Pu-239 oxide result in an incidence of lung cancer approaching 100%. [Parks]

A National Research Council report also has found that cancer risks from low level X-ray and gamma ray radiation are three to four times greater than earlier believed. [AP(b),12/26/89] As research and data are added to the collective scientific understanding of the health effects of low level radiation exposure, regulatory authorities are being asked to reevaluate their standards. Prudence would dictate a sensitivity to this trend in analyzing the impact of INL operations.

"Dr. Karl Morgan, also former head of the International Commission on Radiological Protection (ICRP) who is known as the 'father of health physics', has called the organization he used to run `reckless' for relaxing its standards. `Given that we are beginning to recognize that radiation risks are greater than we used to consider them,' Morgan says. He is now urging both the Environmental Protection Agency (EPA) and the Nuclear Regulatory Commission (NRC) to reject the relaxed allowances." [Statesmen(b)] EPA and NRC adopt the standards set by the ICRP. In December, 1990 the NRC finally revised its thirty-year old standards to one-fifth the exposure level currently allowed, though the regulations will not take effect until 1993. [Tribune(b)]

According to the Nuclear Information and Resource Service, "The commission (NRC) is straining its credibility by adopting an obsolete standard. The new standards reflect recommendations made by leading scientists thirteen years ago." [Tribune(b)] Profiles of all radionuclides of concern, including tritium, must be reassessed to provide additional analyses to ensure the government protects the public health through adequate exposure standards.

Oil, Chemical, and Atomic Workers Union is proposing contract language which requests a 90% reduction of work exposure. "At the present level of 5 rem/year for a work life of forty years, the increase risk for developing cancer is estimated to range from eight times greater than that for the reference "safe industry" according to the Nuclear Regulatory Commission, to 20 times greater by the US Environmental Protection Agency. This risk estimate assumes that in the reference "safe industry" one death per 10,000 workers is acceptable. This accounts only for the cancer risk linked to radiation exposure; it does not reflect the other health and safety risks in the nuclear industry." [OCAW @ I-A] Exposure to non-radioactive carcinogens by DOE contract workers is considered by Union members to be equally as hazardous as radioactive exposures. Additionally, the synergistic (combined) effect of radiation and chemicals is a risk area workers believe the health agencies have overlooked.

The Three Mile Public Health Fund, created and supervised by Federal District Court in Harrisburg, PA announced the results of its study of DOE workers at Hanford, Rocky Flats, and Oak Ridge. Though the court authorized the study in 1987, DOE refused to release the data until 1990 after a protracted court battle which DOE ultimately lost. Dr. Alice Stewart, an internationally recognized epidemiologist, headed up the study. The study confirmed findings reported by Dr. Stewart, George Kneale, and Thomas Mancuso in 1977 which was under contract with DOE. The 1977 Hanford study contract was terminated and all data seized when DOE became aware of the research preliminary findings. It took another 13 years and numerous court orders before the researchers could continue their work.

The research found that workers exposed to very small doses of radiation in the same order of magnitude as background exposure may be at significant increased risk of developing radiogenic cancers. Stewart and Kneale's analysis of Hanford workers showed that there were extra deaths from radiogenic cancers due to occupational exposures. The additional cancer cases were mainly older workers over 40 years at the time of exposure. When exposure reached 26 rems, researchers found an increase of 100% in cancer incidence. Older workers (60 to 65 years) exposed to the same level (26 rem) showed an increase cancer risk 20 times higher than for all workers.

Physicians for Social Responsibility Dead Reckoning, cites INL exposure records acknowledging 154 workers received greater than 5 rem/yr, and 562 received 4 rem to just under 5 rem between 1951 and 1989. This figure includes only prime contractors and does not include subcontractors, construction workers, security guards, or military personnel. [Dead Reckoning@41]

VI. Centers for Disease Control INL Health Studies

A. Health Studies Background

In July 1990, a legal petition drafted by the Environmental Defense Institute (EDI) was filed with U.S. Health and Human Services (HHS) under a provision of the Superfund Act. The petition requested independent INL health studies be conducted by the Centers for Disease Control (CDC). Michael Blain, Ph.D. offered his "Radioecological Effects on Animal and Human Populations Near the Idaho National Engineering Laboratory [Blain] as supportive documentation to the petition. The following organizations were co-petitioners:

American Friends Service Committee, Denver, CO
Citizens for Environmental Quality, St. Maries, ID
Citizens Against Nuclear Weapons & Extermination, Coeur d'Alene, ID
Environmental Defense Institute, Moscow, ID
Focus on Peace and Justice, Burley, ID
Friends of the Earth, Washington, DC
Greater Yellowstone Coalition, Bozeman, MT
Greenpeace USA, Washington, DC
Moscow Chapter, Idaho Conservation League, Moscow, ID
Northern Rockies Chapter Sierra Club, (ID-WA), Hailey, ID
Physicians for Social Responsibility, Washington, DC
Radioactive Waste Campaign, Warnick, NY
SANE/FREEZE: Campaign for Global Security, Washington, DC

Responding to a September 1990 critical report by a peer review panel on DOE's INL Historical Dose Evaluation, then Idaho Governor Cecil Andrus subsequently requested on March 4, 1991 that CDC conduct a dose reconstruction study at INL.

EDI supports CDC's choice to divide the dose reconstruction study into phases and sub-tasks. This is a logical approach that builds on research blocks. INL is an extremely complex site with possibly the most diverse range of operations of any of the DOE sites. Evaluating INL's five operating decades will require equally diverse scientific disciplines.

CDC's INL Dose Reconstruction study was launched in October 1992. Not until January 1995 did CDC establish a formally chartered INL Health Effects Subcommittee (IHES) to give the agency public input into the health research. Unfortunately, CDC appointed individuals to the committee that had a conflict of interest. EDI wrote a letter to David Satcher, Director of CDC, objecting to the appointments to the IHES. EDI found that the inclusion of Mr. Gassell, former director INL Radiological Environmental Science Laboratory and Mr. Horan former INL health physics technician on the IHES do not meet the legal criteria for balanced representation, independence, and freedom from conflict of interest. [45 CFR 11.3] CDC's National Center for Environmental Health's (NCEH) position, as expressed to EDI at various meetings, is that conflict of interest is narrowly defined as direct financial interest. HHS regulation cites Executive Order 11222 which states: "An employee shall not have a direct or indirect financial interest that conflicts substantially, or appears to conflict substantially, with his or her duties as a Federal employee. An employee need not have a financial interest that actually conflicts with his or her duties to violate the prohibition of EO 11222. Any financial interest that could reasonably be viewed as an interest which might compromise the employee's integrity, whether or not this is in fact true, is subject to this prohibition." [45 CFR ss 73.735-802]

EDI's legal consultants believe that a direct financial interest exists with respect to John Horan. He has operated as an employee and as an independent contractor to DOE/ID, and it is reasonable that he will continue to do so in the future. Part of the mission of the IHES will be to assess Mr. Horan's work product. This work product includes his recent INL worker dosimetry study and his environmental safety and health monitoring reports. His direct interest is validating his past assessments since if his work product is found to be inadequate, it will seriously affect his ability to secure future contracts. Additionally, his interest is validating his work product since it will enhance the possibility of future contracts.

Mr. Horan's environmental health and safety monitoring data and reporting spans decades to the Atomic Energy Commission (AEC) era. Mr. Horan was an AEC "expert witness" brought in to defend General Electric (INEL contractor) in the radiation injury suit filed by James Dennis who died of a radiogenic disease caused by exposure during the SL-1 reactor accident cleanup.

The potential for economic loss creates a climate where preferential treatment may be given to DOE and RESL ES&H data and thereby losing the appearance of impartiality of action that will adversely affect public confidence in the integrity of the government's health study research efforts at INL. HHS's regulations state that: "Appropriate safeguards shall be taken to assure that an advisory committee's advise and recommendations will not be inappropriately influenced by special interest, but shall instead be the result of the advisory committee's independent judgment." [45 CFR ss 11.4]

NCEH official's suggestion that the conflict of interest test has been met and if the IHES wishes to impose additional conflict of interest criteria then it is free to do so at its first meeting. CDC is inappropriately relinquishing its legal responsibility in appointing individuals who have a conflict of interest under law. Moreover, CDC cannot allocate responsibility to the IHES when existing regulation would prohibit appointment of certain individuals in the first case. Mr. Horan may have violated disclosure and reporting requirements [45 CFR ss 73.735-901] by failing to inform CDC of his three-year INL worker dosimetry contract with DOE/ID while concurrently he was a member of the CDC's INL Interim Technical Working Group convened to advise CDC on its INL dose reconstruction study. This advisory group was intended to fill a federal advisory committee gap between the initiation of the dose reconstruction study in 1992 and the formation of the FACA chartered IHES in 1995.

CDC Director Satcher chose to ignore EDI's conflict concerns. Mr. Gassell, however, voluntarily removed himself, and CDC replaced him with a Lockheed Martin manager who also has a conflict of interest. Lockheed Martin is the current prime contractor at INL.

VI. B. CDC's INL Phase I Final Report

The Report failed to acknowledge or identify problem areas. An inexperienced reader will question why INL is a Superfund site and why CDC is conducting a multi-million dollar INL Historical Dose-Reconstruction study. The Report's illogical format scatters the individual contaminate sources throughout the document to the point that a reader is unable to gain any comprehensive perspective of any given source facility. The non-sequential format is not even related to contaminate pathways. Notwithstanding the need to merge pathways, there is also a need to merge releases by facility. The Report also failed to describe and analyze facilities through developmental time. Most descriptions characterize current emission systems and waste disposal practices rather than evolutional stages. There must be an effort to differentiate the developmental stages and ramifications on contaminate releases. The drafters of the Report and the agency representatives responsible for quality assurance clearly put aside the scientific method and replaced it with value laden discussions far removed from objective, dispassionate science. This type of quasi-science is all too common and it has earned the federal health agencies research the dubious distinction of "inconclusive by design".

The Report's response to the public's concerns [CDC(c)@xii] is indicative of not only the inadequate applied science but also CDC's disdain for issues brought to the attention of the agency. For instance, "Issue No. 1: Waste Buried at the RWMC" dismisses public concerns related to spent nuclear fuel burial as being only from test reactors (Materials Test Reactor) and not from power reactors. The table titled "Spent Reactor Fuel Dumped at INL" (Section I(E)(1) shows that CDC's claim is not supported by fact. The ninety metric tons of irradiated fuel dumped in the burial ground are hardly insignificant and the table also shows that the Test Reactor Area (location of the Materials Test Reactor) is the least significant contributor to the spent nuclear fuel volumes buried at the RWMC.

The report also trivialized public concerns related to the amount of plutonium buried at the RWMC and failed to quantify the amount using available data. Perhaps CDC does not consider 3,208 pounds (1,455 kg) of plutonium, 1,329 pounds of Americium (603 kg) significant.[ER-BWP-82] But when DOE's own contractor studies show that there is no threshold for internal plutonium exposure that does not cause 100% fatality in test animals [Parks], the public is justifiably concerned. CDC claims that only beta and gamma waste was dumped at the RWMC. [A-22] Similar statements appear at A-21, A-26, and A-30. Perhaps CDC does not know that plutonium, americium, and uranium are alpha emitters. Indeed more than 62,000 cubic meters of Transuranic waste are buried in the Subsurface Disposal Area. [EG&G-M-24884] Transuranic waste is defined as having radionuclides heavier in atomic weight than uranium and in concentrations greater than 100 nano curies per gram.

Characterization in the Report of RWMC Subsurface Disposal Area (SDA) missed the Transuranic Disposal Area within the SDA. Moreover, the Report fails to acknowledge significant volumes of what would be classified Transuranic waste that was dumped (1952-1975) in the SDA's pits and trenches along with low-level waste. The Transuranic Storage Area was added much later (1975), and therefore the Report misrepresents the historic progression and the dumping practices at the site. This is a fundamental point that was specifically emphasized by the Environmental Defense Institute to CDC and Sanford Cohen & Associates at the very beginning of the research project. Namely, each facility must be evaluated chronologically through time because of periodic upgrades and changes to emission control systems. The Report habitually uses current operating procedures and infrastructure to characterize the whole history of the facility.

CDC perpetuates the DOE's propaganda by adopting the Department's descriptions however misleading. "The stated mission of the RWMC is to provide the waste management for the present and future needs of the INL and assigned DOE off-site generators of low-level and Transuranic waste; to retrieve, examine, and certify stored Transuranic waste for ultimate shipment to the DOE WIPP in New Mexico; and to initiate and support research, development and demonstration projects for waste management."[A-20] The words dump, disposal site, radioactive waste internment are nowhere to be found here, thus, making the RWMC sound quite innocuous. CDC perpetuates the myth by characterizing the RWMC as having "good surface drainage and clay sediments to exclude moisture." [A-21] No mention of the fact that the RWMC lies in a flood plain some 40 feet in elevation below the Big Lost River. Flooding of the burial grounds has been a constant problem since the beginning of site development. Dikes were later built but even they were breached on numerous occasions. The dikes now also hold in precipitation so that sump pumps are used to reduce flooding. CDC suggests the U.S. Geological Survey concurred with the site selection, however the historical technical reports show dire warnings against using the site for radioactive waste burial. The Atomic Energy Commission chose to ignore its own experts and proceed with the dump. This decision was made as much because the RWMC site was unusable for anything else because of the flooding problems. Flooding has facilitated the migration of contaminates into the underlying soils and groundwater.

CDC's obsequious description of the RWMC continues. "In the mid-1960's, the Atomic Energy Commission changed waste disposal methods to increase personnel safety and environmental protection. Up to this time, waste containers were stacked to minimize volume occupied. To reduce worker exposure and to reduce risk of accidents during rigging, waste operations specified that waste containers simply be dumped into the open burial pits and trenches. The Atomic Energy Commission subsequently reversed this practice when it recognized the need to minimize burial volume." [A-22] The report fails to mention that change in dumping practices coincided with a labor strike that meant there was not the personnel available to stack waste containers in the trenches. No mention is made of chemical and radionuclide migration 240 feet into underlying ground water, or that all the water faucets at the RWMC have warning signs not to drink the water. Presumably CDC considered the facts potentially disturbing for the reader and chose to provide a calming Report at the cost of science, candor, and credibility.

CERT experiments [2-16] discussed by the Report states "all participants were volunteers," but there is no mention that there was no full disclosure and/or informed consent. The Report also fails to acknowledge that there was no medical follow up to the radiation experiments to determine long-term health impacts on the "volunteers." [CRS(b)]

The Report claims that the Central Facilities Area (CFA) has no significant emissions [3-74] yet DOE documents cite the Health Physics Laboratory at CFA as second on the INL for gamma radiation releases on an aerial monitoring survey. The laundry at CFA is also a high emission area. [ERDA-1536]

Test Reactor Area (TRA) chemical contaminate sample data offered in the Report is 400,000 times lower than data in CERCLA 12/92 Record of Decision (ROD) for TRA Remedial Action. This ROD is a signed cleanup agreement between the State, EPA, and DOE. No mention is made of TRA's radionuclide ground water contamination 176,470 times over EPA's maximum contaminate levels (MCL) in drinking water. The Report only lists 14 radionuclides released at TRA as liquids. Again, the TRA ROD lists 28 nuclides. CDC perpetuates the myth that "The natural absorptive and ion-exchange properties in the soil of the leaching pond were thought to remove most of the radioactive impurities in the pond water." [B-31] With current data available to CDC showing massive migration of chemicals and radionuclides into the groundwater, an objective reader of the Report can only conclude that CDC is deliberately concealing relevant information.

The lack of comprehension of the Report drafters can also be seen in the description of the Idaho Chemical Processing Plant (ICPP). "The plant reprocessed uranium from research reactors and experiments from the US Navy's nuclear propulsion program."[A-1] It is difficult to imagine how CDC could have missed the fact that the ICPP was the final destination of all the Navy warship and training reactors' spent nuclear fuel as well as military and commercial reactor fuel. By volume, INL has 60% of the total DOE (all DOE sites across the country) owned spent nuclear fuel. By fissile mass, INL has 61% of DOE's total.

Feel-good value statements are peppered like saltpeter throughout the report, and emphasize the trivial tone geared to put the reader at ease with the assurance that the INL is a well-run facility. "Strict operational procedures were used from the start of operations at Naval Reactor Facility [NRF] to control the release of radioactive materials".[B-73] Yet the Report is silent on the fact that the NRF is the largest generator (8 million curies) of nuclear waste dumped in the burial grounds. [RWMIS] With such fine management and controls, how on earth did the NRF become a designated Waste Area Group on the INL Superfund site? By not stating problems (errors of omission) the Report authors literally conclude that there are no problems!

The Report's claim that "earthquake activity is absent from this portion of the [Snake River] plain" [A-28] is not supported by DOE's own Quarterly Seismic Reports. [REP-79-061 to 82-004] CDC could not even get the most recent lava flow right (75,000 years) when it occurred within the last 2,000 years. No mention is made of major INL facilities that do no meet seismic structural codes not the least of which is the ICPP's high-level waste tank farm.

CDC's characterization of the LOFT experiments (intentional reactor meltdowns) again misrepresents the program. "Each test or experiment conducted at LOFT was subjected to extensive safety analyses including LOFT Integrated Test System Final Safety Analysis Report, LOFT Technical Specifications, and extensive meteorology of the TAN site." [A-63] With all these controls, CDC leads the reader to believe there were no problems here to be concerned with because of all the safety systems. The Report does not mention the 941,912 curies per year were released out the stack or out of leakage in the containment structure. The last test run of the ten-year testing series alone released more than 8,800 curies. [ERDA-1536]

The Report's characterization of the Naval Reactor Facility (NRF) is equally erroneous. "The NRF then began disposal by pumping radioactive liquids from the S1W and other Radioactive Waste Discharge System tanks to leaching beds. The radioactivity in the water was removed as water percolated into the ground from two infiltration pit areas designated A1W and S1W."..."The leaching beds disposal technique relied on the assumption that radioactive wastes were contained for a sufficient time to render - as their contribution to the regional water table during the waste removal operation - a negligible consequence. This process was affected by ion exchange within alluvial materials or through radioactive decay when radioactive wastes are pooled above sedimentary levels as perched water zones." [B-72] One could only suppose that CDC thinks the radioactive contaminates under the NRF as acknowledged in the CERCLA Record of Decision got there from Soviet nuclear bomb tests.

The preceding comments on CDC's Final Report on the Phase I of the INL Dose Reconstruction study are by no means an exhaustive analysis. The cited areas are only representative of the overall quality of the Report. Clearly, a page by page review of the Report is indicated.

Any member of Congress looking for fat in agency appropriations could readily conclude from CDC's Report that spending additional millions of scarce dollars on this study is not an appropriate use of taxpayer's resources. Since the Report clearly indicates that there is no problem that warrants public concern, we should not be surprised to see funding dry up like a cow pie on a hot southeast Idaho day.

"Inconclusive by Design" is a National Toxics Campaign report that analyzed CDC and the Agency for Toxic Substances and Disease Registry (ATSDR) health studies. This critique of the public health agencies' research demonstrated how they deliberately excluded data from their analysis so that the findings would be inconclusive. The political motivation to add a layer of bureaucratic cover for the polluter - especially when it is another sister agency - has won again.

"Two federal agencies, the Centers for Disease Control (CDC) and the Agency for Toxic Substances and Disease Registry (ATSDR), bear the primary responsibility for safeguarding the nations' environmental health. They are responsible for studying communities exposed to toxic pollution and wastes and making recommendations for public protection. Instead of ensuring a margin of safety and recommending measures to end public exposures to toxins, both of these agencies have routinely funded and conducted studies of efforts of toxic pollution on public health which is inconclusive by design. These intentionally inconclusive studies have been used by polluters and government officials to mislead local citizens into believing that further measures to prevent toxic exposures are unnecessary. In systematically engaging in such practices, the two agencies are violating sound public health policy." [NTCF]

CDC used the Health Effects Subcommittee as a token public participation process. After reviewing the Working Group meeting transcripts it is clear that the agency and its contractor Sanford Cohen & Associates (represented by John Mauro) were told in no uncertain terms that their reporting was inaccurate, misleading, and a rehash of DOE public relations material. And as the transcripts show, Mauro was obliged to state that "we agree". Yet despite this admittance, the Final Report was not corrected. The word science must never be used to describe CDC's Phase I Report unless in conjunction with science-fiction. CDC has again perpetuated its reputation for generating studies that are "inconclusive by design." Or as Ed Martell said, "ignorance is compounded by the sins of omission".

CDC's Phase-I contract with Sanford Cohen and Associates (SC&A) also required them to compile a database of all documents that would be useful in calculating radioactive and chemical doses to the public from site releases. This work product was delivered to CDC in January of 1995. This database is to provide the informational foundation upon which all subsequent phases of the dose-reconstruction study will be built. Consequently, the database is the most crucial part of the whole study. CDC delayed responding for nearly two years to requests from members of its INL Health Effects Subcommittee for copies of the database.

Over the years the Environmental Defense Institute (EDI) has built a modest library of INL operating history documents. Most of these documents were obtained through Freedom of Information Act requests or by making copies of documents in the INL Technical Library in Idaho Falls. These documents have provided the information basis for EDI's Citizens Guide to INL.

EDI after finally receiving a copy of the INL Phase-I database from CDC has conducted a cursory review and finds SC&A's work product wanting. EDI's review consisted of running spot checks to see if selected documents from EDI's library were in the database. The selected documents are of indisputable importance to a credible dose reconstruction study. For instance, the accident reports on the Idaho Chemical Processing Plant (ICPP) criticalities in October 1959, and January 1961 are not in the database. These two criticalities were significant occurrences that resulted in large radioactive releases and dozens of worker exposures. The ICPP RaLa green reactor fuel reprocessing campaigns between 1953 and 1963 released significant amounts of radionuclides to the atmosphere. Dozens of Phillips Petroleum Co. (Operator of the ICPP) reports describing the individual RaLa process runs are not in the database.

Any credible dose reconstruction study must have a thorough understanding of plant emission control systems through evolutionary time. Many documents that review the efficiency of ICPP emission control systems and offer recommendations for system upgrades are not in the database. As we saw from the Hanford Dose Reconstruction study, the emission control system efficiency is a major factor in calculating the release fractions from fuel reprocessing.

Environmental surveillance reports are essential for verifying the calculated source terms. Important documents in this category are missing from the database. Documents relating to the ICPP's Bluenose releases are similarly absent from the database. EDI recently submitted another FOIA request for additional documents related to the Bluenose program - a copy of which was forwarded to CDC.

EDI's library contains a limited number of INL contractor document indexes. Comparing document bibliographies listed in these indexes - documents from their titles suggest a clear relevance to a dose reconstruction study - again, are missing from the Phase-I database. Also, the lack of database indexes on document number suggests that a document specific quality assurance review has never been conducted - besides EDI's cursory review.

EDI lacks the resources and makes no claims to have conducted an exhaustive quality assurance review of the Phase-I database. Only a spot check of selected documents based on a limited knowledge of the site was done. Even at this relatively low level of quality, the database has flunked the test. EDI submitted a list of 122 essential documents that were not found in the database.

EDI renewed its previous demand that CDC convene a quality assurance and control team with adequate resources to conduct a credible review of the Phase-I database. Questions about the adequacy of the Phase-I work have plagued the process and clearly lead to the dismissal of the original contractor, Sanford Cohen and Associates. EDI's legitimate request to have the Phase-I work products peer reviewed have been ignored. Nothing in the current Phase-II task order with Radiological Assessments Corp. mandates a quality assurance review of the Phase-I products let alone the resource allocation to conduct a review. Proceeding on with such uncertainty about the adequacy of the information base is not good science.

EDI's Phase-I quality assurance recommendation is based on four reasons. First, it is part of the National Research Council's Radiation Dose Reconstruction for Epidemiologic Uses report that states the following. "In addition to public participation, other means exist for ensuring the credibility of the study. One of these is through periodic review of the study by scientists who are not engaged in its conduct and have no interest, or appearance of interest, in its outcome." Second, EDI's analysis of the Phase-I final report identified serious inadequacies. Third, only someone with a "Q" security clearance could assess the quality of the Phase-I report, which is beyond the capabilities of the INL Health Effects Subcommittee (IHES) that monitors CDC's research. Fourth, this must be initiated soon because Phase-I provides the informational basis for all subsequent research phases in the dose reconstruction study. Uncertainties about the adequacy of this research foundation component will literally compromise the rest of the work. If inadequacies are found, they must be corrected before proceeding with Phase-II source terms.

In this era of significant Congressional cut backs to CDC on its DOE related health research, EDI advocates that these limited resources be applied solely to document review and source term calculations. A limited window of opportunity exists to access this information that may not exist five or ten years hence. INL documents are being destroyed according to two quarterly contractor reports to CDC. There is simply no incentive on the Department, contractors, or responsible individuals to preserve potentially compromising information.

INL represents orders of magnitude in complexity over relatively simple - single mission production sites - such as Fernald or Rocky Flats. No other site in the DOE complex has had the diversity of nuclear programs as INL. Fifty-two reactors have operated at the site -highest concentration in the world. INL has also had forty-two reactor meltdowns, sixteen of which were accidents and the remaining twenty-six were intentional. Moreover, information on these varied programs is not centralized, but dispersed throughout the country in various government, contractor, and university archives. Accessing the relevant INL information is a monumental task that, if not done correctly and thoroughly, compromises all subsequent work. Contaminate dispersion/pathway modeling and dose calculations can be done at any future time without compromise. Indeed, these methodologies are still in their infancy and are evolving through an arduous trial and error process. Every month, year, and decade that passes, the source term reconstruction process becomes more difficult and problematic. EDI recommends focusing the limited resources on the time sensitive research that will provide a reliable and credible foundation for later dose estimates.

The June 1997 meeting of the INL Health Effects Subcommittee (IHES) generated a consensus recommendation for CDC to convene a quality assurance and control review of its INL Historical Dose Reconstruction Phase-I database and that the reviewers be scientists that are not directly involved in the study, either as participants or as advisors, and that time and resources would be allocated for resolving discrepancies in the results. Quality assurance reviewers must also have appropriate security clearances needed to access classified document holdings. Under intense pressure, CDC reluctantly agreed to initiate the review within the next few months. This represents a significant step in the right direction as to establishing the scientific method to the research project.

VI. C. CDC's INL Health Study Phase-II

The Centers for Disease Control and Prevention (CDC) is moving into Phase-II of its Historical Dose-reconstruction at the Idaho National Environmental Engineering Laboratory (INL). This health study is designed theoretically to quantify what radioactive and chemical contaminates were released from INL and estimate the probable doses to effected populations. Two separate CDC agencies are involved in the research. The National Center for Environmental Health (NCEH) is evaluating off-site impacts and the National Center for Occupational Safety and Health (NIOSH) is studying on-site effects.

To further complicate the issue, NCEH contracts out all the research work to private contractors. The Phase-I contract was awarded to Sanford Cohen Associates and due to questionable work they were not offered the Phase-II contract. NCEH instead turned to Radiological Assessments Corporation who is also conducting studies for NCEH at Department of Energy (DOE) Fernald, Ohio and Savannah River, South Carolina sites.

The Environmental Defense Institute (EDI) has reviewed NCEH's Phase-II work plan presented to Radiological Assessments Corporation. EDI continues to strenuously object to tasking the contractor with: "Reviewing the dose calculations performed by DOE in their Historical Dose Evaluation (HDE), comparing the original documents to the summary information used in the HDE to see if any of the information in the original documents might significantly change the exposures calculated in the HDE". The HDE was peer reviewed in 1990 by a nine member panel headed by John Till. The findings of the peer review were issued in a September 15, 1990 report to Dr. Thomas Gesell, DOE Idaho Operations Office. [Till] The HDE was also extensively reviewed over a two year period by the state sponsored Dose Evaluation Review and Assessment (DERA) Advisory Panel chaired by Dr. Margret von Braun. The findings of the fourteen member panel were released in its final report January 1993. [DERA@80] Both of these review panels recommended that an independent dose reconstruction be conducted by CDC.

" The Panel concludes that the Draft INEL Historical Dose Evaluation does not satisfactorily meet the stated objective. The methodology presented is not sufficiently state of the art nor complete to lend confidence that the dose estimates truly represent upper bounds of exposure. It is likely that if thyroid doses to infants and children had been calculated, they would have exceeded those for adults reported in the study." [RAC@2]

Therefore, it makes no sense now that CDC is well into its INL dose reconstruction study to be doing anything but independent source terms and dose calculations. If DOE wants to compare its calculations with CDC's on their own time and dime that is fine; but reviewing HDE is not CDC's mission here. All review and comparisons of the HDE must be dropped from the task order not only because it is redundant to the work of the other two review panels but also CDC cannot assume accurate analysis of data and accuracy of calculations.

"Future work should include independent collection and verification of data, comparisons between modeled and monitored data, rigorous uncertainty analyses, and a quality assurance program for all data collection and analysis. Doses should be reconstructed for hazardous chemicals and all potential exposure pathways, including groundwater and soil ingestion." [DERA@4]

Is the institutional memory so short that DOE's health studies at other sites like Fernald and Hanford showed only half or a quarter of the radioactive releases ultimately uncovered by independent dose reconstruction studies at those sites. Credibility will only be attached to this research if it utilizes the best available science and that it be completely independent.

Prioritizing the release sites and radionuclides, as mandated in the task order, is perhaps an interesting exercise but if it leads to shortcuts of only conducting source term analysis on the biggest releases then it is unacceptable. The reason for this position is that individually perhaps some sources were relatively small, but collectively and cumulatively, the total may be significant. The public demands that CDC either do the research right or don't do it at all.

Again, the deliverables requiring: "A final report listing the most likely top three sources to the off site public from those sources considered in the HDE", should be completely dropped from the task order as previously explained. Additionally, the task order is not explicit as to the degree to which the various source terms would be identified and what the exact extent of the spectrum of pollutants to be analyzed would be. There is no mention on protocol the contractor is to follow concerning classified information deemed necessary to the research. In view of the ongoing obfuscation by DOE/DOD on this declassification problem, not providing for it in the task order is a significant error. There is no provision in the task order for the physical accumulation of all relevant information into a single publicly accessible archive in Idaho where both CDC and public analysts can conduct their research. The Peer Review Panel recommended that: "Public credibility is strongly enhanced by the availability of these records to permit public repetition of that process." [Till@18] The DERA Panel recommended that: "The public needs to have access to all data and results. We recommend that all relevant classified documents be declassified, and that all documents used in the CDC dose reconstruction be available for public review." [DERA@81,72]

Source terms and dose calculations for the water pathway absolutely must include contaminates in all groundwater not just the aquifer. Specifically, perched water zones must be included. The academic distinction between these two ground waters by CDC is not shared by the general public. This perched water provision is mentioned by the Peer Review Panel. "It would be of interest to include radioactivity that has seeped into the perched water zones as well as the aquifer from the RWMC and any percolation ponds that have been used." [Till @ 19]

The contractor must also be instructed to work collaboratively with NIOSH researchers to ensure that any informational findings relevant to either on-site or off-site research effort must be shared. The need to specifically accommodate resource allocation to this intra-agency exchange cannot be overstated. The capricious division between on-site (NIOSH) and off-site (NCEH) dose research opens a huge crack that workers who have not yet had a medical outcome are going to fall through. The on-site populations closest to the releases and most likely to have been effected have a right to know what they were exposed to even though they are not on the Idaho Tumor Registry yet or happened to be badged or had one of those rare whole body counts at CFA's "copper room". Categories of possible impacted individuals in addition to badged workers are the un-badged construction workers, university biological and environmental monitoring researchers, security guards, bus drivers, Central Facilities maintenance staff, ranchers herding cows and sheep on site. Arbitrarily calculating doses at the fence line and beyond will structurally understate the doses. Screening criteria that excludes short lived isotopes because the site boundary is 20-30 miles from the release point obscures the fact that there were thousands of on-site workers who may have been immersed in the plume as it traveled toward the fence. The DERA Panel recognized this short-coming and recommended the following:

"Because the same models that will be used for the dose reconstruction can be used to estimate doses to workers, we strongly recommend that the proposed future dose reconstruction take advantage of this opportunity to clarify risks to all persons who have worked on the INEL site including military, research, and construction personnel. Omitting these dose estimates would provide an incomplete picture of health risks at the INEL [sic]. Such estimates would also be useful for quantifying risks to members of the public who may have been on the INEL [sic] property during releases." [DERA@79]

Questions about the adequacy of the Phase-I work have plagued the process and may have led to the dismissal of the original contractor, Sanford Cohen and Associates. EDI's legitimate request to have the Phase-I work products peer reviewed have been ignored. Nothing in the current task order mandates a quality assurance review of the Phase-I products. Proceeding on with such uncertainty on the adequacy of the information base is not good science.

EDI's Phase-I peer review recommendation is based on four reasons. First, it is part of the National Research Council's Radiation Dose Reconstruction for Epidemiologic Uses report which states the following.

"In addition to public participation, other means exist for ensuring the credibility of the study. One of these is through periodic review of the study by scientists who are not engaged in its conduct and have no interest, or appearance of interest, in its outcome." [NAS(c)@15]

Second, EDI's analysis of the Phase-I final report suggests serious inadequacies. Third, only someone with a "Q" security clearance could assess the quality of the Phase-I report, which is beyond the capabilities of the IHES Committee. Fourth, this must be initiated soon because Phase-I provides the informational basis for all subsequent research phases in the dose reconstruction study. Uncertainties about the adequacy of this research foundation component will literally compromise the rest of the work. If inadequacies are found, they must be corrected before proceeding with Phase-II source terms.

In this era of significant Congressional cut backs to CDC on its DOE related research, EDI advocates that these limited resources be applied solely to document review and source term calculations. There is a limited window of opportunity to access this information that may not exist five or ten years hence. INL documents are being destroyed. [SC&A@5] There simply is no incentive for the Department, contractors, or responsible individuals to preserve potentially compromising information.

INL represents orders of magnitude in complexity over relatively simple - single mission production sites - such as Fernald or Rocky Flats. No other site in the DOE complex has had the diversity of nuclear programs as INL. Moreover, information on these varied programs is not centralized, but dispersed throughout the country in various government, contractor, and university archives. Accessing the relevant INL information is a monumental task that, if not done correctly and thoroughly, compromises all subsequent work. Contaminate dispersion modeling and dose calculations can be done at any future time without compromise. Indeed, these methodologies are still in their infancy and are evolving through an arduous trial and error process. Every month, year, and decade that passes, the source term reconstruction process becomes more difficult and problematic. Let us focus the limited resources on the time sensitive research that will provide a reliable and credible foundation for later dose estimates.

CDC is in its sixth year of this INL Dose Reconstruction health study. Two agencies within CDC are working on the health study - the National Centers for Environmental Health (NCEH) and the National Institute for Occupational Safety, and Health (NIOSH). Much of the information needed to determine the radioactive releases is classified secret. CDC researchers with security clearances claim they have reviewed the relevant secret documents and prepared a list for the Department of Energy (DOE) to declassify. DOE continues to drag its bureaucratic feet to these public health agency requests for timely declassification.

At a INL Health Effects Subcommittee (IHES) meeting in September 1997, the Environmental Defense Institute's (EDI) representative put a recommendation before the committee that would provide a means by which the committee and independent researchers could determine if CDC was asking for all the relevant secrets.

EDI proposed that the IHES consider a recommendation to DOE that an index of classified documents be generated and made available to the committee and CDC. Such an index would give independent reviewers some means of determining if CDC was requesting declassification of all the information needed to quantify how much radiation was released. Currently, there is no way for IHES or the public to evaluate CDC's work because of the security clearance requirement.

In a remarkable display of unanimity, NCEH and NIOSH together with DOE, and the Navy closed ranks to make a solid front opposing the classified index proposal. Agency arguments opposing the classified index covered a wide range. NIOSH said, “trust us we looked at all the classified documents.” NCEH said, “it would not be useful for a dose reconstruction.” The Navy argued that “it is a waste of tax payer money.” DOE complained that “it will stall the declassification process because reviewers will be bogged down with generating the index.” The majority of the committee was so impressed by this collective agency reasoning that they voted the proposal down. However the Committee did recommend that CDC generate a list of work for others projects conducted at INL.

Since that avenue for transparency was effectively blocked by the public health agencies, the INL Research Bureau (IRB) a coalition sponsored by the Environmental Defense Institute filed a Freedom of Information Act (FOIA) for the index of classified documents. DOE Idaho Operations denied the FOIA request stating that such an index “did not exist.” The IRB appealed the denial to DOE headquarters’ Office of Hearings and Appeals (OH&A) who overruled the Idaho Operations’ denial. OH&A’s ruling was based on the fact that an index did exist and that the Idaho Operations deception about its non-existence constituted a violation of FOIA.. The officials in OH&A deserve considerable credit for standing up to their field office’s position.

In subsequent negotiations with Idaho to comply with the OH&A’s ruling, Carl Robertson, head of INL’s Office of External Affairs, stated that the index would be mailed in a few days. Robertson acknowledged that the reason for the rapid response was because DOE had already sent a copy of the index to CDC during Phase I of the INL Dose Reconstruction Study.

This is a compelling revelation. CDC never disclosed that they had the index and went to the mat trying to kill any attempt by the public to get a copy. Is this a situation where CDC just does not want the public to be able to substantively evaluate the quality of their science; or is the agency an active conspirator in obstruction; or is it both? At the April 1998 IHES meeting, CDC was confronted with their deception and obstruction and admitted that agency did request and receive an index of classified DOE documents during the early part of CDC’s INL Dose Reconstruction Study.

Another example of obstruction occurred in 1994 when CDC stated that after reviewing all the classified documents on Operation Bluenose that they concluded that the secret project did not release any radioactivity to the environment and therefore was not relevant to the INL dose reconstruction study. Unsatisfied with this position, the IRB filed a series of FOIA’s on Operation Bluenose which showed conclusively that there were significant releases. It took CDC four years to finally acknowledge that the Operation Bluenose releases would be included in the dose reconstruction study.

A big part of the problem is money. CDC is loath to admit that additional document searches are needed its Phase-I database is not complete. If a Quality Assurance review finds that another search of the archives will be required, CDC will have to go back to DOE for more money to correct the deficiencies. It’s bad enough having one federal agency (CDC) investigating another (DOE), but it gets even more incestuous, when DOE is paying CDC to reveal its darkest secrets. DOE cut CDC’s budget nearly a third from its earlier meager allocation. The Environmental Defense Institute along with other public interest groups are trying to convince Congress that CDC’s numerous dose reconstruction studies at DOE sites should be funded directly through the U.S. Department of Health and Human Services without and funding from DOE that has a direct conflict of interest.

VII. Making DOE Accountable

A. Epidemiologic Research Activities [by Daryl Kimball]

The involvement of the Department of Energy (DOE) in the supervision of epidemiologic research activities on its workforce and on the health and environmental effects on surrounding communities must end. In its place, an aggressive and coordinated investigatory process to assess weapons complex-related occupational and environmental health effects should be established. This should be accomplished by statute, through a new Congressionally-mandated Radiation and Toxins Health Assessment Office within the Department of Health and Human Services (HHS), superseding the present DOE-HHS Memorandum of Understanding.

The new office should direct, coordinate, and initiate comprehensive occupational and environmental health assessments at weapons complex facilities. It should coordinate ongoing and future efforts with the DOE, other HHS offices and institutes, the Environmental Protection Agency (EPA) and state health departments on all matters of potential public health impacts of these facilities. The goal would be to evaluate the possibility and extent of occupational and off-site health effects, develop health-based occupational and off-site health effects, develop health-based occupational safety and environmental cleanup priorities, and address worker and community health concerns.

A primary task of the new office should be to develop and implement a process for identifying worker and community concerns regarding potential health impacts and to obtain broad and meaningful involvement of independent scientists and the public in the health assessments. Such a process should involve oversight and periodic program review by non-governmental panels of qualified independent scientists and representatives of DOE workers and surrounding communities.

Each epidemiologic project should have direct input from the population being studied- workers and/or residents, including Native American peoples, of nearby communities - at every phase from the planning of research, the dissemination of information about ongoing research activities, and the communication of the study's results.

Complete and unqualified access to DOE and contractor records, and to all other relevant epidemiologic data, must be guaranteed both to HHS and to independent, non-governmental scientific researchers, with no restraint on publication or presentation of findings other than the normal processes of peer review.

Congress should mandate substantially expanded budget for weapons complex-related health research. Substantial additional numbers of highly qualified epidemiologist, and other specialists in occupational and environmental health will be needed to assure competent and adequate study both of the nuclear weapons production workforce, the cleanup workforce, and off-site populations. Adequate funding from the DOE's "050" defense production accounts should be used to support such activities.

How well has the government dealt with its responsibility to investigate the health impact of its nuclear weapons production activities? In our view, both during and after its worst abuses, the DOE has violated the basic principles of unfettered scientific investigation as consistently as it has violated environmental and safety considerations.

While often lacking solid data to support their claims, officials of the Complex asserted that all necessary occupational health and safety precautions were in force, that there rarely, if ever, had been serious accidents or toxic releases to the environment, and that there was no immediate threat to public health.

The credibility of the governments' 40-year record of occurrences that no threats to human health had ever occurred has been severely damaged by revelation in recent years of environmental contamination, mistreatment of "whistle-blowers," and untold health effects suffered by some nuclear weapons workers and off-site populations.

In response to the erosion of the DOE's credibility, former Secretary Watkins appointed a panel to investigate the DOE epidemiology program. The Secretarial Panel for the Evaluation of Epidemiologic Research Activities (SPEERA) held public hearings from September 1989 to March 1990. Among the recommendations contained in its final report, the SPEERA advocated the removal of some epidemiologic functions from DOE control through a Memorandum of Understanding (MOU) between the Secretary of Energy and the Secretary of Health and Human Services. However, our view is that these are positive, but incomplete solutions, and their implementation to date suggests that there is much less progress than meets the eye.

The MOU gives responsibility to HHS for long-range, analytic epidemiology studies, but leaves the DOE responsible for data collection, quality control, descriptive epidemiology and the occupational health surveillance and safety programs to protect workers. Through the MOU, funding for these epidemiologic research activities, even for HHS work, is still the responsibility of DOE. Budgetary discretion always permits control over the scope and direction of research, and in this case, the HHS research effort will be limited by relatively small DOE's annual funding requests.

Negotiations between DOE and HHS dragged on for nine months before the MOU was signed by Watkins and HHS Secretary Louis Sullivan in December 1990. During that time, the DOE was active in direct negotiations with state health departments to commission the same type of studies that were specified as HHS's responsibility under the MOU. DOE funded, state-conducted studies of populations living near DOE weapons plants are now underway in several states. While it is productive to include non-DOE scientists in the epidemiology research effort, it is clear that without coordination and adequate funding and sufficiently independent state-directed research, these efforts may not support the public health policy needs of the populations affected by the weapon's facilities.

DOE recently interpreted the MOU to mean that it has no responsibility for collecting new radiation and worker health data for the analytic studies to be conducted by HHS. The DOE plans to deposit only existing data in the Comprehensive Epidemiologic Data Resource (CEDR). The DOE has indicated that it will not survey its own facilities to prepare an accurate inventory of the types and amounts of data files in its possession to determine what might be useful for epidemiologic research. Without access to the records of exposures and health outcomes of workers in the Complex, and lacking information on the validity and reliability of these basic data, attempts by other scientists at further, more intensive analysis, analysis by different methods, or replication are difficult or impossible.

The DOE-HHS MOU does not resolve the question of which government agency is responsible for the direction and coordination of the full spectrum of health research activities related to the environmental and health consequences of the nuclear weapons complex. As a result of the MOU and other DOE policy initiatives, new research- health surveillance of nuclear weapons production workers, cleanup workers, and off-site populations, as well as descriptive and analytic epidemiology, including dose-reconstruction studies - are currently being conducted by an uncoordinated array of state and federal health agencies. Virtually all funding for this research is dependent on DOE support.

VII. B. The Cost of Secrecy

The cost of secrecy has numerous dimensions. Cleanup of the nuclear weapons complex will cost between 230 and 500 billion dollars.[EMAB] Class-action litigation against the DOE by Downwinders may ultimately rival the cleanup figures. Secrecy made it possible for the government and its contractors to accrue these costs over nearly five decades. Had the truth been told at the time these activities were occurring, public outrage would have made it impossible for their continuation.

Tom Blanton, executive director of the National Security Archive comments that, "even defense contractors who benefit from the reduced accountability that secrecy provides, are complaining about their costs - some $13 billion a year, according to the Aero-space Industries Association - for clearances and information controls mandated in the classification system. But it is the American taxpayer who really foots the bill for secrecy. In 1992 Congress appropriated up to $500 million just to install new locks on the Pentagon's safes." [Blanton] President Clinton, in April 1993, ordered a review of the U.S.'s system of keeping secrets, which could result in the release of millions of government documents. Each year the U.S. government creates between 6 and 7 million new secret documents that the Information Security Oversight Office controls. Tom Blanton proposes the following restructuring of administrative secrecy codes:

- Every secret should have a sunset, an automatic release date no more than 6 years from creation, written on the document by the classifier alongside his or her name - thus establishing accountability.
- The government should only keep secrets when it can show demonstrable harm from openness, and that the harm outweighs the public interest in openness - a balancing test.
- Nothing should be presumptively classified. No document should be exempt from the balancing test, not even the gross inventories of plutonium and highly enriched uranium. The U.S. must fully participate in non-proliferation global accounting of these dangerous materials. Obviously some secrets must be kept, but to paraphrase Lord Acton, absolute secrets corrupt absolutely.
- Order the bulk declassification of broad categories of information, including environmental health and safety data related to DOE sites. An independent review board should take on bulk release of the enormous backlog of Cold War documents, removing declassification decisions from the hands of the originating agencies. The bill Congress passed in 1992 for the John F. Kennedy assassination files provide an excellent precedent.
- Sharply reduce the number of bureaucrats (now about 6,500) empowered to classify documents, and shifting responsibility to the highest levels. Many of these people could be put to work declassifying documents instead.
- Penalize over classification. Currently, only release of classified information carries penalties. Therefore, there is an incentive to over classify new documents, and deny declassification of old documents.
- The security clearance system needs pruning back to ground level, and the addition of due process rights for both cleared and uncleared job applicants. The only way to save on clearance and secrecy costs is to cut back on investigations, on secrets and on secrets-makers.
- Maintain unclassified information in facilities that have unrestricted public access.
- The Freedom of Information Act must be amended to remove the arbitrary agency interpretation of the law that allows agencies to self-determine what information meets the “in the public interest” criteria, and government contractor records must also be subject to FOIA.

Representative John Dingell, (D-Mich.) Chairman of both the House Energy and Commerce Committee and its subcommittee on oversight and investigations, released a report declaring that secrecy causes DOE’s problems. “Widely publicized breakdowns of safety at the governments’ nuclear weapons plants are rooted in a perverse devotion to secrecy and poor management, Congressional investigators said in the report.” ...“The safety problems, which came to light mostly over the past two years, were aggravated by a lack of outside scrutiny and effective oversight from the Energy Department, which pays private companies to run the facilities.”...”The latest blow to the weapons program was struck at the Rocky Flats plutonium fabrication plant, near Boulder, Colorado, where FBI agents swooped in to check out allegations of a cover-up of illegal storage and waste disposal practices.”...“Obsessive secrecy and lack of outside oversight have been hallmarks of the nuclear weapons program since its beginning as the wartime Manhattan Engineering District in the 1940s, Dingell said in a letter accompanying the investigator’s report.”...“The investigators said unchallenged secrecy allowed the Energy Department and its private contractors to neglect a need for improved health and safety programs.”...“This penchant for secrecy and the classified nature of the process of making nuclear weapons contributed to a mindset of emphasizing production at the expense of health and safety.”...“The problems cited in this report indicate a breakdown in the DOE’s entire system to insure compliance with its own policy of producing nuclear weapons without undue risk to its workers and the public at large, the report said.” [AP(j)]

In March 1997, the Commission on Protecting and Reducing Government Secrecy, chaired by Senator Daniel Patrick Moynihan, released a comprehensive report that laid out a new framework for restructuring the culture of secrecy. The following May, legislation was introduced in the Senate and the House of Representatives that reflected the recommendations in the report.

VII. C. GAINING INFORMATION ON LEGACY OF NUCLEAR WEAPONS PRODUCTION

Piercing the veil of secrecy that surrounds the United States Department of Energy's (DOE) nuclear weapons production complex is a formidable challenge. Public interest organizations like the Environmental Defense Institute (EDI) have led the effort to gain information on the DOE's activities at the Idaho National Engineering and Environmental Laboratory (INL) in southeastern Idaho. INL, formerly known as the National Reactor Testing Station, is a DOE nuclear weapon materials production and nuclear reactor testing site which began operations in 1947. Fifty-two reactors have been built at INL, which represents the largest concentration of reactors in the world. Thirteen of these reactors are operating or operable today.

The U.S. Department of Energy (DOE) and its two predecessors, the US Atomic Energy Commission (AEC), and the Energy Research and Development Administration (ERDA), are good examples of how destructive the culture of secrecy can be. The mission of these agencies has been the development, testing and production of nuclear weapons. The absolute secrecy established during the World War II Manhattan Project, which developed the first atomic bomb, continues to the present. This broad veil of secrecy extends to virtually all aspects of nuclear weapons production. Even environmental, health, and safety information is classified despite the fact that this information has no legitimate "national security" value.

Secrecy allowed the federal government and its contractors to produce and test nuclear weapons without outside regulatory oversight. This climate of secrecy and self-regulation further allowed for abuses of everything from the civil rights of "down-winders" to massive unreported environmental contamination. The government's resistance to disclosing information on its past operations is nothing less than a cover-up of these abuses and avoidance of accountability for its actions. Secrecy about radioactive releases to the environment that will be toxic for tens of thousands of years is not justified. This also represents a double standard not applied to corporate America, which for decades has complied with environmental laws.

Public interest organizations which dedicate their efforts to revealing the truth and demanding government accountability are perpetually handicapped by a lack of access to information. It is more the rule than the exception for an organization to spend years battling with an agency over a Freedom of Information Act (FOIA) request. For instance, the Three Mile Island Public Health Fund litigation over release of DOE Hanford, Oak Ridge, and Los Alamos worker exposure records lasted over three years before the DOE was forced by court order to release the information. [TMI]

The U.S. Congress first established the Freedom of Information Act (FOIA) legislation [5 USC ss 552] in 1966 to ensure that the federal government's activities and its records are open and accessible to the public. [Sen.Doc] FOIA established, for the first time in American history, a statutory right of access by any person to federal agency records.

Unfortunately, federal agencies interpreted the exemptions in the original FOIA broadly and employed a variety of means to discourage use of the Act, including high fees, long delays, and claims that they could not find the requested materials. Congress amended FOIA in 1974, 1976, and 1986 in attempts to further define the government's obligations to respond to information requests and to end agency abuses. Each attempt to amend FOIA, however, was met with sufficient conservative Congressional resistance that definitive language is still missing from the Act.

The separation of powers in the U.S. system provides for three branches of government - legislative (Congress), Executive, (President), and Judicial (Supreme Court). Congress legislates laws, the President executes the laws based on his interpretation of the legislation, and the Supreme Court decides if the laws are Constitutional and if the President has executed the laws according to the intent of Congress. With respect to FOIA requests to executive branch agencies, the President exercises his authority through a process called Executive Orders that "... sets out both substantive and procedural criteria for withholding national security information. In order to withhold information under exemption 1 of the FOIA, the government must demonstrate that the information is in fact, properly classified pursuant to both procedural and substantive criteria contained in the Executive Order." [ACLU]

The vague language in FOIA maintains fertile ground for Presidential interpretation. Each President since Lyndon Johnson has issued his respective interpretation of FOIA through Executive Orders. Ronald Reagan and George Bush made government more secretive through Executive Order on National Security Number 12356. [3 CFR 166] This voided President Jimmy Carter's guidelines [3 CFR 190] on releasing classified information, under which agencies were instructed to balance the public interest against any harm to national security that might ensue. Ronald Reagan's Executive Order said that if a bureaucrat believes the release of a classified document might result in any harm, no matter how slight, then the document cannot be disclosed - regardless of the public benefit of disclosure. Ronald Reagan's Order also established what the American Civil Liberties Union calls a "draconian system of classification".

Classified information falls into one of three groups; Restricted Data, Formerly Restricted Data, and National Security Information. Restricted Data is a special category of classified information primarily used by the DOE. The Atomic Energy Act defines Restricted Data as all data concerning (1) design, manufacture, or utilization of atomic weapons; (2) the production of special nuclear material (such as plutonium); or (3) the use of special nuclear material in the production of energy. Formerly Restricted Data relates mainly to the military use of atomic weapons. National Security Information requires protection against unauthorized disclosure for national defense or foreign relations reasons. [DOE/DP-007/1]

Once it is determined that information falls into one of the above three groups, a decision is made about which of the following four levels of protection is needed; Top Secret, Secret, Confidential, Unclassified Restricted. Top Secret is information of utmost importance to national defense and security. Secret is the level for information which in the event of unauthorized disclosure, could be expected to cause serious damage to national security. Confidential is the lowest level of classified information. Unclassified Restricted categories include Unclassified Controlled Nuclear Information, Applied Technology, and Official Use Only. These unclassified restricted information categories were developed by the Reagan Administration to close the information door previously opened by President Carter. The net effect was the reclassification of documents that the Carter Administration had declassified.

In Jimmy Carter's Administration, a bureaucrat could mark a document for automatic declassification after the passage of a specified period of time. The Ronald Reagan Executive Order removed that allowance so that all documents remain classified in perpetuity, or until someone bothers to conduct a declassification review. Since no legal requirement exists for agencies to declassify information or conduct general declassification reviews, it is no wonder little information was released during the Reagan/Bush years. Another means DOE uses to restrict public access is to house unclassified documents in restricted areas that require security clearance for admittance to the archive.

The Environmental Defense Institute anticipated the Department of Energy's (DOE) resistance to releasing documents and granting fee waivers through FOIA by forming a coalition of eleven organizations called the INL Research Bureau. This coalition filed a FOIA request for documents on radioactive / chemical releases to the environment, and documents on accidents which resulted in releases at the Idaho National Engineering Laboratory (INL). DOE effectively blocked the FOIA request by charging $1,227,900 for search/copy costs and denying the fee waiver that is provided under FOIA. [Robertson(a)] On another INL Research Bureau FOIA request, DOE effectively blocked document release by charging $10,400 for INL worker radiation exposure records. [Robertson(c)]

FOIA provides for fee waivers, " 1.) If disclosure of the information is in the public interest because it is likely to contribute significantly to public understanding of the operations or activities of the government, and 2.) If disclosure is not primarily in the commercial interest of the requestor." [10 CFR 1004.9] DOE's fee waiver denial stated: "You [INL Research Bureau] have not shown how release will contribute to a meaningful understanding of government operations or activities." [Robertson(a)]

The only recourse public interest groups have when faced with exorbitant charges and denials of fee waiver, is to take the agency to court. This is a viable option for only a handful of organizations with staff attorneys and substantial resources. Litigation is simply prohibitive for grassroots groups due to the legal and court costs required for long protracted court battles.

Researchers are left with scouring the publicly available literature that includes periodicals, newspapers, university research reports, and reports by other public interest groups. Other useful information sources are agency administrative record repositories, university library government document holdings, Library of Congress, and agency field office public reading rooms. Many times the references given in the public documents offer citations on internal agency documents that can narrow the search or provide lists for document specific FOIA requests.

The Environmental Defense Institute and other public interest groups across the country are advocating for better access through FOIA and for a roll back of the culture of secrecy. President Bill Clinton could issue a new executive order to void the Ronald Reagan-George Bush Executive Orders and once again open the information door on federal agency past and present activities. To his credit, President Clinton instructed "... all Federal departments and agencies to renew their commitments to the Freedom of Information Act, to its underlying principles of government openness, and to its sound administration. This is an appropriate time for all agencies to take a fresh look at their administration of the Act, to reduce backlogs of Freedom of Information Act requests, and to conform agency practice to the new litigation guidance issued by the Attorney General...." [Clinton] Attached to the President's Memorandum is Attorney General Janet Reno's memo that states: "I hereby rescind the Department of Justice's 1981 guidelines for the defense of agency action in Freedom of Information Act litigation. The Department will no longer defend an agency's withholding of information merely because there is a 'substantial legal basis' for doing so. Rather, in determining whether or not to defend a nondisclosure decision, we will apply a presumption of disclosure." DOE Secretary O'Leary responded to President Clinton's non-binding memo by releasing information on "Nuclear Guinea Pigs" and nuclear bomb tests. [ACHRE]

Fundamental change, however, in the business of secrecy is yet to emerge from the Clinton White House. A new executive order is needed to substantially restrict what information can be classified and require a ten-year sunset clause for automatic declassification on the document's cover. Congressional action is also needed to remove the vague language in FOIA, and ensure that future administrations will not have broad interpretation powers on FOIA requests.

The Centers for Disease Control and Prevention (CDC) have reluctantly jointed the ranks of nuclear secrets requesters. In 1992, CDC initiated a full scale Dose Reconstruction Health Study of the affected populations around the Idaho National Engineering Laboratory (INL). After four years of negotiations with DOE and the Defense Department (DOD), CDC is still waiting declassification review of over 1200 INL documents needed in their research. The primary obstacle is the Navy which claims jurisdiction over DOE documents that deal with Nuclear Navy activities at INL. CDC's researchers report: "The time schedule for the declassification effort set by DOE/ID has continually slipped to the point where the project may be affected and the documents not available until after the project contract date has passed. We requested support from the CDC to determine if the schedule can be improved on to facilitate project closure. Presently, we have no estimate when the documents sent to NRF [Naval Reactor Facility] and DOE-Headquarters may be ready for review." [SC&A] "It seems that there may be other [DOE/DOD] priorities for declassification and that this project's declassification effort may be delayed. Such a delay will result in the documents not being entered into the database by the end of the contract period." [SC&A]

Access to classified information is not the only concern of independent and public health researchers who are trying to uncover the truth. The systematic destruction of 65,000 boxes of INL documents out of a total of 100,000 boxes generated since 1951 is a significant concern for researchers. [SC&A(b)] Only after considerable pressure was exerted by the Environmental Defense Institute, did CDC demand that DOE place a moratorium on further destruction of documents. [Chew]

Secrecy is the antithesis of openness and therefore a constant challenge to the democratic process. Every major abuse of power has been conducted in a climate of secrecy. The history of American government chronicles the ongoing struggle between the public's right to know and the government's resistance to full disclosure. The price of secrecy is not just political. According to the Department of Defense contractor's Aero-space Industries Association, $13 billion a year is paid out in tax dollars for security clearances and information controls mandated in the current classification system. [Blanton] The culture of secrecy and non-accountability also contributed to miss-management of radioactive wastes. This inevitably led to extensive environmental contamination and the $500 billion Superfund cleanup of the DOE complex.

Flagrant disregard for populations living in the shadow of nuclear facilities has also resulted in massive tort litigation against DOE's operating contractors. DOE reimburses over $30 million annually for legal fees to outside council retained by its contractors, largely in defense of actions brought by third parties. [DOE(a)] The Hanford Downwinder class action suit is scheduled to go to court in 1998. Tax payers for example, paid $39 million in legal fees to defend DOE's Hanford contractors against "Downwinder" tort claims between 1990 and 1992. [AP(l)] Settling tort claims may end up as big a bill as cleanup of the DOE's nuclear complex. For instance, DOE paid out $73 million in compensation to Fernald (a DOE facility in Ohio) residents for environmental damage.

When citizens have information on their government's activities, they have power to make informed decisions on public policy. When governments withhold information from the public, citizen power is proportionally diminished. The citizen taxpayer is always left with the bill. Democracy's survival depends on openness to information on all government activities.

VII. D. Transportation of Nuclear Waste

Emergency Response Teams with adequate training and equipment are not adequate because the 23 states affected by radioactive waste traffic are unable to generate adequate hazardous materials permit fees to provide funding for appropriate enforcement or emergency response services for existing non-DOE transportation accidents. DOE subsidies are only offered to a couple of the 23 states. The state of Idaho alone saw a 70% increase in hazardous materials accidents in recent years. [Tribune(a)]

The emergency training that has been provided first responders (police, fire, and medical personnel) does not provide the depth necessary to address existing hazardous materials on the rails and roads much less radioactive hazards. Moreover, the federal government does not provide equipment needed nor the funding to provide the necessary equipment for emergency responders. Most emergency response personnel will not have equipment necessary to clean up an accident scene.

6.2 million cubic feet of Transuranic waste currently being stored at 10 different DOE facilities is scheduled to be shipped to the Waste Isolation Pilot Project (WIPP) in southern New Mexico over the next 20 years. DOE currently plans to ship all wastes by truck, with a total of 34,000 shipments. On the route through Colorado, there would be up to 990 shipments per year.

The container that DOE intends to use for shipping Transuranic waste to WIPP, is called the TRUPACT-II. DOE has completed full scale fire, drop and immersion accident tests on a prototype but not on actual production TRUPACTs. According to the SW Research and Information Center which has followed the cask certification issue closely, the prototypes used in the tests are different from the actual casks that will be used for waste shipment. "Among the differences are important containment features - the "O" ring seals, the Z-rings for fires, and the vent ports. Thus, in significant respects the tests may not show whether or not the actual TRUPACTs will meet regulatory standards, which are intended to limit releases of radioactivity, especially in case of accidents. In many of the prototype tests, the container will not be pressurized to actual shipping conditions. Since the stresses on the container and the leakage potential can increase substantially with pressurization, tests with un-pressurized containers will not replicate actual shipping conditions." [Hancock, SWRIC]

Nonetheless, in August 1989, DOE obtained from the Nuclear Regulatory Commission (NRC) certification for TRUPACT-II. Because the 15 production TRUPACTs constructed to date have not met the design specifications of that certification, as a practical matter, DOE still does not have a usable shipping container. To assess radiologic and non-radiologic risks associated with the transport of nuclear waste by truck, DOE has long used a computer model entitled RADTRAN, even though a RADTRAN analysis does not accurately inform the public about the risks associated with nuclear waste shipping.

* The probability of a radiation release from a TRUPACT- II accident is relatively low. By calculating the potential damage of a catastrophic accident only after multiplying by its low probability of occurring, RADTRAN masks the consequences of such an accident. For example, the Exxon Valdez had only one accident in 28,000 shipments (or an average spill of 400 gal./shipment) over 15 years. This sounds like a great safety record, but was it really?
* Based on density, RADTRAN divides the world into three levels of population along the shipping corridor -- urban, suburban and rural. Because anything less than the urban threshold density qualifies as suburban only two miles of the 874 mile route between Rocky Flats and WIPP qualify as urban.
* Because the effects of human error on a probabilistic risk assessment like RADTRAN are so hard to predict, DOE assumes that human error, whether in the manufacture, maintenance of operation of the TRUPACT-II, will not change the outcome, so, human error accounts for zero.

DOE's own calculations show that fewer fatalities and less of a radiation release would result were DOE to maximize shipments by rail. Yet, DOE intends to send all WIPP shipments by truck because it would have more "control."

DOE's maximum credible transport accident assumes a release of only 0.02% of the radiologic contents of a TRUPACT. There is no citation in the WIPP Supplemental Environmental Impact Statement (SEIS) to support this assumption. DOE also makes favorable assumptions about the response time and effectiveness of emergency management that are inconsistent with past occurrences. DOE awarded the first five year contract for WIPP shipments to a firm that has never hauled hazardous materials commercially.

DOE estimates that 20% of the waste bound for the high level waste repository that DOE wants to build under Yucca Mountain in Nevada will come from the nuclear weapons complex. At present, DOE does not have a container for its transport and has essentially no plans for shipping these wastes. DOE does, however, hope to vitrify most of the high-level wastes, generated and stored primarily at Hanford and Savannah River, prior to shipping and emplacement. INL has a calcine process for its high level waste that is stored in silos on site. Most of the issues regarding transport of these wastes are the same as for Transuranic waste. DOE will use RADTRAN, with all of its flaws; they will resist state and local regulation of shipments, they will not provide adequate emergency response training, etc. On the other hand, they have conceded that rail shipments to Yucca Mt. may be safer and intend to use train transport. In 1996, the results from the District Courts reviewing state and city nuclear materials transport regulations have been mixed. One court struck down the Oakland Nuclear Free Zone ordinance; another upheld Colorado's waste transport regulations. Meanwhile, Congress has yet to pass a reauthorized Hazardous Materials Transportation Act that would define tribal, local and state authority over transport of nuclear and hazardous materials.

"If even one percent of the contents of an irradiated fuel cask were to escape in respirable form in an urban area, according to the latest and most authoritative federal health effects studies, thousands of latent cancer fatalities could result, as well as $2 billion in decontamination costs." [Alvarez,(b)6/21/85] The DOE's actions suggest a mistaken view that nuclear transport safety is not a serious issue. Should DOE be allowed to oversee the next generation of cask design, testing and handling, as delegated under present policy? Cask certification powers should be removed from DOE and vested in the NRC to avoid repetition of these dangerous events.

Accident scenarios in the WIPP Supplemental Environmental Impact Statement (SEIS) outlining the worst case or "bounding case" uses average TRU waste from Rocky Flats. However, the average TRU shipment from Rocky Flats is not representative of the average radioactivity of shipments from other major sites. For instance Hanford shipments contain more than 4 times as much radioactivity, Oak Ridge shipments contain more than 2.5 times as much radioactivity, and Savannah River contains more than 12 times as much radioactivity. [SEIS,p.B-9]

VIII. Protection of Radiation Victims

Empty Promises

The DOE promises to run its nuclear weapons production facilities safely. They promise that new projects planned for INL will not affect the health and safety of the general public and facility workers will be protected.

The truth of the matter is that the federal government established the Atomic Energy Act which exempts them from any liability due to injuries sustained by their nuclear weapons production and testing. The Price-Anderson Amendments Act of 1988 was signed into law to continue indemnification to DOE contractors. This legislation goes on to limit contractors working for DOE from liability even if injuries are caused by gross negligence or failure to follow safety regulations. The law "... subjects DOE contractors to potential civil penalties for violations of DOE rules, regulations, and compliance orders relating to nuclear safety requirements. Reduction of up to 50% of a base civil penalty may be given when a DOE contractor promptly identifies a violation and reports it to DOE. Additionally, the Enforcement Policy gives DOE discretion to not issue a Notice of Violation in certain cases." [Operating Experience] An example of how this system failed is when DOE tried to discipline Rocky Flats contractor Rockwell International for violations. Rockwell received a light slap on the wrist amounting to their bonus for the year because they could prove that DOE as the employer knew about the violations for decades.

Witness the 10th U.S. Circuit Court of Appeals decision to overturn US District Judge Bruce Jenkins' finding in 1984 that the government negligently failed to warn or educate downwind residents of radiation hazards from tests conducted by the Atomic Energy Commission at the Nevada Test Site from 1951 to 1962. Jenkins' earlier ruling came after a trial of 24 "bellwether" claims which represented nearly 1,200 plaintiffs suing the government for some 500 deaths and injuries. The U.S. Supreme Court subsequently refused to hear an appeal on the 10th Circuit Court decision because the Atomic Energy Act provides government-contractor exemption from liability. Congress has steadfastly refused to repeal the Atomic Energy Act, however, they recently awarded some limited compensation to Nevada Test Site Downwinders.

There was no question that the government was negligent in conducting the tests and that it gave false and misleading information at the trials. The legal bottom line is that Congress created laws that specifically exempt the government and any contractors who work for the government from liability.

Radiation victims from INL can find no compensation for their injuries. [Cawley] Not only can they not sue the government or the contractors for whom they worked, but Idaho law does not recognize long term radiation injuries. Typically it takes 10-20 years for radiation related injuries to surface after exposure. Again the legal bottom line exempts even the state Workman Compensation Commission from covering long term radiation injuries.

Sweetheart contracts between AEC/DOE and the state Workmen Compensation Commissions provided for: "Hiring of the state's claims administrator in the Tri-Cities [Hanford] was subject to approval by the Atomic Energy Commission (now DOE). That language is still in the current contract. From the beginning of the contract until today, state officials agreed to accept censored and deleted files on workers radiation injuries. The (Labor and Industries) Department will accept the Contractor's description of any accident, even though full details may not be given. This procedure is necessary in order to ensure against the possibility of disclosure of secret information." [Spokesman(e)]

"In 1984, the Ninth Circuit Court of Appeals in San Francisco ruled the workers could sue because the Nevada contract with DOE nullified the integrity of the state's industrial insurance system." [Ibid] The New York Times states, "The DOE has routinely awarded millions of dollars in performance bonuses over the last decade to contractors that run nuclear weapons factories racked by safety, health, and environmental deficiencies according to Government Accounting Office records." [Schneider] INL contractors were awarded $7.3 million in bonuses for 1993, $14.36 million in 1995. [AP(d),1/4/96]

Promises made by the Department of Energy must consequently be viewed as hollow promises. Individuals or communities have no legal standing in court. Safety would by definition have a low priority because there is no accountability.

The author interviewed Michael Cawley who worked at INL between 1955 and 1974 as a machinist. Mr. Cawley was diagnosed as having extensive pulmonary and pleural fibrotic disease that is an incurable and life threatening lung disease. Court documents support his allegation that he was exposed to radiation many times over the course of his eighteen years of employment at INL. This included unprotected exposure to beryllium. Dr. William R. Berry and Dr. Grady at the Boulder, Colorado Medical Center both substantiate Mr. Cawley's contention that his lung disease was caused by radiation exposure while working at INL. [Cawley, 1988] “In 1966 Cawley was exposed to a significant amount of radioactive material. Having passed through a storage area, he was informed by a health physicist that the area was contaminated. He was instructed to remove his clothing and take a shower. The health physicists discovered that Cawley had radioactive particles lodged in his nose, which the health physicist attempted to remove through the use of a small brush.” [Cawley© @2] Cawley’s notice of injury and claim for benefits was filed with the Idaho Industrial Commission [Workman’s Compensation] June 29, 1979. The State Commission would not even give Cawley a hearing on the merits until 1990 when the Idaho Supreme Court ordered the State to respond and pay Cawley $983.23 for legal costs. [Ibid] The benefits the State tried to deny Cawley totaled $207,900.56. [Cawley(d)] Cawley’s legal documents list the following exposures: 1) Fast Neutron beam exposed from the Materials Test Reactor Neutron Chopper in 1956; 2) Plugged pneumatic radioactive material (W.A.P.D. B.4 sample) transfer tube requiring MTR evacuation; 3) MTR July 1966 storage area exposure; 4) SL-I reactor explosion January 1961; 5) J.A.-10 Fuel element loading at the ETR canal. [Cawley(e)]

The author interviewed Richard Hansen who lives near Rupert, Idaho (Minidoka county) southwest of INL, in an area characterized as "Cancer Ridge" by the local residents and media. [AP(I), 2/18/89] Rupert residents are the first domestic users of the Snake River Aquifer down-gradient of INL. Hansen says that within the 36- square mile area around his home, there are 60 cancers. These diseases range from thyroid, pancreas, colon, leukemia, and female reproductive cancers. Hansen, a staff researcher in archaeology with the University of California at Los Angles and a Rupert farmer, is asking for scientific studies to determine whether the cancer rate is excessive. Hot-spot phenomenon is discussed Allan Benson’s book “Hanford Radioactive Fallout”. [Benson, p.28 & 36] In 1997, State health studies of cancer rates in Minidoka county found that there is elevated levels of seven types of cancers when the county incident rates (observed) were compared with the state as a whole (expected). This comparison likely understates the problem because the Idaho counties in the north have high cancer rates likely due to Hanford radioactivity. Also see Section V Independent health studies.

Cancers in Minidoka County

Cancer Site/Type	Observed	Expected
Parotid/Salivary	4	3.6
Stomach	37	22.09
Rectosigmoid/Rectum	48	43.82
Bone	4	2.79
Ovary	30	29.2
Brain/CNS	28	21.47
Liver	6	3.82

[IDH&W(d)]

As previously stated, Physicians for Social Responsibility's Dead Reckoning report, cites INL exposure records acknowledging 154 workers received greater than 5 rem/yr, and 562 received 4 rem to just under 5 rem between 1951 and 1989. This figure includes only prime contractors and does not include subcontractors, construction workers, security guards, or military personnel. [Dead Reckoning@41]

An example of non-monitored subcontract workers is Kenneth Grover who worked as a night security guard at INL between 1956 and 1959. The author interviewed Grover's daughter who clearly remembers that her father was irradiated during an accident at the site. As a result of his exposure and induced radiation sickness, he was forced to take a three month medical leave from work. Kenneth Grover died a few years later after suffering from cancer and heart disease. The Grover's lived in Monteview, Idaho, just east of the site. Three of Grover's children have thyroid dysfunction problems and one daughter has periodic hair loss, both are symptoms of radiation exposure. A partial listing of 100+ INL accidents and intentional radioactive releases between 1952 and 1995 is provided in attached Appendix.

Clair Burket moved his wife and four old daughter Mary to Idaho Falls in 1958 to work on the Aircraft Nuclear Propulsion Project (ANP) at INL's Test Area North. General Electric was the operating contractor for both the ANP as well as the SL-1 Reactor accident cleanup at the Auxiliary Reactor Area. When the SL-I blew up in 1961, Burket along with other ANP workers were called down to the SL-1 site to extract the three dead bodies and cleanup the contamination. Clair Burket died several years later of a massive brain hemorrhage at the age of 33 and his family believes his premature death was the result of exposure to radiation at the site. Mary attributes her thyroid problems to exposure as an infant to iodine-131 releases from the site. Mary's attempts through Freedom of Information Act requests to access her father's dosimetry records have thus far been denied on the grounds that DOE claims not to have any of Burket's exposure records. Even though the National Institute for Occupational Safety and Health is doing an INL worker mortality study, the agency is uncooperative in assisting in Mary's quest for her father's records.

The author interviewed Jean Dennis, the widow of James Dennis, who was a member of the SL-1 involuntary Army demolition crew brought in by General Electric under contract with AEC to dismantle the reactor after it blew up in January 1991. The 38 eight by ten photographs taken by the AEC and submitted as evidence in Dennis' litigation against General Electric, shows Dennis right beside the damaged reactor core placing the explosive charges on the support beams that held up the 80 ton concrete and lead operating room floor above the reactor vessel. The photos also show the two huge clouds of debris that went into the air when the two separate charges went off, covering Dennis, his partner Arthur Limeruk, and spreading the residual contaminates over a large area. Dennis died of a rare blood cancer called Waldenstrom's micro globulin anemia (blood & bone marrow cancer), which his medical documents confirm, was caused by exposure to 50 rem/hr for nine hours and ten minutes at the SL-1 site. [Dennis ,p.10] Dennis' documents further challenge the government's acknowledged exposure of whole body - 2135 mrem, and skin - 3845 mrem [Dennis citing AEC/SL-1,CAB] as grossly understated. Dennis claimed he received internal exposure because of the contamination in his nose. GE's health physics technicians however made no attempt to swab out his nose to remove the contamination or provide chelates to flush out the contaminates. Dr. Charles Miller M.C., hematologist / oncologist, chief of Medical Services at Letterman Army Medical Center and Dennis' internal physician, supports the allegation that Dennis' cancer was caused by exposure to radiation. [Dennis ,p.17] The government refused to grant Dennis any compensation for his radiation exposure injuries that caused his early death. The US Justice Department defended General Electric John Horan, an INL health physics technician, was an expert witness brought in by the Atomic Energy Commission to refute Dennis' claims to radiation induced injuries. Horan was also in charge of the Health Physics Department at the site and in charge of worker monitoring of the SL-1 cleanup workers. See Section I Accident History.

Time ran out for self-described INL Downwinder Chuck Walker who died at the age of 44 from chronic myelogenous leukemia - the rarest form of all leukemia. Walker's testimony to the State Oversight Committee and recorded by Idaho State Journal reporter Mary Duan stated that:

"As a young boy in Jefferson county near the border of the INL he remembers an explosion in the late 1950's that lit up the night sky from his home in Dubois. He remembers smoke pouring from stacks at the then Atomic Energy Commission site, and government workers running frantically at a monitoring station a mile away from his family's farm."..."I've spent hours and hours going over my health history with doctors from the

University of Utah and the Fred Hutchinson Cancer Institute," he said. "They say that I must have gotten a good-sized dose of radiation at one time or another. The first time they identified this kind of cancer was after Hiroshima and Nagasaki."..."I don't understand why the department is not looking at Jefferson County. It's closer to the site than any other", Walker told the committee. "If the doctors are right in telling me that the only place I could have gotten this from is the site, what will the oversight committee do to make sure they don't get away with this again." [Id St Journal(b)]

Between 1989 and 1992, over $39 million of taxpayer money has been spent defending DOE Hanford contractors against radiation victims. A class-action suit has been filed by thousands of Hanford's Downwinders against DOE's contractors for health and environmental damage. Documents gained through the Freedom of Information Act by the Seattle Times revealed that DOE is paying all the contractor's legal expenses - $15 million for 1992 alone.

Judith Jurji, President of the Hanford Downwinders Coalition says that, "what we have here is taxpayer money going to fight its own people, which is the ultimate slap in the face." Contractors being defended by DOE are Du Pont, UNC Nuclear Industries, Atlantic Richfield Hanford Co., General Electric, Rockwell, and Westinghouse. Jurji believes the trial will bring everything out in the light of day, in a public forum, and the government would have to answer some very tough questions.

Other cases against DOE contractors operating the Nevada Test Site and the Fernald nuclear weapons plant in Ohio have been settled. Fernald residents received $73 million in compensation for environmental damage. It is unconscionable that the federal government has turned against its own people and sided with its big business contractors. The government simply does not own up to its responsibility to compensate people injured by its nuclear bomb factories. Instead of fighting the people and wasting collectively hundreds of millions on legal defense of the criminals, the responsible thing to do is use the money to help those injured.

"Inadequate oversight at the DOE allowed some of the nations' largest law firms to bill the government excessively, including steep photo copying fees in a Hanford case and expensive dinners in Seattle, investigators say. The lawyers, doing work defending DOE contractors against class-action suits, claimed $70 million in legal bills for six lawsuits since 1990, the DOE estimates. About $29 million of that was spent in a case involving the Hanford nuclear reservation in Richland, Wash., including $175,000 in copying fees at 20 to 25 cents a page. Investigators for the General Accounting Office told Congress on July 13, 1994 that DOE officials often did not receive copies of the bills and rarely reviewed the legal costs. 'This was the standard way for the DOE - turning an operation over to a contractor and just paying the bill.' Victor S. Rezendes of the GAO told the House Energy and Commerce subcommittee on oversight and investigation. 'The agency does not know the full costs associated with defending its contractors in litigation, does not have criteria setting forth what costs are allowable for legal services and does not have procedures requiring detailed contractor and DOE review of billed costs', he said." [AP(m)]

The Congressional Office of Technology Assessment (OTA) released a report in April 1993 that cites that DOE is unprepared to protect tens of thousands of workers who would soon embark on a 30-year cleanup of the DOE complex. OTA's 80-page report said that protection of workers in environmental restoration projects of any kind was often inadequate, but that the DOE, because of the way it is organized, might do worse than private polluters in cleanup. DOE and its contractors continue to operate under an organizational structure that presents serious obstacles to progress in safeguarding worker health and safety, the report said. [Times ©]

IX.A. Appendix

Partial Listing of INL Accidents/Unusual Occurrences (1952-97) [DOB & OE]

1952

June 6; EBR-1 pyrophoric sodium coolant leaks from reactor causing fire;

1953

April 15; EBR-1 reactor fuel element melts down [ANL-5577];

***1954 ***

January; Materials Test Reactor (MTR) fuel cladding melted that released beta and gamma activity into the coolant process water in excess of 40,000 dps/ml [disintegrations per second/ milli-liter]. Workers were exposed to "activities as high as five to seven roentgens per hour inside the MTR tank where it is necessary to work in order to change a number of experiments." [Peaceful Uses of Atomic Energy, 8/55]

June; MTR reactor fuel rod plate melting;

July 22; BORAX-I reactor was intentionally put into an "excursion" which melted the fuel rods. An explosion resulted spreading fuel and contaminated coolant in a 350 ft. radius around the reactor building. The contaminated soil was just covered up with gravel. 720 Ci released in a cloud that was visible for 3 miles downwind before dissipating. The contaminated soil was covered up with gravel. [ERDA-1536 @ C-3] [DOE/ID-12119 @A187]

July; ICPP released 51 uCi (51 x 10^6 pCi) of long-lived fission product accidentally in one discharge 244,000 gal. to the waste injection well. [ERDA @C-3]

***1955 ***

January 10; ICPP emissions resulting in air contamination at INL;

June 18; Navel Reactor S1W was in excersioned resulting in fuel melting and 310 Ci radioactivity released;

July 27; Accident - worker contaminated with radioactivity.

November 29; ERB-I reactor had an accidental "excursion" which melted 50% of the fuel rods and resulted in contamination of the building from released long-lived fission products. 10 grams of Pu and 52 kilograms of U-235 in fuel.

November 24; Electrician exposed to 450 mR/hr during ICPP RaLa Run No. 1 [PTR-185];

***1956 ***

February 22; Radioactive emissions from release of 46,134 Ci airborne radioactivity from IET nuclear engine test #3;

March 24; Transportation Accident - carload of uranium scrap derailed and scattered;

June ; IET Test #4(B&C) releases 1.9 million Ci;

July 23; Workers exposed to gamma rays at Materials Test Reactor;

August 1956, the ICPP accidentally released 1 Ci of long-lived fission products to the injection well discharging to the aquifer.

November; Electrician exposed to 450 mR/hr in ICPP centrifuge [PTR-185];

December 6; ICPP RaLa Run No.3 Shipping pot released air-borne activity into PM area

December ; IET Test #6 releases 8,953 Ci;

***1957 ***

March; Materials Test Reactor fuel element damaged during an excursion.

March 20; Fuel Element Burn Tests (A)(B) involved Reactor fuel rods being burned in open air pits releases 78.3 Ci;

September; IET test #8 releases 2,152 Ci;

***1958 ***

February 10; ICPP Workers exposed to C0-60 & I-131 during RaLa run accident releasing high levels radiation into building for 5 minutes and releasing one million pico curies of iodine-131;

February; IET test #10 releases 1.65 million Ci;

March 11-27; BORAX-IV was intentionally excursioned into a meltdown, resulting in long-lived fission products leaking from the fuel and high radiation and building contamination. Cesium-138 was dominating release and a dose at 500 feet was 12 mR/hr.

March; Accidental release of 1 Curie of I-(131) to atmosphere at ICPP during waste transfer.

April; IET test # 11 releases 4,635 Ci;

May; IET test # 12 releases 29,070 Ci;

May 28; RaLa run at ICPP releases 49.5 curies iodine-131. Thirteen RaLa runs occurred in 1958.

June; OMRE reactor accident - coolant released to atmosphere.

July; Fission Products Field Release Tests (FPFRT) through September (9 tests) involved open air melting of reactor fuel to observe radiation dispersion. 1,334.36 Ci released;

July; Between July and August, ICPP released particulate fallout to the north-east. Maximum dose from a single particle was 25 mrads inhalation and 17 mrads ingestion using Ce-141 as the most hazardous isotope. Part of the release source was solvent process building near the ICPP stack that was venting directly to the atmosphere, however the major source could not be determined.

August; ICPP blower failure caused 10 uCi (10,000,000 pCi) long-lived fission product release to air.

September; ICPP Solvent Burner failure released .25 Ci of long-lived particulate fission product to atmosphere;

October 29; ICPP filter failure released 1,200 Ci long-lived fission particles to atmosphere from fuel element cutting facility resulting in contaminating 200 Acres around ICPP;

November 18; IET test #13 released 9,730 Ci green fission product contaminating 1500 acres south of IET. Ground contamination four hours after release was two micro curies per square foot (two million pico curies) at a distance of 2.5 miles. Primary activity was iodine-131.

November; ICPP pump leak spilled 1000 R/hr waste water (100 curies long-lived fission product) on floor of process building that was later moped up and dumped at RWMC;

December; ICPP waste collection tank released 1 Ci radioactive noble gas and Iodine to the atmosphere caused by a leaking flange;

December 9; ICPP liquid waste release (ten times allowable amount) of 29 Ci including 7 Ci Strontium-90;

***1959 ***

March 3; ICPP Accident - fission release to waste tank vault;

April; ICPP spill in fuel process building of 100 Ci;

May; IET test # 14 released 13,456 Ci;

June; IET test # 15A released 1,954.98 Ci;

June; IET test # 15B released 1,223.36 Ci;

July 9; ICPP released 105 mCi (.105 Ci) of plutonium to the atmosphere. The release was the result of burning plutonium contaminated waste solvent.

September; ICPP accidental leak in NaK heat exchanger;

October; ICPP high-level waste tank service line leaked;

October; Materials Test Reactor released of long-lived fission product gasses;

October; IET test # 16 released 294.42 Ci;

October 10; ICPP accidental release of SR-91 and Ba-139 to atmosphere;

October 16; Criticality accident at ICPP vessel WH-100 released 4E+19 fissions of U-235 (350,000 Curies) 21 workers exposed - some at 50 R/Hr [IDO-10035];

November 30; Engineering Test Reactor rupture of coolant impale tube in reactor;

November; IET test #17 released 6,402 Ci;

***1960 ***

February; IET test # 18 released 14,757 Ci;
February 9; Worker exposed while falling on "hot" equipment while cleaning at ICPP;
February 15; ICPP criticality Incident, [Ginkel];
February; IET test # 19 released 11,381 Ci;
June; IET test # 20 released 10,249 Ci;
August; IET test # 21 (FEET #1) released 3,752 Ci;
August; IET test # 22 (LIME) released 10,522.2 Ci;
October; IET test # 23 (FEET#2) released 2,890 Ci;
October; IET test # 24 (LIME-II) released 7,725.9 Ci;
November 16; OMRE solvent burning experiment .03 Ci;
November; IET test # 25 released 10,171.26 Ci;
December; Materials Test Reactor fuel assembly failure, apex-714;

1961

January; Materials Test Reactor fuel assembly failures;
January 3; SL-1 reactor explosion with fatalities Spec.5.C. John A. Byrnes, Spec.4.C. Richard L. McKinney ; Spec.1.C. Richard C. Legg, released 1,128 Ci January 3 -April; Workers exposed at INL during SL-1 cleanup;
January 7; 50 worker exposures to Si-110 at ETR reactor;
January 25; ICPP criticality accident in vessel H-110 released 5,200 Ci to environment 20 workers exposed [IDO-10036];
February; IET test # 26 released 10,090.66 Ci;
March 27; MTR spectrometer fire;
September 27; OMRE reactor coolant impurities loop fire;
December 12; Engineering Test Reactor fuel element meltdown due to coolant blockage;

***1962 ***

May 10; Fuel element flow blockage in the engineering test reactor [IDO-16780]
March; ML-1 reactor pressure vessel leak;
March; ICPP uncontrolled high-level waste leak in two tanks into vaults;
Jun-Aug; Overexposure of decontamination workers in SL-1 recovery;
August; EBR-II reactor corrosion in coolant seal plug;
August 24; Truck trailer accident load contamination I-129;
September; Worker exposure to 500 R/hr ICPP "E" Cell decontamination [IDO-14599]
November 5; SPERT-I test No. 1 intentional reactor meltdown caused 240,000 Ci released including 500 Ci Iodine.
November 13; MTR reactor fuel meltdown caused by coolant flow blockage. Accident required evacuation.
November 19; Worker exposed to Ir-192 during radiography;
November 25; MTR reactor debris in coolant;

***1963 ***

May 27; Controlled Environmental Radioiodine Test (CERT) May through December 1977 included 29 releases of 32 Ci of Iodine-131.
April-May; ERB-2 reactor coolant pump failure;
August 3; Container of radioactive material dropped and leaks at INL terminal;
October 19; Fuel failure-Borax -V reactor [Forum-Memo];
November; ICPP Accident resulting in plutonium contamination.
November 10; SPERT-I test No. 2 intentional reactor fuel melt down releasing 530 Ci.

***1964 ***

April 1; SNAPTRAN-3 test destruction of SNAPTRAN 2/10A-3 reactor in an open water tank.

Radioactive cloud traveled 21 miles, released 24,000 Ci;
April 14; SPERT-I reactor destruct test No. 3 released 1900 Ci.;
May 10; ICPP tank released 5 Ci long-lived fission waste released to ground from leaking line coupling. Three acres inside and ten acres outside the ICPP fence were contaminated.
May 10; Accident causes spread of radioactive waste from Radioactive Waste Management Complex;
July 7; Borax-I excursion released 714 Ci;
July 10; ICPP explosion containing plutonium piercing worker's arm;
July 22; Worker exposed straightening "hot" wire;
Oct. 21 through July 21, 1965 released 32.72 during CERT experiments;

***1965 ***

January; EBR-II reactor fuel element failure [ANL-7010];
January; ATR reactor vibration leak in coolant system;
August; ML-1 reactor coolant leak and shutdown;
September.9-13; Leak of 10 curies of I-131 from airfreight shipment. 64 people receiving dispositions in thyroids.

1966

January 11; SNAPTRAN-2: SNAP 10A/2 Reactor intentionally destroyed in open air tests at Test Area North. Radiation readings of 2.7 R/hr from a remote detector. Radioactive plume traveled 30 Kilometers (off-site) released 600,000 Ci.;
September 8&9; Uncontrolled fire in RWMC waste in SDA;

Between July 1961 and January 1966, 3,210 whole body counts of workers at TRA, ICPP, SPERT, TAN, and CFA. Forty six of these counts showed activity greater than 0.1 uCi (uCi = micro-curie or 10-6). Six of the more significant exposures are listed in the following table. [PTR-789 @5]

Case	Nuclides observed	Activity (uCi)	Remarks
A	I-131	0.20	Medical Experiment (count taken at termination)
B	Zr-95 Nb-95	0.10	Contamination on external surface of body
C	Hg-197	0.29	8.75 mrem to kidney, 7.3 mrem to gastrointestinal tract
D	Co-60	0.10	Radioactive contamination on external surfaces of body
E	Mn-54	0.15	Radioactive contamination on external surfaces of body
F	Co-60	1.50	93 mrem to lungs, 94 mrem to gastrointestinal tract, 3 mrem to whole body

1967

February 20; Engineering Test Reactor fuel element melt down due to clogged coolant lines caused by duck tape left over reactor coolant lines. 7.398 g of fuel was lost
November 30; Relative Diffusion Tests (RDT) between November and October 1969 released 10.04 Ci. of radio-Iodine-131.

***1968 ***

February; EBR-II reactor sodium coolant release which immediately ignited the 80 gal radioactive Sodium-24. The sodium coolant is pyrophoric when it comes in contact with air. Boiler plant building and control room contaminated with 4 mCi (4 x 10^{-3}Ci) Na-24. [ERDA-1536@C-5

May 3; Experimental Cloud Exposure Study (EXCES) between May and April 1970 released 987.6 Ci of radioactive Xe-133 and Na-24.

June 14; Contamination from the failure of a first-stage burner while burning enriched fuel elements RDT test;

***1969 ***

August; Tan Support Facility 10,000 gal high-level waste tank overflowed, contaminated soil had radiation readings of 5 Rad/hr at one foot;

August; Experimental Cloud Exposure Study (EXCES) test released 600 Ci;

September; ICPP accidental release 19 Ci long-lived fission product to injection well;

October; ANL-W released 413 mCi of zirconium-niobium-95, cesium-137, cerium-144, cobalt -60, antimony-124 were dumped in a ditch at the ANL-W in uncontrolled incident;

December; ICPP uncontrolled release 1.5 uCi (1.5 x 10^{6} pCi) <u>in excess</u> of the discharge limits of Sr-90 were dumped to the ICPP injection well

***1970 ***

April 7; Experimental Cloud Study (EXCES) tests released 352.6 Ci through May 25;

June 1; Uncontrolled fire in RWMC SDA waste;

July; Test Reactor Area tank failure released .578 Ci;

***1971 ***

January; ICPP ruthenium released 1 Ci;

February; TSF tank overflowed, 293 gal, .88 Ci long-lived fission waste product released;

March 3; Long-distance Diffusion Tests (LDDT) released between March and September 1000 Ci Kr-85, & 12.3 Ci Iodine-131;

May 5; Accident- contamination which caused evacuation of the ETR reactor building;

May 18; During attempt to remove the highly radioactive KAPL J-10 In-Pile tube from ETR core using the NR-2 transfer cask to ETR canal, the In-Pile tube fell out of the cask striking the shielding block on the top of the reactor. Twelve workers were exposed to over 25 rad/hr. Radiation Juno instruments could only read a maximum of 25 rad/hr. All 26 workers at the Test Reactor Area were evacuated to the main gate. [J-10]

September; Tan Support Facility liquid waste evaporator incident release 266 uCi cesium- 137 (266 million pCi),.0142 uCi Sr-90 (14,000 pCi), .0142 uCi Yttrium-90 (14,000 pCi);

***1972 ***

January; ICPP released 1 Ci. of radioactive Ruthenium-106 from the main stack;

May; ICPP accidental release 1 Ci Ruthenium-106 to environment;

May; Waste Calcine Facility accidental release 10 Ci long-lived fission waste product;

***1974 ***

April; ICPP waste line to high-level waste tank broke releasing 1,000 Ci of Cs-137, Cs-134, Sr-90, and Eu-154 to the soil.

October; ICPP tank line leak released 3,000 Ci Eu-154 with an additional 3,000 Ci contaminated soil left in ground;

***1975 ***

September; ICPP high-level waste line rupture was "discovered" releasing an estimated 14,000 gal of liquid waste containing 30,000 Ci. No accurate amount of release has been established indicating considerably more could have leaked out. To date, it has never been cleaned up. [Ibid.]

***1976 ***

January 16; ICPP diversion valve leak, 12 gal. containing 500 mCi (.5 Ci) Sr-90, 500 mCi (.5 Ci) Ce-137, 130 mCi (.13 Ci) Ce-144;

September; ICPP waste line leak, 20,000 gal.60 mCi (.06 Ci) released;

October; ICPP's Waste Calcine Facility cyclone failure contaminated building with 230 mCi (.23 Ci) Sr-90, 40 mCi (.04 Ci) Ru-106, 230 mCi (.23 Ci) Cs-137. Contamination covered up not cleaned up.

***1977 ***

November 1; Accident - radioactive waste truck high-centering on railroad tracks;

***1978 ***

October 17; ICPP criticality accident occurred in first cycle uranium extraction system in CPP-601 building, lasting 20 minutes releasing a radioactive plume (including Iodine) which traveled beyond the boundary to the SW. 6,200 Ci release resulted in one month plant closure and evacuation;

***1981 ***

July 20; Accident - workers exposed to radioactive particles;

***1983 ***

November 17; cancer victim seeking $11 million from INL blast;

***1984 ***

March 12; Report on ducks carrying INL radiation off site;

October; CPP-603 spent fuel storage (IFSF) radiation Shield Door Rails fail. The cause is determined to be from movement of door and/or seismic events. [ID-WINC-ICPP-1990-9020]

***1985 ***

February 15; Accident - worker exposure;

July 9; LOFT Reactor core intentional melt down resulting in fission products leaking into reactor building released 8,800 Ci plus .09 Ci of Iodine, this was the last of eight test series between 1979 to 1985; [A-58]

***1986 ***

December 10; Accident - 2 workers contaminated at INL;

***1987 ***

March 1; Accident - welders exposed to radiation ;

***1988 ***

October 30; Radioactive Ruthenium gas release at ICPP stack Released .17 Ci; Explosion at ICPP resulting in one fatality.

1989

Feb. 27; ICPP employee bypasses radiation monitors and takes contamination home after work shift.

1990

May 9; ICPP-603 IFSF shield door rails inadequate to sustain seismic event. The door hinges had failed in 1984 and the plug had been removed. In 1990 unsuccessful attempts were made to replace the plug in preparation of Ft. St. Vrain fuel.

Nov. 16; Contamination at 4,000 ppm beta-gamma spread outside a controlled area at ICPP-603

1991

Jan.29; NWCF stack monitor found out of calibration

Feb.11; ICPP fuel dissolver exploded, spraying three workers with highly enriched uranium and heated nitric acid; a forth worker was also exposed when he came to their aid. The facility remains closed because of explosion damage and high levels of contamination. Office of Nuclear Safety concluded that the initial contractor investigation & the corrective actions taken by the DOE/ID were inadequate. [Ryan @ 53]

May 2; Failure of EBR-II Fuel can carrier at cpp-603 allowed four cans of fuel to drop out of the can carrier and on top of the criticality control fixture which separates the two tiers of fuel in each storage pot. Faulty welding at ANL-W of the can was the fault.

May 20; Advanced Test Reactor fuel element fell from handling tool to water storage canal floor.

May 29; EBR-II reactor shutdown due to neutron detectors were not operative.
June 4; ATR reactor scrammed due to under voltage to coolant pump.
June 10; Idaho State files RCRA air/water quality violations and fines totaling $127,793.
June 11; Specific Manufacturing Capacity facility fire in exhaust filter caused by loss of coolant to deburring operations.
June 20; EBR-II shutdown due to no filtering and radiation monitoring on common stack violations.
June 21; Radiation contamination in material prepared for off-site shipment labeled "non-radioactive asbestos".
June 25; Operator's left hand is contaminated up to 100 mR beta gamma and 3,000 counts per minute beta gamma on his right hand at the NWCF while cleaning liquid sample cell
July 2; TRA Hot Cell worker contaminated with radium-192.
July 4; Denitrator Off-gas drain malfunction results in highly alpha contamination (Zone-III)
July 8; ICPP worker drained uranium concentrate into unauthorized container.
ICPP liquid radioactive leak into glove box violation.
July 9; Unplanned shutdown of the Fuel Storage Basin ICPP-603
July 11; WERF radioactive waste incinerator lost negative pressure in ash room caused by vent damper failure.
July 17; Argonne-W Hot Fuel Examination facility violates OSR for no annual electrical inspection on cooling blowers to fuel storage pits.
July 19; WERF incinerator shut down due to pressure cell disconnected which detects differential between rooms.
July 25; NWCF activated rapid shutdown system due to off-gas compressor shutdown during power dip
July 29; Central Facility Area Laundry OSR diocty 1-phthalate violation.
Aug.6; Personal contamination to 500 cpm at ICPP-627 Radiological Materials Area
Aug.6; NWCF shutdown due to plugged filters however it took nearly three hours before operators shut down and no spare filter banks were available during that time.
Aug.9; Incineration violation when waste containing greater than 25 mrem/hr limit was incinerated.
Aug.13; ATR reactor scrammed due to loss of power to coolant pump.
Aug.13; Unplanned shutdown of the Fuel Storage Basin at CPP-603 after extensive corrosion of fuel hanger yokes was found.
Aug.; Unexplained personnel exposure at Test Reactor Area Hot Cell of up to 560 mRem and radiation beams up to 700 mRem/hr [Blush Report DOE Office of Nuclear Safety 4/2/93]
Sept.11; WERF incinerator emissions pre-filters and HEPA filters failure - filters were found completely breached.
Sept.13; NWCF failure of off-gas atmospheric protection system (APS) HEPA filters. The HEPA filters, F-OGF-100/101/102 failed a special requested DOP test after nine months of service. When the filters were changed out it was discovered the filter media had deteriorated. Two of the filters had the filter media missing or partially missing. The third filter's media was intact, but was discolored. Depending on when the filters failed, the APS could have operated for the entire nine months without HEPA filters. ID-WINC-ICPP-1991-1058
Oct.14; ATR reactor scrammed due to low coolant pressure caused by malfunctioning temperature control valve.
Oct.16; ATR reactor scrammed again due to low coolant pressure caused by another malfunctioning temperature control valve.
Oct.18; ICPP evacuated due to gamma radiation during Fort St. Vrain fuel handling. Fuel handling operation suspended. Radiation detection monitor shielded with lead to quiet alarm. Spent fuel radiation levels being investigated. A few days later an alarm went off in the Irradiated Fuels Storage Facility as a result of these emissions levels. DOE's response was to disconnect the alarm.

[Ryan @ 54]
Oct.24; Radioactive Waste Management Complex safety envelope violations at SWEEP plant.
Nov.5; WERF incinerator shut down due to unapproved modifications to emissions HEPA filter; and non-approved drums used for shipment and disposal; and exceeding weight limits in incinerator.
Nov.7; ICPP steam generator dust explosion (Jan. 23)
Nov.27; ICPP high-level waste tank leak detection system failed...due in part to sensors and high radiation levels in the valve box greater than 21,500 cpm which repeatedly set off alarms.
Nov.28; ICPP evacuated after radiation alarms sound. [Times News (h)]
Dec. 3; Personal contamination at 1,000 cpm at ICPP-666 while unloading NRF fuel.
Dec.6; Contamination spread in an ICPP-666 Radioactive Materials Area while unloading NRF fuel canister contaminating two workers.
Dec. 22; ICPP-604 Process off-gas System HEPA filter monitors inoperable.

1992

Jan.6; Inspection found 9 alarms disconnected at the ICPP
Jan. 15; WINCO employee takes Cesium-137 contaminated section of pipe off site in his briefcase;
Jan.16; Advanced Test Reactor spilled 350 gallons of sulfuric acid into the "cold" waste pond;
Jan.19; ICPP Process Off-gas System blowers failed for two days while NWCF and other operations continued to operate
Jan.24 NWCF exceeded State limits on nitrogen oxide on five different occasions between 6/89 to 1/92
Feb.1; Fire in CPP-1605 which contains offices and equipment for engineering services
Feb.5; Personnel skin contamination to 100 cpm at the Remote Analytical Lab
Feb. 19; Radioactive contamination found outside controlled areas at Test Reactor Hot Cell Building - radiation readings ranged 1,500 to 28,000 DPM
Feb.1 Fire in CPP-1605
Mar. 4; Significant corrosion found in spent fuel storage racks at ICPP-603. Racks are supposed to prevent fuel rods from getting too close together - thus starting an uncontrolled reaction. DOE report acknowledges uncertainty regarding the facility condition following a major seismic event and the risks associated with such an event
Mar. 6; Container of Plutonium-239 found on the ground outside the ICPP-630 building;
Mar. 18; Radiation beam in the Test Reactor Area Hot Cell was left uncovered. Radiation levels of 20 rem/hr inside the cell and 2 rem/hr outside the cell wall were detected. 18,000 Ci. of Cobalt-60 were charged to the beam. Report calls the incident as a near miss in the sense that prompt fatalities could have resulted from the manner in which the facility was being operated. [Also see Ryan@52]
Mar.16; CPP-603 Middle basin spent fuel bucket yoke failed causing fuel to fall to pool floor
Mar.24; Personnel contamination to 1,000 cpm at the ICPP Flurorinel Dissolution Process Facility
Apr. 1; Unauthorized removal of criticality alarm system warblers at the ICPP.
Apr. 2; Employees forced to stay inside of ICPP due to unplanned radiation release from main stack containing 3 mrem/hr beta-gamma. [ID-WINC-ICPP-1992-0035] Contaminants spread beyond the ICPP boundary fence. Five to six acres had to be decontaminated. Ryan cities flakes the size of quarters falling on 40 acres around ICPP, and DOE sent notice of this incident to Idaho and the Fort Hall Reservation with a cover page erroneously stating; "This is a Drill". [Ryan @ 53][also see DOB 4/3/92], stating flakes 2 inches in diameter released] The released radionuclide composition was Cs-137, Sb-125, and Ru-106.
Apr. 7; Radionuclide release via excessed contaminated file cabinet. 10,000 cpm alpha (Radium-226)
Apr. 12; Advanced Test Reactor was scrammed when a diesel generator supply power failed;
April; High power scram at TREAT reactor caused by incorrectly calculating critical rod position by operator trainee [Blush Report]
May.2; Failure of an EBR-II fuel can carrier at ICPP-603 that caused the fuel to drop out of the can

May 11; Radioactive contamination found on roadway at Test Area North with readings of 700 mR/hr and a welding rod reading 70,000 dpm.

May 18; Unscheduled power outage at Advanced Test Reactor resulted from a malfunctioning rod becoming disconnected requiring the reactor to be scrammed.

May 22; CPP-603 lost commercial and standby power generator due to ICPP operator errors

May 26; Unscheduled power outage at ICPP resulted when operator attempting to shut off an alarm in Irradiated fissile Materials Storage and turned off the whole power supply that could not readily be turned on.

May 27; An error found in the irradiation of dosimeters for use in the DOE Laboratory Accreditation Program. Dosimeters for the past three years have been irradiated to higher levels than anticipated and incorrectly read as a result of the errors.

May 28; Idaho State inspection may result in notice of RCRA violations.

June 17; Radiation detected streaming from collimator port at Test Reactor Area Hot Cell # 1. Radiation readings of 700 mR/hr even with shielding. Additional shielding was not sufficient to stop the radiation. A similar incident happened on 3/18/92 Office of Nuclear Safety reviewed historical radiological survey records and discovered a surveillance report in August 1991 which revealed several unexplained employee exposures to dangerous levels of radiation. The Office of Nuclear Safety stated that the DOE/ID did not follow up on this surveillance report and line management failed to respond to the concerns until after the March 1992 incident. [Also see Ryan]

June 25; Personnel contamination to 3,000 cpm beta-gamma at the ICPP NWCF

July 1; NWCF HEPA filter failure due to rapid pressure rise and defective or failed filter material. This incident occurred while spare filter bank was undergoing filter change out and was not available for use. Three hours elapsed before the decision was made to shut down the Calciner

July 7; ICPP-603 BORAX-V fuel bucketed yoke failed causing fuel to fall to pool floor

July 18; ICPP NWCF unplanned shutdown due to clogged HEPA filters

July 25; NWCF activation of the rapid shutdown system due to compressor failure

Aug.2; Power failure at ICPP and 70 mph wind storm causes significant building damage;

Aug.7; Advanced Test Reactor scrammed due to loss of coolant and loss of backup diesel generator; restart delayed by malfunctioning control rod.

Aug.11; ICPP shipping cask had loose bolts on trunnion hold-down blocks

Aug.11; Personal Skin contamination in ICPP-640 Electrolytic Dissolution Area

Aug.12; Advanced Test Reactor remains shut down pending resolution of control rod problem.

Aug.19; Personal skin contamination at the ICPP New Waste Calcining Facility

Aug.21; Release of radioactivity from ICPP main stack - 25,000 counts per minute (cpm)

Aug.25; Unauthorized disconnection of alarms in ICPP-637

Aug.28; Personal contamination of 1,200 cpm at ICPP-666 Fuel Storage Area

Sept.1; Loss of stand-by power to evacuation sirens at the ICPP Remote Analytical Lab

Sept.12; Personnel contaminated to 20,000 dpm at the ICPP New Waste Calciner

Sept.17; Power outage at ICPP-604 Waste Treatment and loss of instrumentation and ventilation - these facilities operate the ICPP off-gas emission systems

Sept.18; Loss of contingencies against criticality accidents at ICPP-603 caused by side by side placement of highly reactive fuels;

Sept.21; Personnel contamination to 10,000 dpm in the ICPP-604 sample corridor

Sept.22; ICPP NWCF radiation detection instruments found out of tolerance

Sept.23; Three personnel contaminated to 1,500 cpm at NWCF

Sept.27; Sixteen radiation monitors found out of compliance at ICPP and instead of replacing the monitors managers chose to rescind the compliance order

Sept.22; Criticality infraction at ICPP Fuel Storage Basin (CPP-603) were 25 highly reactive fuel elements were stored adjacent to each other. Carbon steel fuel hanger failed allowing fuel to drop to bottom of basin. Violation of double contingency rule.

Sept.29; ANL-W female worker contaminated and left site to shop in Idaho Falls. Contamination not detected until return to the site.

Oct.13; Two workers in full bubble suits were decontaminating a tank floor, the air compressor supplying air to their suits stopped. 250 gal reserve tank provided air for exit.

Oct.20; Worker receives second degree burns while purging a nitric acid (13 Molar) line with compressed air.

Oct.21; Loss of control of radioactive material, building contamination to 50,000 dpm at ICPP-603

Oct.26; Improper fuel storage configuration at ICPP CPP-603. Two instances of expended fuel component configuration. violating criticality separation

Oct.29; Violation of ESA for radioisotope processing at INL. Preparations of isotope processing failed to properly align air sampling equipment to the hot cell - while irradiated targets were in the cell, but before processing began. Operators failed check list for valve alignment and provisions of Experimental Safety Analysis (ESA).

Nov.23; Improper fuel storage at ICPP building 603. Continuing investigation from 10/26 revealed north and middle basins have another improper fuel storage configuration and more corroded carbine steel support hangers. Ryan cites 25 highly radioactive fuel elements were stored adjacent to each other, and in the same area, corrosion caused a carbon steel hanger to fail which resulted in a bucket containing spent fuel to drop to the floor creating a potential criticality. [Ryan @ 54]

Nov.8; ERB-II reactor scrammed due to power perturbation caused by loss of the feed water pump and the secondary sodium loop. Scramming also caused loss of power to the ANL-W site.

Nov.15; Personnel contamination to 400 cpm at the ICPP NWCF

Nov.19; Personnel contamination to 10,000 cpm at the ICPP NWCF

Nov.28; ICPP evacuated because of radionuclide particulate releases at CPP-603

Dec.1; ICPP High-level waste tanks WM-101 and 102 vault sump level instrument probes (leak detection) were discovered to be connected to the transmitter in reverse

Dec.27; Kerosene fire in the Calciner Cell of the New Waste Calcining Facility. During cold operations of the NWCF kerosene fuel which had leaked from a Calciner fuel nozzle ignited resulting in a small fire in the Calciner vessel cell floor which burned for about 35 minutes. Nozzle connection was installed improperly (threads reversed).

1993

Jan.4; Advanced Test Reactor scrammed. During a lC-W loop experiment, a scram occurred due to loss of flow signal because of an operator error. The operator did not properly follow the procedure and a reset button was depressed which caused the loop pumps to turn off and the reactor scrammed.

Jan.4; Criticality Alarm System Warblers found Inoperable in CPP-651 and 603.

Jan.6; Unsafe entry into ICPP WL-101/102 Tank vaults by health physics technicians without proper protection.

Jan 9; New Waste Calciner forced to shut down due to plugged final off-gas filter plugging

Jan.25 Personal contamination by spray of 13 molar nitric acid at ICPP-601. Operator was not wearing the PPE specified by the HWP

Jan.28; New Waste Calciner again forced to shut down due to defective off-gas filters

Feb.2; State issues notice of violations based on May 18-22 1992 inspection. Notice cites, among other, things, a lack of training, and labeling and administrative deficiencies under the state hazardous waste management act.

Feb.26; ICPP-603 underwater fuel storage review found an additional five fuel canister failures.

Mar.4; ICPP-603 fuel canister yoke hook failed

Mar.9; NWCF worker contaminated to 12,000 Disintegrations per minute (dpm) and other areas of the mezzanine were the worker was were found to be contaminated to 100,000 dpm

Mar.13; Worker contamination to 800 dpm at CPP-604 tank farm

April 15; Contamination released from containers sent to ICPP from Pantex via commercial carrier

May 17; Personnel Skin contamination at Argonne-west. The contamination occurred at Fuel Cycle Facility Radioactive Liquid Waste System. Contaminated liquid (tritium and possibly strontium and cesium was sprayed on two individuals standing outside the radiation barrier when flexible tubing became disconnected from an adapter. The two individuals were no wearing protective clothing since they were outside the radiation control area. Individuals were decontaminated.

Sept. 8; A damaged C cell battery was found in the ATR reactor vessel outside of the core region and removed; a thorough inspection of the vessel revealed no other debris and the vessel was closed up.

Sept. 13; Crushed parts of a flashlight were found inside the ATR reactor vessel, but outside the core region and no debris was found on the fuel. Detailed inspections were conducted including the use of an underwater camera video system, but other missing flashlight parts were not found. Reactor operation was delayed for more than two days and in-vessel inspections will be performed following each nuclear re-qualification testing event.

Sept.. 24; Approximately one and a half sticks of unexploded dynamite were uncovered during the excavation of an existing underground storage tank at INL Research Center. The site was immediately cleared and an explosive expert was called to the scene where it was determined that no other explosives existed. The dynamite, which appeared to be residue from initial construction was removed and safely detonated.

Oct 12; Approximately 1,540 gallons of diesel fuel leaked from the Central Facilities Area Tank Farm through an open drain valve on a fuel tank.

Dec 12; Two construction workers at the ICPP Tank Farm received whole body radiation doses of 770 mrem and 507 mrem and skin doses of 4,469 mrem and 2,040 mrem while completing work on a valve box.

"During calendar year 1993 at INL, there were 5,145 individuals monitored by whole body counting and 3,116 individuals monitored with urine/fecal analyses. Record summary data does not permit differentiation of how many who have whole body counts may have also had urine/fecal analyses. Of these individuals monitored, six had positive doses for plutonium and one had a positive dose for uranium. The 6 positive plutonium doses ranges from 14 mRem to 53 mRem committed effective dose equivalent. One uranium dosed was 11 mRem committed effective dose equivalent." [DOE Facts @ 2-87]

1994

Jan.21; A leak of unknown volume breached secondary containment at ICPP-604. [Boise Weekly]

April 4; During refueling of the Advanced Test Reactor, 19 workers received internal radiation exposure caused by underwater control rod cutting operations in preparations for disposal. Workers using a remote control saw were cutting through a control rod of hafnium and aluminum and either the saw arced or hit the hafnium which got into bubbles of hydrogen and rose to the surface of the pool. The highest dose was 2 mRem. Hafnium has a half life of 45 days. The facility was evacuated. OCAW union said exposure was 1.3 REM and internal uptake of 96 microcurie of hafnium-181.

April 15; A chlorine leak at ANL-W occurred when 40 pounds of chlorine gas leaked while changing out a tank at a water treatment facility. Of the 40 people exposed, one person was hospitalized for respiratory distress; and seventeen others were treated for respiratory distress. The 900 site personnel were evacuated for two hours. The leak continued for over 41 minutes until an ANL-W Haz-mat team closed the valve. [OE-95-21][DOE/EH-0527]

April 24; Test Reactor Area engineer violated safety procedures by not surveying his clothing before leaving the site. His cloths and shoes were contaminated with Cobalt-60 and Cesium-137 which he took home. The workers home then had to be checked and decontaminated.

1995

March 22; Unauthorized valve modification to Emergency Firewater Injection System is not corrected prior to reactor startup. [OE-95-13]

March 22; Concrete floor core drilling project at the Advanced Test Reactor dropped a 14 pound plug to the floor below were no safety barriers had been erected to prevent access and possible injury. [OE-95-13]

April 13; Decontamination manifold in the New Waste Calcine Facility and an air purge line had become internally contaminated with process fluid. The contact radiation level on the manifold was 3 R/hr. Personnel evacuated the immediate area.

April 13; Contaminated equipment used in an attempt to unplug a resin discharge line in the Test Reactor Area Warm Waste Treatment Facility (WWTF) was placed in the system engineer's office and in the uncontrolled tool crib.

June 30; An operator at the Test Reactor Area was exposed to acid fumes after 1,000 pounds (66 gal) of concentrated sulfuric acid was released while he was purging a tanker truck and fill line used to fill a site acid storage tank. Approximately 25 feet by 50 feet of ground was contaminated. The operator required medical treatment.

July 3; Several pipefitters working at the Advanced Test Reactor were exposed to 50,000 counts per minute by over a dozen isotopes because their anti-contamination (anti-c) clothing provided inadequate protection in the work environment. In another event, a DOE Environmental Health Representative was contaminated while conducting an inspection of the check valve work that was the subject of previous pipefitter contamination. In both cases the Pro-Tech 2000 anti-c clothing did not prevent the migration of graphite particles through the material or protect individuals during bending, kneeling, extreme temperatures, or presence of contaminated liquids.

July 6; A construction worker at the New Waste Calcine Facility was exposed to 383 millirem when he mistakenly worked in a different area with a higher dose rate and failed to hear an alarming dosimeter.

July 12; A construction worker received 383 millirem exposure when instructed to lay blotter paper over a high contamination area at the ICPP

Aug. 19; Misplacement of spent reactor fuel in ICPP-666 storage pool during re-racking operations caused radiation releases amounting to 200 mRem.

Aug. 24; The Advanced Test Reactor Emergency Fire Water Injection System would be rendered inoperable during a design basis earthquake. The purpose of the injection system is to pump water into the reactor core to prevent irradiated fuel elements from being uncovered in the event of a loss-of-coolant accident or a complete loss of coolant flow during an earthquake.

Sept. 25; At the ICPP Tank Farm, a construction worker was contaminated by work tools when he helped to install radiation monitors on a valve box. The tools had 3 rem/hr beta/gamma contamination. They took a whole body count of the worker which revealed 4.6 nanocuries of internal contamination.

Dec 14; INL Mercury Retort Plant was shut-down and evacuated when propane tank truck attempted to refill a 10,000 gallon propane tank through the wrong port. Forty pounds of propane were released inside and outside the plant.

1996

Feb 8; Argonne-West Sodium Component maintenance Shop was evacuated when a highly reactive sodium potassium (NaK) when a transfer line overheated. Workers were attempting to treat 40 year old Experimental Breeder Reactor - I NaK coolant. NaK will burn if exposed to water or air.

Feb 20; Construction worker died in a fall off a stack of radioactive waste containers at the Radioactive Waste Management Complex.

Feb 22; Safety Analysis of the Advanced Test Reactor found breaks in the coolant piping and fuel damage to be “anticipated” events but that allowable exposure limits for workers would not likely be exceeded and that off-site exposures would also not likely be exceeded.

Mar 20; Criticality safety limits were exceeded when Uranium-235 spent fuel plates were found to be stored in twice the allowable limits of moderator. Moderators increase the hazard of accidental criticality of relatively low masses of fissionable material. The aging plastic moderator caused it to adhere to some of the fuel plates, which slowly oxidizing because the plate ends were cut off prior to shipment to INL.

Mar 21; Idaho Department of Health and Welfare send DOE/ID notice of 61 violations of State Hazardous Waste Management Act and levee penalties totaling $317,300,000.

Mar 28; A 25 year old crane at the Naval Reactor Facility failed, and dropped an 8,500 pound load of reactor refueling equipment. The 8 foot drop significantly damaged the equipment.

May 28; Pipe fitter was burned by sulfuric acid dripping from ceiling after a pipe failed while flushing bulk chemical storage tank at the Advanced Test Reactor. 25-30 ml of acid were ejected. The worker was only protected for a potential frontal spray not an overhead spray.

July 11; A site alert was declared when a range fire northeast of the ICPP perimeter fence. The fire occurred inside a controlled contamination area. Previous survey records show arsenic and cesium contamination that would become airborne as a result of the fire.

July 18; Uranium bearing storage bottles found improperly stored in ICPP violating criticality standards.

July 22; Five construction workers were contaminated during demolition of the ICPP Waste Calcine Facility. Whole body counts showed 500 mrem internal exposure to Cs-137, Sr-90, Pu-238, and Pu-239. The five workers were not wearing respirators yet were working in the immediate area were another group of workers were cutting and removing piping that contained contamination. LMITCO fined $25,000 by DOE for violations of nuclear safety regulations under the Price Anderson Amendments Act. [Star 3/11/97]

Nov. 25; ANL-W EBR-II ventilation monitors found to be inoperable for at least seven months during which time over 28 spent fuel assemblies had been processed

Nov 30; During a dismantling operation of a reactor spent fuel subassembly two fuel pins were dropped. One of the fuel pins fell below the machine and could not be retrieved with standard handling equipment.

Dec 3; ANL-W maintenance workers found that the emergency power diesel generator had been disconnected from the system for over a month.

Dec 25; Advanced Test Reactor while under full power scrammed by experimental loop ‘watchdog’ timer scram system. The experimental loop primary and secondary DPU operating systems failed triggering the shutdown.

1997

Jan 6; Mixed waste shipped from INL’s Waste Reduction Operations to Envirocare disposal site was mislabeled and caused worker contamination with lead-227. Envirocare was shut down.

Jan 13; Two INL workers were contaminated during a HEPA filter change out when the second of two filters became disengaged from the lifting device and dropped 12 feet to the cell floor. The Radiological Control Technician (RTC) received 779 mrem and the Operator received 535 penetrating exposures from Cs-137. The RTC’s shoe was contaminated with 6,000 dpm Cs-137. [DOB 1/16/97]

Feb.8; Nuclear Metals incorrectly shipped classified depleted uranium in boxes labeled as empty to INL SMC facility which violated Department of Transportation regulations.

Feb.13; A 6M drum of plutonium was shipped by air to Los Alamos without legal authorization and notification to the US Department of Transportation. All shipments were suspended pending an investigation.

Feb.17; Argonne-West Hot Fuel Examination Facility technician received an internal plutonium 239 dose of 143 mrem in addition to external exposure of 1600 dpm on his arm.

Feb.24; A Test Reactor Area Hot Cell operator was exposed to 3.15 rem on his right hand while moving an irradiated sample from a hot cell into a lead cask. Delays in the processing of extremity dosimetry created the potential for exceeding extremity dose limits.

Feb.24; Advanced Test Reactor accident resulted in 410 pounds of Freon when a scaffold fell on and broke a chiller unit line. Operators attempting to use self-contained breathing apparatus found five to be unusable. Freon, according to NIOSH is immediately dangerous to life or health in concentrations as low as 2 ppm.

Feb.27; DOE imposed $25,000 civil penalty on Lockheed Martin Idaho Technologies under the Price Anderson Act for multiple failures to maintain radiation exposures as low as reasonably achievable.

Mar.1; A Test Reactor Area Technician received a whole body neutron exposure of 1865 millirem the month of April and the source of the exposure could not be determined.

Mar.13; Two cesium-137 sources containing 27.5 mCi and 12 mCi with a potential dose rate of 111 mrem/hr were lost and a search was unable to determine their location.

March 20; State fines DOE $970,000 for missing RWMC Pit-9 cleanup milestone.

April 27; Advanced Test Reactor spent fuel element fell off handling device during transfer from reactor to storage pool

May 12; During a trial burn at the WERF incinerator, the chlorine emissions exceeded the administrative limit. Operators ignored monitoring instruments and proceeded with operations.

June 5; Worker exposed to 40,000 dpm of Gd-153, Eu-152, and Co-60 during decontamination of Hot Cell Facility despite wearing a double set of Personnel Protective Equipment. [6/9/97 DOB]

Aug 25; Five workers were exposed to nitrogen oxides while conducting a remote video inspection of underground ICPP Calciner valve box. NIOSH safety limits of 5 ppm were exceeded but the immediately dangerous to life limit of 20 ppm were not exceeded.

Aug 25; State of Idaho Division of Environmental Quality sent DOE/ID a Notice of Non-Compliance for 135 violations of Hazardous Waste Management Act and set penalties at $892,725.

Sept 8; Workers discover that liquid storage tanks (v-1,v-2, v-3, v-9, v-13, and v-14) at Special Nuclear Material Storage Facility contained fissile material in concentrations equal to 45% required for a critical mass. The tanks in question were not controlled as a Criticality Control Area.

Sept 17; Six workers at Test Reactor Area Hot Cell Facility were contaminated with europium resulting in evacuation. Facility contamination measured 260,000 dpm where the workers were located. Two of the six workers received uptakes of 10 to 30 mrem OVER 50 years committed effective dose equivalent and a maximum organ dose of 57 mrem committed dose equivalent to bone surfaces. Radiological surveys determined contamination escaped the Hot Cell. LMITCO claims the six worker exposures were at the 100 mrem level. [Star 9/23/97] This resulted in notices of violation under the Price-Anderson Amendments Act and LMITCO fines of $125,000.

Sept 19; DOE Office of Enforcement and Investigation issued Notice of Violation under the Price-Anderson Act to Lockheed Martin Idaho Technologies and INL Operations Office for six Severity Level III safety violations.

Oct 6; A lead shipment from INL contained contamination on the bed of the truck as high as 10,000 cpm. The trailer is owned by Tri-State Motor Transport.

Oct.7; Workers shirt contaminated during work in the basement buffer area in the manipulator repair glove box room.

Oct 25; Advanced Test Reactor operators discover five holes in gas-tight reactor confinement boundary (during operations) that subcontractors had left unfilled. This breached the reactor gas-tight confinement boundary. A similar event occurred on December 16, 1996 at the same location.

Nov 20; An unprotected Test Reactor Area worker was sprayed with 50 milliliters of sulfuric acid foam while disconnecting an air hose to an air sparge line.

Dec 3; An Argonne-West emergency power switch prevented the transfer of diesel generator power when outside power outage fails to reactor coolant and other process systems. The switch was left off a month earlier (November 9) during diesel maintenance. During that time there was no effective emergency backup power system.

Dec 8; ICPP New Waste Calcine facility maintenance fitter was contaminated after he removed his acid suit in a high contamination area. A radiological control technician measured 8,000 dpm beta/gamma on the fitter's knees, 3,200 dpm beta/gamma on his stomach, and 39,000 dpm beta/gamma on his modesty clothing. The fitter had removed his acid suit during the job because of heat stress caused by inadequate breaks and excessive hours.

Dec 18; RWMC waste storage building WMF-634 radiation survey required by the state revealed seven Sandia transuranic waste boxes with surface americium-241 contamination levels at 2,500 disintegrations per minute (dpm) per 100 square centimeters. All personnel were evacuated from the building.

Undated winter 1997-98; Managers reported fire caused when an engine overheated and caused a fire because the cooling water drain was plugged with ice which prevented circulation of cooling water through the engine coolant heat exchanger.

1998

Jan 6; Fire resulted from an overheated diesel powered water pump when the discharge line froze.

Jan 8; ICPP reactor fuel handlers dropped a container of uranium bearing material

Jan 12; The Advanced Test Reactor at the Test Reactor Area had an uncontrolled shutdown after a secondary coolant line system piping leaked.

Feb.3; Workers respirator air line failed due to the plunger being reversed in the quick disconnect line which could have been serious if the worker was in a contaminated are at the time of discovery.

Feb 26; Five lithium containers were found to be improperly stored in a nitrogen charged glove-box instead of the required argon charged glove-box. Lithium reacts with nitrogen and can result in a highly exothermic reactions when exposed to water or oxygen.

March 1; An liquid waste evaporator that was processing uranium oxide spilled 50 gallons of the waste on to the building floor when it lost steam used to heat the evaporator. No safety control systems were installed to shut the process down in the event of a malfunction.

March 11; WERF chlorine emissions limit exceeded during incinerator operations of 33 boxes of MLLW indicated HCL concentrations rose rapidly.

March 13; ANL-W Fuels Manufacturing Facility glove-box fire broke out when a technician was consolidating cans of passivated uranium hydride (uranium corrosion) in an air atmosphere glove-box and opened one can (1.7 kg) resulting in a spark that caused a fire in both cans. Despite putting Met-L-X designed to extinguish metal fires on the blaze, it took ten minutes before it was brought under control.

March 17; Test Reactor Area operator inadequately secured one end of a hose that went to a drain pit sump resulting in a spill of waste containing halogenated and non-halogenated solvents and hydrofluoric acid. Some of the 16 gallon spill went into the soil around the pad.

March 18; Worker found contamination on his right shoe during the decontamination of a seal rube bag-out ring at the manipulator maintenance.

March 19; Test Area North employee received an unexpected radiological exposure to neutron from an improperly stored americium-beryllium source which was stored on the top shelf in a room below the employee's office for six years. Investigators believe other workers were also exposed.

March 19; Test Reactor Area TRA-605 waste water spill to environment while transferring spent filter resin to Resin Disposal Cask.

April 1; Test Reactor Area (TRA-777C) underground waste storage tank leak detection system non-functional and leaks possible and undetected.

April 3; Test Reactor Area underground waste storage tanks leak detection alarm was found to malfunctioning. Due to noncompliance with inventory control requirements, investigators were uncertain if a release had occurred.

April 8; Specific Manufacturing Capacity Facility at Test Area North found that they had been shipping contaminated resins off-site since March of 1997 resulting in loss of control of nuclear materials.

May 5; ATR operator inserted an experiment capsule into the wrong capsule irradiation position, and was lost. Because it was in the wrong position it was not discharged from the reactor and was over irradiated. [OES-98-19]

June 9; Test Reactor Area raw water tank found to contain PCB's.

June 30; Three reactor operators exposed at Advanced Test Reactor with trimethylamine above the short-term (15 minutes) exposure limit while recharging anion exchange resin in a demineralized tank. The operators were exposed for less than 30 seconds and may have resulted in personnel injure.

July 21; Advanced Test Reactor Critical Facility emergency shut down when an unplanned power excersion resulted from control cylinder withdrawal failed to operate.

July 28; One Test Reactor Area worker (Kerry Austin) killed and 14 other workers sustained life threatening injuries when trapped in building 648 during preparation for electrical system preventive maintenance, a high-pressure CO2 fire suppression system unexpectedly activated when workers opened the last of several electrical circuit breakers. Workers did not have means to safely escape and were deprived of clear exit pathways, emergency breathing apparatus. No alarms sounded or evacuation warning alarms.

Aug.9; INTEC plant wide emergency communications and alarm system failed and the backup power system and battery backup also failed.

Aug.19; Eleven workers received external exposure at Fuel Conditioning Facility during a seal tube repair when a release of radioactive contamination to the operations corridor occurred. Of the eleven, four workers received an uptake, (determined by whole body count) with the highest reading being 23 nanocuries of cesium-137.

Oct.7; Fire Alarms found inoperable at INTEC.

Oct.15; Two workers at Waste Experimental Waste Reduction Facility (WERF) incinerator were exposed to 2.68 times the permissible OSHA levels for cadmium dust of 5 micrograms per m3, during cleaning the an incinerator off-gas heat exchanger.

Oct.26; Fuel Storage Area found to not meet seismic code requirements because of a misapplied computer code for soil structure interaction used in seismic analysis.[98-43]

Sept.; DOE Office of Oversight Progress Report September 1998 found that "Workplace safety at INL has deteriorated since 1994" and that "corrective actions plan found that deficiencies were not resolved and that lessons learned from previous accidents were not being effectively applied. In environmental management and controls, data indicate weak regulatory compliance and inadequate, short-term, quick-fix solutions. Long term solutions are only in the conceptual stages, with no defined strategies, plans of action, or milestones." "Specifically, one-fifth of all INL occurrences in 1997 were related to radiation protection (personnel contamination) and environmental management occurrences have increased by one-third from 1994 through 1997."

Sept.1; INTEC radiation laboratory analysts received internal plutonium-239 exposure from inhalation that measured 0.1 mrem from unprotected work on plutonium-contaminated graphite molds. [Operational Experience Summary 98-47

Sept.21; DOE fines LMITCO $55,000 for violation Price Anderson Act resulting from Advanced Test

Reactor Critical Facility disabling of the seismic scram subsystem discovered in October 1997.

Sept. ; DOE Oversight Analysis Group issues Office of Oversight Progress Report covering INL's non-compliance with environmental regulations, poor implementation of worker safety and health programs and privatization issues. The report cited, "workplace safety performance has deteriorated," "recurring problems in work control and facility authorization basis, noncompliance with environmental regulations, and cost overruns associated with the Pit-9 project," "INL has not established an effective process to pro-actively track and prioritize corrective actions. Further, ES&H functions and activities are not always integrated into programs or work planning." "Worker competence and safety performance are also impacted by the reduction enforce at INL since the beginning of integrated management. The reductions have affected the experience level of workers and reduced morale. Since 1994, INL has experienced to workplace fatalities, a serious electrical shock, and many unplanned exposures and near misses involving workplace hazards." "Significant weaknesses are also noted in INL's environmental management program as shown by the site's having received four Notices of Violation from the State of Idaho for environmental non compliance since 1994, as well as 4 of the 26 DOE Enforcement Actions issued by DOE through June 1998." "In recent years, weakness in work planning and controls have resulted in two Type A accidents as well as many near misses involving workplace hazards. The identified programmatic deficiencies include insufficient worker training, lack of hazard identification and control, and inadequate supervision of work."

Sept. 28; On 9/27/98 the Region VI (Idaho) Radiological Assistance team was deployed to Idaho Falls to investigate two cooler-type containers bearing cesium transport index 5 labels. The containers were discovered in a residential home's garage. The team determined that the containers held sealed radioactive sources, on cesium-137 and one amercium-241." [DOE Daily Filed Management Report, September 28, 1998]

Nov.4; Waste Experimental Waste Reduction Facility (WERF) incinerator worker seriously injured when thrown against an air receiver and into a concrete wall from the concussion following a catastrophic air compressor explosion. Compressor parts, debris, and oil were propelled into the south end of the compressor room, and immediately filling it with atomized lubricating oil and smoke.

Nov.25; RWMC fire alarm notification to other facilities was found to be "non-functioning" for over three weeks.[Operational Experience Summary 98-48

Dec. 14; Advanced Test Reactor forced into unscheduled shutdown.

Dec.17; Two workers at Argonne-West 752 analytical Laboratory and two workers at Fuel Conditioning Facility received carbon monoxide exposure when a fork lift truck was left running next to the intake for two breathing air compressor. The four workers showed signs of CO exposure and were transferred to INL Dispensary.

Dec.22; Six workers contaminated at the New Waste Calcine Facility incinerator during waste transfer operations. Additionally, two pickup trucks, some road surfaces, and hallway carpets in another INTEC were contaminated when workers left the NWCF.

Undated; INTEC (ICPP) Fuel Element Cutting Facility (CPP-603) HEPA filter failure resulted in outside ground contamination of 131,302 square feet. [Waste Area Group 3, RI/FS page 2-129]

1999

Jan.3; Fire at Argonne-West Sodium Process Facility resulted when a sodium leak (four ounce) in the reaction vessel sodium injection lines. The process was shut down and the facility evacuated.

Jan.6; At Test Reactor Area, an Iridium-192 pellet was unknowingly removed from a cell charging port at the TRA Hot Cell Facility and resulted a radiation filed of approximately 800 rem/hr on contact. Three workers were exposed to 2 rem/hr and one worker received 14 rem/hr exposure.

Jan 7; INTEC NWCF and CPP-665 & 679 fire detection system found inoperable due to degradation, down for two weeks fore being corrected. Operator attempted to cover up by destroying printout. [ID-LITCO-Landlord Occurrence Reports 9901]

Jan. 11; New Waste Calciner Facility fire erupted while bringing the NWCF into operation, a flexible, braided stainless steel oxygen hose for the calciner vessel #4 fuel nozzle failed. This failure resulted in a spray of kerosene mist, which ignited in the cell.

Jan. 11; Butte County High School student was contaminated during tour of Advanced Test Reactor Canal Area. Cobalt-60 contamination measuring 23,500 disintegrations per minute (dps) was found on the students shoes.

Jan.15; New Waste Calciner Facility incinerator fire in the oxygen/kerosene fuel loop was caused by missing seals. It is believed that absence of these seals allowed oxygen and kerosene to leak, mix and catch fire at calciner operating temperatures.

Jan.19; INTEC a maintenance electrician at CPP-601 and 640 received contamination (12,000 cpm) beta-gamma, the gamma scan showed Cs-137 at 6,000 dpm. [ID-LITCO-Landlord Occurrence Reports 1998-0002]

Feb.3; ICPP, Two of four air compressors crucial to radiological material transport between systems failed.

Feb. 4; Waste Experimental Reduction Facility (WERF) incinerator worker exposed to contamination when he entered a mixed-waste incinerator chamber to remove hardened hearth ash from an ash hopper. A stand down order was issued

Feb.12; INTEC standby power generator starting float mechanism disconnected preventing startup. [ID-LITCO-Landlord Occurrence Reports]

Feb. 17; INTEC nitric acid leak contaminated employee’s head and arm. [ID-LITCO-Landlord Occurrence Reports]

Feb. 17; Advanced Test Reactor operators found that a flux trap target capsule holder assembly had been rotated 90 degrees from its intended position since 1994. Miss orientation of the targets could have caused a variation of the neutron flux peaking within the flux trap resulting in operating the advanced test reactor outside its safety authorization basis.

Feb. 19; INTEC high-level waste transfer error from VES-WH-101 Tank Farm containing 1976 gallons went to VES-WL-133 and 1325 gallons went to VES-WM-100 for a total of 3,301 gallons. [ID-LITCO-Landlord Occurrence Reports]

Feb. 23; Test Area North radiological control technician worker was contaminated with 2,000 dpm cesium-137 when he walked through water that had become contaminated when it leaked from the roof onto the facility duct-work.. Fan room floor contamination measured 23,900 dpm gamma.

March 8; INTEC diesel driven fire water pump batteries exploded during test startup. [DOE Operational Experience Summary 99-12]

March 9; INTEC Fuel Storage Area operators failed to store a fuel assembly in the storage port that was specified on a fuel receipt record which could have resulted in a criticality but luckily was stored with compatible fuel assemblies.

March 10; INTEC power failure at CPP-603 and CPP-1758. [ID-LITCO Landlord Occurrence Reports.]

March 16; INTEC NWCF individual (with Science Applications) was exposed doing NWCF off gas sampling. [ID-LITCO-Landlord Occurrence Reports]

March 21; Waste Experimental Reduction Facility (WERF) incinerator operator was radiologically exposed to europium and the waste sizing room was also contaminated. The cause of the accident was inaccurate isotopic data from the site waste-tracking database. Contamination levels were greater than one-million dpm beta-gamma and 17,500 dpm alpha.

March 22; Advanced Test Reactor crane dropped a 400 pound irradiated inpile tube assembly being lifted from the reactor core and narrowly missed hitting a worker. The uncontrolled fall damaged the storage well and docking plate.

April 1; INTEC NWCF individuals received exposure to methylene chloride and toluene during off-gas sampling over two months. The exposure data indicated values that exceed twice the value of the limits established for a 40 hour workweek of methylene chloride of 105 ppm; toluene at 166 ppm. Samples at the base on INTEC main stack exceeded OSHA limit of 25 ppm. [ID-LITCO-Landlord Occurrence Reports 1999-006]

April 7; INTEC NWCF high radiation area (exceeded 1 rem/hr) found unattended when it should have been in a secured locked box. [ID-LITCO-Landlord Occurrence Reports]

May 5; INTEC bacterial contamination found in potable water supply. [ID-LITCO-Landlord Occurrence Reports]

June 13; INTEC emergency alarm and personnel emergency paging system was found non-functional when managers attempted activate the facility incident response team to respond to a personnel injury. The system has a history of intermittent failures.

June 21; ANL-W West Fuel Conditioning Facility special nuclear materials security handling requirements were violated causing a general shut down of the facility.

June 30; ANL-W employee performing an oil vapor test on a breathing air system was burned by concentrated sulfuric acid expelled from a drager tube. The employee received burns to the right side of the neck, the right forearm, and the little finger of the left hand.

July 12; INTEC (ICPP) fire in a power beaker resulted in loss of power, communication, and ventilation system failure. The New Waste Calcine Facility (high-level waste incinerator) at INTEC was evacuated when backup generators, and battery backups failed. Three radiologically contaminated areas within facility radiological buffer areas were found and the cause was due to ventilation failure. Fuel Receiving and Storage Facility and Irradiated Fuel Storage Facility at INTEC were also evacuated because backup generator power failed to be automatically routed into the system. A similar power failure occurred at ANL-W in 1997.

July 15; INTEC NWCF shift supervisor certification expired two months earlier in violation of operating rules. [ID-LITCO-Landlord Occurrence Reports]

July 20; RWMC Pit-9 waste characterization program shut-down due to sonic drilling into the pit could cause the mixture of potassium and sodium nitrates and organic chemicals in the waste to explode or ignite.[Star 7/22/99 pg 4]

July 27; ANL-W rigger injured in construction accident

August 23; INTEC, three of four air compressors fails and the fourth was unable to maintain plant air demand. [ID-LITCO-Landlord Occurrence Reports]

August 24; INTEC New Waste Calcine Facility operators failed to refuel a diesel powered portable air compressor causing it to shut down and resulting in a loss of plant air. The facility manager ordered an evacuation because the air compressor shutdown reduced the plant air supply and caused the ventilation system intake dampers to close. Failure to maintain the minimum air supply resulted in a facility evacuation and could have resulted in additional facility evacuations or the spread of contamination. Investigators determined that the portable air compressor was being used as a backup supply because three of the four permanently installed air compressors were out of service.

August 25; Operator suffered heat stroke while working in high-temperature area. Worker was wearing three sets of personal protection equipment and a full face mask respirator. He worked one hour when the maximum safe limit is 15 minutes. Management fails to provide refrigerated air lines for workers because of expense

Sept.15; INTEC air quality check on portable breathing air compressor expired but still in use. [ID-LITCO-Landlord Occurrence Reports]

Sept. 17; Specific Manufacturing Capability Facility operator incorrectly opened the main flush valve to the evaporator process resulting in a spill of 20 gallons of uranium process liquid on the floor of the plant.

Sept. 20; INTEC radiation worker contaminate on his arms at INTEC Tank Farm 20,000 dpm/ 50 mrem whole body that went through protective clothing. [ID-LITCO-Landlord Occurrence Reports 1999-0011]

Sept.23; Hydrogen gas and a spark produced a quick fire at the Advanced Test Reactor destroying the

HEPA filters

Oct.24; INTEC Calciner air compressor shutdown because it ran out of fuel. “This resulted in a shortage of plant air impacting operating facilities when pressure dropped below the limits required to sustain operations.” NWCF was evacuated. [1999-0011 Final Report]

Nov. 6; A leaky valve in the primary coolant system caused an unscheduled shut down of the Advanced Test Reactor (ATR. The ATR lost 55 hours of operation. An internal report concluded that a lack of preventive maintenance contributed to the problem. This forced shut down “cost $392,000 because preventive maintenance was not performed. A nearly identical failure occurred in 1996. [DOE/IG 3/01]

2000

Jan. 24; An over-pressurization condition in a furnace caused an explosion that led to an exhaust stack falling to the floor. Although no one was injured, this was the second failure of this furnace. A report on the incident cited improper maintenance as the problem. Incident reports identified other furnace problems, all related to inadequate maintenance. DOE/IG audit states “We further noted that, as of April 2000, the backlog of preventive maintenance was approximately 311,000 hours.” [DOE/IG 3/01]

March 17; Test Area North Hot Shop Special Equipment Service Room had two radiation penetration areas without shielding. The Hot Shop also had “several additional straight through radiation penetrations.” [Operational Experience Summary 98-47]

August 5; The Test Reactor Area potable water supply was contaminated after the area’s chlorination system failed. A report linked the problem to maintenance that was neglected. Auditors found that $362,700 (just for IFSF operation) was transferred out of the maintenance budget and into current operating budget. [DOE/IG 3/01]

2002

Nov. 20; Four workers at ATR received radioactive contamination on Nov. 20, when a shipping cask loaded with Cobalt-60 failed to depressurize properly after a routine cask pressure check. The incident occurred at the Advanced Test Reactor. The four workers – a heavy equipment operator, and engineer, a mechanic and a pipe fitter – were wearing the proper protective clothing and were quickly decontaminated. Three of the four tested positive for nasal contamination and were further tested for internal contamination. None of the three was found to be internal contaminated. [DOE/ID Press Release November 25, 2002]

2003

August 14; AMWTP at RWMC fire during venting of a 55 gallon waste drum containing a sludge mixture of plutonium contaminated solvents mixed with concrete. The drum was part of a retrieval of buried mixed waste at the INL RWMC burial ground. About 20 drums were found to be “bulging from built-up pressure, such as hydrogen gas.[Times-News August 14, 2003] [also see the Albuquerque Journal (8/14/03) that states “the drum contained radioactive sludge from the Rocky Flats nuclear weapons plant in Colorado. In the 1970s, drums from Rocky Flats were sent to Idaho for long-term storage until a permanent waste dump could be built. In this case, however, flames leapt from the drum as soon as it was vented.”

2004

July 26; INTEC vapor leak that first started June 24 involving a gas cylinder that contains anhydrous (containing no water) hydrofluoric gas. Employees were instructed to remain indoors. This is an active work area were old cylinders are being recovered form an existing burial pit. The 40-year-old cylinders are being retrieved and stored.[DOE News Release 7/26/04]

2005

Nov. 8; RWMC propane leak caused the evacuation of 650 employees in the vicinity of RWMC and the AMWTP. Initial reports indicated the propane was leaking from an overfill line on a 1,000-gallon propane tank. Further reports indicated the leak is coming form a failed line or valve leading to a pair of 1,000 gallon propane tanks connected in series as part of the a heating system at the

RWMC's Accelerated Retrieval Project Facility. [DOE/ID News Release 11/8/05] Other reports indicate that propane leaks occurred twice during the summer of 2005.

DOE order O 232.1A Effective Date 8/012/97 closed public access to DOE's Occurrence Reporting and Processing of Operations Information.

2006

June 22: During a Safety Analysis Report (SAR) review, Advanced Test Reactor personnel identified a Potentially Inadequate Safety Analysis (PISA) condition regarding Primary Coolant System (PCS) overpressure protection in relation to a complete loss of heat sink (LOHS). Upon a LOHS condition, the PCS water will heat up, expand, and cause a pressure increase. Additional flow from the gland seal water (GSW) pump was not considered in the analysis. However, combining the GSW flow of 68 gallons per minute (gpm) with the LOHS transient flow (maximum of 622 gpm) would result in a total flow of 690 gpm. This would exceed the capacity of the SAR minimum required relief valve flow. The currently installed PCS relief valves have a combined certified relief capacity of 700 gpm, which would provide adequate protection for this transient. Appropriate notifications were made and an Unreviewed Safety Question evaluation was initiated. There were no restrictions or interim controls associated with this PISA conditions. (NE-ID--BEA-ATR-2006-0007)

June 22: During a Safety Analysis Report review, Advanced Test Reactor personnel identified a Potentially Inadequate Safety Analysis condition regarding an extreme over-speed of the diesel-powered standby pressurizing pump. The analysis assumed that only the pressurizing pump would be affected by the diesel over-speed, and did not take into account the flow increase from the diesel-powered gland seal water pump. Appropriate notifications were made and an Unreviewed Safety Question evaluation was initiated. (NE-ID--BEA-ATR-2006-0008)

May 22: During routine plant observations, it was noted that an unused Advanced Test Reactor (ATR) fuel element storage position was moving laterally approximately 1/2 inch. Movement was most likely induced by the flow from the canal recycle system. At the time, no other storage positions were noted to be moving and this condition was treated as a material deficiency. An extent of conditions review was performed and two additional storage positions were found to move greater than the design dimensional tolerance (1/32 inch). Initial assessment indicates that due to the large amount of conservatism built into the criticality safety evaluation for the fuel storage grid, this small amount of lateral movement poses no threat to criticality safety and no interim controls are required. ATR management has removed the three storage locations from service until a new detailed criticality analysis of the grid is completed. (NE-ID--BEA-ATR-2006-0005)

June 26: During post-maintenance testing at the Advanced Test Reactor Critical (normal shutdown/outage period), the #3 safety rod failed to drop into the reactor core, as required. A spare actuator controller was installed in the #3 position and the test repeated. The #3 safety rod again failed to drop into the reactor core, indicating performance degradation associated with the actuator controllers and their circuitry. Plant and Nuclear Safety Engineering commenced an evaluation of the problem for indication of a possible original design deficiency and a reasonability determination of the existence of a potential inadequacy in the safety analysis (PISA). There was no safety impact since the discovery was during facility shut down. Currently, there are no programmatic impacts. There is potential for future impacts, if further evaluation reveals the need for component redesign. (NE-ID--BEA-ATR-2006-0009)

July 26: A review of the powdered uranium inventory stored at the Nuclear Materials Inspection and Storage Facility (NMIS) was conducted to determine if it was within the safety basis to repackage and permanently remove the material from the facility. The quantity of material in some of the individual packages was large enough to raise a question about whether the current safety documentation was sufficient, resulting in an unreviewed safety question finding. Interim controls were established for the movement of uranium powders from these approved storage areas. (NE-ID--BEA-ATR-2006-0010)

Aug 2: Operations personnel were routing tubing through the Advanced Test Reactor Loop 2B transmitter cabinet when the tubing came in contact with a conduit. The radiological controls technician noted a spark coming from the end of the conduit upon contact. Work was immediately stopped, management was notified and boundaries were established to restrict access to the area. The source of the spark was determined and power to the energized wiring was tagged out. The wiring was placed in an electrically safe configuration by insulating the exposed ends of the wiring and then power was restored. (NE-ID--BEA-ATR-2006-0011)

Aug. 7: Battelle Energy Alliance has a zero defect policy for administration of the lockout/tag out (LO/TO) process. Recently two events fell short of the zero defect expectation and caused the contractor to stop work and a critique and safety stand downs were conducted. Subcontractors were then trained on the LO/TO requirements and the contractor's expectations. In neither case was work performed without hazard mitigations in place. (NE-ID--BEA-ATR-2006-0012)

June 7: The Design Basis Reconstitution (DBR) team discovered a minor calculation error in the high pressure set point of the Advanced Test Reactor plant protection system. When primary coolant system pressure increased to a pre-determined value, the ATR core and several pumps are shutdown automatically. Due to the inaccuracy, the automatic shutdown may have been slightly delayed. The miscalculation was of such small magnitude, it was determined that no additional controls or limits were required for the continued operation of the ATR. The DBR is an effort to search for and correct errors and inconsistencies in the design of the ATR. Similar DBRs have been conducted on numerous commercial nuclear reactors. (NE-ID--BEA-ATR-2006-0006)

Aug. 21: During non-routine maintenance on several Advanced Test Reactor switchgear and motor control centers, the systems control panel was placed under Lockout/Tag-out (LO/TO). During a control panel recheck an energized power source was found. Work was immediately stopped. A critique was held and the cause was identified prior to work restarting. (NE-ID--BEA-ATR-2006-0013)

Aug. 22: Neutron Radiography Reactor operations were being performed when an automatic **reactor <u>shutdown</u> occurred**. No observable failure was identified. The reactor was restarted by reactor operations personnel following verification that the high voltage power supply spurious alarm was clear and operational checks of the reactor protective circuits were completed satisfactorily. Reactor operations personnel did not notify management immediately and did not obtain permission for continued operation. **As a result, the reactor has been shut down and cannot be restarted without line management authority**. A critique is being performed. (NE-ID--BEA-NRAD-2006-0001)

Aug. 23: It was discovered that the Advanced Test Reactor's Safety Analysis Report did not fully analyze the bounding of accidents for reflector <u>aging</u>. A Potentially Inadequate Safety Analysis was identified after this discovery. Compensatory measures were taken, appropriate notifications were made, and an Unreviewed Safety Question Determination was initiated. (NE-ID--BEA-ATR-2006-0014)

Aug. 28: Part of the ongoing Advanced Test Reactor Design Basis Reconstitution Program includes review of the Safety Analysis Report (SAR) and supporting calculations. This review has resulted in a Potential Inadequacy in the Safety Analysis in Section 15.6, "Decrease in Primary Coolant Inventory." One of the supporting calculations had several deficiencies. The calculations will be corrected and changes made. Interim controls have been established to assure secondary coolant system activity remains within the controlled limits. (NE-ID--BEA-ATR-2006-0015)

Oct. 2: During a standard review, it was determined that a more detailed analysis was needed for a maximum potential accident scenario at the Advanced Test Reactor spent fuel storage canal. No compensatory measures were required because requirements are already in place to prevent the movement of loads over irradiated fuel in the canal. Appropriate management notifications were made, and a more detailed safety review was initiated. (NE-ID--BEA-ATR-2006-0023)

Oct. 2: A condition was identified at the Advanced Test Reactor regarding inconsistencies in a maximum hypothetical accident analysis associated with radiological consequence analysis. Appropriate interim measures were taken, management notifications were made, and a more detailed safety review was initiated. (NE-ID--BEA-ATR-2006-0024)

2007

July 31: While working on the Advanced Test Reactor Critical, operators noted that an instrument light for an amplifier was indicating erratically. The instrument was declared out of service, the failed amplifier was replaced, and required post-maintenance testing completed. (NE-ID-BEA-ATR-2007-0016).

Aug. 9: During a maintenance outage of the Advanced Test Reactor, a discrepancy was identified in the safety documentation of the reactor. A review of the concern is under way while the reactor is in maintenance shut down, and no interim controls are required. (NE-ID-BEA-ATR-2007-0017).

Sept. 19: Electricians working at the Advanced Test Reactor discovered electrical energy in an area that was supposed to be de-energized to allow for maintenance. Work was stopped and an investigation undertaken to determine the source of the energy. (NE-ID-BEA-ATR-2007-0018).

Oct. 3: Equipment required for the safe operation of the Advanced Test Reactor (ATR) is identified using a rigorous analysis process and documented in the ATR Safety Analysis Report (SAR). Operation, maintenance, and modification of the ATR are accomplished only after careful review of the SAR for impacts to this safety analysis. When the SAR was upgraded in the late 1990s, a discrete list of this safety-related equipment was developed. Contrary to DOE administrative requirements, there is currently no procedure for maintaining this safety-related equipment list. This is not a safety issue because the list is not used for safety-related decision making – the source analysis documents are. (NE-ID- BEA-ATR-2007-0019)

Oct. 4: During a review of historical ATR documents, it was discovered that a fuel storage requirement had been inappropriately removed from operating procedures. Past operating procedures required that fuel used in the reactor not be placed within 12 inches of the wall of the fuel storage canal during the first 17 days of its storage. The heating of structural materials caused by their absorption of radiation may adversely affect the structural performance of those materials. The 12 inches of separation allows the canal water to shield the walls from the more intense radiation emitted by the fuel during the first 17 days of storage. This requirement was based on extremely conservative assumptions regarding ATR operations which yielded far higher wall radiation exposures than actual operations do. The requirement has been reincorporated into facility procedures. (NE-ID-BEA-ATR-2007-0020)

Oct. 18: A total power outage occurred at INL when a phase conductor on a power pole fell to the ground and tripped the breakers at both ends of the power line. The power pole and cross arm were burned, but the conductor was not damaged. The power pole was repaired and the line was re-energized. (NE-ID-BEA-CFA-2007-0007).

Oct. 24: During startup of the Advanced Test Reactor Critical, the reactor operator reported that instrumentation was showing abnormal readings. **He stopped the start-up procedure and ordered the reactor shut down pending review.** (NE-ID-BEA-ATR-2007-0021).

Oct. 29: At the Advanced Test Reactor, "dampers" are used to prevent the release of radioactive material from the facility in the event of an incident. Several years ago, backup dampers were upgraded to provide the same kind of protection as primary dampers. While both the backup and primary dampers would close in the event of a release at ATR, current safety documentation only requires that one or the other is in service during reactor operations. This is inconsistent with a higher-level safety requirement, and is under review. (NE-ID-BEA-ATR-2007-0023).

Oct. 29: As part of an ongoing evaluation process to ensure that safety documentation at the Advanced Test Reactor is consistent, three issues were identified. These deal with how much pressure the reactor confinement system can withstand; an improper evaluation of the heating, ventilation and air conditioning system performance during a radiation release; and improper evaluation of the effect of negative air pressure on the confinement system. Both the ATR contractor and DOE have evaluated these issues and found there is no impact to the safe operation of ATR. An evaluation of the issues and how to correct them is ongoing. (NE-ID-BEA-ATR-2007-0022).

Nov. 5: Proper procedures were not followed when workers could not get a large sliding door to open at the Advanced Test Reactor building. A worker complained of shoulder pain resulting from manual efforts to force open the stuck door, was examined and released back to work with restrictions. An investigation into the failure to follow proper procedures is underway and corrective actions will be put in place. (NE-ID-BEA-ATR-2007-0024).

Nov. 15: During a planned power outage at the Reactor Technology Complex, power was unexpectedly lost to another building in the area. Work in progress, including crane operations and containment work requiring filtered air movers, was impacted. Upon discovery of the unexpected power loss, a decision was made to complete the work in order to restore power quickly to the affected building. A critique was held to determine the cause of the incident and to identify lessons learned. (NE-ID-BEA-ATR-2007-0025).

Dec. 3, 2007

DOE Cites Battelle Energy Alliance, LLC for Price-Anderson Violations

The U.S. Department of Energy (DOE) today notified Battelle Energy Alliance, LLC (BEA) that it will fine the company $123,750 for violations of the Department's nuclear safety requirements. BEA is the DOE Idaho Operations Office prime contractor for the operation of the Neutron Radiography (NRAD) reactor. The Neutron Radiography Reactor is used to non-destructively examine irradiated materials; the imaging technique utilizes thermal neutrons and is used for quality control purposes in industries which require precision machining.

The Preliminary Notice of Violation (PNOV) issued today cited a series of violations that occurred on August 20, 2006 during the restart and subsequent automatic unplanned shutdown of the NRAD reactor. Violations include failures to adhere to technical safety requirements and reactor operating instructions, inadequacies in the reactor operating instructions, failure to correct known problems with a reactor component, and failure to adequately conduct management assessments in reactor operations.

The proposed civil penalty of $123,750 is based on the significance of the violations yet reflects substantial mitigation granted by DOE for BEA's identification of the issues and corrective actions they have taken to prevent recurrence of the identified deficiencies. While

the deficiencies in NRAD reactor operations did not compromise reactor safety systems, they did represent a significant departure from what the Department expects in the operation of its reactors. BEA will have 30 days to respond with any objections to the notice.
The Price-Anderson Amendments Act of 1988 authorizes the Energy Department to undertake regulatory actions against contractors for violations of its nuclear safety requirements. The enforcement program encourages departmental contractors to identify and correct nuclear safety deficiencies at an early stage, before they contribute to or result in more serious events.

2008

Feb. 11: A leak was discovered in the non-radioactive system that supplies sealing and cooling water to the shaft seal on the primary coolant pump at the Advanced Test Reactor during recent operations**. The reactor was shut down to allow a switch to a different primary coolant pump with a non-leaking seal system, and the reactor was restarted. (NE-ID-BEA-ATR-2008-0003).**

March 4: It was determined there is a discrepancy between a computer model's projections for how quickly safety rods can be inserted at the Advanced Test Reactor, and the response time predicted in current safety documentation. Interim safety controls will be implemented while the issue is further analyzed. (NE-ID-BEA-ATR-2008-0005).

May 6: During start-up of the Advanced Test Reactor, it was determined that a system that indicates power levels in the reactor lobes was not functioning properly, even though it was not required at lower power levels. Limits were placed on reactor operations as a precaution until the system is restored. (NE-ID-BEA-ATR-2008-0007).

May 13: The Advanced Test Reactor was inadvertently shut down when an operator hit the wrong computer command. Normal reactor shutdown procedures were followed. The test and debug computer displays will be password protected in the future to prevent a similar inadvertent shutdown. (NE-ID-BEA-ATR-2008-0009)

June 5: The Advanced Test Reactor experienced an unplanned shutdown due to an electrical malfunction. The reactor went into an unplanned outage to allow for troubleshooting and repair of the problem. (NE-ID-BEA-ATR-2008-0010)

June 26: While inspecting the Advanced Test Reactor during a planned outage, a flow restrictor component was found out of its installed experiment position in the vessel tank. A review of the reactor loading records showed the flow restrictor was installed as part of the vessel closeout process. The closeout process will be revised to include performance of the final visual inventory and inspections after all in-vessel operations are complete and all long-handled tools are removed from the vessel. (NE-ID-BEA-ATR-2008-0013).

July 10: During operation of the Advanced Test Reactor on July 5, operators observed an intermittent reactor vessel low differential pressure alarm. Follow-up investigation revealed electrical interference between the cables of a regulating rod and the differential pressure instrument, causing fluctuations in the differential pressure. Spacers were placed between the cables to limit the interference. Testing was performed and validated that the electrical interference was eliminated. (NE-ID-BEA-ATR-2008-0015).

July 15: A systems engineer determined that an electrical breaker installed in the switchgear cubicle of a pump at the Advanced Test Reactor was not the breaker that was expected to be installed. It was then determined that a required response check of the system was not conducted as prescribed. The pump was placed out of service until the required check could be performed. The pump was not operating at the time the discrepancy was found. (NE-ID-BEA-ATR-2008-0016 and 0017).

July 29: It has been determined that there is an error in the computer code used as part of accident analysis at the Advanced Test Reactor and the Advanced Test Reactor-Critical. After an analysis of the error was conducted, it was determined the error would not significantly change the conclusions of the safety analysis done for the reactors, and no interim restrictions or requirements on reactor operation were necessary. (NE-ID-BEA-ATR-2008-0018).

Aug. 7: Operators noticed unusual noises caused by vibration from a coolant pump at the Advanced Test Reactor. The pump was removed from service and the reactor was shut down. A technical evaluation was performed on the remaining coolant pumps and reactor operations resumed. (NE-ID-BEA-ATR-2008-0019).

Aug. 7: While exiting the storage canal area at the Advanced Test Reactor, an employee set off a personnel contamination monitor alarm when contamination was discovered on the operator's shoe. The contamination was removed and analyzed. Detailed surveys were performed in the canal area and additional controls were implemented for entry in that area.
(NE-ID-BEA-ATR-2008-0020).

Aug. 11: An alarm went off while a primary coolant pump was being restarted at the Advanced Test Reactor. Operators noted that a stand-by pump was running inadvertently. Both pumps were shut down and management notified. (NE-ID—BEA-ATR-2008-0021).

Sept. 22: It was discovered that the engine block heater thermostat on a diesel firewater pump failed at the Advanced Test Reactor Complex. The reactor was in shutdown condition and defueled, and the pump is not required to be operable when the reactor is defueled. The pump was declared inoperable and will be repaired. (NE-ID-BEA-ATR-2008-0027).

Sept. 11: While removing an experiment from the Advanced Test Reactor, it was discovered that configuration of the lift equipment was not in compliance with the drawing in the operating procedure. However, evaluation by the engineering staff determined that the configuration used was an acceptable and safe method for the lift. Management was notified of the non-compliance and an incident critique was held. (NE-ID-BEA-ATR-2008-0024).

Sept. 15: During inspection of a circuit breaker at the Advanced Test Reactor, suspect bolting material was discovered. A non-conformance report was placed into the tracking system for resolution. (NE-ID-BEA-ATR-2008-0025).

Nov. 3: The Advanced Test Reactor was shut down and a review undertaken after an investigation identified potential seismic concerns with a cinder block wall in the facility. Compensatory actions were taken to ensure the wall would not damage required utility systems in a seismic event, and the reactor was restarted. (NE-ID-BEA-ATR-2008-0028).

2009

March 10: During startup of the Advanced Test Reactor on March 8, it was determined that a primary coolant check valve was not seating properly. Startup preparations were stopped [shutdown], the primary coolant system was depressurized and the reactor was defueled so the check valve could be replaced. (NE-ID-BEA-ATR-2009-0003).

March 19: An operator at the Advanced Test Reactor discovered that an inflatable seal on the canal bulkhead at a fuel storage facility was no longer maintaining required pressure because of an air leak. Spent fuel cask movements in the canal area affected by the failed seal were prohibited until the failed seal is repaired or modifications completed. (NE-ID-BEA-ATR-2009-0004).

March 26: It was determined that an existing safety analysis of the Advanced Test Reactor does not fully address the possibility that emergency cooling pumps at the reactor could be submerged before they are able to fulfill their safety function following a reactor shutdown in a particular accident scenario. No compensatory action was taken because subsequent calculations showed that the emergency cooling pumps would remain operational for the required time. (NE-ID-BEA-ATR-2009-0005).

March 30: During a routine safety walk down of the Advanced Test Reactor, a facility representative discovered a slightly open door on a 480-volt electrical panel. The open door provided a small opening where a person could contact energized wires. The electrical panel with the open door was roped off for further investigation. (NE-ID-BEA-ATR-2009-0006).

June 9: An operator at the Advanced Test Reactor noted power variations in one of the reactor's experimental lobes. After consulting with ATR engineering and verifying the indications were from a failure of the instrumentation system, the ATR shift supervisor declared the instrumentation system inoperable, and initiated limiting conditions on reactor operations. The indication problem was corrected and the limiting condition on reactor operations was removed the same day. (NE-ID-BEA-ATR-2009-0013).

June 29: An equipment operator noted the improper assembly of wire rope components on a mobile crane during a daily pre-use inspection at the Advanced Test Reactor Complex. Other suspect/counterfeit wire clamps were also noted. This crane was tagged out of service and further mobile crane inspections discovered suspect/counterfeit components. These cranes were also tagged out of service. (EM-ID-CWI-BIC-2009-0002).

Aug. 24: A review was initiated to look at the Advanced Test Reactor primary coolant system chemistry. In the course of the review, it was noted that the technical safety requirements limits for pH of the ATR primary coolant system water allow a low range (pH 4.7) that <u>could possibly cause damage to the thin boehmite oxidation layer that is on the fuel.</u> Interim controls after the discovery have been put into place that do not allow the pH of the primary coolant system to get below 5.0. A review of chemistry logs has been performed to ensure that none of the fuel in the canal has been exposed to a pH less than 5.0. (NE-ID—BEA-ATR-2009-0020).

Sept. 16: It has been determined that evacuation sirens located at the Advanced Test Reactor Complex are mounted within office buildings that are not designed to withstand significant seismic events. A review of the safety analysis at the facility is underway. (NE-ID—BEA-ATR-2009-0021).

Sept. 30: An automatic <u>shutdown</u> of the Advanced Test Reactor occurred when a circuit breaker on a diesel bus tripped open on a ground fault indication. An investigation was initiated into the cause of the ground fault trip. The reactor remained in a safe condition and was restarted following review of the shutdown. (NE-ID—BEA-ATR-2009-0022).

Oct. 12: An automatic <u>shutdown</u> of the Advanced Test Reactor occurred as the result of an error by an experiment operator who failed to follow proper procedures. The reactor remained in a safe condition; a critique was conducted and corrective actions taken.
(NE-ID—BEA-ATR-2009-0023).

Nov. 17: While connecting a battery charger to a battery bank at the TRA-604 Battery Room, an electrician was burned on both hands by an electrical arc. The injured electrician was treated at the Central Facility Area medical dispensary and then driven home. The doctor found first and second degree burns over 5 percent of the electrician's hands. Electrical work was stopped and access to the battery room secured pending a critique of the incident. (NE-ID—BEA-RTC-2009-0002).

Fuel Burnup Record: Idaho National Laboratory scientists have set a new world record for fuel burnup with a reactor fuel for next generation high temperature gas reactors. As part of a nearly three-year experiment, about 19 percent of the fuel's low-enriched uranium has been consumed in the INL's Advanced Test Reactor – more than double the previous record set by German researchers. Better reactor fuels mean more efficient heat and power production and less waste when the fuel is spent.

Nov. 24: Start-up of the Advanced Test Reactor was interrupted by an instrument problem. The problem was diagnosed and corrected and reactor <u>start-up</u> resumed.
(NE-ID-BEA-ATR-2009-0024).

Dec. 2: The Advanced Test Reactor was <u>shut down</u> when a calculation error was discovered in the assurance package for that particular reactor operating cycle. The reactor remained in shutdown until the error was corrected and a re-calculation performed. (NE-ID—BEA-ATR-2009-0025).

2010

Jan. 12: The shift supervisor at the Advanced Test Reactor entered into a limiting condition [shut-down] for operation of the reactor when two instrument systems used to calculate water flow in the reactor were declared out of service. Limiting conditions for operation are a Department of Energy approved method to ensure safety of nuclear facilities while system performance is evaluated. The shift supervisor used other data systems to verify the safety of reactor operations while the systems were repaired and returned to operation. (NE-ID—BEA-ATR-2010-0001).

Nuclear Research: The INL's Advanced Graphite Capsule project will test over 2,000 different samples of graphite in the INL's Advanced Test Reactor over a 10-year period. The tests are part of work to certify the graphite that is used in many parts of advanced nuclear reactor designs.

Feb. 11: An air leak was detected from two pressurized seals on the bulkhead at the head of a nuclear fuel storage canal. Cask handling was prohibited in the canal until the seal was repaired. (NE-ID—BEA-ATR-2010-0003).

March 9: An electrician violated a lock out/tag out when he mistakenly disconnected the electrical system for the wrong pump motor at the Advanced Test Reactor. The motor was not energized at the time, and there were no injuries or damage to equipment. A lock out/tag out was applied and a critique of the incident was scheduled. (NE-ID—BEA-ATR-2010-0004).

April 8: An operator at the Advanced Test Reactor noted that the distribution breaker for the Plant Protective System channel C battery charger had tripped open. An attempt was made to reset the breaker, but it immediately tripped open again. The system is not required to be operable while the reactor is shut down, and it was taken off-line. (NE-ID—BEA-ATR-2010-0006).

April 26: Two subcontractors violated posted radiological control area entry instructions while delivering waste boxes to a storage pad at the Advanced Test Reactor Complex. Because of the low radiological fields present in the area, the two workers did not receive significant exposures. A radiation engineer will complete a radiological exposure questionnaire to document any dose received. (NE-ID—BEA-RTC-2010-0001).

May 5: Several instances of suspect/counterfeit bolts were discovered during a recent outage at the Advanced Test Reactor. Some of the suspect bolts were determined to be non-load bearing and acceptable for use. They will be replaced when future maintenance activities require disassembly of the components. All other suspect bolts were removed pending determination for disposal or destruction. (NE-ID—BEA-ATR-2010-0008).

June 7, 2010 INL.gov website Information Update

"**On May 30, 2010, Idaho National Laboratory voluntarily interrupted [shutdown] routine testing at the Advanced Test Reactor because operators detected momentary, higher-than-normal radioactivity levels in the reactor's primary coolant and building exhaust systems.**

"The radioactivity levels detected were too low to trigger any routine reporting criteria, but warranted interruption of testing at the ATR to allow for experiment analysis and removal of the source. No measurable exposure to workers or the public occurred.

"One of the ATR's functions as a test reactor is to test how new nuclear fuel designs perform. During this testing, experiments may release minor quantities of radioactivity into the reactor's primary coolant system. INL's continuous monitoring of ATR systems quickly detects such release conditions, should they occur.

"ATR staff has now determined that the experiment which released fission products into the reactor coolant is one of several testing new types of low-enriched fuel that could be used in research reactors that currently run on highly-enriched uranium. Testing at the ATR will resume after the experiment causing the increased radioactivity is removed and normal scheduled maintenance work is completed."

June 15: A need for further safety analysis was determined at the Advanced Test Reactor. As part of ongoing review of the safety documentation at the reactor, it was determined the existing analysis does not look at what would happen in the unlikely event that all five experiment loops in the reactor failed during an earthquake. The preliminary analysis showed that this accident is already enveloped by other accidents in the unlikely category and it does not have any affect on safe reactor operation (NE-ID—BEA-ATR-2010-0009).

July 8: A laborer, working at the Advanced Test Reactor Complex, cut the index finger and thumb on his left hand while trying to cut a plastic sprinkler pipe. The employee was evaluated by a doctor, who referred the employee to an off-site specialist. A review of the event and critique were performed. (NE-ID—BEA-RTC-2010-0002).

July 14: An engineer at the Advanced Test Reactor reported that the lubricating oil viscosity for a diesel firewater pump was out of specification. The pump was declared out of service, **operations were limited according to procedure, and a service request to change the lubricating oil and filter on the firewater pump was submitted and approved**.
(NE-ID—BEA-ATR-2010-0010).

July 20: An operator injured his elbow while moving a grating at the Advanced Test Reactor canal. The injury occurred in June, but was not fully diagnosed for a few weeks. The operator eventually had outpatient surgery. An accident investigation was initiated and a critique scheduled. (NE-ID—BEA-ATR-2010-0011).

July 22: Management at the Advanced Test Reactor (ATR) noted data anomalies from the Wide Range Neutron Level ion chamber. Specifically, the measured current from the ion chamber was expected to level out at high voltage, but did not. A critique was held and ATR engineering was asked to perform a technical evaluation of the chamber. (NE-ID—BEA-ATR-2010-0012).

July 27: The Advanced Test Reactor was shut down following discovery of low oil pressure in one of the two primary coolant pumps. The pump was secured at temperatures well below acceptable levels and there was no equipment damage. (NE-ID—BEA-ATR-2010-0013).

Aug. 9: The safety analysis for the Advanced Test Reactor is continually reviewed. In a recent review, it was determined that a more conservative or safer approach would be to adjust the interim operating controls for the ATR surge tank, which affects the initiation time of the Emergency Firewater Injection System (EFIS). This was due to review of the ATR surge tank volume. The new controls were slightly more stringent. However, the actual EFIS as tested will operate much faster than the safety analysis requires. (NE-ID—BEA-ATR-2010-0015).

Summary of Advanced Test Reactor Shutdowns
1973 Through 3/27/12
September 20, 2012 [3]

Year	Shutdown/ Scrams Dates	Power Restricted Dates	Total Shutdowns Power Restrictions	Comments DOE Document Citation
1973	Feb. 2			Foot Note (FN) [4]
1974	Jan. 15			FN [5] + FN 6
	June 5			FN 3 + FN 6
	Sept. 12			FN 3 + FN 6
1977	Feb. 9			FN [6] + FN 6
1980	11			FN [7] + FN 6
	Total 16	?	Total 16	

[3] DOE Occurrence Reports database (https://orpspublic.hhs.doe.gov/orps/)
[4] Incident Report, Aerojet Nuclear Co., ANC-73-11, ATR, 2/2/73; "A scram was received …for run startup. **A second scram** received at 0906 hours, Feb. 2, 1973."
[5] Incident Reports, Aerojet Nuclear Co., ANC-73-11, 2/2/73; ANC-74-5 (ATR-74-1) 1/15/74.
Aerojet Nuclear Co,, Unusual Occurrence Reports (UCR), ANC-74-60 (ATR-74-27), 6/5/74.
UCR, Aerojet Nuclear Co., ANC-74-64, (ATR-74-31), 9/10/74.
[6] Unusual Occurrence Reports (UCR), EG&G-77-26 (ATR-77-19), 3/9/77.
[7] Advanced Test Reactor Capabilities and Future Operating Plans, F. Marshall, INL, pg. 3.
"The number of unplanned scrams decreased from 11 in 1980 to 1 in 2004."

Year	Shutdown/ Scrams Dates	Power Restricted Set backs	Total Shutdowns Power Rest.	Comments/ DOE Document Citation
1991	4			FN [8]
1992	1			FN 6
1993	1			FN 6
1996	1			FN 6
1998	2			FN 6
1999	1			FN 6
	Total 10	?	Total 10	
2000-	Jan. 2			NE-ID-BBWI-ATR-2000-0003
	Jan. 11			NE-ID-BBWI-ATR-2000-0004
	Feb. 1			FN 6
	Sept. 27			NE-ID-BBWI-ATR-2000-0020
2001	Feb. 6			NE-ID-BBWI-ATR-2001-0004
2002	Nov. 1 +			Internal Office Memo 11/18/02
	1			NE-ID-BBWI-ATR-2002-0008 + FN 6
2003	Aug. 21			NE-ID-BBWI-ATR-2003-0012
2004	July 10			NE-ID-BBWI-ATR-2004-0007
	Total 9	?	Total 9	
2005	1			NE-BEA-ATR-2005-0004
2006		Sept. 14		NE-BEA-ATR-2006-0019
	Total -1	Total 1	Total 2	

2007		June 17		NE-ID-BEA-ATR-2007-0013
	June 25			FN 6+NE-ID- BEA-ATR-2007-0014
	Dec. 13			Reported in 2008; NE-ID- BEA-ATR-2008-0001
	Total 2	Total 1	Total 3	

[8] DOE Freedom of Information documents provided to EDI.

Year	**Shutdown/ Scrams Dates**	**Power Restricted Limiting Conditions Dates**	**Total Shutdowns Power Rest. Limiting Conditions**	**Comments/ DOE Document Citation**
2008	Jan. 9			NE-ID- BEA ATR-2008-0001
	Feb.7			NE-ID- BEA ATR-2008-0003
	Feb. 11			FN 6
		April 30		NE-ID- BEA -ATR-2008-0007
	April 1			NE-ID- BEA -ATR-2008-0008
	May 1			NE-ID- BEA ATR-2008-0009
	May 13			FN 5
	June 3			NE-ID- BEA ATR-2008-0010
	Aug. 5			NE-ID- BEA ATR-2008-0019
	Aug. 11			FN 6
		Oct. 15		FN 7 (water power alarm)
	Oct.16			FN 7 NE-ID- BEA-ATR-2008-0028
	Nov.21			FN [9] (PCS activity RERTR)
	Total 11	Total 2	Total 13	
2009	Jan. 19			FN 7 (outer shim control)
	Mar. 8			FN 6 +NE-ID-ATR-2009-0003
		Mar. 17		FN 7 (regulator rod #2 failure)
	Mar. 10			FN 6
	May 31			FN 7 (high neutron level) + ATR-CR-5-31-09
	Sept. 29			FN 7 + NE-BEA-ATR-2009-0022
	Oct. 8			FN 7 + 6+ NE-ID-ATR-2009-0023
	Oct. 12			FN [10] (loss diesel power) +FN 7
	Oct. 14			FN [11] + FN 6
	Nov. 6			FN [12] + FN 7
		Nov. 22		FN 6+NE-ID-BEA-ATR-2009-0024
	Dec. 1			FN 7+NE-ID-BEA-ATR-2009-0025
	Total 10	Total 2	Total 12	

[9] DOE/ATR Unplanned Shutdowns Slow Setbacks Reductions in Power FY-09-2010 (October 1, 2008 –September 31, 2010 (FOIA).

[10] INL Initial Notification Report. FOIA Doc.# 9, 13 October 2009, Shutdown 10/12/09. Critique Rpt. ATR-CR-10-13-2009

[11] INL Initial Notification Report. FOIA Doc, 15 October 2009, Scram, 14 October 2009.

[12] INL Initial Notification Report. FOIA Doc.#10, Shutdown, 6 November 2009.

2010		Jan. 12		NE-ID-ATR-2010-0001
	Feb. 14			FN 7+ FN [13] (Channel A vent failure)
	May 27-30			FN 7+FN [14] (Increase Rad. PCS/Stack)
		July 13		FN 7 (quad IV flow inst. Failure) + INL Initial Not. Rpt. 14/7/10
	July 23			FN 7 (M-6 PC pump lub. Failure) + NE-ID-BEA-ATR-2010-0013
		July 25		FN [15] + FN 7
	July 26			FN [16] (low coolant flow)
	Oct.12			FN [17]+ NE-ID-BEA-ATR-2010-0019
	Oct. 26			FN [18] + FN 6 + INR 26 Oct. 2010
	Nov. 17			FN [19] INR 11/17/10
	Total 7	Total 3	Total 10	

2012*		Mar. 6-26		NE-ID-BEA-ATR-2012-0007 + 0008 +0010+0014
	Mar. 22			NE-ID-BEA-ATR-2012-0013
	Mar. 27			NE-ID-BEA-ATR-2010-0015
		May 9		NE-ID-BEA-ATR-2012-0017 (fire water pump failure)
		June 5		NE-ID-BEA-ATR-2012-0021 (fire water pump failure)
	Total 2	Total 3	Total 5	
Totals 1973 to 3/27/12	Total 67	Total 12	Total 79	

*Through 3/27/12

Additional References:

1. Advanced Test Reactor Outage Risk Assessment, July 9, 1998, INEEL/Con-97-0463; Conf-980616
2. INL Reactor Outage, 2/5/08, DOP-7-7.2.7, Rev.24.

---

13 INL Initial Notification Report (INR). FOIA Doc.#14, 15 February 2010, Shutdown 2/14/2010. DOE/ATR Unplanned Shutdowns Slow Setbacks Reductions in Power FY-09-2010 (FOIA)

14 INL Initial Not. Rpt. FOIA Doc.D-3-#15, 30 May 2010, Shutdown 5/27/10. DOE/ATR Unplanned Shutdowns Slow Setbacks Reductions in Power FY-09-2010 (FOIA). ATR stack effluent 105 Ci/day.

15 INL Initial Not. Rpt. FOIA Doc., 26 July 2010, Reduced power 25 July 2010.

16 INL Initial Not. Rpt. FOIA Doc., October 2010

17 INL Initial Not. Rpt. FOIA Doc. E-1 13 October 2010, Scram 12 October 2010.

18 INL Initial Not. Rpt. FOIA Doc. #18 , 26 Oct 2010

19 INL Initial Not. Rpt. FOIA Doc. 17 November 2010, Shutdown 17 November 2010.

IX. Appendix B

Listing of INL Reactors & Facilities by Area

Facility Area	Acronym
Argonne-National-Laboratory-West	ANL-W
Now called Materials and Fuels Complex	MFC
Operating or Operable Reactors	
Experimental Breeder Reactor-II	ERB-II
Integral Fast Reactor	IFR
Neutron Radiography Reactor	NRAD
Argonne Fast Reactor Critical	AFSR
Transient Reactor Test Facility	TREAT
Zero Power Plutonium Reactor	ZPPR
Safety Test Reactor Facility	STF
Sodium Loop Safety Facility Reactor	SLSF
TRIGA Research Reactor	TRIGA
ANL-W----Non-Operating-Reactors	
Zero Power Physics Reactor No 2	ZPPR-II
Zero Power Physics Reactor No 3	ZPPR-III
Argonne-West Operating Facilities	ANL-W
(now called Materials and Fuels Complex)	MFC
Hot Fuel Examination Facility/North	HFEF/N
Hot Fuel Examination Facility/South	HFEF/S
(Fuel Cycle Facility)	FCF
Laboratory and Office Building	L&OB
Fuel Manufacturing Facility	FMC
Spent Fuel Pool	NRSD
ZPPR Dry Fuel Storage	ZPPR
TREAT Dry Fuel Storage	TREAT
ANL-W Waste Discharge Sites	
Radioactive Scrap and Waste Facility	RSWF
Injection Well between T-1 & ZIPPR	ANL-10
Waste Pond	ANL-01
Three Ditches	
Injection Well at Building 768	ANL-15
Two Injection Wells at Building 759	ANL-16
Injection Well at Building 720	ANL-17
TREAT Leach Field	ANL-21

Radioactive Waste Management Complex	RWMC
Subsurface Disposal Area	SDA
Transuranic Disposal Area	TDA
Transuranic Storage Area	TSA
Compactor Building	
Stored Waste Experimental Pilot Plant	SWEEP
LCCDA Chemical Seepage Pits	
Intermediate Level TRU Storage Facility	ILTSF
Advanced Mixed Waste Treatment Plant	AMWTP
Naval Reactors Facility (operating or operable)	NRF
Large Ship Reactor "A"	AIWA
Large Ship Reactor "B"	AIWB
Natural Circulation Reactor	S5G
Submarine Thermal Reactor	S1W(STR)
High Temp. Marine Propulsion Reactor 630-A	
NRF Operating Facilities	
Expended Core Facility	ECF
Spent Fuel Water Basins	
Dry Cell Fuel Cutting	
Idaho Chemical Processing Plant	ICPP
(now called Idaho Nuclear Technology Center	INTEC
Fluorinel Dissolution and Fuel Storage	FAST(CPP-666)
(Zirconium fuel reprocessing)	
New Waste Calcine Facility	NWCF(CPP-659,694)
Waste Calcine Facility	WCF
Denitration Facility	CPP-602
Remote Analytical Laboratory	RAL(CPP-627)
(Pilot Plant fuel reprocessing)	
Headend Process Plant	CPP-640
Fuel Receiving and Storage Building	
Underwater Fuel Storage Facility	FSF (CPP-603)
Irradiated Fuel Storage Facility	IFSF (CPP-603)
Fuel Element cutting Facility	FECF (CPP-603)
Waste Treatment Building	CPP-604
(Three 18,000 gal. waste tanks)	
(Process Evaporator Waste)	
Calcine Waste Storage Bins (underground)	
High-Level Waste Tank Farm (underground)	
(Eleven 300,000 gal. Tanks)	
Underground Fuel Storage Facility	CPP-749
Aluminum Fuel Reprocess Building	CPP-601
Fuels Processing Facility	FPF (CPP-631)
Process Improvement Facility	CPP-637
CPP Percolation Ponds #1 & #2	CPP-67
Non-operating	
CPP Waste Injection Well (Sealed Off)	CPP-23

USGS Waste Injection Well	USGS-50
Waste Calcine Facility	WCF
Auxiliary Reactor Area	ARA
Auxiliary Reactor Area - I (dismantled)	ARA-I
Army Reactor Program Support Building	
Mobil Power Plant Reactor No 1	ML-1
Nuclear Effects Reactor	FRAN
Fast Spectrum Refractory Metals Reactor	710
Hot Critical Experiment	HOTCE
Chemical Evaporation Pond	
Auxiliary Reactor Area - II	ARA-II
Stationary Low Power Reactor - I (dismantled)	SL-1
Auxiliary Reactor Area - III	ARA-III
Army Gas Cooled Reactor Experiment	GCRE
Auxiliary Reactor Area - IV	ARA-IV
Power Burst Reactor Facility	PBF
Evaporation Pond	PBF-10
Warm Waste Injection Well	PBF-05
Corrosive Waste Injection Well	PBF-15
Chemical Waste Evaporation Pond	
SPERT Area	SPERT
Operating Facilities	
Waste Experimental Reduction Facility	WERF
Dismantled Facilities	
Special Power Excursion Reactor Test - I	SPERT-I
Special Power Excursion Reactor Test - II	SPERT-II
Special Power Excursion Reactor Test-III	SPERT-III
Special Power Excursion Reactor Test-IV	SPERT-IV
SPERT Leach Pond	PBF-16
Test Area North	TAN
Non-Operating or Dismantled Reactors	
Experimental Beryllium Oxide Reactor	EBOR
Aircraft Nuclear Propulsion	ANP
Initial Engine Test	IET
Loss-of-Fluid Test	LOFT
Split Table Reactor	STR
Spherical Cavity Reactor Critical Exp.	SCREC
SNAP-10A Transient Reactor No 1	SNAPTRAN-1
SNAP-10A Transient Reactor No 2	SNAPTRAN-2
SNAP-10A Transient Reactor No 2	SNAPTRAN–3
Water Reactor Research Test Facility	WRRTF
Heat Transfer Reactor Experiment. No 1	HTRE-I
Heat Transfer Reactor Experiment. No 2	HTRE-II
Heat Transfer Reactor Experiment. No 3	HTRE-III

TAN Operating or Operable Facilities	
Water Reactor Research Test Facility	WRRTF
Technical Support Facility	TSF
Decontamination Facility Hot Shop	TAN-607
Fuel Storage Pool	TAN-607
Fuel Cask Storage Pad	TAN-SFCTSP
Containment Test Facility	CTF
Radioactive Materials Laboratory	TAN-RML
Radioactive Liquid Waste Storage	RLWSF (TAN-666)
Radioactive Materials Storage Pool	
Warm Shop	
Specific Manufacturing Capacity Facility	SMC/CT
Process Experimental Pilot Plant	PREPP
Aircraft Nuclear Propulsion Hanger	
Initial Engine Test Control Bunker	
Operating Waste Discharge Sites	
WRRTF Evaporation Pond at TAN-762	WRRTF-03
WRRTF Two-Phase Pond at TAN-763	WRRTF-02
LOFT Disposal Pond	LOFT-02
TSF Disposal Pond	TSF-07
TSF Intermediate-Level Rad. Disposal	TSF-09
Central Facilities Area	CFA
Radiological/Environmental Sciences Lab.	RESL
Hazardous Waste Storage Facility	HWSF
Laundry & Decontamination Facility	CF-617
Maintenance Shops & Cafeteria	
Waste Drain Field	CFA-08
Motor Pool Pond	
Standards Calibration Laboratory	CF-698
Willow Creek Building (document archive)	WCB
Naval Ordinance Disposal Area	NODA
Navy Unexploded Ordinance Burial Ground	
Experimental Breeder Reactor Area	ERB-1
Test Reactor Area	**TRA**
Now called Reactor Technology Center	RTC
Operating or Operable Reactors	
Advanced Reactivity Measurements Fac.	ARMF-1(TRA-660)
Advanced Test Reactor	ATR (TRA-670)
Advanced Test Reactor Critical	ATRC
Coupled Fast Reactivity Measurements	CFRMF
Non-Operating Reactors	
Engineering Test Reactor	ETR
ETR Critical Facility Reactor	ETRC
Material Test Reactor	MTR

TRA Operating Facilities	
Hot Cell Facility	TRA-632
Alpha-Wing Laboratory	TRA-661
TRA Operating Waste Sites	
TRA Hot Waste Tanks #2,#3,#4	TRA-613 & TRA-15
TRA Warm Waste Retention Basin	TRA-04
TRA Brine Tank at TRA-631	TRA-20
TRA Cold Waste Disposal Pond	TRA-08
MTR Fuel Canal	TRA-603
ARMF Fuel Canal	TRA-660
ATR Fuel Canal	TRA-670
TRA Non-Operating Waste Sites	
TRA Chemical Waste Disposal Pond	TRA-06
TRA Warm Waste Pond	TRA-03
TRA Non-Operating Facilities	
Cavity Critical Reactor	CREC
Critical Experimental Tank	CET
Reactivity Measurement Reactor Facility	RMF
Shield Test Pool Facility Reactor	SUSIE
Waste Injection Well	TSF-05
Waste Injection Well	USGS-53

BORAX Area

Dismantled	
Boiling Water Reactor Experiment No 1	BORAX-I
Boiling Water Reactor Experiment No 2	BORAX-II
Boiling Water Reactor Experiment No 3	BORAX-III
Boiling Water Reactor Experiment No 4	BORAX-IV
Boiling Water Reactor Experiment No 5	BORAX-V

Army Reentry Vehicle Facility Area	ARVFS
Defense Nuclear Testing Ground	

EOCR/OMRE Area (decommissioned)

Organic Moderated Reactor Experiment	OMRE
Experimental Organic Cooled Reactor	EOCR

IX. Appendix C

Glossary of Terms

Actinide: Any of a series of chemically similar, mostly man-made radioactive elements with atomic numbers ranging from actinium (89) through lawrencium (103). [ROD@9-1]

Alpha - relatively large slow moving particles (positive charge consisting of 2 protons and 2 neutrons) that will not penetrate clothing, a sheet of paper or the outer layers of skin. Serious cell damage can result if inhaled or ingested. Alpha sources may be associated with spent nuclear fuel. In addition to many other heavy radioactive elements, alpha particle emitters include uranium, americium, radium, thorium, and plutonium-238.

Background Radiation: The amount of ionizing radiation to which a person is exposed from natural sources, such as terrestrial radiation due to naturally occurring radionuclides in the soil, cosmic radiation originating in outer space, and naturally occurring radionuclides deposited in the body. [NRC@125] Heated debate continues between the public and government definitions of background. The federal government insists that background include man-made radiation from "global fallout as it exists in the environment (such as from the testing of nuclear explosive devices." [DOE/EIS-0218F@9-1] By including man-made fallout, the government is able to trivialize the impact of any given nuclear plant.

Beta - small particles (usually electrons) that, depending on energy, may penetrate several layers of skin causing serious skin damage especially to the lens of the eye. May be shielded with materials such as aluminum, glass or plastic. Found in reactor, hot cell and radioactive waste storage areas. Beta particle emitters include strontium-90, Cesium-134/137, Krypton-85, (high energy) and tritium (low energy).

Biological Half-life: The average time it takes for the body to eliminate on half the amount of a radionuclide (as measured in radioactivity) starting at the time that the radionuclide was ingested. {Connor@61]

Calciner: This incineration process takes liquid high-level waste (HLLW) generated during the chemical reprocessing of spent reactor fuel and burns off the combustible liquid portions of the waste and then mixes the residual ash with a granular calcine for easier handling and storage. The calcine process as applied to HLLW is unique to INL and consequently, the site does not have near the massive inventory of HLLW that Hanford or Savannah River have.

Characterization: The determination of waste or spent nuclear fuel composition and properties, whether by review of process knowledge, nondestructive examination or assay, or sampling and analysis, generally done to determine appropriate storage, treatment, handling, transportation, and disposal requirements. [ROD@9-2]

Cladding: In this context, cladding refers to the metal covering around the fissile portion of reactor fuel. The cladding acts as an initial containment for mixed fission products that are produced during the operation of a reactor. There is a wide range of cladding materials some of which include zirconium, aluminum, stainless steel, and graphite. Failed fuel refers to nuclear fuel whose external cladding has cracked, pitted, corroded, or potentially allows the leakage of radioactive gases.

Criticality: The conditions in which a system is capable of sustaining a nuclear chain reaction such as in a nuclear reactor. If a reactor loses its coolant system or if the fuel rod cladding fails, a meltdown can result. Uncontrolled criticality can occur for instance in a spent fuel reprocessing plant were sufficient fissile material collects in a geometrically unstable situation that results in spontaneous criticality. If adequate spacing between fuel rods in a fuel storage facility, spontaneous criticality can also occur.

Curie (Ci) - is a measure of radioactivity of a substance equaling 37 billion disintegrations per second. (DPS) Curies are also used to quantify the total radioactive energy concentration in a given quantity of material - such as Pico curies per liter (pCi/L), or Pico curies per gram (pCi/gram). EPA Maximum Contaminate Level (MCL) standard for cesium-137 is 10 pCi/gram, or 200 pCi/L. Due to the extreme biological affects of radionuclides, these exposure standards are expressed in Pico curies, or one part per trillion.

Pico Curie (pCi) - is equal to 1,000,000,000,000 th of one Curie; or 10^{-12} Ci
Nano Curie (nCi) - is equal to 1,000,000,000 th of one Curie; or 10^{-9} Ci
Micro Curie (uCi) - is equal to 1,000,000 th of one Curie; or 10^{-6} Ci

Mill Curie (mCi) - is equal to 1,000 th of one Curie; or 10^{-3} Ci

Decay (radioactive): The spontaneous disintegration of the nucleus of an unstable atom resulting in the emission of particles and energy.

Decay Products: A new isotope created as a result of the disintegration of a radioactive, parent atom. As the parent atom gives up particles and energy in an attempt to stabilize its nucleus, it transforms itself into new isotopes and elements whose characteristics and radioactive properties can be quite different from the parent radionuclide

For example, as an atom of uranium-238 undergoes natural decay, it transforms itself into several so-called "daughter" products such as radium-226 and polonium-210, which are considerably more biologically harmful than the original parent atom. [Connor@60]

Dosimetry: A generic term that means absorbed dose, dose equivalent, effective dose equivalent, committed effective dose equivalent, or total effective dose equivalent. Also see REM

Fissile Material: Any material fissionable by thermal (slow) neutrons; the two primary fissile isotopes are uranium-235 and plutonium-239 which are also the primary material in nuclear reactor fuel.

Fission: The splitting or breaking of a nucleus into at least two other nuclei and the release of a relatively large amount of energy. Two or three neutrons are usually released during this type of transformation.

Fission Products: The nuclei (i.e. cesium-137) produced by fission of heavy elements (i.e. uranium-235), and their radioactive decay products.

Fuel Elements: Nuclear reactor fuel including both the fissile and the structural material serves as cladding.

Gamma: highly penetrating photon radiation(similar to x-rays but higher energy); energetic gamma may pass through the body while others are absorbed, more by bone than soft tissue. May be shielded by very dense material such as lead, concrete or large quantities of water. Found in reactor, hot cell and radioactive waste storage areas. Gamma ray emitters include cobalt-60, chromium-51, and Iodides.

Neutron - May be highly penetrating. Human tissue damage results from energy imparted to hydrogen atoms as they are struck in the body. May be shielded by materials containing large amounts of hydrogen atoms such as paraffin, polyethylene and water. Found in operating reactor areas. Neutron particle emitters include uranium-235 and plutonium-239 when they undergo fission reactions.

Nobel Gases: This is a category of radioactive gases that are generally short-lived (a day or less) . They are sometimes referred to as chemically inert gases because they do not readily interact in the environment. They are, however by no means harmless because they are readily dispersed in the environment and resist becoming absorbed by plants, animals and humans.

Half-life - is the amount of time it takes for a substance's radioactivity to be reduced by half. The half-life determines how long a substance will remain radioactive. For example, cesium-137 has a half-life of about 30 years. That means that if a liter of water has 500 pCi/L concentration of Cs-137, that water will have a concentration of 250 pCi/L in 30 years; 125 pCi/L in 60 years; and 62.5 pCi/L in 90 years. The whole life of a radioactive substance is approximately its half-life times twenty years.

High-level Waste: Spent nuclear reactor fuel, and the highly radioactive waste material that results from the reprocessing of spent nuclear fuel, including liquid waste produced directly from reprocessing and any solid waste derived from the liquid that contains a combination of transuranic and fission product nuclides in quantities that require permanent isolation. High level waste may include the highly radioactive material the Nuclear Regulatory Commission consistent with existing law, determines by rule requires permanent isolation.

Ionizing Radiation: Radiation that is sufficiently energetic to dislodge electrons from an atom. Ionizing radiation includes x and gamma radiation, beta particles, alpha particles and heavier charged atomic nuclei. Neutron radiation, a product of nuclear fission in reactors and during nuclear detonations also ionized indirectly by colliding with atomic nuclei. Conversely, non-ionizing radiation is all other radiation including microwave and other electro-magnetic forms of radiation that involves the transfer of energy through space but is not sufficiently energetic to dislodge electrons in the atoms it interacts with. [Connor@58]

Low-level Waste: A catchall term for any radioactive waste that is not spent fuel, high-level, or transuranic waste. There are four categories of LLW - Class A, Class B, Class C, and greater than Class C (GTCC). Low-level does not mean low-risk.

Maximum Contaminate Level (MCL): The maximum permissible levels of a contaminate in water which is delivered to the free flowing outlet of the ultimate user of a public water system. This is a Environmental Protection Agency promulgated standard.

National Environmental Policy Act (NEPA): A Federal law, enacted in 1970, that requires the Federal government to consider the environmental impacts of, and alternatives to, major proposed actions in its decision-making processes.

Off-gas: This generally refers to the radioactive/chemical releases to the atmosphere from a nuclear plant.

Radionuclide: Atoms that emit ionizing radioactivity in the process of trying to stabilize an energized and unstable atomic nucleus. A radionuclide is identified by element and by an isotopic number which represents its atomic weight. [Connor@58]

Rad (R) (radiation absorbed dose) is a unit of dose equal to the deposition of 100 ergs of energy per gram of material being irradiated. A Roentgen is basically equal to one Rad.[IEER] The rad measures the amount of radiation absorbed by the exposed material. This number must be related to other factors in determining the effective dose to a human. [PSR]

Rem - (Roentgen Equivalent Man) measures the damage to a human from radiation exposure. It is determined by multiplying the number of rads by a number reflecting the potential damage caused by that particular type of radiation. [PSR] The Rem is a unit of dose that takes into account the relative biological damage due to various kinds of radiation energy (i.e.. Beta, Gamma, Alpha) absorbed by tissue. In general, the larger the amount of energy deposited per unit length of tissue, the greater the radiation damage per unit of absorbed radiation energy; that is, the greater the ratio of rems to rads. A rem is equal to 1000 millirem (mRem). Idaho's State exposure standard for gross beta is 4 mRem/yr (.004 rem).[Oversight 1991 @25] EPA radiation dose equivalent standards for the public were lowered in 1990 to 10 mRem/yr. DOE and NRC standards for workers are 5 rem/yr which have not changed for 35 years. British standard for workers is 1.5 rem/yr.

"Because of the particle mass and change, 1 rad deposited in tissue by alpha particles creates a more concentrated biological damage than 1 rad of gamma rays. To compensate for this difference in damage and subsequent effect, a new unit was created - the rem. This is called the dose equivalent. The absorbed dose is measured in rads and the dose equivalent is measured in rems. The rad and rem are related by a quality factor as follows: Number of rems = Q times the number of rads; where Q is the quality factor that has been assigned the following value: Q = 1 for beta particles and all gamma rays; Q = 10 for neutrons from spontaneous fission and for protons; Q = 20 for alpha particles and fission fragments. The quality factor is meant to approximately account for the relative harm caused by various types of radiation." [Federal Register, Vol. 56, No 138, 1991]

RaLa: The term RaLa is an abbreviation for radioactive lanthanum-140 which is a decay product of barium-140. RaLa as used here refers to all phases of barium-140 production and development to actual production facility operation. Barium-140 was produced at INL for military nuclear programs.

Raffinate: When spent reactor fuel is processed, initially, it is dissolved into a solution using acids and solvents and the liquid is called supernate. After multiple uranium/plutonium extraction processes (PUREX), the residual liquid waste is called raffinate and is sent to underground high-level waste tanks prior to being sent to the calciner for solidification.

Source Term: The amount of radioactive materials or chemicals released from a site, facility or point source of emissions to the environment over a given period of time. The source term is commonly used in dose reconstruction and for radio nuclides, is expressed in terms of particular radio nuclides and measured in curies. [Connor@60]

Throughput: This is a term used in relation to feed stock for a processing plant. For instance, the throughput for the Idaho Chemical Processing Plant would be the type and characteristics of the spent reactor fuel reprocessed at the plant. For an incinerator, it would be the type of waste run through the burner.

Transuranic Element: The 13 known atomic elements with higher atomic numbers (as determined by the number of protons in the atomic nucleus) than uranium, which has an atomic number of 92. The presence of transuranics in nuclear emissions and nuclear wastes has particular importance for public and worker health because most transuranics emit alpha radiation and many like plutonium-239 have very long radioactive half-lives. [Connor@60]

Transuranic Waste: Waste containing more than 100 nanocuries per gram of waste of alpha-emitting transuranic isotopes, with half-lives greater than 20 years, except for (a) high-level radioactive waste; (b) waste that the DOE and EPA has determined does not need the degree of isolation required by 40 CFR 191; or (c) waste that the Nuclear Regulatory Commission has approved for disposal on a case-by-case basis in accordance with 10 CFR 61. [HLW/EIS @D-34] The sum total of individual TRU isotopes curie concentration in a given waste unit must be more than 100 nCi/g. The TRU standard prior to 1984 was 10 nano curies per gram. Currently this category of waste between 10 and 100 nano curies per gram is called alpha-low-level. Pursuant to the Federal Court enforced agreement between Idaho and DOE, alpha-low-level waste will continue to be managed as TRU waste. [ROD@45]

Vitrification: The process of immobilizing waste that produces a glass-like or ceramic-like solid that permanently captures the radioactive materials.

IX. Appendix D

Conversion Factors and Converting Unites of Measure

Volume

Units	Equivalence
milliliter (ml)................	0.001 L [cubic centimeter (cc)]
liter (L).....................	1,000 cc or 1,000 ml
cubic meter (cu m)......	1,000 liters; 35.3 cubic feet (cu ft.)
cubic meter..................	264 gallons (gal)
gallon (gal)..................	3.79 liters (l)(L)
cubic foot (cu ft.)..........	7.48 gal; 28.3 liters
acre-foot (ac ft.)...........	43,560 cu ft.; 1 acre 1 ft. deep

Mass

gram (gm) …………..	1 cc or ml of water
kilogram (kg)..............	1,000 grams (gm); 2.205 lb
metric ton....................	1,000 kg; 2,205 lb.
pound.........................	454 gm
ounce (oz)..................	28.4 gram (gm)
short ton ……………	2,000 lbs.; 0.91 metric tons ; normal U.S. ton

Scientific Notation [20]

1,000,000,000	$= 10^{9}$	E+09	giga	billion
1,000,000	$= 10^{6}$	E+06	mega	million
100,000	$= 10^{5}$	E+05		
10,000	$= 10^{4}$	E+04		
1,000	$= 10^{3}$	E+03	kilo	thousand
100	$= 10^{2}$	E+02	hecto	hundred
10	$= 10^{1}$	E+01	deca	ten
1	$= 10^{0}$	E+00		
0.1	$= 10^{-1}$	E -01	deci	tenth
0.01	$= 10^{-2}$	E -02	centi	hundredth
0.001	$= 10^{-3}$	E -03	milli (m)	thousandth
0.0001	$= 10^{-4}$	E -04		
0.00001	$= 10^{-5}$	E -05		
0.000001	$= 10^{-6}$	E -06	micro (u)	millionth
0.000000001	$= 10^{-9}$	E -09	nano (n)	billionth
0.000000000001	$= 10^{-12}$	E -12	pico (p)	trillionth

X . References

A few references in this Citizens Guide are in foot notes. Most references are in [brockets] and are listed below in alphabetical order.

Accident list compiled from the following sources:

*Peaceful Uses of Atomic Energy, proceedings of the International Conference in Geneva, August 1955,V2,p276

*Was Arco Reactor Occurrence an "Accident", "Incident", or "Experiment", Oak Ridger, April 10,1956

*International Series of Monographs on Nuclear Energy, Reactor Safeguards, p.309

*Idaho Chemical Processing Plant Technical Progress Report, July-September, 1959, IDO-14514

*Radiation hazards and protection, Atomic Industry Reporter, July 6, 1960

*Nuclear incident at the Id. Chemical Processing Plant, February 15, 1960,IDO-10035

*Nuclear Safety, vol.3, no.3, March 1962, p.74, p.79

*Nucleonics, October 1963, p.80-83

*Nuclear Engineering, March 1961, p.94

*Fuel element flow blockage in the ETR, 5/10/62, IDO-16780

*Forum Memo, November 1963, p.32

*AEC letters to Local 2-652 OCAW, 11/27/63, 1/23/64, 4/15/64

*A summary of industrial accidents in USAEC facilities, December 1965, TID-5360

*Post Register, Idaho Falls, Idaho, Rocky Barkers' file of his coverage of INEL

*ERDA-1536, 1977

* DOE/ID-12119 Vol. 2 August 1991

ACLU(a); Litigation Under the Federal Freedom of Information Act and Privacy Act, 14th Edition A. Adler, American Civil Liberties Union Federation, 1989

ACLU(b); Litigation Under the Federal Freedom of Information Act and Privacy Act, 13th Edition A. Adler, American Civil Liberties Union Federation, 1988

[20] “Scientific Notation is a convenient way of writing very large and very small numbers. For example, 635,000 is written as 6.35×10^{5} in scientific notation. This number is read as follows: ‘6 point 35 times ten raised to five.’” Institute for Energy and Environmental Research (IEER); “The Yellow Pages.” IEER.org offers excellent “technical reference guides for activists, citizens and policy makers on nuclear waste and cleanup issues.”

ACHRE; White House October 4, 1993 Memorandum for Heads of Departments and Agencies, Subject: The Freedom of Information Act; Guidebook to the Freedom of Information Act and Privacy Act, Volume 2 Release #16, 8/94, Appendix D5.

Administrative Record; Remedial Investigation Feasibility Study, Test Reactor Area, Summary Tables of Chemical and Radiological Analysis, Appendix G-484 and 485, Analytica-ID-12782-1 @ D-615 to D-632, EG&G Idaho

AEC; "Radiation Standards including Fallout", U. S. Atomic Energy Commission Hearings, June 4-7, 1962, p. 944

Aley; INEL Ground Water Study sponsored by EG&G, Six man group led by Wilgus Creath, written by Thomas Aley, 1980

Allen; Personal discussions with Duane Allen, representative for Labors Union International at INEL and former President of Oil Chemical and Atomic Workers Union local in Idaho Falls

Alvarez(a); Nuclear Safety Problems at DOE Sites, Testimony given to Congressional Subcommittee by Robert Alvarez, Environmental Policy Institute, September 1988

Alvarez(b); Safety Problems with Nuclear Waste Transportation, Robert Alvarez, Environmental Policy Institute, 6/ 21/85

Alvarez(c); Occupational Radiation Health Risks: Folklore and Fact, Robert Alvarez, Environmental Policy Institute, June 1985

American Portrait: History of the Nuclear Jet Engine, AH Belo Corp., Bryon Harris Producer, WFAA-TV Dallas, 1993

Albuquerque Journal, "Ceiling Slab Falls at WIPP as Expected",2/6/91

Andrus(a); Testimony given by Idaho Governor Cecil Andrus, May 16, 1991 Idaho Falls Idaho on NPR Draft Environmental Impact Statement

Andrus(b); Letter to DOE's Leo Duffy, June 10, 1992, Attached "Critique of DOE's Spent Fuel and Waste Management Technology Development Plan

Andrus(c); Press Release Aug. 9, 1993, "Andrus: agreement radically reduces waste volume to INEL ;Navy agrees to comply with court mandate

Andrus(d); Letter from Governor Andrus to Sec. O'Leary and Sec. Dalton, Aug 9, 1993

Andrus(e); Andrus v. Sierra Club, 422 US 347, 363, n.21 (1979)

Analytica-12782-1; Remedial Investigation Feasibility Study, Test Reactor Area Perched Water System, Operable Unit 2-12, Idaho National Engineering Laboratory 1992 US Department of Energy

ANL-EA; Environmental Assessment, Electrometallurgical Treatment Research and Demonstration Project in the Fuel Conditioning Facility at Argonne national Laboratory-West, US Department of Energy Office of Nuclear Energy, Science and Technology, May 15, 1996.

ANL-Plan; Proposed Plan for Waste Area Group 9, Argonne National Laboratory-West, Idaho National Engineering and Environmental Laboratory, January 1998, Department of Energy INL Environmental Restoration Program

ANL-RI/FS; Comprehensive Remedial Investigation / Feasibility Study for Argonne National Laboratory-West Operable Unit 9-04 at the Idaho National Engineering Laboratory, U.S. Department of Energy

ANL-5277; Report for the EBR-II Leach Pit Sampling and Analysis Program and Monitoring Well Instillation, Argonne National Laboratory West, Idaho Falls, Idaho, prepared by Golder Associates, May 7, 1992

APEX-445; Final Report First Meltdown Experiment, Operation Boot, January 2, 1959,General Electric

APEX-509; Summary Report of HTRE No.3 Nuclear Excursion, November 18, 1958, General Electric

AR-RF-1158; Engineering Design File; DOE Complex-Wide Spent Nuclear Fuel Shipment Estimates for DOE Programmatic SNF Management EIS, EIS-TRANS-20 REV.2, March 1995, H.W. Heiselmann

AP(a); Groundwater Supplies Drained, Associated Press, 1/1/89

AP(b); Study Reassesses Radiation Risk, Associated Press, Washington, December 26, 1989

AP(c); Idahonian/Daily News, "Defense Dollars", August 17, 1991

AP(d); INEL Contractor Gets Doubled Bonus Based on Performance, Moscow/Pullman Daily News, January 4, 1996, Associated Press, Idaho Falls

AP(e); Radioactive Iodine found in aquifer south of INEL, Associated Press, Idaho Falls, Daily News, February 13, 1993
AP(f); INEL assessed fines for alleged violations, Associated Press Idaho Falls, Nov., 15, 1994
AP(g); Waste facility may be leaking into water supply, Associated Press, Idaho Falls, 3/15/94
AP(h); Equipment, personnel failures raise safety questions about INEL reactor, Idaho State Journal, 12/14/93, Associated Press, Idaho Falls
AP(I); “USGS to test wells for cancer agent”, Rupert (AP), 2/18/89, Coeur D’ Alene Press
AP(j); “Report shows secrecy causes DOE problems”, Associated Press Washington, Times News 6/19/89
AP(k); “Congress might still fund INEL’s star wars research”, Idaho Falls (AP), 9/30/90
AP(l); "Suit fought on your dime, Taxpayers have paid millions to defend nuke disaster", Associated Press, Richland, WA, March 7, 1992.
AP(m); Scott Sonner, Washington, July 14, 1994
ARA ROD; Record of Decision Auxiliary Reactor Area -I Chemical Evaporation Pond, Operable Unit 5-10, Idaho National Engineering Laboratory, December 1992
ATSDR; Health Consultation, Interim Action Planned for Pit 9 at RWMC at INEL, 00A9, Federal Program Branch, Division of Health Assessment and Consultation, Agency For Toxic Substances and Disease Registry, Michael Brooks, M.S.H.P., Sept. 24, 1993
Audubon; “Supercritical”, Boyd Norton, Audubon Magazine, May 1980, Norton was the Manager of the SPERT tests at NRTS during the early 1960s
Audin(a); Nuclear casks recalled for safety questions, Lindsay Audin
Audin(b); Testimony of Lindsay Audin, Nuclear Transportation consultant, to the USDOE concerning issues related to the Transportation of Plutonium to and from SIS plant, 3/26/88
Batt(a); Settlement Agreement, Signed by Robert Nordhaus and Thomas Grumbly for Department of Energy; Steven Honigman and Admiral Bruce DeMars for the Department of Navy; and Philip Batt and Alan Lance for the State of Idaho, October 16, 1995
Batt(b); Philip Batt v. United States of America, U.S. District Court for the District of Idaho Civil No. 91-0035-S-EJL, October 17, 1995, Consent Order and Joint Motion for Entry of Consent Order Based on Settlement Agreement
BEMR(a); Estimating the Cold War Mortgage, 1995 Baseline Environmental Management Report, Executive Summary, March 1995, U.S. Department of Energy Office of Environmental Management
BEMR(b); U.S. Department of Energy Idaho Operations Office Draft Baseline Environmental Management Report, December 15, 1994, Revision C
BEMR(c); 1995 Baseline Environmental Management Idaho, U.S. Department of Energy Idaho Operations
BEMR(d); 1996 Baseline Environmental Management Report, Executive Summary, June 1996, U.S. Department of Energy Office of Environmental Management, DOE/EM-0290
Benson, Allen; Hanford Radioactive Fallout, Hanford's radioactive Iodine-131 Releases, (1944-1956), Allen Benson,Ph.D., High Impact Press, Cheney, WA, 1989
Bergman; December 23, 1988 Memo from W. Bergman to R. Quong, Subject: Review of some health and safety aspects of the incinerator planned for the LLNL decontamination and Waste Treatment Facility, University of California, Lawrence Livermore National Laboratory
Blain; Radioecological Effects on Animal and Human Populations Near the Idaho National Engineering Laboratory, Michael Blain,PH.D.,Carl Johnson,MD.,Carol Kreider,BS., Robert Nicholas,BS., May 1985, Presented to the annual meeting Association for the Advancement of Science
BEIR #5; Health Effects of Exposure to Low Levels of Ionizing Radiation National Academy Press, Washington DC,1990, BEIR#5
British Medical Journal; Results of Case-Control Study of Leukemia and Lymphoma Among Young People Near Sellafield Nuclear Plant in West Cumbria, Martin Gardner, Michael Snee, Andrew Hall, Caroline Powell, Susan Downes, John Terrell, British Medical Journal, vol.300 17 February, 1990
Bertell; No Immediate Danger, Prognosis for a Radioactive Earth, Rosalie Bertell, Book Publishing, 1985
Bradley; Tharan Bradley Manager of the NRF presentation at the Naval Reactors Facility, 9/21/93, to DOE

ERMAC during a tour of the NRF site ; also see Spent Fuel Working Group @32
Bills, C. Wayne, Letter from AEC, C. Wayne Bills, SL-1 Coordinator B.F. Rinehart, USAEDL Demolition Section, SL-1:CWB
Biggs; Rocky Flats Fluid Bed Incinerator, Exposure of Citizens due to Normal Operations and Explosions, executive summary, J. Goldfield, P.E., Niels Schonbeck, Ph.D., Gale Biggs, Ph.D., Sept. 1, 1987
Blanton; Canceling the Classifieds, Can We Stay Ahead of the Russians in the Openness Race? Washington Post, June 6, 1993, Tom Blanton, Executive Director National Security Archives
Boise Weekly; Cleaning up spills or cleaning up stories, What you don't know about INEL, Dave Madison, Boise Weekly, January 24. 1995
Brookings Institute; "U.S. Nuclear Weapons Cost Study Project", Stephen Schwartz project director, 1996
BRWM; Board on Radioactive Waste Management (BRWM), Commission on Physical Sciences, Mathematics, and Resources, National Research Council, National Academy Press, page 3)
Burning Radioactive Waste: What Comes Out of the Stack, Sierra Club Pub., by Radioactive Waste Campaign
Bush; US Department of Energy Nuclear Weapons Complex Modernization Report, December 1988 Commonly known as the 2010 Report
Cawley(a), Michael video interview by Alan Lifton, 1988, and numerous phone conversations with author
Cawley(b); Before the Industrial Commission State of Idaho, Michael P. Cawley, Claimant, vs. Idaho Nuclear Corporation, Insurance Company of North America, Surety, Defendants, IC 79-282579 Filed 3/10/83
Cawley(c); In the Supreme Court of the State of Idaho, Michael P. Cawley, Claimant-Appellant v. Idaho Nuclear Corporation, Employer and Insurance Company of North America, Surety, Defendants Number 17514, December 29, 1990, Also see Idaho Supreme Court 1989 Opinion No. 145.
Cawley(d); Letter from attorney John Ingelstrom, March 20, 1990 to Mike Cawley with State Industrial Commission Benefit Calculations
Cawley(e); Notarized statement by Michael Cawley dated October 31, 1989 listing exposure incidents 1956 - 1974
Clinton; White House October 4, 1993 Memorandum for Heads of Departments and Agencies, Subject: The Freedom of Information Act; Guidebook to the Freedom of Information Act and Privacy Act, Volume 2 Release #16, 8/94, Appendix D5.
Civiak; "Nuclear Weapons Material Production: Options for Meeting tritium and plutonium needs", updated September 20, 1988, Robert Civiak Science Policy Research Division, Congressional Research Service
Cochran(a); The DOE's Savannah River Plant Reactors and US Requirements for Tritium and Plutonium for Nuclear Weapons, Thomas B. Cochran, Pd.D., Robert S. Norris, Ph.D. and William M.Arkin, October 19,1988,Natural Resources Defense Council
Cochran(b); Comments on Special Isotope Separator, Dr. Thomas Cochran, Natural Resources Defense Council, quoting: Inhaled plutonium oxide in dogs, Pacific Northwest Lab. Annual report for 1985 to the DOE office of Energy Research, Part 1, Biomedical Sciences, Feb 1986, pp.3-17
CCNS; Concerned Citizens for Nuclear Safety et. al. Vs. Unites States Department of Energy, U.S. District Court, Court for the District of New Mexico, Civil action No. 94-1039 M, April 2, 1996
CDC(a); Draft Preliminary Project Plan, Idaho National Engineering Laboratory, Environmental Dose Reconstruction Project National Centers for Disease Control, February 1992
CDC(b); Draft Plan to Identify, Retrieve, and Evaluate All Documents And Data Pertinent to a Historical Dose Reconstruction at the INEL, prepared for CDC by S. Cohen Associates, January 1993
CDC(c); Final Plan to Identify, Retrieve, and Evaluate All Documents And Data Pertinent to a Historical Dose Reconstruction at the INEL, prepared for CDC by S. Cohen & Associates, April 1993
CDC(d); INEL Dose Reconstruction Working Group Meeting, Coeur d' Alene, Idaho, May 25, 1994 Nancy Schwartz Reporting, verbatim transcript.
CDC(e); Identification and Prioritization of Radionuclide releases from the Idaho National Engineering and Environmental Laboratory, Draft Report prepared by Risk Assessment Corp., September 2000.
CDC/ATSDR; Draft Workshop on Energy Related Epidemiologic Research Agenda, Participants Comments, December 3-4 1991, Atlanta, GA,

CFR(a); 10 CFR 60.2. “High-level radioactive waste means: (1) irradiated reactor fuel, (2) liquid wastes resulting from the operation of the first cycle solvent extraction system, or equivalent, and the concentrated wastes from subsequent extraction cycles, or equivalent, in a facility for reprocessing irradiated reactor fuel, and (3) solids into which such liquid wastes have been converted.”

CFR(b); 45 CFR ss 11, Committee Management. Subsection 11.3 states: "Department officials shall be guided by the HHS Standards of conduct (45 CFR 73.735), the Federal Personnel Manual, and the Federal Conflict of Interest statutes (18 USC 201 et seq), in preventing conflicts of interest or appearance of conflicts of interest on the part of Department employees concerned with advisory committees, advisory committee members and staff, and consultants and experts concerned with advisory committees." Classification Policy Study; July 4, 1992, U.S. Department of Energy Office of Classification, Washington D.C.

Chew; Letter on Moratorium on Destruction of Epidemiologic Records and Human Radiation Experiments Records (OPE-SP-94-404) from Eddie Chew, Heath Physicist, Environmental Support Group, DOE Idaho Operations Office November 7, 1994, to Dr. Charles Miller, Chief, Environmental Dosimetry Section, National Center for Environmental Health, Centers for Disease Control and Prevention.

Committee to Bridge the Gap v. Department of Energy, U.S. District Court Central District of California Honorable Edward Rafeedie, Case No. CV-90-3568-ER

Connections(a); The Newsletter of the Hanford Health Information Network, Vol. 2, No. 2, Spring 1996

Connections(b); The Newsletter of the Hanford Health Information Network, Vol. 2, No. 4, Fall 1996

Connor: Burdens of Proof, Science and Public Accountability in the Field of Environmental Epidemiology with a Focus on Low Dose Radiation and Community Health Studies, Tim Connor, Energy Research Foundation, 1997

Congressional Research Service, Library of Congress Report " American Nuclear Guinea Pigs: Three Decades of Radiation Experiments on US Citizens, November 1986, for US House of Representatives Subcommittee on Energy Conservation and Power (5-156) p 22- 24

CRP; Community Relations Plan for Remedial Investigations at the INEL, DOE Field Office-Idaho, Environment Restoration Div., August 1991

D’ Antonio; Atomic Harvest, Hanford and the Lethal Toll of America’s Nuclear Arsenal, Michael D’ Antonio, Crown Publishing Group

Dead Reckoning, a Critical Review of the DOE's Epidemiologic Research, Physicians for Social Responsibility's task force on health risks for nuclear weapons production, H. Jack Geiger, MD, David Michaels, PhD. 1992, citing INEL Historic Radiation Exposure Distribution, Whole Body Exposure in REM, Employees only (preliminary Draft), November 22, 1991 (unpublished data)

Deadly Deceit, Low Level Radiation, High Level Cover-up, Benjamin Goldman, Jay Gould, Four Walls Eight Windows, 1990

Deadly Defense; Military Radioactive Landfills, Radioactive Waste Campaign, 1988

DEIS(a); Draft Environmental Impact Statement for the Sitting, Construction Operation of New Production Reactor Capacity, April 1991, DOE/EIS-0144D

DEIS(b); Department of Energy Programmatic Spent Nuclear Fuel Management and INEL Environmental Restoration and Waste Management Draft Environmental Impact statement June 1994, DOE/EIS-0203-D

Dennis, James Affidavit, March 27, 1962

Denver Post; Public Hearing must Precede Flats Burn, Judith Brimberg, July 21, 1991

Department of Energy; FY-1993 Congressional Budget Request, Materials Production and Other defense Programs, Naval Reactors

Department of Energy; FY-1994 Congressional Budget Request, Materials Production and Other Defense Programs

Department of the Navy; Letter from J. Kiell, Naval Reactors, March 12, 1992 to A. J. Wickenheiser, Greenpeace, Surface Ship Refueling Overhauls, Submarine Refueling Overhauls, 1957 to 1990

DEQ; Notice of Public Comment Period and Opportunity for a Public Hearing Regarding an Application to construct an air pollution emitting source, Idaho Department of Health and Welfare Division of Environmental Quality, January 17, 1996, Tony D. Wilson, Program Division Specialist

DEQ(b); Idaho Department of Health and Welfare, Division of Environmental Quality, Notice of Violation Based on the September 1995 and January 1996 Inspections of the Idaho National Engineering Laboratory by Division of Environmental Quality, March 21, 1996 delivered to Don Rasch, U. S. Department of Energy

DERA; Report of the Dose Evaluation Review and Assessment (DERA) Advisory Panel, to the Idaho Department of Health and Welfare, January 1993, Review of INEL Dose Models and INEL Historical Dose Evaluation, Margrit von Braun, Ph.D., P.E. Chair.

DOB; Daily Operations Brief for Secretary of Energy, Hazel R. O'Leary, Document faxed daily to Lisa Crawford who in turn distributes to Environmental Defense Institute DOBs relevant to INL, also see Unusual Occurrence Reports and Operating Experience Weekly Summary, Office of Nuclear Safety, Series [Numbers 95- 1 to 51 and 96- 1 to 49, and 97 1 to 49]

Dickson; Environmental Survey of a Former Reactor Site 24 years after Intentional Destruction, R. Dickson, Radiological and Environmental Sciences Laboratory, USDOE Idaho, EG&G Idaho

Dirt; "Dirt In the USDOE Nuclear Waste Cleanup Budget", Heart of America, July 1991, Jerry Pollet, Jim Beard

DOE(a); DOE Counsel General Contract Reform Team Report by the Subgroup on Contractor Litigation and Outside Counsel Fees, June 1993, page 1.

DOE(a); Spent Fuel Working Group Report on Inventory and Storage of the Department's Spent Nuclear Fuel, November 1993, USDOE Office of Environmental Health and Safety

DOE(b); Department of Energy, Waste Management Operations Priority System Fact Sheet, Spring 1991

DOE-2/6/96; US Department of Energy Openness Press Conference Fact Sheets, February 6, 1996

DOE-9/23/97; Department of Energy Richland Operations Office, Karen Randolph, Director Office of External Affairs dated September 23, 1997, to Chuck Broscious, Coordinator INL Research Bureau

DOE/DP-007/1; "Understanding Classification", DOE Assistant Secretary for Defense Programs, Office of Classification, Revised June 1978, DOE/DP-007/1

DOE/EA-0831; Environmental Assessment, High-Level Waste Tank Farm Replacement Project for the Idaho Chemical Processing Plant at the INEL, June 1993, US Department of Energy Idaho Operations Office

DOE/EA-1148; Draft Environmental Assessment, Electrometallurgical Treatment Research and Demonstration Project in the Fuel Conditioning Facility at Argonne National Laboratory-West, U.S. Department of Energy, Office of Nuclear Energy, Science and Technology , January 29, 1996

DOE/EH-0072; Environmental Survey Report, INEL, USDOE, September 1988,p.2-8

DOE/EH-0520; Office of Nuclear and Facility Safety, Safety Notice, Office of Operating Experience Analysis and Feedback, U.S. Department of Energy, Washington DC, April 1996

DOE/EH-0525; Highly Enriched Uranium Working Group Report on Environmental, Safety and Health Vulnerabilities Associated with the Department's Storage of Highly Enriched Uranium, Volume II: Number 5, INEL Working Group and Site Assessment Team Reports, US Department of Energy, December 1996

DOE/EH-0415; Plutonium Working Group Report on Environmental , Safety and Health Vulnerabilities Associated with the Department's Plutonium Storage, Volumes I & II, November 1994

DOE/EH/OEV-22-P; Environment, Safety, and Health Needs of the US Department of Energy, September 1988

DOE/EIS-0203F; Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement, April 1995, Office of Environmental Management, Idaho Operations Office

DOE/EIS-0218F: Final Environmental Impact Statement, Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel, Volume 1, February 1996

DOE/EM-0319: Linking Legacies, January 1997, Connecting the Cold War Nuclear Weapons Production Process to their Environmental Consequences, US Department of Energy, Office of Environmental Management

DOE Facts(a); Declassification of Today's Plutonium Inventory at Argonne National Laboratory-West Near Idaho Falls, Idaho, Department of Energy Office of the Press Secretary, 12/7/93, p 32

DOE Facts(b); Declassification of Today's Highly Enriched Uranium Inventories at Department of Energy Laboratories, US Department of Energy office of Press Secretary, 6/27/94

DOE FY93; Department of Energy FY-93 Budget for Naval Reactors Development @ 416

DOE/ID-10087-87; Effluent Information System/On-site Discharge Information System,1987 Executive Summary,

September 1988 DOE ID Operations Office
DOE/ID-10087-85; Effluent Information System/On-site Discharge Information System, 1985 Executive Summary, September 1986 DOE ID Operations Office
DOE/ID-10183; INEL Pit 9 Remedial Investigation Feasibility Study Vol. II Administrative Record
DOE/ID-10527; Work Plan for Waste Area Group 1, Operable Unit 1-10, Comprehensive Remedial Investigation / Feasibility Study, Idaho National Engineering Laboratory, US Department of Energy Idaho Operations Office, DOE-ID-10527, March 1996.
DOE/ID-10531; Comprehensive Remedial Investigation/Feasibility Study for the Test Reactor Area, Operable Unit 2-13 at the Idaho National Engineering Laboratory, 1996, Lockheed Idaho Technologies Company, Idaho Falls, ID
DOE/ID-10544; Regulatory Analysis and Proposed Path Forward for INEL High-level Waste Program, Nuclear Operations Division High-level Waste Directorate, U.S. DOE Idaho Operations, 10/96. Hereinafter called DOE-ID-10544
DOE/ID-10557; Comprehensive Remedial Investigation / Feasibility Study for the Test Area North Operable Unit 1-10, Idaho National Engineering Laboratory, US Department of Energy Idaho Operations Office, DOE-ID-10557, November 1997
DOE/ID-12111; Summaries of the INEL Radioecology and Ecology Program, O. Markham, June 1987
DOE/ID/12119; INEL Historical Dose Evaluation, USDOE ID Operations Office, Aug 1991
DOE/ID-22071; Capacity of the Diversion Channel Below the Flood Control Dam on the Big Lost River at the Idaho National Engineering Laboratory, US Geological Survey, Investigations Report 86-4204, C. Bennett, October 1986
DOE/ID-22109; Statistical Summaries of Stream-flow Data for Selected Gaging Stations on and near the Idaho National Engineering Laboratory through 1990, US Geological Survey Investigations Report 92-4196, M. Stone, L. Mann, L. Kjelstrom, 1993
DOE/ID-22124; Radionuclides, Stable Isotopes, Inorganic Constituents, and Organic Compounds in Water from Selected Wells and Springs from the Southern Boundary of the Idaho National Engineering Laboratory to the Hagerman Area, Idaho 1994, U.S. Geological Survey Open File Report 95-718, October 1995, R. Bartholomay, L. Williams
DOE/ID-22125; Chemical Constituents in Water from Wells in the Vicinity of the Naval Reactors Facility, Idaho National Engineering Laboratory, Idaho 1994-95, US Geological Survey, Open-File Report 95-725
DOE/ID-22130; Radionuclides, Stable Isotopes, Inorganic Constituents, and Organic Compounds in Water from Selected Wells and Springs from the Southern Boundary of the Idaho National Engineering Laboratory to the Hagerman Area, Idaho 1991-93, U.S. Geological Survey Open File Report 95-725, November 1995, B. Tucker, L. Knobel, R. Bartholomay
DOE/ID-22133; Evaluation of Radionuclide, Inorganic Constituent, and Organic Compound Data from Selected Wells and Springs from the Southern Boundary of the Idaho National Engineering Laboratory to the Hagerman Area, Idaho 1989 through 1992, U.S. Geological Survey Water Resources Investigations Report 97-4007, January 1997, R. Bartholomay, L. Williams
DOE/ID-22139; Preliminary Delineation of Natural Geochemical reactions, Snake River Plain Aquifer System, Idaho National Engineering Laboratory, US Geological Survey, Water Resources Investigations Report 97-4093, May 1997
DOE/ID-22141; Radiochemical and Chemical Constituents in Water from Selected Wells and Springs from the Southern Boundary of the Idaho National Engineering Laboratory to the Hagerman Area, Idaho 1996, US Geological Survey, Open-File Report 97-360
DOE/ID-22143; Chemical and Radiochemical Constituents in Water from Wells in the Vicinity of the Naval Reactors Facility, Idaho National Engineering Laboratory, Idaho 1994-95, US Geological Survey, Open-File Report 97-806
DOE/ID-22152; Radiochemical and Chemical Constituents in Water from Selected Wells and Springs from the Southern Boundary of the Idaho National Engineering Laboratory to the Hagerman Area, Idaho 1997, US Geological Survey, Open-File Report 98-646
DOE/ID-22155; Geologic Controls of Hydraulic Conductivity in the Snake River Plain Aquifer at and Near the INL, Idaho, US Geological Survey, Report 99-4033, February 1999.
DOE/ID-22161; Radiochemical and Chemical Constituents in Water from Selected Wells and Springs from the Southern Boundary of the Idaho National Engineering Laboratory to the Hagerman Area, Idaho 1998, US Geological Survey, Open-File Report 99-473
DOE/ID-22169; Radiochemical and Chemical Constituents in Water from Selected Wells and Springs from the Southern

Boundary of the Idaho National Engineering Laboratory to the Hagerman Area, Idaho 1999, US Geological Survey, Open-File Report 00-399

DOE/ID-22175; Radiochemical and Chemical Constituents in Water from Selected Wells South of INL, Open File Report 01-138, May 2001.

DOE/ID-22176; Radiochemical and Chemical Constituents in Water from Selected Wells and Springs from the Southern Boundary of the Idaho National Engineering Laboratory to the Hagerman Area, Idaho 2000, US Geological Survey, Open-File Report 01-358

DOE/ID-22180; Tritium in Flow from Selected Springs that Discharge to the Snake River, Twin Falls - Hagerman Area, Idaho, 1994-99, Open File Report 02-185, May 2002.

DOE News; For Immediate Release, July 31, 1995, Radiation Experiment Records Made Available to the Public, US Department of Energy, Idaho Operations Office

DOE/RW-006(a); U.S. Department of Energy Integrated Data Base for 1991, Revision 7, October 1991, U.S. Spent Nuclear Fuel and Radioactive Waste Inventories, Projections, and Characteristics, Prepared by Oak Ridge National Laboratory

DOE/RW-006(b); U.S. Department of Energy Integrated Data Base for 1993, Revision 10, December 1993, U.S. Spent Nuclear Fuel and Radioactive Waste Inventories, Projections, and Characteristics, Prepared by Oak Ridge National Laboratory

DOE/RW-0006.Rev.11; Integrated data Base Report- 1994; US Spent Nuclear Fuel and Radioactive Waste Inventories, Projections, and Characteristics, US Department of Energy, Office of Civilian Radioactive Waste Management, Office of Environmental Management, September 1995

DOE This Month; May 1995, Vol. 18, No. 5, U.S. Department of Energy, Washington, D.C.

DOE This Month; January 1997, Vol. 20 No. 1, U.S. Department of Energy, Washington, D.C.

DOE/US-0001; Report of Department of Energy Working Group on External Regulation, December 1996 U.S. Department of Energy

DOE/1994; Plan of Action To Resolve Spent Nuclear Fuel Vulnerabilities, Phase I, February 1994, U.S. Department of Energy. Also, Plan of Action To Resolve Spent Nuclear Fuel Vulnerabilities, Phase II, April 1994, U.S. Department of Energy. Also, Plan of Action To Resolve Spent Nuclear Fuel Vulnerabilities, Phase III, October 1994, U.S. Department of Energy.

Dunning(a); Phone conversation with Dirk Dunning, Oregon Department of Energy, 2/14/97

Dunning(b); Memorandum from Gordon Dunning, Chief, Radiation Effects of Weapons Branch Division of Biology and Medicine, Subject: Meeting of the ANP Life Sciences Working Group, January 19, 1959

EA; Environmental Assessment of the Proposed Adoption and Implementation of a US Policy on Receipt and Reprocessing of Spent Research Reactor Fuel, US Department of Energy, February 1991

EDI(a); Comments on INEL Federal Facilities Agreement and Consent Order, Environmental Defense Institute, Chuck Broscious, Oct. 18,1992

EDI(b); Motion to Intervene or in the Alternative for an Order Granting Leave to File Amicus Curiae Brief, in US District Court of Idaho, August 25, 1993, in USA vs. Andrus

EDF-94-WASTE-0104; Engineering Design File, TRU, LLW, GTCC, Hazardous Waste, & Industrial Waste Generation, Storage, and Treatment Volumes, 3/22/95, D. Morton, K. Hendrickson

EGG 3/22/94; EG&G Idaho Interoffice Correspondence, March 22, 1994 to Jean Holdren, from Bruce Schnitzler, subject SL-1 Isotopic inventories - BGS-03-94

EGG-2389; Annual report 1984, Environmental Surveillance for the INEL Radioactive Waste Management Complex and Other Areas, Beth Reyes et. al., U. S Department of Energy, EG&G Idaho

EGG-ER-8644; Conceptual Model and Description for the Effected Environment for the TRA Warm Waste Pond (Waste Management Unit TRA-03), Idaho National Engineering Laboratory, EG&G Idaho, October 1989

EGG-9967; Remedial Investigation/Feasibility Study For Pad-A, Operable Unit 7-12 Waste Area Group 7 Radioactive Waste Management Complex, Idaho National Engineering Laboratory, Volume 1 of 2 V. Halford, et. al., EG&G Idaho

EG&G-2612(90); Environmental Monitoring for EG&G Idaho Falls facilities at the Idaho National Engineering Laboratory, also see August 1991

EG&G-ER-10610; Test Reactor Area, WWP, Treatability Results, EG&G Idaho, January 1993

EGG-ER-10616; Results of the Pilot Scale Treatability Study for the Test Reactor Area Warm Waste Pond, Volume II; Appendices, April 1993, N.R. Soelberg et. al., EG&G Idaho
EGG-ER-10643; Remedial Investigation Final Report with Addenda for the Test Area North Groundwater Operable Unit 1-07B at Idaho National Engineering Laboratory, J. Kaminsky, EG&G Idaho, January 1994
EGG-ER-10802; Feasibility Study Report for Test Area North Groundwater Operable Unit 1-07B at Idaho National Engineering Laboratory, F. Dunnivant, EG&G Idaho, January 1994
EG&G-ERP-BWP-67; EG&G Idaho Engineering Design File, 1991
EGG-ERP-BWP-64; Methodology for Determination of a Radiological Inventory for Pit 9 and Corresponding results, J.J. King, 7/24/91
EGG-J-02083; Leach Testing of INEL Waste Forms in a Gamma Field, R. Schuman, EG&G Idaho
EG&G-M-24884; Investigation of the Subsurface Environment at the INEL, Radioactive Waste Management Complex, B. Russell et al., 1985
EG&G-WM-6875; Idaho National Engineering Laboratory Ground Water Monitoring Report EG&G Idaho
EG&G-WM-8804; Power Burst Facility Remedial Investigation / Feasibility Study, EG&G Idaho
EGG-WM-8792; Central Facility Area Environmental Monitoring Motor Pool Ditch, EG&G Idaho April 1992
EGG-WM-9973; Remedial Investigation Feasibility Study Central Facility Area Motor Pool Ditch Oak Ridge National Laboratory, June 1992
EGG-WM-10001; Remedial Investigation Feasibility Study Auxiliary Reactor Area Chemical Percolation Pond, EG&G Idaho
EGG-WM-10002; Remedial Investigation Test Reactor Area Perched Water System, OU-2-12, June 1992
EG&G-WM-10000; Test Reactor Area Warm Waste Pond, Sediment Treatability Study Phase-I, November 1991, EG&G Idaho
EG&G-WM-10090; Sampling and Analysis Plan for RWMC Subsurface Disposal Area, EG&G Idaho April 1992
EG&G-WM-10903; A Comprehensive Inventory of Radiological and Non Radiological Contaminates in Waste Buried In the Subsurface Disposal Area of the INEL RWMC During the Years 1952-1983,June 1994, Lockheed
EG&G-WTD-9438; A Brief Analysis and Description of Transuranic Wastes in the Subsurface Disposal Area of the Radioactive Waste Management Complex at INEL, Arrenholtz and Knight, Remedial Investigation Feasibility Study, RWMC, Administrative Record, EG&G Idaho, August 1991
EMAB; Minutes Environmental Management Advisory Board to the U.S. Department of Energy, April 17-18, 1995
EMSSAB; Meeting Minutes November 19-20, 1996, Environmental Management Site Specific Advisory Board, Idaho National Engineering Laboratory, Idaho Falls, ID 1/9/97, Energy Daily; December 22, 1994
Environmental Science Foundation, Newsletter, July 1997, Volume 4, Issue 3.
EPA(a); USEPA Region 10 Compliance Order 1085-10-07-3008, 8/15/87
EPA(b); USEPA Comments, March 8, 1993 letter to Lisa Green, Environmental Restoration Division, DOE/ID, from Linda Meyer, WAG-2 Remedial Project Manager, EPA Region-10 with attached Test Reactor Area Warm Waste Pond Treatability Study Comments
EPA(c); U.S. Environmental Protection Agency, Office of Radiation Programs and Center Technology Control, Radiation and Mixed Waste Background information Document Volume 2: Risk of Radiation exposure, 520/1-91-010-2, Washington, DC: U.S. EPA, May 1991.
U.S. Environmental Protection Agency, Office of Research and Development, Risk Reduction Engineering Laboratory, SITE Superfund Innovative technology Evaluation: Technology Profiles, EPA/540/5-90/006, Cincinnati: OH, U.S.EPA, November 1990.
ENICO-1054; A Continuous Plutonium Monitor for Nuclear Facility Off-Gas Streams, Exxon Nuclear Idaho Co., October, 1980
ENICO-1086; Process Verification Testing for Burning TBP-Containing Organic Solvents in NWCF, EXXON Nuclear Idaho, June 1981
ENICO-1131; Evaluation of Stainless Steel Tank Corrosion in CPP High Level Radioactive Waste Service, Exxon Nuclear Idaho Co., April 1983
ENICO-1108; Model of Iodine-129 Process Distributions in a Nuclear Fuel Reprocessing Plant, Exxon Nuclear Idaho Co., April 1982
Environmental Magazine; March, 1993, page 42
Environmental Progress(a); A Report from the USDOE Office of Environmental Restoration and Waste

Management, July 1991 DOE/EM-0014P; and July 1993
Environmental Progress(b); A Report from the USDOE Office of Environmental Management, Winter 1996, Vol. 5 Number 1

ERDA-1536; Waste Management Operations, INEL Final Environmental Impact Statement, US Energy Research & Development Administration, September 1977
ERDA-1552; Final Environmental Impact Statement, Safety Research Experiment Facilities, INEL, September 1977, US Energy Research & Development Administration
ER-BWP-82; Engineering Design File, Pit 9 Project, Revised Plutonium, Americium-241, and Uranium-235 Inventory estimates for Pit 9 Based on the 1993 Historical Data Task, EG&G Idaho Inc.
ERD-93-002; Engineering Design File, Borax I/SL-1 Remedial Investigation Feasibility Study, M.Abbott, 2/23/94
Facing Reality; The Future of the US Nuclear Weapons Complex, P. Gray, R. Boone, Tides Foundation, 1992
FACA; Federal Advisory Committee Act, Public Law 92-463-Oct.6, 1972,HR-4383, 80 Statute 381
Federal Register; Part II, Environmental Protection Agency, 40 CFR Parts 141 and 142, National Primary Drinking Water Regulations; Radionuclides; Proposed Rule, Thursday July 18, 1991
Federal Register; 57 Federal Register, May 26, 1992, page 22054
Federal Register; 58 Federal Register Number 41, March 4, 1993
FET; Foundation on Economic Trends v. Heckler, 22 ERC 1375, 1388 (DC Cir. 1985) citing 677 F2d at 889, also see NRDC, Notice of Intent, 11/4/88
FFA/CO(a); US Environmental Protection Agency, Region 10, State of Idaho, Department of Health and Welfare, and the US Department of Energy, Federal Facility Agreement and Consent Order, Administrative Docket No. 1088-06-29-120, July 22, 1991
FFA/CO(b); Response to Comments on the INEL Federal Facility Agreement and Consent Order, by Idaho Dept. Health and Welfare US Environmental Protection Agency, US Dept. Energy, Dec.6,1991
FFA/CO(c); Federal Facility Agreement negotiations Presentations by Joe Nagel, Director, ID Department of Environmental Quality
Fallout, An American Nuclear Tragedy, Philip Fradkin, University of Arizona Press, Tucson, NM, 1989
FONSI, Proposed Finding of no Significant Impact, on Off-Site Fuels Policy, USDOE, May 10, 1991
FOE; "Reducing the Department of Energy FY 1993 Nuclear Weapons Budget" Tom Zamora and Peter Gray, Friends of the Earth, March 3, 1992
GAO/NSIAD-92-134; Nuclear Submarines, Navy Efforts to Reduce Inactivation Costs, U.S. General Accounting Office, July 1992
GAO/NSIAD-92-256; Nuclear Powered Ships, Accounting for Shipyard Costs and Nuclear Waste Disposal, U.S. General Accounting Office, July 1992
GAO/RCED-89-13; Water Pollution, Stronger Enforcement Needed to Improve Compliance at Federal Facilities, US Government Accounting Office
GAO/RCED-90-101; Nuclear Health and Safety, Need for Improved Responsiveness to Problems at DOE Sites, March 1990
GAO/RCED-91-100; US General Accounting Office, Nuclear Materials, Decreasing Tritium Requirements and their effect on DOE Programs, February 1991,
GAO/RCED-91-56; US General Accounting Office, Nuclear Health and Safety, Environmental Problems at DOE's Idaho National Engineering Laboratory, Feb 1991
GAO/RCED-92-64FS; Nuclear Health and Safety: Radiation Events at DOE's Idaho National Engineering Laboratory, US General Accounting Office, January 1992
GAO/RCED-95-109FS; Department of Energy, Information on DOE’s Human Tissue Analysis Work, General Accounting Office, May 1995
Gen. Atomics; "The Modular High Temperature Gas-Cooled Reactor, Inherently Safe Nuclear Power", General Atomics
Glenn(a); Senator John Glenn, News Release, April 15, 1991, Glenn Releases Study Finding Major Environmental Problems at DOE's INEL
Glenn(b); Senator John Glenn News Release, February 24, 1992, "Glenn says Workers, Residents Exposed to Excessive Radiation at INEL"

Goff; "The Sorption of Select Radionuclides on Basalt and Interbed Materials of the Snake River Plain Southern Idaho", Thesis Presented to the Graduate School of Clemson University, Russell Goff, August 1994
Goldfield; High Efficiency Particulate Arresters, HEPA Filters in the Nuclear Industry, Joseph Goldfield, consulting engineer, Denver, Colorado, September, 1988
Greenpeace(a) World Authority Tightens Radiation Limits, Toronto Canada Green Peace, March 2, 1990
Greenpeace(b); Nuclear Free Seas, Naval Nuclear Propulsion After the Cold War, H.Kristenen, September 1992
Greenpeace(c); Letter from Jonathan Kiel, Department of the Navy, Naval Sea Systems Command, Washington, DC, to Amy Wickenheiser, Greenpeace USA, March 12, 1992
Grumbly(a); Statement of Thomas P. Grumbly, Assistant Secretary for Environmental Restoration and Waste Management, USDOE, FY 1995 Appropriations Hearings, 3/8/94
Grumbly(b); Draft DOE Charter Environmental Management Site Specific Advisory Board, issued by US Department of Energy Assistant Secretary of Environmental Management Thomas Grumbly
Grumbly(c); Draft Memorandum for the Secretary, from USDOE Assistant Secretary of Environmental Management Thomas Grumbly, February 17, 1994, page 2
Hatfield; "Plutonium Cushion Report", Senator Mark Hatfield,10/87
Hancock; Description of Trupact Waste Shipping Container, Southwest Research and Information Center, Don Hancock
Hanford Tank Waste Task Force Final Report, Submitted to WA State Department of Ecology, USDOE, USEPA, September 1993
HAN-40193; "Project Bluenose Committee Experiments," letter to William Rubinson, Brookhaven National Laboratory, Upton, Long Island, New York, from Donald G. Sturges, Chief, General Electric Operations Division Hanford, July 13, 1951
HAN-40477; "Bluenose and Other Matters," Office Memorandum, United States Government, to Donald G. Sturges, Chief, Operations Division, Hanford Operations Office, from S.G. English, Chief, Chemistry Branch, Division of Research, Washington, D. C., July 27, 1951
HAN-41861; "Shipment of Irradiated J Slugs to Arco," Letter to AEC Hanford Operations Office, from Manager General Electric Reactor Section Hanford.
HAN-51053; Shipments to Arco," Memo to Pittman, AEC Washington, DC from Sturges, Hanford Operations Office, 7/8/53
HAN-52865; "Forecast of Spent Fuel Shipments from Hanford to ICPP" Memo from Pittman AEC Washington, DC from Sturges, Hanford Operations Office, 12/1/53
HAN-53121; "Shipments of Irradiated Enriched Uranium from Hanford to Arco Han-52743" Memo to J.Gary Savannah River Operations from D. Sturges, Hanford Operations Office 12/21/53
HAN-53734; "Shipments of Irradiated Enriched Uranium to Arco," Memo to W.A. Erickson, Idaho Operations Office, from Sturges, Hanford Operations Office, 2/10/54
HAN-53823; "Shipments of Irradiated J Slugs to Arco" Memo to AEC Division of Production, Washington, DC, from Manager Hanford Operations Office, 2/18/54
HAN-53928; "Shipments of Irradiated J Sugs from Hanford to Arco," Letter to AEC Hanford Operations Office from Priode, General Electric Hanford, 2/23/54
HAN-54108; "Shipments Irradiated Enriched Uranium to Arco" Memo to W.A. Erickson, Contract Administration Branch Idaho Operations Office, from D. G. Sturges, Chief Operations Division Hanford Operations Office, 3/12/54.
HAN-56557; [HW-32594] "Scheduling RaLa Shipments" H.R. Freitag, Chief SF Accountability and Administrative Branch General Electric Hanford, 9/21/54
HAN-56895; "Project Bluenose - Future Plans", October 27, 1954 letter to O. H. Greager, Manager, Technical Section, General Electric Company, Hanford Atomic Products Operations Richland Washington, from Donald G. Sturges, Chief, Operations Division
HAN-58025; Shipment of J Slugs to Arco; General Electric Hanford memo to C.A. Priode, Manager Production Section from A.T. Gifford Operations Division, 2/10/55
HAN-58154; "Shipment of J slugs to Arco" Letter to AEC Hanford Operations office, from General Electric Hanford 2/28/55.
HAN-58488; "Preparation of ICPP Release Data"; Memo between (illegible name) U.S. AEC, Washington D.C. and A.T. Gifford, Assistant Chief, Operations Division, Hanford Operations Office Richland Washington
HAN-58767; "Report on Bluenose Program Single Channel Experiment", April 12, 1955 letter to D.G

Sturges, Chief, Operations Division, U.S. Atomic Energy Commission, Hanford Operations Office from O.H. Greager, Manager, Pile Technology, Engineering Department General Electric, also General Electric Company April 12, 1955 report with same number (HAN-58767) titled "A compendium of Hanford Effort in Support of Project Bluenose,"

HAN-59174; "Review of Bluenose Program", U.S. Government Office Memorandum from Paul G. Holsted Chief, Planning and reports Branch, Operations Division, May 26, 1955

HAN-59297; "Bluenose Experimental Cost," Office Memorandum, United States Government, June 8, 1955 from Paul G. Holsted, Chief, Planning and Reports Branch, reports total costs for experiment at $50,000

HAN-62172; "Shipments of Ruptured C and J Slugs to Arco" Memo to Philipson, Idaho Operations Office, from Gifford, Hanford Operations Office, 4/18/56

HAN-61940; J and C Slugs Shipments to the ICPP; Memo to Priode, General Electric Hanford from Holsted, Operations Division General Electric Hanford, 3/26/56

HAN-62997; "Gaseous Fission Product Release" Memo to Beard, Idaho Operations Office, from Holsted,Hanford Operations Office, 7/20/56

HAN-63584; Letter to S.G. English, AEC Washington, DC from Carl Bennett Operations Research and Systems General Electric Hanford, 9/27/56

HAN-63688; Gas Release Report,10/20/56, to G. V. Beard, Idaho Operations Office AEC from F.V. Vance Phillips Petroleum Operations Evaluation Group

HAN-63688; "Reporting Bluenose Releases" Memo to English, AEC Washington, DC from Beard, Idaho Operations Office, 10/8/56

HAN-63997; "Shipments to the ICPP" Memo to Philipson, Idaho Operations Office from Gifford, Hanford Operations Office 11/13/56

HAN-64357; "Reporting Bluenose Releases", December 21, 1956, to G. V. Beard, Idaho Operations Office AEC from F.V. Vance Phillips Petroleum Operations Evaluation Group

HAN-64284-1; "Gas Release Report" 11/19/56, to G. V. Beard, Idaho Operations Office AEC from F.V. Vance Phillips Petroleum Operations Evaluation Group

HAN-64357; "Gas Release Report" F. Vance, Phillips Petroleum Idaho Operations, 12/14/56

HAN-68946; Memo to Philipson, Division of Operations Idaho Operations Office, from Gifford, Process Engineering and Manufacturing Division, Hanford Operations, "C and J Slug Shipments to ICPP, 5/8/58

Hain; Conversation and fax from Kathleen Hain, Manager DOE/ID Environmental Restoration Program, March 18, 1998

Health Physics Magazine; Number 40, 1981, pages 173-181

HEAL(a); Perspectives, Hanford Tank Wastes: Chaos for Cleanup, Hanford Education Action League, No.12, Winter 1993

HEAL(b); Perspectives, HEAL, Winter 1993, citing Lokken, R.O. et al., Durability of Double Shell Tank Waste Grouts, PNL-7835, June 1992, page 2.

HEAL(c); Pork and Schemes: A HEAL Special Report on Hanford's Cleanup Budget, by Todd Martin, June 1, 1994, Hanford Education Action League.

HEAL(d); "Previous Green Run Tests Released Radiation at Oak Ridge and Hanford, August 27, 1992

Hewlett; Richard and Francis Duncan, 1969, Atomic Shield, A History of AEC , University of Pennsylvania Press

Horner; letter to Secretary O' Leary August 25, 1995 on behalf of coalition, Daniel Horner, Nuclear Control Institute, Washington, DC

Hoskins; Spent Nuclear Fuel, Presented to the EMSSAB-INEL by A.P. Hoskins, Westinghouse Idaho Nuclear Co., 7/11/94

HHS; US Department of Health and Human Services, Committee Management, 45 Code of Fed. Reg., Subtitle A (10-1-91 Edition),Part 11

HR.4571; 102n Congress, 2n Session, Mr. Gephart, Mr. Richardson, Mr. Markey, Mr. Towns, and Mr.Waxman, March 25, 1992

Hull; Plutonium ES&H Vulnerability Assessment, Argonne National Laboratory, Tom Hull, DOE HQ, 1995

ICP-1126; Reference Facility Description for the Recovery of Iodine, Carbon, and Krypton, Allied Chemical Idaho Chemical Programs, INEL, DOE, April 1978

ICPP-SRD-1; ICPP Safety Review Document, March 1974
ICPP-1187, Methods Evaluation for the Continuous Monitoring of Carbon-14, Krypton-85 and Iodine- 129 in Nuclear Fuel Reprocessing and Waste Solidification Facility Allied Chemical, March 1979
ICPP RI/FS; Session 1 Presentation, Introduction Scope of Comprehensive Remedial Investigation/Feasibility Study and Idaho Chemical Processing Plant Background, Talley Jenkins, DOE/ID, January 17, 1996
ID; State of Idaho Comments on DOE's Off-Site Fuels Policy, 6/24/9
ID v US; Idaho Department Health and Welfare v. United States, 959 F.2nd 149,153 (9th Cir. 1992)
IDEQ; Idaho Division of Environmental Quality Comments on Central Facility Area Motor Pool Ditch Remediation, 1992
Idaho State Journal(a); "Andrus pokes holes in DOE's findings", Tim Jackson, Idaho State Journal, 8/26/94
Idaho State Journal(b); "Grand Teton Park man be due for 7.0 quake", Salt Lake City (AP) 12/7/93
Idaho State Journal(c); "Tools, cloths, sludge part of buried waste at INEL site", Tim Jackson, 1/28/96
Idaho State Journal(d); " Cancer victim charges INEL to blame, investigation incomplete", Mary Duan,11/9/90
Idahoan(a); "Defense Dollars, Pentagon takes more in taxes from Northwest than it spends in Region", Idahoan / Daily News, Associated Press, 8/17/91
Idahoan(b); "U.S. leads democracies in economic growth, poverty", Associated Press, Sept. 19, 1991
Idahoan(c); Associated Press, February 18, 1991, Now called Moscow/Pullman Daily News
IDH&W(b); Idaho Department of Health and Welfare letter to DOE/INEL Augustine Poitrolo, RE: Notice of Violations, 6/5/91
IDH&W(c); Idaho Public Health Brain Cancer Study Report, April 25, 1997, Idaho Department of Health and Welfare.
IHH&W(d); Comparison of Cancer Incidence Rates Between Selected Counties and the Remainder of the State of Idaho, Cancer Data Registry of Idaho, Idaho Hospital Association and Cancer Cluster Analysis Work Group, Division of Health, Idaho Department of Health and Welfare, March 1995
IEER(a); Estimating Risks and Doses from the Nuclear Weapons Complex; Case Study of the Feed Materials Production Center, Fernald, OH, Institute for Energy and Environmental Research, B. Franke, Arjun Makhijani, Stacy Stubbs, December 2, 1991
IEER(b); Radioactive and Mixed Waste Incineration, D. Kershner, S. Saleska, A. Makhijani, Institute for Energy and Environmental Research, June 1993
IEER(c); High-Level Dollars Low-Level Sense, A. Makhijani, S. Saleska, Institute for Energy and Environmental Research, 1992 Apex Press
IEER(d); Fissile Materials, In a Glass, Darkly, Technical and Policy Aspects of the Disposition of Plutonium and Highly Enriched Uranium, Arjun Makhijani, Ph.D., Annie Makhijani, Institute for Energy and Environmental Research, 1995
IEER(e); Plutonium, Deadly Gold of the Nuclear Age; by a special commission of International Physicians for the Prevention of Nuclear War and the Institute for Energy and Environmental Research, H.Hu, A. Makhijani, K. Yih, 1992
IEER(f); Tritium, The environmental, health, budgetary, and strategic effects of the Department of Energy's decision to produce tritium, Hisham Zerriffi, Herbert Scoville Jr., January 1996, Institute for Energy and Environmental Research
IEER(g); Containing the Cold War Mess: Restructuring the Environmental Management of the US Nuclear Weapons Complex, Marc Fioravanti, Arjun Makhijani, Institute for Energy and Environmental Research, October 1997.
ICP-1003; Zirconium Fuel Reprocessing Campaign of 1971, January 1972, Idaho Chemical Processing Plant
IDO-10054-81; Radioactive Waste Management Information, 1981 Summary and Record to Date, June 1982, DOE ID Operations Office
IDO-10035; Nuclear Incident at the Idaho Chemical Processing Plant, US Atomic Energy Commission, National Reactor Testing Station, March 17, 1960
IDO-10036; Nuclear Incident at the ID Chemical Processing Plant, US Atomic Energy Commission, National Reactor Testing Station, January 25, 1961
IDO-10054(80); Radioactive Waste Management Information, 1980 Summary and Record to date, July 1981
IDO-12053; Controlled Environmental Radioactive Tests, Progress Report Number 2, USAEC, Aug. 1966, pg.2
IDO-12082(58); Annual Report Health and Safety Division for Idaho Operations Office for 1958

HREX 0727013

IDO-12085; Activation and Fission Products in the Environment near INEL Radioactive Waste Management Complex, April 1978, O. Doyle Markham, ID Operations Office, US Department of Energy

IDO-12087; Ecological Studies on the INEL Site, 1978 Progress Report, Markham, December 1978 ID Operations Office, US Department of Energy

IDO-14287; Operation of Disolver off Gas System at CPP, IDO, during NP Processing, Phillips Petroleum Co., Idaho Operations Office, November 7, 1953

IDO-14295; Development of Rala Process Utilizing MTR Fuel Elements, E. Anderson, M. Weech, February 20, 1954, Phillips Petroleum Co., Idaho Operations Office

IDO-14300; Status of Development of the RaLa Process as of April 1, 1954, E. Anderson, et.al., Phillips Petroleum Co. Atomic Energy Division

IDO-14306; Status of Development of Rala Process as of May 20, 1954, E.L. Anderson, M.E. Weech, Phillips Petroleum Co. Atomic Energy Division

IDO-14307; Development of RALA Process for Instillation at Idaho Chemical Processing Plant, E. Anderson, July 8, 1954, Phillips Petroleum Co.

IDO-14334; Experience of Handling Low Level Active Liquid Wastes at the Idaho Chemical Processing Plant, S. Fairborne, at.el., June 17, 1955, Phillips Petroleum Co. Atomic Energy Division

IDO-14344; Pilot Plant Development of a Process for Separating Barium-140 from MTR Fuel, 9/1/55 B. Legler et. al., Phillips Petroleum Co., Atomic Energy Division

IDO-14362; Progress Report for April Through June 1955, Technical Branch, Idaho Chemical Processing Plant, C. Stevenson, et.al., February 6, 1956, Phillips Petroleum Co., Atomic Energy Division

IDO-14364; Technical Progress Report for July Through September 1955 C. Stevenson, May 1 1956 Phillips Petroleum Co., Atomic Energy Division, Idaho Operations Office

IDO-14383; Technical Progress Report for October through December 1955, Idaho Chemical Processing Plant, c. Stevenson, et.al, September 1, 1956, Phillips Petroleum Co.

IDO-14410; Technical Progress Report for Jan. through Mar. 1957, ID Chemical Processing Plant, July 18, 1957, Phillips Petroleum Co.

IDO-14414; Startup Operation of a Production Facility for Separating Barium-140 from MTR Fuel, 8/1/57, Phillips Petroleum Co.

IDO-14419; Technical Progress Report for April through June 1957, Idaho Chemical Processing Plant, c. Stevenson, et.al, September 25, 1957, Phillips Petroleum Co.

IDO-14422; Chemical Processing Technology, Quarterly Progress Report, Third Quarter 1957, Phillips Petroleum Co Atomic Energy Division

IDO-14430; Technical Progress Report for October through December 1957, Idaho Chemical Processing Plant C. Stevenson, February 14, 1958, Phillips Petroleum Co, Atomic Energy Division

IDO-14443; Technical Progress Report for January through March 1958, Idaho Chemical Processing Plant September 15, 1958, Phillips Petroleum Co. Atomic Energy Division

IDO-14445; Laboratory Development of a Process for Separating Barium-140 from MTR Fuel, E. Anderson, et. el., March 27, 1959, Phillips Petroleum Co.

IDO-14453; Technical Progress Report for April through June 1958, Idaho Chemical Processing Plant, c. Stevenson, et.al, November 5, 1958, Phillips Petroleum Co., Atomic Energy Division

IDO-14471; Technical Progress Report for January through March 1959, Idaho Chemical Processing Plant, C. Stevenson, et.al, August 27, 1959, Phillips Petroleum Co.

IDO-14494; Technical Progress Report for April through June 1959, Idaho Chemical Processing Plant, c. Stevenson, et.al, March 22, 1960, Phillips Petroleum Co.

IDO-14512; Idaho Chemical Processing Plant Technical Progress Report, October to December 1959, Phillips Petroleum Company, NRTS

IDO-14502; Treatment, Processing and Future Disposal of Radioactive Wastes at the Idaho Chemical Processing Plant, J. Stevens, March 7, 1960, Phillips Petroleum Co.

IDO-14509; Technical Progress Report for July through September 1959, Idaho Chemical Processing Plant, c. Stevenson, et.al, June 12, 1960, Phillips Petroleum Co.

IDO-14532; Hazards Survey, ICPP Power Fuels Demonstration Program August 30, 1960,

Phillips Petroleum Co., Idaho Operations Office
IDO-14567; Chemical Processing Technology Quarterly Progress Report, April - June 1961, Phillips Petroleum Co. Atomic Energy Division, National Reactor Testing Station
IDO-14599; Chemical Processing Technology Quarterly Progress Report, J. Huffman, IDO-14599 Phillips Petroleum Co., Idaho Operations Office, July-September 1962.
IDO-14661; Chemical and Process Development Branch Annual Report, fiscal Year 1965, Phillips Petroleum Company, Atomic Energy Division, National Reactor Testing Station
IDO-16375; Hazards Associated with the Operation of the MTR at 40 MW July 27, 1955, IDO-16375
IDO-16491; SPERT II Hazards Summary Report, February 1959
IDO-17158; Crack in the Engineering Test Reactor Primary Cooling System, E.H.Smith, Phillips Petroleum Co., March 1966
IDO-19301; SL-1 Recovery Operations, Combustion Engineering, June 30,1961
IDO-22052; Probability of Exceeding Capacity of Flood Control System at the National Reactor Testing Station, US Geological Survey, P. Carrigan, Jr., January 1972, TID-4500
IDO-22054; Digital Modeling of Radioactive and Chemical Waste Transport in the Snake River Plain Aquifer at the National Reactor Testing Station, Idaho, J. Robertson 1974
IDO-22056; Hydrology of the Solid Waste Burial Ground, as Related to the Potential Migration of Radio nuclides, INEL, J. Barraclough et al., US Geological Survey, August 1976, Open File Report 76-471
IDO-22062; Evaluation of a Predictive Ground-Water Solute Transport Model at the INEL, ID, B. Lewis et al., USGS, 1982
IH&W(a); INEL Oversight Program, "Wastes at the INEL", R. Owen, A. Merrit, 1991
IHES; Idaho National Engineering Laboratory Health Effects Subcommittee Meeting Official transcripts Pocatello, Idaho June 5-6, 1996, Nancy Schwartz Reporter, page 241
IN-1376; Critical Experiments on a Modular Cavity Reactor, May 1970, Idaho Nuclear Corp. Idaho Falls, Idaho, NASA-CR-72681
IN-1078; Retention of Iodine on Selected Particulate Filters and a Porous Silver Membrane Being Considered for the LOFT Maypack, J. Keller et.al., Idaho Nuclear Corp., US Atomic Energy Commission, May 1967
INEL-94/0026; Work Plan for Waste Area Group 2 Operable Unit 2-13 Comprehensive Remedial Investigation/Feasibility Study, A. Lientz, et.al., April 1995, Lockheed Idaho Technologies Company
INEL-94/0119; ICPP Radioactive Liquid and Calcine Waste Technologies Evaluation Final Report and Recommendation, April 1995, High Level Waste Processing, Lockheed Idaho Technologies Co.
INEL-94/0241; Preliminary Scoping Track 2 Summary Report for Operable Unit 7-01, December 1994, Lockheed Martin, Idaho National Engineering Laboratory
INEL-95/0027; Remedial Investigation Feasibility Study Operable Unit 5-05 and 6-01, March 1995
INEL-95/0056; Waste Area Group 3 Comprehensive Remedial Investigation/Feasibility Study Work Plan (final) Volume 1, August 1995, Lockheed Idaho Technologies Co.
INEL Fact(a); INEL Community Relations Fact Sheet, September 1994
INEL Fact (b); INEL Community Relations Fact Sheet, April 1992
INEL Reporter; INEL Environmental Restoration Program Publication, March 1993
INEL Oversight Program; Hazardous and Mixed Waste, Alan Merrit, Idaho Department of Health and Welfare (IDHW), 1991

Initiatives; Power Fluidic Devices, Initiatives in Environmental Technology Investment, Waste Policy Institute, June 1997
IT Corp; Remedial Investigation Feasibility Study SL-1 and BORAX-I, number 10136, R. G. Filemry, et. al., 8/30/95
Jackson; “Researchers expand cancer investigation”, Tim Jackson, Idaho State Journal, 12/13/96
Justice Downwind, America's Atomic Testing Program, Howard Ball, Oxford University Press, NY, NY, 1986
J-10; “Incident Synopsis J-10 In-Pile Tube”, May 18, 1971, Fmc-276-71, from Michael Cawley documents See Cawley
Journal; "Closing of 2 US Nuclear-Weapons Sites Urged in Draft of Plans" , Wall Street Journal, October 26, 1988

Keppe; Keppe v. Sierra Club, 427 United States 390,409-10 (1976)]
Killing Our Own, The Disaster of America's Experience with Atomic Radiation, Harvey Wassermann, Norman Solomon, Delta Books, NY, NY, 1982
Keystone; Interim Report of the Federal Facilities Environmental Restoration Dialogue Committee, A Federal Advisory Committee Chartered by US Environmental Protection Agency and Facilitated by the Keystone Center, February 1993, page 3
Kimball; “Epidemiological Research Activities”, Daryl Kimball, Physicians for Social Responsibility, Washington, DC
LA Times; "Monument to Atomic Age: Dump for Nuclear Waste", Jennifer Warren, Los Angeles Times,3/19/89
League of Women Voters of Moscow, "Testimony to the State of Idaho EPA, and DOE to be read into the Public Record at the Public Meeting in Boise, Idaho February 5, 1992
Lyle; Letter from Gerry Lyle, Assistant Manager ER/WM INEL to Lynn Mineur, League of Women Voters of Moscow, January 26, 1992
Markham; Plutonium, Am, Cm and Sr in Ducks Maintained on Radioactive Leaching Ponds in Southeastern Idaho, O.D. Markham et. al., April 27, 1988, Health Physics Vol. 55, No. 3, September 1988
Mann; Letter from Larry Mann, Supervisory Hydrologist, U.S. Geological Survey, Water Resources Division, Idaho Falls, ID, 12/12/95, to Chuck Broscious, Environmental Defense Institute
Medvedev; Nuclear Disaster in the Urals, Zhores A. Medvedev, 1979, W.W. Norton & Co.
McNeel; Letter from Kliss McNeel, Manager Environmental Technical Support Unit, EG&G Idaho, to Paul Allen, DOE Idaho Operations Office, on Naval Reactor Facility record in the radioactive waste management information system - KM-37-93, September 7, 1993
Morgan(a); "How Dangerous is Low-Level Radiation", New Scientist, April 5, 1979, p.18-21, Karl Z. Morgan, M.D., Georgia Institute of Technology, Atlanta
Morgan(b); Bulletin of Atomic Scientists, October 1978, Karl Z. Morgan
Moore; Control Technology for Radioactive Emissions to the Atmosphere at U.S. Department of Energy Facilities, E.B. Moore, Project Manager, October 1984, Prepared for the Eastern Environmental Radiation Facility, U.S. Environmental Protection Agency, Montgomery, Alabama, by Pacific Northwest Laboratory, Richland, Washington.
NAS; An Assessment of Continued R&D Into an Electo-metallurgical Approach for Treating DOE Spent Nuclear Fuel, National Research Council, 1995, Basiki, Frewd, et. al.
NAS(1996); National Academy of Sciences, Defense Wastes, Separations and Transmutations Report, 1996, page 93, hereinafter called NAS, 1996
NAS(c); Radiation Dose Reconstruction for Epidemiologic Uses, Committee on an Assessment of CDC Radiation Studies, Board on Radiation Effects Research, Commission on Life Sciences, National Research Council, National Academy Press, Washington DC, 1995. Page 15.
New Production Reactors Program Plan; USDOE, December 1990, DOE/NP/0007P
Norton; “Supercritical”, Boyd Norton, Manager of SPERT Reactor tests during 1960s, Audubon Magazine May 1980, p. 89-105
Nuclear Legacy; Public Citizen, Critical Mass Project, Scott Saleska, September 1989, p.3-4-/6-7, quoting DOE, Integrated Data Base, 1988
NRDC(a); Comments of the Natural Resources Defense Council on the Department of Energy's Proposal to Revise 10 CFR Part 1021 December 17, 1990, Dan Reicher, James Werner
NRDC(b); Reicher; Statement of Dan Reicher on behalf of the Natural Resources Defense Council before the subcommittee on Superfund and Oversight regarding Federal Facility Compliance with CERCLA and RCRA, August 4, 1988
NRDC(c); Comments on "Land Disposal Restrictions for Newly Listed Wastes and Contaminated Debris", submitted by James Werner on behalf of the Natural Resources Defense Council, February 24, 1992 to US Environmental Protection Agency, Washington, DC
NRDC(d); Natural Resources Defense Council, Memorandum, January 21, 1992 "Idaho Chemical Processing Plant Wastes, J. Werner, B.Holman
NRDC(e); "Environmentalists Find Administration Budget Inadequate for Cleanup Requirements", Natural Resources Defense Council Press Release, January 29, 1992, James Werner & Sarah Silver NRDC(f); J.Werner and D. Reicher, Natural Resources Defense Council, Before the DOE Defense

Nuclear Facilities Panel, Armed Services Committee, US House of Representatives, Regarding DOE Budget 93, 3/30/92
NRDC(g); Comments of the Natural Resources Defense Council on the Carnegie Commission Report, Facing Toward Government: Non-governmental Organizations and Government's Quest for Scientific and Technical Guidance, James Werner, February 16, 1993
NRC; Radiation Dose Reconstruction for Epidemiologic Uses, Committee on an Assessment of CDC Radiation Studies Board on Radiation Effects Research Commission on Life Sciences National Research Council, 1995
NRF-Plan; Proposed Plan for Waste Area Group 8 - Naval Reactor Facility, Idaho National Engineering and Environmental Laboratory, January 1998, Department of Energy INL Environmental Restoration Program
NRF-RI/FS; Final Comprehensive Remedial Investigation/Feasibility Study for the Naval Reactor Facility, Idaho National Engineering and Environmental Laboratory, Waste Area Group 8, October 1995, U.S. Department of Energy
NRT-910521-N/C; Nuclear Remediation Technologies, Test Reactor Area Warm Waste Pond, Remedial Investigation Feasibility Study, Sediment Treatability Study, September 1992, p. 2-5, 4-17
NTCF; "Inconclusive by Design, Waste Fraud and Abuse in Federal Environmental Health Research", Environmental Health Network, National Toxins Campaign Fund, Sanford Lewis, Brian Keating, Dick Russell
NWCRS; Proposal for Locating the Nuclear Weapons Complex Reconfiguration Site at the INEL, June 3,1991, ID Operations Office
NWF; National Wildlife Federation v Appalachian Regional Comm. 677 F.2nd 883,888 (D.C. Cir.1981) also see Natural Resources Defense Council Notice of Intent 11/4/88
OE-95-35; Operating Experience Weekly Summary, Operating Experience Program Office of Nuclear and Facility Safety, U.S. Department of Energy, August 25 -August 31, 1995
OCAW; Health and Safety Language, Appendix I, Oil Chemical Atomic Workers, 10/4/90
OCS-IR-95-256; Department of Energy Idaho Operations Office Fy-1995 - 1997 Work Force Restructuring Plan, Idaho National Engineering Laboratory
Olsen; National Academy of Sciences, EG&G Cleanup Meeting, July 31,1989, Idaho Falls, compiled by Cheril Olsen. Also see "INEL seals off wells emitting harmful vapers" Post Register, Rocky Barker, 10-21-87
OP-98-01; State of Idaho INL Oversight Program Review and Evaluation of the ICPP Irradiated Fuel Storage Facility Modifications, March 1998
OPTR 95-01; Review of Idaho National Engineering Laboratory Seismographic Networks and Seismic Hazards Program, J. Zeollweg, K. Soreje, State of Idaho, INEL Oversight Program, Technical Report 95-01, October 1995
Operating Experience; Department of Energy Office of Nuclear and Facility Safety, Operating Experience Weekly Summary, April 1995, these weekly publications are further identified by date

Oregon; Environmental Radiological Surveillance Report on Oregon Surface Waters, 1961 - 1983, Oregon Department of Human Services, Radiation Control Section
OTA(a); Complex Cleanup, The Environmental Legacy of Nuclear Weapons Production, US Congress Office of Technology Assessment, Feb.1991
OTA(b); US Congress, Office of Technology Assessment, Hazards Ahead: Managing Cleanup Worker Health and Safety at the Nuclear Weapons Complex, OTA-BP-O-85, February 1993
Oversight (a); State of Idaho INEL Oversight Program, Annual Report, July 1, 1990 to June 30, 1991
Oversight (b); State of Idaho INEL Oversight Program, Annual Report July 1, 1991 to June 30, 1992, December 1992
Oversight (c); INEL Reference Information, State of Idaho INEL Oversight Program, January 6, 1996, Bob Ferguson
Pad-A ROD; Record of Decision, Declaration for Pad A at the Radioactive Waste Management Complex Subsurface Disposal Area at the Idaho National Engineering Laboratory, January 1994
Parks; Inhaled Plutonium Oxide in Dogs, Pacific Northwest Laboratory Annual Report for 1985 to the DOE Office of Energy Research, Part 1, Biological Sciences, J. F. Parks, February 1986, cited in Natural Resources Defense Council, Thomas Cochran et.al. Testimony 2/26/87
P61SH050; INEL Radioactive Waste Management Information System Non-Decay Summary

Database List (P615H050) USDOE, 10/24/89, see RWMIS
Peaceful Uses of Atomic Energy; Proceedings of the International Conference in Geneva, Aug. 1955 vol.2, p. 276
PBF ROD; Power Burst facility Record of Decision, Power Burst Facility Corrosive Waste Sump and Evaporation Pond, Operable Unit 5-13, Waste Area Group 4, Idaho National Engineering Laboratory, September 1992
PBF Plan; Proposed Plan for an Interim Action of the Power Burst Facility Corrosive Waste Sump and the Power Burst Facility Evaporation Pond, March 1992
Petition; Petition for Rulemaking, Yakima Indian Nation, State of Washington, State of Oregon, transmitted to the Nuclear Regulatory Commission January 2, 1990
PG-WM-84-012; Radiological Characteristics and Decision Analysis for the Initial Engine Test (IET) Hot Waste Line, August 1984, EG&G Idaho
PG-WM-84-013; Radiological Characterization and Decision Analysis for the Decommissioning of Army Reentry Vehicle Facility (ARVF), August 1984, EG&G Idaho
PG-WM-85-008; Decontamination and Decommissioning Plan for the Initial Engine Test Facility and Associated Hot Waste Line, March 1986, EG&G Idaho
Post Register; "Nuclear Waste Bins Questioned", Post Register, Rocky Barker
Post Register(b); "INL: DOE hopes Dam Will Keep Floods from Nuke Waste", Brandon Lommis, Idaho Falls Post Register, 5/7/97
Plutonium, Deadly Gold of the Nuclear Age; by a special commission of International Physicians for the Prevention of Nuclear War and the Institute for Energy and Environmental Research, International Physicians Press, 1992
Plutonium The First Fifty Years; USDOE report on plutonium inventories as of September 1994, released February 1996
PNL-4621; Control Technology for Radioactive Emissions to the Atmosphere at US Department of Energy Facilities, E.B. Moore, October 1984, Prepared for the Eastern Environmental Radiation Facility, US Environmental Protection Agency, by Pacific Northwest Laboratory, Richland WA
Programs & People; Waste Deep, Barricading Harvester Ants from Radioactive Waste at INEL, Spring 1994, University of Idaho College of Agriculture
PR-W-79-001; Decontamination and Decommissioning Plan for the Heat Transfer Reactor Test Assemblies HTRE-2 and HTRE-3, January 1979, EG&G Idaho
PR-W-79-038; A History of the Radioactive Waste Management Complex, at INEL, September 1979, EG&G Idaho
PSR (a); DOE Health Legislation and Directives, Physicians for Social Responsibility, Todd Perry, David Lewis, Daryl Kimball, 1990, Washington, DC
PSR (b); Health Research Bulletin, Vol. 2, Issue 2, Summer 1995, Physicians For Social Responsibility, Washington, DC
PTR-181; Uncertainties Associated with RaLa Material Balance Calculations, F. T. Tingeg, February 19, 1957 Phillips Petroleum Co.
PTR-185; Preliminary RALA Hot Run Status Report, L. Legler, 3/19/57 Phillips Petroleum.
PTR-749; ICPP Processing Run No. 20, June 13 to September 13, 1963 Phillips, Petroleum
PTR-789; Whole Body Count Measurements Within Phillips Petroleum Company, Atomic Energy Division National Reactor Testing Station, 1961 - 1966, March 1966
Quigg; Tritium Warning, Bulletin of Atomic Scientists, March 1984 Catherine Thiel Quigg
Quigley; Childhood Cancer Research Institute, December 1989 Report, Dianne Quigley
Quigley; Childhood Cancer Research Institute, January 1991 Report, Dianne Quigley
RAC; Radiological Assessments Corp. September 12, 1990 letter to Dr. Thomas F. Gesell, Department of Energy, Idaho Operations Office, from John E. Till, Chairman, on behalf of panel members, Frank Gifford, Horan, James Ruttenber, Margrit von Braun, Bernard Grahm, Jerold Lietch, Paul Voilleque', and F. Ward Whicker. The letter states: " The Panel concludes that the Draft INEL Historical Dose Evaluation does not satisfactorily meet the stated objective. The methodology presented is not sufficiently state of the art nor complete to lend confidence that the dose estimates truly represent upper bounds of exposure. It is likely that if thyroid doses to infants and children had been calculated, they would have exceeded those for adults reported in the study.
Radioactive Waste Campaign's Recommendations to the National Academy of Sciences Meeting on INEL

Wastes, April 1990
Radioactive Waste Management Information System; Solid Master Database, P61SH090, printouts, 1954 to 1989, Books 1 through 5, a.k.a. RWMIS
RE-A-77-027; ETR Reactor Building Seismic Analysis, July 1, 1977, G. L. Thinnes, EG&G Engineering Division
RE-A-78-038; ATR Reactor Vessel Seismic Analysis, R.F. Davidson, EG&G Engineering Analysis Division
RE-A-80-062; Thermal Analysis of ANL-W HFEF-5 Waste Containers Buried in Soil Vaults at the Radioactive Waste Management Complex, May 1980, EG&G Idaho
RE-A-80-102; Stress Analysis of the ICPP Radioactive Liquid Waste Storage Tanks, EG&G Idaho Inc., 9/80
RE-E-76-081; ATR Building Seismic Analysis, R.F. Davidson, December 13, 1976,EG&G Engineering Division
RE-E-77-102; ETR Primary Coolant System Seismic Analysis, G.L. Thinnes, EG&G Engineering Division
RE-P-77-047; CFA Laundry Radioactive Liquid Effluent for 1976 EG&G Idaho, June 1977
RE-P-79-061; INEL Quarterly Seismic Report April to June 1979
RE-P-80-005; INEL Quarterly Seismic Report October to December 1979
RE-P-80-065; INEL Quarterly Seismic Report April to June 1980
RE-P-80-090; Soil and Tank Radioactivity at the TAN 616 Tank Area A. Novick, L Keoppen, P. Randolph
RE-P-81-008; INEL Quarterly Seismic Report October to December 1980
RE-P-81-016; Radiation and Fissile Assay of RWMC Soil Samples Collected in June 1978, 1/81, EG&G Idaho
RE-P-81-037; INEL Quarterly Seismic Report January to March 1981
RE-P-82-004; INEL Quarterly Seismic Report October to December 1981
RE-P-82-053; Radiological Characteristics of the TAN-IET Facility EG&G Applied Science Division, June 1982
Record of Decision; Declaration for Pit 9 at RWMC SDA at INEL, Idaho Falls, October 1993
Report # 100-58, House Armed Services Committee, April 15, 1987, p.315,
Reporter; INEL Reporter, November 1993
Review of Radioactive Waste Management Complex - Core Drilling Program, Thomas Aley, et al., Associated Resource Consultants, Inc., 1980
Robertson(a); Letter from Carl Robertson, Freedom of Information Officer, USDOE, Idaho Operations Office, March 2, 1989, to Chuck Broscious, INL Research Bureau.
Robertson(b); Letter from Carl Robertson, Freedom of Information Officer, USDOE, Idaho Operations Office, April 25, 1989, to Chuck Broscious, INL Research Bureau.

Robertson(c); Letter from Carl Robertson, Freedom of Information Officer, USDOE, Idaho Operations Office, October 7, 1991, to Chuck Broscious, INL Research Bureau.
Rocky(a); Rocky Flats Interagency Agreement, January 22, 1991
Rocky(b); Rocky Flats Community Relations Plan, January 1991
Rocky(c); Agreement of Principal, Between the U.S. Department of Energy and the State of Colorado, June 28, 1989
Rockwell; Review of the exhaust air filtering and air sampling, building 71, Rocky Flats Environmental Master File, 3/14/63
Rocky Mountain News; Filter Damage Still Plagues Flats, Janet Day, August 30, 1990
ROD(1995); Record of Decision, Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho Nat. Engineering Lab. Environmental Restoration and Waste Management Programs, May 1995, page 15
Rosengren; Some Little-Published Difficulties with a Nuclear Freeze Office of International Security Affairs, DOE, October 1983
RSWF; Radioactive Scrap and Waste Facility, T.P. Zahn, November 11, 1995, Argonne National Laboratory presentation to INEL Site Specific Advisory Board
RWMIS; see Radioactive Waste Management Information System above P61SH090
RWMC Drawing # 416511; Radioactive Waste Management Complex Diagram, EG&G Idaho, J.H. Nelson, 5/4/82, Revised March 19, 1992, F. Y. Hyner
RWMC Fact; Idaho National Engineering Laboratory Community Relations Plan Fact Sheet, November 1991
Ryan; Harold Ryan, Senior US District Judge, summary judgment , 6/28/93, Public Services Co. of Colorado v. Cecil Andrus; United States of America v. Cecil Andrus , Civil No 91-0035-S-HLR & 91-0054-S-HLR
S.2506; US Senate Bill in 102d Congress, 2d session, Mr. Wirth, Mr. Gorton, and Mr. Gore April 1, 1992
Safe Energy Communication Council; “Cutting Your Losses Means Cutting Nuclear Programs”,

Press Release, June 1, 1995, Contact Mary Myers
SB v DOE; Shoshone-Bannock Tribes v U. S. Department of Energy, Civil No. 91-0436-E-EJL (D. Idaho, Nov. 1, 1991)
SC&A; Sanford Cohen and Associates Quarterly Reports (October - December 1993, page 5) and (January - March 1994, page 7) to Leeann Denham, Project Officer, Centers for Disease Control and Prevention.
SC&A(b); Sanford Cohen and Associates Quarterly Report, January 31, 1994, to Leeann Denham, Project Officer, Centers for Disease Control and Prevention.
Seattle Post-Intelligencer; "Risks surfacing at nuclear burial ground" Matthew Wald, The New York Times, 1/18/89
Secrecy; Report of the Commission on Protecting and Reducing Government Secrecy, 1997, US Senate Document 105-2, Senator Daniel Patrick Moynihan, chair
Senate; U.S. Senate Armed Services Committee, Subcommittee on Nuclear Deterrence, Arms Control and Defense Intelligence, Hearing On: Shipment of Spent Nuclear Fuel, 28 July 199, Questions and Answers for the Record
SCFS; Southern California Federation of Scientists et.al. vs. Regents of the University of California, Superior Court of California, County of Alameda, North County Branch, October 21, 1987.
Sierra Club vs. United States Department of Energy, Civil Action No. 87-706.
Schlack; Comments on Department of Energy's New Production Reactor, Kate Schlack, 1991
Schwartz; Active U.S. Nuclear Weapons Production Facilities, as of April 1995, Stephen Schwartz, Brookings Institute
Schneider(a); New York Times, 10/26/88, Keith Schneider
Schneider(b); "Dangerous Arms Plants get Bonus", Seattle Post-Intelegencer October 26, 1988, New York Times copyright by Keith Schneider story
Sen.Doc; The history of the 1966 FOIA is reprinted in "Freedom of Information Act Source Book, Subcommittee on Administrative Practices and Procedure, Senate Judiciary Committee, 93rd Cong., 2nd Sess., 1974, Sen. Doc. No. 93-82.

Shoshone; "Shoshone-Bannock Tribes Stop Nuclear Waste Shipments from crossing Fort Hall Reservation", Press Release, October 24, 1995, Contact Delbert Farmer, Chairman
Sierra Club Legal Defense Fund vs DOE/Rockwell, 1987 and Tri-Valley Cares vs. DOE/Lawrence Livermore, 1988
SIS; Special Isotope Separation Project, Final Environmental Impact Statement, November 1988, DOE/EIS-0136
Site Specific Plan; Department of Energy Idaho Operations Office Environmental Management Fiscal Year 1993 Site Specific Plan
SL-1 Plan; Proposed Plan for Operable Units 5-05 and 6-01, Stationary Low-Power Reactor 1 and Boiling Water Reactor Experiment I Burial Grounds, May 1995, INEL ER Program
SNF Vulnerabilities; Plan of Action to Resolve Spent Nuclear Fuel Vulnerabilities, Phase I, U.S. Department of Energy, Executive Summary, February 1994
SPEERA; Report to the Secretary, The Secretarial Panel for Evaluation of Epidemiologic Research Activities for DOE, 3/90
SFP; Draft Idaho Chemical Processing Plant Spent Fuel and Waste Management Technology Development Plan, April 24, 1992, US Department of Energy, Idaho Operations Office
Spent Fuel Working Group Report on Inventory and Storage of the Department's Spent Nuclear Fuel, November 1993, USDOE Office of Environmental Health and Safety
SPG-31-93; Standing Root Cause Committee Report on Investigation: Fuel Can Corrosion at CPP-603 Underwater Fuel Storage Facility; OR-93-0012, S.P. Gearhart chairman, Westinghouse Idaho Nuclear Co.
Spokesman(a); "Tritium Contamination in Eastern Washington", 4/84, Spokesmen Review
Spokesman Review(b); " Reports and Comments", Larry Shook, 5/4/84
Spokesman(c); "Deal may affect Hanford injury, death claims", Sept 9, 1990, K. D. Steele, Spokesmen Review
Spokesman(d); "State wants end to Hanford Health secrecy" Nov 10, 1990, K.. D. Steele, Spokesmen Review
Spokesman(e); Karen Doran Steele, 9/9/90 quoting contract language between Washington Department of Labor and Industries and Department of Energy, Spokesman Review
STAR(a); Lockheed Martin Idaho Technologies, STAR, published at the Idaho National Engineering Laboratory,

May 28, 1996.
STAR(b); Lockheed Martin Idaho Technologies, STAR, published at the INEL, May 28, 1996.
STAR(c); Lockheed Martin Idaho Technologies, STAR, published at the Idaho National Engineering Laboratory, January 1997.
Star(d); Lockheed Martin Idaho Technologies, STAR, published at the Idaho National Engineering Laboratory, May 20, 1997.
Statesman(a); "INEL Plutonium in Snake River Aquifer", Dec. 3, 1979
Statesman(b); “Earthquake threat worries critics of INEL”, Andrew Gaber, Idaho Statesman, 1994
Stewart; Research Proposal - Further Tests of Cancer Effects of Low Level Radiation, Alice M. Stewart, M.D., F.R.C.P. Senior Research Fellow, Birmingham University, GB, Nov.1985
STP; Idaho National Engineering Laboratory, Proposed Site Treatment Plan, March 1995, DOE/ID-10493, U.S. Department of Energy Idaho Operations Office.
Strand; Permanence of Suppression of the Primary Immune Response in Rainbow Trout, Salmo Gairdneri, Sublethally Exposed to Tritiated Water during Embryogenesis, John Strand, M. Paul Fujihara, Ted Poston and C.Scott Abernethy, Ecological Sciences Dept. Pacific Northwest Laboratory, Richland Washington, Radiation Research 91,533-541 (1982) Academic Press
Summary of RCRA Facility Investigation Activities at Test Area North, USDOE, Idaho Operations Office
TAN Fact; Community Relations Plan Fact Sheet, January 1992, DOE Studies Groundwater Contamination at Test Area North
TAN Plan(a); Community Relations Fact-sheet, "DOE Studies Groundwater Contamination at the Test Area North, 1/92
TAN Plan(b); Proposed Plan for an Interim Action to Reduce the Contamination Near The Surrounding Groundwater at the Test Area North, INEL, Jan.1992

TAN Plan(c); Proposed Plan for Waste Area Group 1, Test Area North, Idaho National Engineering and Environmental Laboratory. February 1998, INL Environmental Restoration Program
TAN(d); Field Sampling Plan for Operable Unit 1-10: Test Area North, D. L. Michael, Lockheed Idaho Technologies Company, Idaho National Engineering Laboratory, March 1996
TAN ROD; Record of Decision, Technical Support Facility Injection Well (TSF-05) and Surrounding Groundwater Contamination (TSF-23), Operable Unit 1-07A, Waste Area Group 1, Idaho National Engineering Laboratory, September 1992
TAN Sludge; Summary of RCRA Facility Investigations Activities at Test Area North, Table 1, Tan Sludge Sample TSF-050, Collection Date 071090 to 071090 page B-5
TAN-5171; Test Area North Leach Pond Sediments, Operable Unit TSF-07, D. B. Harelson, 9/1/92, Number 5171
TAN ROD; Record of Decision, Technical Support Facility Injection Well (TSF-05) and Surrounding Groundwater Contamination (TST-23), Operable Unit 1-07A, Waste Area Group 1, September 1992, Idaho National Engineering Laboratory
Test Reactor Area Hazardous Conditions and Incidents Report, Test Reactor Area Remedial Investigation Feasibility Study, Administrative Record
Tiger; USDOE Tiger Team Idaho National Engineering Laboratory Assessment, Executive Summary, August 1991
Till; Findings and Recommendations of the Review Panel for the Draft INEL Historical Dose Evaluation, September 15, 1990, John Till, Chair.
Times(a); "150 in Idaho Protest Plan to Build New Reactor", New York Times, November 11, 1988
Times(b); “Explosions Feared at Arms Factories, Senate Staff Report Sees Risk of Reactions that Could Spread Radiation”, New York Times, Matthew Wald, 12/10/93
Times(c); Mathew Wald, 3/10/93, New York Times
Times News; "Documents show massive INEL radiation release", Times News, May 26, 1989
Times News(a); "Though INEL Water Checks Again Under State's Eye, Funds are Absent" Twin Falls Times News, 2/9/79
Times News(b); "INEL: What is in the ground?, N.S. Nokkentved, 8/29\89, A 16 page special report
Times News(c): "A Hot Issue", N.S. Nokkentved, 10/14/90
Times News(d); “Snake River flow sinks to record low”, 7/4/92

Times News(e); “INEL tanks secure, but sometimes pipes leak”, N.S. Nokkentved, 10/15/90
Times News(f);” Documents show massive INEL radiation release”, N.S. Nokkentved, Times News, May 26, 1989
Times News(g); “DOE reluctant to drain INEL problem tanks”, N.S. Nokkentved, 7/27/92
Times News(h); “Apparent false alarm empties INEL facility”, Times News, Nov. 28, 1991
Times News(I); “New cleanup process proposed for INEL radioactive graveyard”, Times News, Sept. 12, 1996
Tousley; U.S. House of Representatives Committee on Natural Resources, Memo, 10/28/92, from Dean counsel, Subcommittee on Energy and Mineral Resources, RE: Regulation of DOE Nuclear Facilities Request for Comments
TMI; Three Mile Island Public Health Fund, for and on behalf of Class III certified in re Three Mile Island Litigation, C.A. 79-0432 (M.D. Pa.), v. United States Department of Energy; complaint No. 1:)V-89-1185.
Trash; Trash to Cash, Waste Management Inc.'s Environmental Crimes and Misdeeds, Charlie Cray, Third Edition, May 1991, Greenpeace USA
TRA Hazardous Conditions and Incidents Report; Test Reactor Area Warm Waste Pond Remedial Investigation / Feasibility Study, Administrative Record
TRA Plan; July 1991, Proposed Plan for a Cleanup of Warm Waste Pond Sediments at Test Reactor Area at the Idaho National Engineering Laboratory
TRA ROD(a); Record of Decision, Test Reactor Area Perched Water System, Operable Unit 2-12, Idaho National Engineering Laboratory, December 1992
TRA ROD(b); Declaration for the Warm Waste Pond at the Test Reactor Area at the Idaho National Engineering Laboratory Declaration of the Record of Decision, Augustine Pitrolo, Manager DOE Field Office Idaho, 12/3/91

TRA ROD(c); Explanation of Significant Difference for the Warm Waste Pond Sediments Record of Decision at the Test Reactor Area at the Idaho National Engineering Laboratory, Reuel Smith INEL Community Relations Office
Tree-1013; Onsite Environmental Surveillance Report for the Radioactive Waste Management Complex, Annual Report 1975
Tree-1061; Containment of Transuranic Contamination at the Early Waste Retrieval Project, J Harness, J. McKinney, January 1977, EG&G Idaho, Idaho National Engineering Laboratory
Tree-1047; Early Waste Retrieval Interim Report, July1 1975 to September 30, 1976, D. Card, EG&G Idaho, February 1977, Idaho Operations Office, ERDA
Tree-1321; Early Waste Retrieval Final Report, J. Bishoff,R. Hudson, EG&G Idaho, August 1979, Idaho Operations Office
Tree-1171; The Subsurface Migration of Radionuclides at the Radioactive Waste Management Complex, 1976-1977
Tree-1265; Early Waste Retrieval Interim Report, Oct. 1 to Sept. 30, 1977, Mckinley, McKinney, EG&G Idaho, May 1978
Tree-1284; Long-term Management Plan INEL Radioactive Waste, J. Mckinney, December 1978, EG&G Idaho, Idaho National Engineering Laboratory
Tribune(a); "Trucking Infractions up in 1987", Lewiston Morning Tribune, February 28, 1988
Tribune(b); "Feds tighten up limits on radiation exposure", H. Josef Hebert, Associated Press, 12/14/90, Lewiston Morning Tribune
Tri-City Harold; “Missed Placed Threats”, Richland Washington, 8/21/90, Robert C. Dupy, Galen Winsor.
Tritium; Cumulative Genetic Effects from Exposure to Male Mice to Tritium for Ten Generations, D. Mewissen, A. Ugarte, Department of Radiology and Franklin McLean Memorial Research Institute, University of Chicago, IAEA-SM-237/67
Tritium; Extinction of a Mouse Colony following Multi-generation Exposure of Male Progenitor to Low- Level Tritium, Mewissen, Ugarte, Rust, Department of Radiology, Univ. of Chicago, Lab. of Radiobiology, The Free University of Brussels, Belgium
Tritium; Distribution and Incorporation from Tritiated Water or Tritiated Precursors of DNA, RNA or Proteins, D.J. Mewissen et al, Dept. of Radiology, University of Chicago, IAEA-SM-232/63
Tritium; Toxicity: Effect of Low-Level HOH Exposure on Developing Female Germ Cells in the Mouse, R. Dobson, M. Cooper, Bio-Medical Division, Lawrence Livermore Laboratory, University of California, 58,91-100 (1974)

Tritium; Incorporation in Rats Chronically Exposed to Tritiated Food or Tritiated Water for Three Successive Generations, Pietrzak-Flis, I. Radwan, Z. Major, M. Kowalska, Central laboratory for Radiological Protection, Warsaw, Poland, 6/23/81, RES. 22,434-442 (1982)
Tritium; Permanence of Suppression of the Primary Immune Response in Rainbow Trout, Salmon gairdneri, Sub-lethally Exposed to Tritiated Water during Embryogenesis, J.A.Strand, M.P. Poston, C.S. Abernathy, Radiation Research, 91,533-544 (1982)
Tritium; The Overlooked Nuclear Hazard, Ian Fairlie, The Ecologist Vol.22, No.5, September/October 1992
Tritium; Unusual Dose-Response of Chromosome Aberrations Induced in Human Lymphocytes by very low Dose Exposures to Tritium, Tada Aki Hori and Sayaka Nakai, Division of Genetics, Nat. Inst. of Radiological Sciences, Japan, Mutation Research ,50(1978)101-110
Tritium; also see Strand
Tritium; Tritium in the Savannah River Site Environment, C.Murphy, Westinghouse Savannah River Co. WSRC-RP-90-424-1
TSP(a); Radiation Dose News Letter, Winter Edition, December 1992, Publication of the Technical Steering Panel of the Hanford Environmental Dose Reconstruction Project
TSP(b); Technical Steering Panel of the Hanford Environmental Dose Reconstruction Project, Fact Sheet #14, August 1992 Gaining Access to Hanford Documents
TSP(c); Radiation Dose News Letter, Fall Edition, October 1993, Publication of the Technical Steering Panel of the Hanford Environmental Dose Reconstruction Project
TYP; Draft Idaho National Engineering Laboratory Environmental Management Ten Year Plan, Date Issued - July 31, 1996, Idaho National Engineering Laboratory, Lockheed Martin Idaho Technologies Company, Idaho Falls, Idaho 83415.
UIWR; University of Idaho; Snake River Plain Aquifer , Idaho Water Resources Research Institute, University of Idaho, publication #877
USAEC; Advisory Committee on Biology and Medicine, Minutes of the 50th meeting, March 9, 1956, p.7, Reynolds Elec. C. (CIC Library), Los Vegas, NV
UE&T; Initiatives in Environmental Technology Investment, Urban Energy and Transportation Corporation Vol. 2, December 1995
US v Andrus; United States of America v. Andrus, Civil Action No 91-0035 S HLR, Joint Memorandum Opposing Environmental Defense Institute's Motion to Intervene, September 7, 1993
US Department of Energy Budget Request, Vol.1, FY 1989, Feb. 1988
US Department of Energy Budget Request, FY92, DOE/CR/-0001&3
USGS; Water- Quality Data for Selected Wells on or Near the INEL, 1949 through 1982, US Geological Survey, Open File Rpt. 84-714, July 1985
Wald(a); Report Sees Explosion Risk at Energy Dept. Plants, Matthew L. Wald, New York Times December 10, 1993
Wald(b); “Big Price Tag for A-Bombs, Study Finds 50-Year Cost to U.S. is Almost $4 Trillion, Matthew L. Wald, New York Times, July 13, 1995
Washington State SANE/FREEZE; "Startling Facts about Military Spending", January 20, 1990, Janie Shinkoskey
Weida; “An Economic Critique of DOE’s Attempt to Privatize Cleanup of the Nuclear Weapons Complex” Global Resource Action Center for the Environment, Dr. William Weida, New York, NY, 5/9/97
Werner; Idaho Chemical Processing Plant Wastes, Memorandum, 1/21/92 James Werner, senior engineer, Blan Holman, research associate, Natural Resources Defense Council
Williams; Charles; January 31, 1983 letter from Charles Williams, INEL manager to Governor John Evans, Subject: INEL Radioactive Waste Data
Wilks; Comprehensive Technical Report, General Electric Direct-Air-Cycle Aircraft Nuclear Propulsion Program, P.H. Wilks, 1962, Nuclear Safety, APEX-921, cited in DOE/ID-12119
WINCO-1001; Iodine-129 Control Monitor for Evaporation Off-Gas Streams, Westinghouse Idaho Nuclear Co., March 1984
WINCO-1053; Fitting the Convective-Dispersive Solute-Transport Equation to Soil Column Effluent Data, Westinghouse Nuclear Co., April 1988
WINCO-1050; Inventories and Properties of ICPP Calcined High-Level Waste, Westinghouse Idaho

Nuclear Co., Feb.1988
WINCO-1216; ICPP Radioactive Liquid and Calcine Waste Technologies Evaluation Interim Report, J. Murphy, Westinghouse Idaho Nuclear Co., June 1994
WMP-77-3; Waste Management Program, History of Buried Transuranic Waste at INEL, W. M. Card, EG&G Idaho, Idaho Falls, Idaho, March 1977
WIPP; Evaluation of the Waste Isolation Pilot Plant as a water - saturated nuclear waste repository, Scientists Review Panel on WIPP, January 1988, panel include 11 PH.D's from the University of New Mexico, Albuquerque, N.M.
WP; Washington Post, February 28, 1988, p.A4
Wong; Micronzonation for Earthquake Ground Shaking at the Idaho National Engineering Laboratory, Ivan Wong, Susan Olig, and Douglas Wright, Woodward Clyde Federal Services, November 1995
WR-B-96-03; Audit of Construction Management at the INEL, US Department of Energy, Office of Inspector General, October 1995