Environmental Defense Institute

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Comments on Agreement to Implement Plan for Buried Radioactive Waste

Idaho National Laboratory OU-7-13/14 (October 2007)

I. Summary

These Environmental Defense Institute (EDI) Comments expand on previous Idaho National Laboratory buried waste comments (10/25/07) and supplemental comments (11/11/07) submitted earlier. [1]

On July 1, 2008, the State of Idaho and the Department of Energy (DOE) filed a legally binding agreement in U.S. Federal District Court called "Agreement to Implement U.S. District Court Order Dated May 25, 2006. [2] This new Agreement details DOE's Idaho National Laboratory (INL) buried radioactive waste removal obligations.

Idaho is again capitulating to DOE in this new Agreement by vacating crucial parts of the original 1995 Settlement Agreement with DOE that stipulated 65,000 cubic meters (cm) of transuranic waste be exhumed and sent to a non-Idaho deep geologic repository. This new Agreement only requires DOE to exhume not less than 6,238 cm from the Radioactive Waste Management Complex Subsurface Disposal Area (RWMC/SDA). This is significantly less than the 1995 Agreement stipulating removal of 65,000 cm of transuranic waste, which was at the time, a gross underestimate. [3] Also the 96.8 acre SDA "Retrieval Area" is now reduced to only 5.65 acres based on DOE's "review of shipping and disposal records." The accuracy of these disposal records have been repeatedly shown to be grossly deficient especially during the earlier years when there was no attempt to segregate waste types and shipments were simply loosely dumped in whatever pit/trench was open at the time. [Ibid]

DOE's secrecy is common knowledge and its intent to keep is previous/current operations buried. But this Agreement goes further by stating that retrieval operations must be suspended when it "implicates national security issues involving classified information, such factors constituting the exclusive basis upon which DOE may request the suspension of a retrieval

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[1] Access to DOE's buried waste documentation continues to be difficult despite EDI's Freedom of Information Requests, therefore, EDI must continue to update comments as new information is released by DOE.

[2] A copy of the Agreement is available at; http://www.deq.idaho.gov/inl_oversight/contamination/agreement_waste_removal_2008/ ; This Agreement is signed by James Rispoli, DOE Assistant Secretary for Environmental Management; Admiral Kirkland Donald, Director Naval Nuclear Propulsion Program; C. K."Butch" Otter, Governor of Idaho; and Lawrence Wasden, ID Attorney General .

[3] Chuck Broscious, Citizens Guide to Idaho National Laboratory, page 130; http;//www.environmental-defense-institute.org

obligation under this Agreement." [pg. 8]

Groundwater monitoring data show extensive migration of RWMC/SDA radioactive and hazardous contaminates into the underlying Snake River Aquifer. Idahoans' and downstream Snake River populations can be legitimately outraged by this Agreement and the State's complicity to allow DOE to leave most of this waste in place where it will continue to pose a significant hazard to the public.

The Department of Energy, Idaho Department of Environmental Quality and the Environmental Protection Agency ("Agencies") buried waste Plan for the Idaho National Laboratory (INL) Radioactive Waste Management Complex (RWMC); Operable Unit 7-13/14; October, 2007 ("Plan"). This slick publication offers no detailed information about waste characterization or current contaminate plumes (except for volatile organic compounds vapor extraction) so the public is left without crucial data on which to make an informed decision.

The Agencies "Preferred Alternative" [pg 25] will leave huge quantities of hazardous and long-lived radioactive waste in place to further contaminate Idaho's sole source aquifer. Of the 35 acres in the RWMC Subsurface Disposal Area (SDA) the agencies only plan on "targeted waste retrieval from 4.8 acres." Even IDEQ has reservations. "[T]he State has not agreed to accept DOE's currently proposed retrieval area of 4.8 acres." [pg. 40] Leaving the remaining 30.2 acres of SDA buried waste permanently in place in a flood zone to continue leaching hazardous and radioactive contaminates into the underlying aquifer is unconscionable. The RWMC lies in a localized depression about 40 feet lower than the nearby Big Lost River that flooded the RWMC numerous times in the past. [See Section III below]

The Plan will leave over 1,200 (13 rows) "soil vaults" (DOE documents show >20 rows) permanently in place with only grouting to reduce waste migration. Grouting is a known failed containment method because radiation degrades the grout over time and grout cannot be injected underneath the waste. Indeed, DOE claims grouting only "**reduces transport of contaminates into the vadose zone and aquifer**." [pg. 26] The soil vaults largely contain INL Naval Reactor Facility spent nuclear fuel parts that individually contain over 10,000 curies of remote handled waste. It is no wonder that DOE is averse to exhuming this deadly waste that it currently has no other disposal site available to take it. However, these soil vault containers can be exhumed and put into the existing NRC permitted above ground shielded interim storage at INL/INTEC. Additionally, as documented below , DOE fails to acknowledge that about 90.28 metric tons of spent nuclear fuel was dumped in the SDA. This action literally puts future generations that rely on the Snake River Aquifer at significant and indefinite risk for potentially thousands of years (the toxic radioactive half-life of much of this waste).

The Environmental Defense Institute (EDI) believes that DOE's Remedial Investigation/Feasibility Study for the RWMC/SDA is grossly inadequate in waste characterization, therefore, the Risk Assessment and proposed Plan for cleanup of the buried waste is subsequently deficient. [4]

Because of inadequate waste characterization, the Environmental Defense Institute only supports the Agencies Plan Alternative No. 5; Full Retrieval, Treatment, and Disposal in a fully permitted non-Idaho geologic repository. [5] The fact that the RWMC lies in a flood zone disqualifies under Nuclear Regulatory Commission regulations any alternative that leaves waste in place in this shallow burial dump.

Alternative 5 that would remove "all" the buried transuranic/plutonium, is dismissed by the agencies for incorrect and inappropriate reasons. This alternative is what the public was promised in 1970, and promised again, in 1995, and would remove the 30,000 cubic meters of buried TRU, and remove the rest of the buried plutonium as well, that was re-defined as "low level" in 1982, to avoid

[4] See Citizens Guide to INL; http://environmental-defense-institute.org/publications

[5] Nuclear Criticality Safety Issues Pertaining to the INEEL SDA; J.A McHugh, R.A. Knief, and M.A. Robkin, May 3, 2000 ;

overfilling WIPP in New Mexico.

The Department of Energy (DOE) issued 7/18/07 a "Notice of Intent (NOI) to prepare an environmental impact statement (EIS) for the disposal of Greater-Than-Class C (GTCC) low-level radioactive waste (LLW). The NOI is the first of a series of steps to prepare the EIS, which will be a primary component in the determination of how and where to dispose of GTCC LLW. "

This EIS is significant because of the huge volumes of GTCC waste in the Idaho National Laboratory Radioactive Waste Management Complex Subsurface Disposal Area Soil Vaults discussed in detail below.

DOE/ID, IDEQ and EPA must suspend the INL/RWMC/SDA Buried Waste Cleanup Plan until the above GTCC EIS final is published in the Federal Register. The Nuclear Regulatory Commission (NRC) regulations prohibit GTCC waste disposal in near-surface landfills and require that GTCC waste be disposed in a geologic repository. [6]

Independent documentation shows this waste contains 640,000 curies of radioactive material in about 57,000 cubic meters of waste in the SDA. DOE's own numbers are 634,000 curies in 36,800 cubic meters. [7] EDI believes both of these waste curie content numbers grossly understated. The RWMC near surface waste landfill violates NRC disposal regulations for high-level spent nuclear fuel, GTCC, Transuranic (TRU) waste all of which are in the RWMC/SDA in significant quantities as documented below.

EDI therefore rejects the Agencies preferred alternative. Also see EDI's buried waste detailed comments on our website http://environmental-defense-institute.org/publications.

II. Site Description

This section is included as a documented challenge to Agencies grossly misleading Site History/Background and buried waste characterization information.

The Radioactive Waste Management Complex (RWMC) is the largest of the numerous INEEL/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]

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

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[6] Title 10 Code of Federal Regulations (CFR) Subsections 72.3 and 61.55

[7] Buried TRU Contaminated Waste Information for USDOE Facilities; June 2000.
For more information on DOE plan see; http://idahocleanupproject.com/]

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 National Reactor Test Station (NRTS) now called Idaho National Laboratory (INL) 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, INEEL 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 INEEL", [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 INEEL 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 INEEL. [WMP 77-3 @ 14]

In later years, DOE facilities at Mound, Battelle-Columbus, Argonne-east, and Bettis also dumped at INEEL. "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 INEEL 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. These 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	GTCC		1,200	
Pit-20 >600 w/2 drums each hole	shielding /remote handling			SW corner Pit-20 array concrete vaults GTCC
Pad - A	Mixed Alpha LLW	1972-78	18,232	2,020

Notes for above table: [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; Greater than Class C Low-level Waste (GTCC) requires deep geologic disposal.

Soil Sampling at RWMC

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 INEEL 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 interbeds 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 interbeds 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.*

III. Flooding Issues at the RWMC

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	1990	0.04 +/- 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 solubility 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 alphas. [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 INEEL 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, INEEL'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. INEEL 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 INEEL 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 INEEL 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 INEEL 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 Macky 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 INEEL EIS acknowledges that Macky 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.

IV. Summary of Waste Dumped in the Subsurface Disposal Area

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 (RTC)	460,000
ID Chemical Processing Plant (INTEC)	690,000
Naval Reactors Facility	4,200,000

Argonne-West	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 INEEL's Radioactive Waste Management Complex Pit 9 and the development and testing of waste treatment technologies at INEEL. 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 INEEL; 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 irretrievability does not cause inordinate delays in getting on with cleanup." "Let the ultimate best form for the waste drive decisions, neither 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 INEEL'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 INEEL 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 INEEL 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 INEEL 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 INEEL 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 INEEL 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 is 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 INEEL 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 INEEL 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 INEEL [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	191,726	"
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 INEEL 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 IDO14532 @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 INEEL 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, and 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 INEEL, 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 INEEL. 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 INEEL, with the option to treat up to an additional 120,000 cm of waste generated by future INEEL 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 INEEL 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, then manager of the State of Idaho's INEEL 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 INEEL's Pit-9."[Star7/15/97]

Additional Flooding Issues at RWMC

Since the radioactive waste will be extremely hazardous for tens of thousands of years and flooding will flush contaminates down into the aquifer, a conservative risk assessment would model the upper 95-percent confidence limits for the estimated 100-year peak flow of 11,600 cf/s. USGS has proposed this additional research to DOE, but the Department thus far is not willing to provide the funding. A USGS hydrologist notes, "The flow of 11,600 cfs represents the upper 95 percent confidence limit flow for the estimated 100-year peak flow (Kjelstrom and Berenbrock, 1996, p6). Future modeling needs are to model the area with this flow. We've expressed this to the INEEL and also have expressed that the WSPRO model used has limitations and that an application of more stringent models (two dimensional) is needed to refine and better delineate the extent of possible flooding of the Big Lost River." [6]

USGS estimates the mean 500-year Big Lost River flood rates at 9,680 cf/s (34% greater flow rate than the mean 100 year flood).[7] This 500-year flood would inundate the ICPP and

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[6] Charles E. Berenbrock, U.S. Geological Survey Hydrologist, March 25, 1999 email to Chuck Broscious

[7] Estimated 100 Year Peak Flows and Flow Volumes in the Big Lost River and Birch Creek at the Idaho National Engineering Laboratory, U.S. Geological Survey, Water Resources

surrounding area. These potential hazards must be taken into consideration when making hazardous mixed radioactive waste decisions in these vulnerable areas because of the long-term consequences and the potential for additional aquifer contamination.

Cascading events should also be considered. This is known as a worst case scenario where one event triggers another event. For instance a 500-Year flood plus failure of Mackay Dam (built in 1917) resulting in estimated flows of 9,700 + 54,000 cubic feet per second respectively would be an example of a cascading event. Failure of Mackey Dam is non-speculative in view of the 1976 failure of the Teton Dam of similar construction and the fact that Mackey Dam lies within 11 miles of a major earthquake fault line that produced the 1983 Borah Peak 7.3 magnitude quake. An internal 1986 DOE report that analyzed the impact of Mackey Dam failure scenarios notes that, "Mackay Dam was not built to confirm to seismic or hydrologic design criteria," and "the dam has experienced significant under seepage since its construction." [8] This EG&G study acknowledged that the ICPP, Navel Reactors Facility, and the Test Area North (LOFT) facilities would be flooded with at least four feet of water moving at three feet per second.

USGS did not consider cascading events but noted previous studies showing that failure of Mackay Dam alone would result in 6 feet of water at the INEEL Radioactive Waste Management Complex (RWMC). Other studies recognized by USGS note that, "Rathburn (1989, 1991) estimated that the depth of water at the RWMC, resulting from a paleo-flood [early] of 2 to 4 million cf/s in the Big Lost River in Box Canyon and overflow areas, was 50-60 feet." "If Mackey Dam failed, Niccum estimated that peak flow at the ICPP would be at 30,000 cfs." [9] Comparing these flow rates with the USGS estimate 100-year mean flow of 6,220 cfs that would flood the north end of the ICPP with four feet of water, and a Mackey Dam failure becomes a real disaster potential with respect to the existing underground waste at the ICPP.

DOE is relying extensively on the Big Lost River Diversion Dam (located at the western INEEL boundary) to shunt major flood waters away from INEEL facilities. The last comprehensive analysis of this diversion dike system (below the diversion dam) was conducted by USGS in 1986 in a report titled *Capacity of the Diversion Channel below the Flood Control Dam on the Big Lost River at the INEL*. In this study USGS estimated a mean flow rate of 9,300 cf/s, 7,200 of which went into the diversion channel and "2,100 cf/s will pass through two low swells west of the main channel for a combined maximum diversion capacity of 9,300 cf/s." "A sustained flow at or above 9,300 cf/s could damage or destroy the dike banks by erosion.

Investigations Report 96-4163, page 11 shows flow rates for 5-year, 10-year, 100-year, and 500-year floods

[8] Flood Routing Analysis for a Failure of Mackey Dam, K. Koslow, D. Van Hafften, prepared by EG&G Idaho for U.S. Department of Energy, June 1986, EGG-EP-7184, page 15

[9] USGS 98-4065, page 6

Overflow will first top the containment dike at cross section 1, located near the downstream control structure on the diversion dam." [10] This USGS study did not analyze the construction of the diversion dikes but they would likely fail as did the upstream diversion dam, built at the same time that the Army Corps of Engineers found deficient. "On the basis of a structural analysis of the INEEL diversion dam (U.S. Army Corps of Engineers, written comments, 1997), the dam was assumed incapable of retaining high flows. The Corps indicated that the diversion dam could fail if flows were to exceed 6,000 cf/s. Possible failure mechanisms are: (1) erosion of the upstream face of the dam that results from high-flow velocities and loss of slope protections (rip-rap), (2) overtopping of the diversion dam by flows exceeding the capacity of the diversion channel and culverts, (3) piping and breaching of the diversion dam because of seepage around the culverts, and (4) instability of the dam and its foundation because of seepage."[11]

Failure of the diversion dam and/or the diversion channel dikes would directly impact the Radioactive Waste Management Complex (RWMC) burial grounds. A 1976 USGS report notes, "The burial ground is within 2 miles (3.2 km) of the Big Lost River and the surface is approximately 40 feet (12 m) **lower than the present river channel**. Sediments in the burial ground contain grains and pebbles of limestone and quartzite, suggesting that in recent geologic past, flood waters of the Big Lost River flowed through the burial ground basin. Two eroded notches or 'wind-gaps' in the basalt ridge bordering the west of the burial ground also suggest past Big Lost River floods." "A large diversion system on the Big Lost River was constructed by the AEC to control flood waters by diverting water into ponding Areas A, B, C, and D. The nearest of these, Area B is less than a mile [south] from and about 30 feet (9m) **higher** in elevation than the burial ground." [12]

USGS *Arco Hills SE* and *Big Southern Butte* quadrangle topographic maps clearly show the RWMC flooding vulnerability as do other USGS reports that note, "If [diversion] dike 2 [at ponding Area B] fails, large flows will drain directly toward the solid radioactive waste burial grounds." [13] These vulnerabilities must be taken into consideration when DOE attempts to leave the buried transuranic waste at the RWMC and not exhume and relocate it to a safe permanent repository.

Building dams around the proposed INEEL CERCLA Disposal Facility (ICDF) as was done at the RWMC is not an acceptable flood protection answer because lateral water migration will go under the dams and local precipitation will be held in exacerbating the leachate conditions. The liner of the ICDF will not be capable of maintaining integrity with the increased hydraulic pressure during a flood because they are only capable of blocking what minimal surface water may leak past the cap and infiltrate the waste. There are good legitimate reasons

[10] Capacity of the Diversion Channel Below the Flood Control Dam on the Big Lost River at the Idaho National Engineering Laboratory, US. Geological Survey Water Resources Investigations Report 86-4204, C. M. Bennet, page 1 and 25

[11] USGS 98-4065, page 9

[12] Hydrology of the Solid Waste Burial Ground, as Related to the Potential Migration of Radionuclides, Idaho National Engineering Laboratory, U.S. Geological Survey, Open File Report 76-471, J.Barraclough, August 1976, page 8

why dumps (even municipal garbage dumps) are not allowed by statute in flood zones. Dams by definition are only functional if there is regular maintenance which cannot be assumed once DOE ends institutional control of INEEL in a hundred years. Dumping the waste on top of the ground and mounding the cover over it will result in the cap eroding over the long-term which again is unacceptable.

Nuclear Regulatory Commission restrictions prohibiting citing radioactive waste disposal dumps on 100 year flood plains must be observed. [NRC 10 CFR ss 61.50] The reason for these restrictions is because the flood water will leach the contaminates out of the waste and flush the pollution more rapidly into the aquifer. Since these wastes will remain toxic for tens of thousands of years, they must be disposed of responsibly in a safe permanent repository.

The legal requirements of the process are spelled out in the National Environmental Policy Act that requires Environmental Impact Statements and public hearings. Only un-containerized wastes that can be compacted during placement should be allowed so as to minimize subsidence caused by container decomposition. Biodegradable, VOC, collapsible, soluble, TRU, or Greater than Class C Low-level, and Alpha-low-level waste must also be excluded from the RWMC dump and sent off-site.

USGS reports identified factors favoring downward waste migration. “In order for waste isotopes to be carried downward by water, four basic requirements are needed: 1.) availability of water, 2.) contact of the water with the waste, 3.) solubility or suspendability of the waste in water, 4.) permeability in the geologic media to allow water flow downward.” [15] This USGS report describes in detail how all four conditions are met at INEEL including the solubility factor where they note “Hagan and Miner (1970) leached five different categories of solid waste from Rocky Flats [the main source of plutonium in the RWMC] with ground water from the INEL and Rocky Flats and measured the plutonium concentrations and pH of the leachate. They found the highest Pu-239 concentration in leachates from the acidic-graphite wastes, 62,000 to 80,000 ug/l plutonium or (3.8×10^{9} to 4.9×10^{9} pCi/L).” [Ibid]

The most reliable indicators of contaminate migration are onsite sampling data. Cesium-137, plutonium-238,-239,-240 were all found at the 240 foot interbeds under the RWMC. [IDO-22056@74] Forty-one % of the samples from the 240 foot interbeds contained radionuclides. [Ibid.@87] Other literature confirmation of plutonium at 240 feet includes: "Radionuclides (including Pu-238.-239.-240, Am-241, Cs-137, Sr-90) have been detected in soils and in sedimentary interbeds 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

[15] USGS 76-471 page 68-69

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 those 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	1990	0.04 +/- 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.

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, INEEL'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. INEEL 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 INEEL 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 INEEL 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 INEEL indicated an average horizontal permeability of about 55 feet per day and vertical permeability of about 15 feet per day." [IDO-22056@48]

An updated analysis 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 Mackey Dam have not been investigated in this paper. The INEEL 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.

A 1993 USGS report titled *Speciation of Plutonium and Americium in Ground Waters from the Radioactive Waste Management Complex* notes: “The solubility of plutonium, when added in the low-oxidation-state form [Pu (III) and (VI)], did not exceed 50 percent (of the amount added) in any of the waters from wells that penetrate the Snake River Plain Aquifer.” “In water from well 92, however, which is completed in a perched aquifer at a much shallower depth than the water table, 83 percent of the Pu (III) and (VI) remained in solution 30 days after it was added.” “In experiments using the high oxidation states Pu (V) and (VI), virtually all the added plutonium remained in solution in the water from all wells, and remained in the relatively soluble high oxidation states.” “The results indicate that although low-oxidation-state plutonium is generally insoluble in water [50%] from the Snake River Plain Aquifer, it is more soluble in water from the perched aquifer and could, in time, are leached from the waste and ultimately reach the Snake River Plain Aquifer.” The report goes on to note that the reason for the increased solubility of plutonium in the perched water is due to the 222,000 gallons of hazardous wastes including acids and solvents were also dumped in the RWMC.[16] The solubility of actinides and there mobility is a big issue with the ICPP high-level waste tanks contaminated soils because this resulted from raffinate (nuclear fuel processing waste) leaks which transuranic are already dissolved in a acid/solvent solution and therefore highly mobile. Flooding of the ICPP would therefore result in extensive migration of contaminates to the underlying aquifer.

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[16] Speciation of Plutonium and Americium in Ground Waters from the Radioactive Waste Management Complex, Idaho National Engineering Laboratory, Idaho, U.S. Geological Survey, Water Resources Investigations Report 93-4035, J. Cleveland, A. Mullin, 1993, page 1

Chemical Contaminates in the Dissolved and Suspended Fractions of Ground Water from Selected Sites, Idaho National Engineering Laboratory and Vicinity, Idaho 1989, U.S. Geological Survey, Open File Report 92-51, pg 33, shows organic solvents under RWMC

Plutonium in Groundwater at the NTS: Observations at ER-20-5, J.L.Thompson, A.B. Kersting, D. Finnegan, Chemical Technology Division, Los Alamos National Laboratory, Isotope Sciences Division Lawrence Livermore National Laboratory, December 1997, that shows extensive plutonium migration at the Nevada Test Site .

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	460,000
ID Chemical Processing Plant	690,000
Naval Reactors Facility	4,200,000
Argonne-West	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 kilograms	1,455 kilograms
Americium-241	44 kilograms	58 kilograms
Uranium-235	386 kilograms	603 kilograms

[ER-BWP-82 @A-4]

Most of the [solid] wastes at INEEL 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 INEEL] continued until 1957 with no upper limit for the level of radiation. Items of up to 12,000 rems per hour were buried [at INEEL]."[Deadly Defense@50] Standard operating practice throughout INEEL'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'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 INEEL 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]

Navy Spent Reactor Fuel Operations

The US Nuclear Navy sends all its spent reactor fuel to INEEL 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, INEEL 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 INEEL 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 INEEL 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.

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 INEEL 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		[INEEL 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 INEEL with similar characteristics have been designated unsafe and scheduled for closure. Therefore, the Navy's claim " that operation of the INEEL-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 INEEL raised that standard to zone 3.

Flooding accident scenarios postulated in the INEEL 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 INEEL'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 INEEL'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 INEEL 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 INEEL burial grounds. (See RWMC section IV[D]).

Summary of Nuclear Navy Waste
Dumped at INEEL'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 INEEL 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 INEEL

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	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	

USDOE, Radioactive Waste Management Information System Master Solid Database, 10/24/89

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 INEEL 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 INEEL 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 INEEL generated by the state INEEL Oversight Program is offered here to demonstrate that there is a range of volumes between different analysts and different information sources.

State's INEEL Oversight Program 1991 Summary of INEEL 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 INEEL Oversight Program, "Wastes at the INEEL"]

Considerable variation in the volume of buried transuranic (TRU) waste (and other waste types) exists between different source documents. For instance, INEEL 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 x 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 INEEL 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 INEEL. 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 INEEL's RWMC Burial Grounds 1952 to 1980 [RWMIS]

Generator	Mass in grams
Argonne National Laboratory-West INEEL	2,177,150
Idaho Chemical Processing Plant INEEL	9,246,306
Naval Reactor Facility, INEEL	27,707,700
General Dynamics, General Atomics Div. San Diego, CA	22,861,440

General Electric, Vallecitos Atomic Lab Pleasenton, CA	11,568,800
Special Power Excursion Reactor Test INEEL	14,517
Test Area North (INEEL)	16,433,193
Test Reactor Area (INEEL)	273,866
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 INEEL

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.

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 INEEL 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 INEEL 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]

V. Conclusion

Environmental Defense Institute (EDI) presents documentation above to authenticate waste characterization deficiencies. Therefore, EDI's only support of the Agencies Plan "Buried Waste Environmental Investigation Feasibility Study Alternative No. 5; Full Retrieval, Treatment, and Disposal in a fully permitted non-Idaho geologic repository. This position is supported by the Nuclear Regulatory Commission regulatory standards stated above. EDI reserves the right to submit final comments on this proposed Plan and DOE analyses.

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Respectfully submitted by

Chuck Broscious
President of EDI Board of Directors

Attachment A:

Environmental Defense Institute Comments on RWMC Pit – 4 Remediation, May 26, 2004

Attachment A

Environmental Defense Institute

Troy, ID 83871-0220

May 26, 2004

Public Comment on Remediation Plan for Department of Energy (DOE) Idaho National Engineering and Environmental Laboratory (INEEL) Radioactive Waste Management Complex (RWMC) Pit-4 Remediation

Submitted on Behalf of the Environmental Defense Institute
by Chuck Broscious

I. Summary

The Environmental Defense Institute (EDI) appreciates the opportunity to comment for the official record on the proposed RWMC Pit-4 remediation plan. [1] If additional information becomes available, EDI reserves the right to submit additional supplemental comments.[2]

Generally, this Plan is yet another "penny-wise-dollar foolish" project because it fails to commit to serious buried waste exhumation that would mitigate the continued migration of hazardous and radioactive waste into the Snake River Plane Aquifer.

The uncertainty in waste characterization (the process of determining what is in the waste) is so huge, that DOE credibly must commit to exhuming **all** the Pit-4 waste and evaluate it drum by drum.- box by box. Given the forty years of its internment (and random dumping that itself compromised containers), it is likely all the waste is just a corroded mixed up mess! DOE acknowledges that waste containers were just randomly dumped into Pit-4 (as opposed to stacking the containers) and it is this period when records/data have the biggest information gaps. Therefore, DOE's Plan to exhume only a small (21%) portion of the waste (in a specific area) is not credible, and categorically deficient. Given the available inadequate monitoring and disposal data, DOE simply offers no convincing evidence to the public to support such a limited exhumation project for Pit-4.

DOE is the federal agency (tasked with managing the most deadly operations on the planet) that based on its legal and legislative record puts public health and safety in a lower priority than saving money and will go to extreme lengths to avoid compliance with the law.

The bottom line is that this Pit-4 Plan is categorically deficient under federal regulatory requirements (discussed below), and lacks the requisite commitment by DOE to "get the waste out of Idaho."

II. Pit-4 Remediation Plan Comments

DOE's Plan states that Pit-4 is a "non-time-critical removal action." [page 1] The fact that this buried waste at the RWMC generally and Pit-4 specifically is migrating into the Snake River Aquifer since the Pit-4 waste interment in 1963, by any observer, represents an immediate hazard. This "non-time-critical" designation is not based on credible risk-based assessments given the documentation available showing RWMC waste migration into the Snake River Plane Aquifer.

DOE, state, and EPA reports on aquifer contamination resulting from RWMC buried waste go back several decades in addition to the ever-present flooding risks. [3] Nuclear Regulatory Commission regulations on "disposal site suitability requirements for land disposal" [10 CFR 61.50(a)(5 through 7) state in pertinent part:

> "The disposal site must be generally well drained and free of areas of flooding or frequent ponding. **Waste disposal shall not take place in a 100_year flood plain**, coastal high_hazard area or wetland, as defined in Executive Order 11988, `Floodplain Management Guidelines.' (6) Upstream drainage areas must be minimized to decrease the amount of runoff which could erode or inundate waste disposal units. (7) **The disposal site must provide sufficient depth to the water table that ground water intrusion, perennial or otherwise, into the waste will not occur.**" [emphasis added]

The fact that the RWMC lies some forty feet *below* the elevation of the Big Lost River, immediately to the north-east, and the fact that the RWMC has experienced numerous floods in the recent past (1952, 1962, 1969, and 1982), would disqualify this site for land disposal of any waste - even municipal garbage under RCRA Subtitle D or Subtitle C hazardous waste disposal.

DOE offers no apparent monitoring data to justify the limit of only 21% of the Pit-4 waste as opposed to exhuming the entire Pit-4 contents of 1,600,000 cubic feet of waste. [page 6] By comparison, DOE conducted a systematic probe assessment of Pit-9 that showed significantly higher estimates of the radioactivity of the waste than the previous estimates using the same data used in the Pit-4 estimates.[4]

DOE fails to acknowledge two previous successful RWMC buried waste retrieval projects in 1974 and 1976 nor are other more extensive Subsurface Disposal Area waste inventory reports acknowledged. [5] Also see, Early Waste Retrieval Final Report, J. Bishoff, EG&G Idaho, Idaho National Engineering Laboratory, August 1979, TREE-1321, notes that the project was to investigate methods, risks, and hazards associated with the retrieval of 65,000 cm of transuranic waste in the burial ground. "Waste retrieved included drums, loose waste, and contaminated soil. Approximately 67% of the drums retrieved were severely breached. Free liquid leaked from about 6% of the drums, and 5% were externally alpha-contaminated. Although alpha-contamination levels often exceeded 2,000,000 counts per minute, available equipment and established operating and safety procedures protected personnel ..." There simply is no credible excuse for DOE's dragging its collective feet in getting on with this essential remediation work other than simply not wanting to spend the money required. This "limited" 21% removal of Pit-4 waste is clearly more cost cutting and stalling that must be challenged! There is no dispute that the Rocky Flats waste dumped at the RWMC represents an immediate hazard. DOE, however, fails to acknowledge equally significant onsite reactor waste from on-sit INEEL programs such as Initial Engine Test (IET), SNAP-TRAN, SL-1 dumped at the RWMC during the period Pit-4 was open (1963-1967). This waste included reactors, reactor parts, irradiated fuel. [6] Mush of this waste would also be legally classified as "Class-C" and "greater than Class-C Low-level waste" that the Nuclear Regulatory Commission (NRC) regulations specifically prohibit disposal in shallow land burial such as Pit-4. NRC regulations on "greater than Class C" state that waste be interned in engineered deep geologic repositories due to the extreme radiological hazard this waste presents. NRC regulations on "land disposal of radioactive waste" in "near surface disposal facilities" [10 CFR 61.55(a)(2)] states in pertinent part:

"Class-C [low-level] waste is waste that not only must meet more rigorous requirements on waste form to ensure stability but also requires additional measures at the disposal facility to protect against inadvertent intrusion. The physical form and characteristics of Class C waste must meet both the minimum and stability requirements set forth in Sec. 61.56. (iv) Waste that is not generally acceptable for near_surface disposal is waste for which form and disposal methods must be different, and in general more stringent, than those specified for Class C waste. In the absence of specific requirements in this part, **such waste must be disposed of in a geologic repository** as defined in part 60 or 63 of this chapter unless proposals for disposal of such waste in a disposal site licensed pursuant to this part are approved by the Commission." [emphasis added] [7]

Moreover, the State of Idaho stipulated in the Settlement Agreement with DOE, that "low-level alpha waste" (greater than 10 and less than 100 nCi/gm) also be removed from INEEL. The 1995 Settlement Agreement states: "1. DOE agrees to treat spent fuel, high-level waste, and transuranic wastes in Idaho requiring treatment so as to permit ultimate disposal outside the State of Idaho. 2. DOE shall as soon as practicable, commence the procurement of a treatment facility [facility] at INEL for the treatment of mixed waste, transuranic waste and alpha-emitting mixed low-level waste [treatable waste]." [8]

DOE's misguided "targeting Rocky Flats waste" ONLY has no credible risk management basis. It can only be considered ludicrous for DOE to rely on "package labeling or distinctive packaging to identify non-targeted waste" that will be left in place. [page 11] This waste has been in the ground for over forty-years. This reliance on "labeling" is indicative of how ungrounded this plan actually is, and ignores the previous (1970's) retrieval projects (noted above) that found the containers completely compromised and labeling non-existent.

DOE's Plan offers so may caveats to what waste will be "targeted" for extraction, that the public is left with little or no assurance that this is a serious retrieval operation. [page 11]

Moreover, DOE's Plan provides for "thermal treatment" of some extracted waste to remove volitile organic compounds (VOC) that currently are prohibited for disposal at the transuranic disposal site (WIPP) in New Mexico.[page 16] The public is justifiably concerned that this "thermal treatment" means "incineration," and DOE's lack of full disclosure on this crucial part of the project feeds the public's lack of confidence about the impact on environmental, health and safety issues. [pages 16 and 28]

Additional uncertainty is pervasive on DOE reliance on DOE Order 435.1 that is currently being litigated by the Natural Resources Defense Council (NRDC). U.S. Federal Court found DOE Order 435.1 illegal under the Nuclear Waste Policy Act, however DOE has appealed that ruling to the Ninth Circuit Court of Appeals. Six states have filed a joint Amicus Brief in support of NRDC case. [9]

III. What is in the RWMC Buried Waste?

INEEL, located near Idaho Falls, Idaho, is a federal nuclear reservation owned by DOE. INEEL is only one segment of the federal government's nuclear weapons production complex.

The INEEL over its fifty-year operating history has generated on-site or received via off-site shipments, significant quantities of high-level radioactive spent nuclear fuel waste (i.e. Nuclear Navy spent nuclear fuel), and transuranic (TRU) waste (i.e. DOE's Rocky Flats Site) from fabrication of plutonium nuclear bomb components.

INEEL uses many sites for permanent disposal of transuranic waste including injection wells into the aquifer and unlined percolation ponds. [10] The largest and most significant INEEL disposal site is the Radioactive Waste Management Complex (RWMC) Subsurface Disposal Area (SDA), where Pit-4 is located, and the Argonne National Laboratory-West, Radioactive Scrap and Waste Facility, located on the INEEL site. [11] Internal DOE documents gained by EDI through Freedom of Information Act requests and other state and federal agency administrative records, show more than ninety (90) metric tons of high-level irradiated reactor fuel was dumped in the RWMC. EDI has provided an itemized listing of this irradiated reactor fuel interned at the RWMC SDA. [12]http://www.environmental-defense-institute.org

DOE's Rocky Flats Plant in Colorado shipped substantial quantities of plutonium waste to INEEL. EDI's investigations into these Rocky Flats shipments show that considerably more plutonium was shipped to INEEL than is disclosed by the parties to this case. EDI's Amicus Brief Exhibit No. 2 documents EDI's contention and further shows that the concentrations of plutonium and highly enriched uranium waste dumped in the SDA poses a significant criticality hazard. [13] [8]

Flooding of the RWMC and other radioactive waste disposal sites poses a significant hazard due to contaminates being flushed through the soil column to the aquifer. EDI's Amicus Brief Exhibit No. 3 shows the hydro-geologic vulnerability of the INEEL buried waste sites including the RWMC to flooding, incidents, which have already occurred in 1962, 1969, and 1982, as well as Idaho Nuclear Technology and Environmental Center (INTEC) formerly known as the Idaho Chemical Processing Plant (ICPP) where DOE plans to permanently dispose of HLW and TRU waste.

Buried or otherwise dumped radioactive transuranic waste is currently contaminating the Snake River Aquifer. U.S. Geological Survey (USGS) reports show plutonium in aquifer wells some twenty miles south of the INEEL boundary. [14] See Exhibit No. 4. USGS reports also show groundwater flow, or "conductivity" in the Snake River Plain Aquifer can reach 32,000 feet per day, or 6.06 miles per day. [15] Contaminates discharged at INEEL have the potential to move rapidly through the aquifer to public water sources.

INEEL over its operating history has received significant quantities of spent reactor fuel from dozens of sources. A high percentage of this irradiated reactor fuel was "reprocessed" using an aqueous process which dissolves the fuel rods in acid/solvent solution that then makes it possible to extract highly enriched uranium and other nuclear isotopes for various United States nuclear military programs. The mixed hazardous and high-level radioactive liquid waste (HLLW) and TRU waste was then interned primarily but not exclusively in underground storage tanks. These HLLW tanks were never intended to be the permanent repository for this waste both because of the known toxicity of the waste, the limited service life of the tanks themselves, and the fact that at the time it was illegal under federal statute. The concrete vaults that encase the eleven high-level 300,000-gallon tanks at the Idaho Nuclear and Environmental Technology Center (INTEC) are known to leak. A 1994 State of Idaho investigation showed that over a twenty-three month period (11/92 to 9/94) about 123,500 gallons of contaminated water was pumped from the tank vault sumps. The investigation concluded that the source of the water was precipitation, irrigation, and leaking tank waste system lines. [16] DOE's reliance on these failed containment systems for permanent disposal of HLW under DOE Order 435.1 is misguided and puts EDI members and the general public at significant risk. The INEEL sits directly atop the Snake River Plain Aquifer, designated by US Environmental Protection Agency (EPA) as a regional sole source aquifer. Protection of this aquifer is main component to the 1995 Settlement Agreement. [17]

Past and current INTEC HLW mismanagement practices have resulted in massive hazardous and radioactive waste contamination of the groundwater under the facility. This recognized groundwater contaminate pathway represents a significant hazard to the general public and EDI's members just with current contaminate levels. Migration of buried waste contaminates into underlying soil and perched ground-water zones are extensively studied by US Geologic Survey and their report notes: "These zones are an integral part of the pathway for contaminates to move to the Snake River Plain Aquifer. Water moves rapidly through surficial [sic] sediments ..." [18]

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[8] Nuclear Criticality Safety Issues Pertaining to the INEEL SDA; J.A McHugh, R.A. Knief, and M.A. Robkin, May 3, 2000

If DOE's Order 435.1, that will allow permanent disposal in these already leaking waste tank units, is not stopped, more pollution will migrate to the aquifer, further putting EDI members and the general public at risk. See EDI Amicus Brief Exhibit No. 3, page 24 that shows radioactive groundwater contamination under INTEC greater than 60,000 times the EPA regulated maximum concentration level for drinking water. The hazard is intensified by the fact that the U.S. Geological Survey report shows that the top ground level of the INTEC HLW Tank Farm is within the Big Lost River 100-year flood plain, which means the bottom of the tanks are some 50 feet **below** the 100-year flood levels. [19] Flooding of these HLW tanks and the related HLW processing buildings will flush pollutants into the aquifer and endanger the general public and EDI members, since these radionuclides are toxic for tens of thousands of years.

At INEEL, the primary facility for reprocessing irradiated nuclear reactor fuel, also called spent nuclear fuel (SNF), is the Idaho Nuclear and Environmental Technology Center (INTEC) formerly known as the Idaho Chemical Processing Plant (ICPP). The INTEC underground HLLW Tank Farm, consisting of eleven 300,000-gallon tanks with a current volume of about 1.4 million gallons, [20] is only part of a large complex of an <u>additional</u> 127 HLLW tanks that are part of the INTEC HLLW treatment operations (also called INTEC Liquid Waste Management System). EDI Amicus Curiae Brief filed in federal court 8/2/02 in NRDC vs. DOE (Case No. 01-CV-413 (BLW)), lists these 127 HLLW tanks, their location and what process they are attached too, however the waste volume of their sediment contents is uncertain. Some of these additional tanks that are part of the INTEC Liquid Waste Management System (ILWMS) high-level waste processing system are listed in the *Idaho High-level Waste Draft Environmental Impact Statement as* a significant criticality hazard due to the high concentration of fissile (uranium and plutonium) material content of the tanks. [21] NRDC's Complaint to the Court (Case No. 01-CV-413 (BLW)) did not mention these additional 127 tanks nor the HLLW contents in characterizing the INEEL hazards, yet it is a crucial issue the Court (in this USA v. Kempthorne case) must evaluate because DOE Order 435.1 will specifically affect the final disposition and closure of all these tanks and whatever residual waste contents are left in the tanks. Moreover, all the INTEC HLLW tanks do not meet the requirements of the Resource Conservation Recovery Act (RCRA), and therefore do not have RCRA permits as storage units much less permanent disposal units.

The process of closure of these HLLW tanks at INEEL has begun. At issue here is not the need to close the tanks, but what federal statutes and the Settlement Agreement stipulations on buried HLW/TRU waste will be appropriately implemented and enforced to assure proper closure in order to protect the public and environment. The Idaho Department of Environmental Quality (IDEQ) issued an RCRA HLLW tank Closure Plan (RCRA/HWMA Permit Docket No. 10HW-0204) for two INTEC tanks. EDI alleges that the Closure Plan violates the Nuclear Waste Policy Act (NWPA), and RCRA. EDI 1/16/02 Amicus Curiae Brief before IDEQ shows that HLLW units are within the 100-year flood plain of the Big Lost River and therefore violate RCRA HLW disposal restrictions. Although this Closure Plan only immediately affects five HLLW tanks (WM-182, 183, 184, 185, and 186) it will set a precedent for the closure process for all of the 138 HLLW tanks at INTEC. DOE's August 9, 2002 Record of Decision to leave 49 high-level waste tank waste in place will likely be repeated at INEEL. The INTEC Tank Closure Plan violates 40 CFR 191 for disposing mixed high-level radioactive waste in near-surface internment that cannot meet the 10,000-year minimum requirement.

The Tank Closure Plan violates 40 CFR 265.112(b)(4) that states in pertinent part, "A detailed description of the steps needed to remove or decontaminate **all hazardous waste residues** and contaminated containment system components, equipment, structures, and soils during partial and final closure including, but not limited to, procedures for cleaning equipment and removing contaminated soils, methods for sampling and testing surrounding soils, and criteria for determining the extent of decontamination necessary to satisfy the closure performance standard." (Emphasis added). And Subpart J--Tank Systems 40 CFR Sec. 265.197(a) Closure and post-closure care states " At closure of a tank system, the owner or operator must **remove or decontaminate all waste residues**, contaminated containment system components (liners, etc.), contaminated soils, and structures and equipment contaminated with waste, and manage them as hazardous waste." [Emphasis added]

DOE is currently (via DOE Order 435.1), and EDI contends illegally, delisting a previous fifty-year DOE policy that "sodium bearing waste" (SBW) contained in INEEL tanks is HLW. DOE now says that: "SBW is liquid waste that is generated from decontamination operations of INTEC facilities involved in the processing of spent nuclear fuel and the treatment of HLW. SBW contains hazardous and radioactive materials and is classified as mixed transuranic waste." [22] This is at issue here because seven (WM-108 through WM-186) tanks are classified by DOE as SBW tanks in the INTEC Tank Farm. Delisting of these tanks as HLW tanks by DOE has major implications with respect to closure of these and all other HLW units. EDI contends that DOE's own operator reports show that many of these SBW tanks received "first cycle raffinate." [23]Also see; other internal INEEL documents show that sodium compounds were used for the purpose of converting reactor fuel rods into a liquid. Sodium nitrate and sodium hydroxide was used in the 1950's at INEEL as a primary part of the SNF reprocessing operation. SEE; Progress Report of April-June 1955, February 6, 1956, Phillips Petroleum, pg.5, IDO-14362; Chemical Processing Technology, Quarterly Progress Report, April – June 1961, page 4 and 15, IDO-14567; Development of RaLa Progress, Utilizing MTR fuel elements, Period ending 2/20/54, page 27, IDO-14292; Status of Development of RaLa Progress as of 4/1/54, page 5, IDO-14300: Laboratory Development of a Process for separations Ba-140 from MTR Fuel, March, 27, 1959, page 14, IDO-14445. Raffinate is the high-level waste remaining after first, second, or third cycle solvent extraction of highly-enriched uranium from SNF. The State of Idaho maintains that sodium-bearing waste in the INTEC Tank Farm is HLW. The State notes in the forward to the Idaho High-Level Waste Environmental Impact Statement (IHLW/EIS) that:

"Reprocessing at INTEC used a three-cycle solvent extraction process to recover highly enriched uranium from spent fuel. Each cycle created liquid waste, as did decontamination activities. DOE recently adopted Radioactive Waste Management Order (DOE Order 435.1) identifies HLW as liquid produced 'directly in reprocessing.' Idaho interprets this HLW definition to include waste from the first reprocessing cycle (non-sodium bearing waste) and second and third cycles (sodium bearing waste). This interpretation is consistent with language in the Settlement Agreement [and Consent Order] that identifies both sodium-bearing waste and non-sodium bearing waste as HLW. In addition, liquid from the second and third extraction cycles was routed to an evaporator before being discharged to the Tank Farm. As such, these liquids contain radioactive fission products in sufficient concentrations to warrant permanent isolation in a geologic repository." [24]

DOE's attempt to delist the SBW tanks defies its own internal contractor documents that show the history of these tanks. For example, the closure of INTEC HLLW tanks (WM-182, 183, 184, 185, and 186) as non-HLLW units shows an annualized history for these tanks. According to DOE's own internal reports, these tanks received both Aluminum and Zirconium clad fuel raffinate between 1955 and 1997. Only after 1997 did these tanks receive sodium-bearing waste. [25] The sediments or heels in these tanks are a result of the SNF reprocessing waste generated between 1955 and 1997 and therefore are HLW defined by NWPA. The State of Idaho and EPA regulators are thrusting a "Risk-Based" closure plan that has a multitude of questionable assumptions without supporting sampling data, and specific limits on tank heels left in place, all of which are not fully disclosed. Specifically, how much tank heel will be left in the tanks and grouted over in order to meet the "Risk Based" no harm criteria? Even more egregious is the fact that the DOE technology development that currently exists can remove nearly all the tank sediments, yet for cost cutting measures this has not been implemented . [26] DOE estimates that about 20,000 gallons of tank sediment heels are in each of the eleven HLW Tank Farm units which would leave a total of 220,000 gallons permanently interned. [27]

Fundamentally, EDI alleges that easily exhumeable mixed hazardous high-level waste from the INTEC tanks will be sent to other un-RCRA permitted treatment, storage, disposal (TSD) at INTEC (i.e., High-level Liquid Waste Evaporator (HLLWE), Process Equipment Waste Evaporator (PEWE), and the Liquid Effluent Treatment and Disposal (LET&D). This is illegal!

During the tank closure plan review, EDI and David McCoy unsuccessfully requested reopening or extension of the period for public comment pursuant to 40 CFR 124.10 and 124.14. Because of information that raises substantial new questions related to DOE's proper closure of High Level Waste Tanks, we objected to IDEQ's determination that: "Based on our review of your submittal, the DEQ remains confident that the plan for moving forward with the Closure of the first two of eleven Tank Farm Facility (TFF) tanks is compliant with [Hazardous Waste Management Act] HWMA regulations, and it represents full disclosure on the part of DOE to address the operational realities associated with closure of the mixed waste tanks." This statement fails to address the various crucial legal issues EDI and McCoy presented in our "Request for Investigation" some of which include: Decontamination steam jets do not have the capacity (according to INEEL experts) to remove the solids in the tank heels, therefore leaving about 30,000 gallons of mixed high-level waste sediments in the two tanks. [28] Decontamination water/steam jet sprays will not resuspend the heel solids nor remove hazardous heavy metal waste because, as INEEL experts pointed out, they are precipitates of a < 2 mole acidic raffinate; Grout will not mix with the tank heels which violates the RCRA and EPA's Land Disposal Restrictions; Grout will only "roll over tank heels" and sandwich them between the tank bottom, and required sampling of the final waste form to validate encapsulation is not planned or technically possible as identified by INEEL expert's comments; Grouting of the vault completely under the tank is believed by INEEL's own engineers as impossible, yet the Closure Plan nonetheless assumes it, which in turn invalidates the Plan's Risk Assessment assumptions, and fate and transport modeling; The "Risk-based Clean Closure" does not offer sampling data to specify the minimum amount of tank heels that will be left in the tanks to satisfy this criteria. Grouting of the tanks sumps will only partially "float" the tanks causing deformation and possible breaching of the fifty-year-old tanks. Closure Plan Risk Assessment fails to include 400 rem/hr soil contaminate loading for cesium-137 (102 million picocuries/gram), strontium-90 (56.8 million pCi/g), and plutonium (276 nano curies per gram) that are the result of tank vault and service line leaks as required in 40 CFR 265.111; Tanks WM-182 and 183-history shows aluminum and zirconium reactor fuel reprocessing raffinate up until 1993 and 1997 respectively that produced the solid high-level waste precipitate in the tank heels. Sodium bearing liquid waste was only subsequently added after these dates, therefore DOE's claim to strictly SBW with respect to the tank heels is false; Tank heel solids (raffinate precipitates) are mixed high-level waste by definition (42 USC 10101 et.seq. and therefore cannot be legally disposed in shallow land burial as designated in the Tank Closure Plan's "Landfill Closure Plan". Also see: (40 CFR191 Disposal of High-level Waste) and (Nuclear Waste Policy Act at 42 USC ss 701 et seq.) DOE estimates that for the eleven underground tank farm, the heels or sediments will be the equivalent of between 79,000 and 220,000 gallons. [29] Risk-Based assessment fails to include the fact that the tanks are some forty feet below the 100-year flood plain of the Big Lost River and the leaching effect of contaminated soil, tank vaults, and tank contents into the Snake River Plain Aquifer. Disposal of hazardous waste is also prohibited by RCRA in a flood plain as previously discussed. The tanks have leaked reactor fuel reprocess waste (according to INEEL experts) into the tank vaults thereby extensively contaminating the concrete vault floor and sides, which was not factored into the Risk Assessment as part of the contaminate loading factors in the fate and transport modeling.

The thrust of this discussion related to the INTEC high-level tanks also applies to the RWMC Pit-4 Remediation of buried waste because the same obfuscation of fundamental statutory and regulatory requirements are employed by DOE.

IV. ENDNOTES:

[1] Engineering Evaluation/Cost Analysis for the Accelerated Retrieval of a Designated Portion of Pit-4, U.S. Department of Energy, Idaho Operations Office, April 2004, DOE/NE-ID-11146. Hereinafter referred to as Pit-4 Plan or the "Plan."

[2] EDI gained through the Freedom of Information Act voluminous printouts of the INEEL Radioactive Waste Management Information System, and we intend to review this data (related to Pit-4 waste interred) in coming months.

[3] Also see Environmental Defense Institute "Snake River Aquifer at Risk.," http://www.environmnenta-defense-institute.org

[4] "OU 7-10 Stage 1 Subsurface Exploration and Treatability Studies Report, Initial Probing Campaign December 1999 - 2000, Bechtel Idaho, INEEL/EXT-2000-00403.

[5] "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," EG&G Idaho, June 1994, EGG-WM-10903

[6] EG&G-WM-10903, page 1-7, 2-21.

[7] 10 CFR 61.55 provides tables of specific nuclides and concentration levels as well as a formula for calculating the cumulative activity level for determination of waste classification.

[8] Settlement Agreement, Signed by then Idaho Governor Philip Batt, Thomas Grumbly (DOE), Admiral Bruce DeMars (Department of Navy), October 1995, page 6 (E)(2).

[9] Christine Gregoire, Washington Attorney General on behalf of the states of Idaho, Oregon, New Mexico, New York, South Carolina, Washington, and the New York State Energy Research and Development Authority. U.S. Court of Appeals for the Ninth Circuit. NRDC v. Abraham, No. 03-35711.

[10] Hydrologic Conditions and Distribution of Selected Constituents in Water, INEEL, Idaho, 1996 through 1998, Report 00-4192, US Geological Survey, September 2000, DOE/ID-22167.

[11] Kathleen Trever, IDEQ, Declaration, 2/18/02

[12] Environmental Defense Institute Amicus Curie Brief, U.S.A. v. Kempthorne, Civil No. 91-0054-S-EJL, filed in U.S. District Court for the District of Idaho, August 26, 2002.

[13] Criticality occurs when sufficient quantities of fissionable material spontaneously (or under controlled conditions in a nuclear reactor) produce a self sustained nuclear reaction. An uncontrolled criticality event in buried waste represents an extreme hazard due to radioactive releases to the environment. Three spontaneous and apparent criticality fires occurred at the RWMC in September 1996 and June 1970. (PR-W-79-038 page 30.
[14] Radiochemical and Chemical Constituents in Water from Selected Wells South of the INEEL, Idaho, May 2001, US Geological Survey, Report 01-138, DOE/ID-22175.
[15] Geologic Controls of Hydraulic Conductivity in the Snake River Plain Aquifer at and Near the Idaho National Engineering Laboratory, US Geological Survey, Report 99-4033, February 1999, DOE/ID-22155, page 1.
[16] Geologic Controls of Hydraulic Conductivity in the Snake River Plain Aquifer at and Near the Idaho National Engineering Laboratory, US Geological Survey, Report 99-4033, February 1999, DOE/ID-22155, page 1.
[17] 1995 Settlement Agreement, page 8.
[18] A Transient Numerical Simulation of perched Ground-Water Flow at the Test Reactor Area, Idaho National Engineering and Environmental Laboratory, Idaho, 1952-94, US Geologic Survey, Report 99-4277, DOE/ID-22162.
[19] Preliminary Water-Surface Elevations and Boundary of the 100 Year Peak Flow in the Big Lost River at the Idaho National Engineering and Environmental Laboratory, Idaho, US Geological Survey, Water-Resources Investigations Report 98-4065, DOE/ID-22148
[20] Idaho High-Level Waste and Facilities Disposition Draft Environmental Impact Statement, December 1999, DOE/EIS-0287D, page C.9-10, herein after called HLW/EIS.
[21] HLW/EIS, page 5-206.
[22] IHW/EIS, page 1-11
[23] Allied Chemical Corp., Idaho Chemical Processing Plant, August 7, 1972, Composition of First and Second-Cycle Raffinate Wastes, Rhdo-4-72, also see INEEL WAG-3 OU-3-13 Comprehensive Remedial Investigation Feasibility Study, Vol. VII.
[24] Ibid. note # 24
[25] Idaho Hazardous Waste Management Act/Resource Conservation Recovery Act Closure Plan for INTEC Tanks WM-182 and WM-183, December 2000, INEEL High-level Waste Program, Bechtel BWXT, for USDOE, page 8 and 9.
[26] http://apps.em.doe.gov/ost/itsra...Advanced Waste Retrieval Systems; http:// www.tanks.org
[27]IHLW/EIS, page 1-17
[28] See DOE contractor Bechtel internal comment document on the INTEC Tank Farm Closure Study Final 90%; New INTEC Liquid Waste Storage Plan; INTEC Tank Farm Facility Incidental Waste Study Final 90%.
[29] HLW/EIS, page 1-17 and page C.9-13