Environmental Defense Institute

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What is Buried at Idaho National Laboratory's

Radioactive Waste Management Complex

Subsurface Disposal Area

Five Year Review

Waste Area Group (WAG) 7

CERCLA Cleanup

at

Idaho National Laboratory

for

U. S. Department of Energy

Compiled for

Environmental Defense Institute

by

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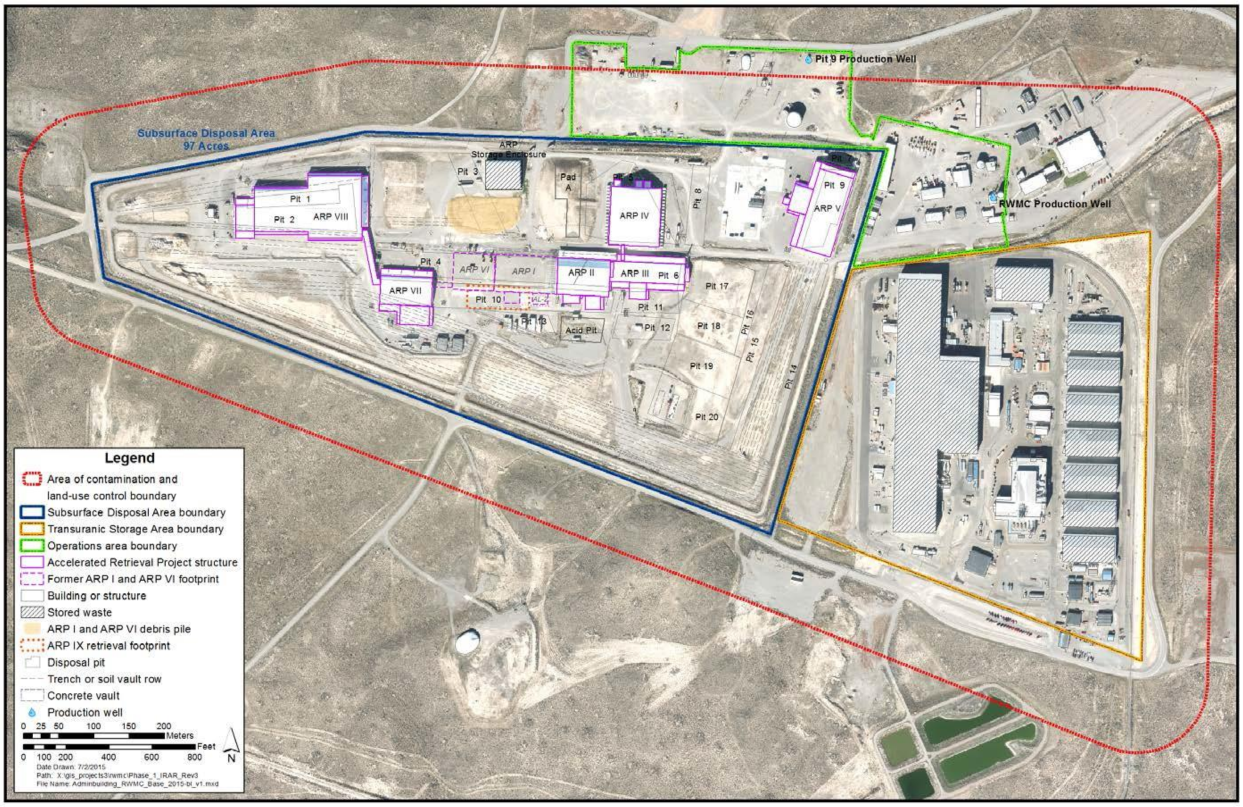
Revision G

Radioactive Waste Management Complex



Section I. Summary

This Environmental Defense Institute (EDI) report is intended to shed light on two recent issues related to radioactive waste in Idaho:

1. The importation of more radioactive waste in the form of spent nuclear fuel (SNF) to the Department of Energy's (DOE) Idaho National Laboratory (INL), and
2. The stipulated Five Year CERCLA (Superfund) Cleanup Review process at the INL Radioactive Waste Management Complex (RWMC) Subsurface Disposal Area.

Specifically, the *Draft Supplemental Analysis for Two Proposed Shipments of Commercial Spent Nuclear Fuel to Idaho National Laboratory for Research and Development* [1] has raised significant public debate. Former Idaho Governors Cecil Andrus and Phil Batt filed notice of intent to sue current Governor Otter for violating the 1995 Federal Court Settlement Agreement and Consent Order [2] that both Andrus and Batt fought very hard to finalize. DOE and current Governor C. "Butch" Otter are attempting to significantly amend the original Settlement Agreement to allow DOE to bring in more nuclear waste in the form of spent nuclear fuel. [3] Andrus and Batt are justified on calling DOE's claim that the new spent nuclear fuel (SNF) is needed for research bogus. This old government story, used for decades, that the former Governors finally recognized and put a stop to it in 1995 with the Federal Court sanctioned Settlement Agreement.

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. [4] This new Agreement significantly modifies DOE/INL buried radioactive waste removal obligations by allowing DOE to leave most of the buried radioactive waste in place.

Idaho is again capitulating to DOE in this new Cleanup Agreement by vacating crucial parts of the original 1995 Settlement Agreement with DOE that stipulated at least 65,000 cubic meters (cm) of transuranic (TRU) waste [5] be exhumed and sent to a non-Idaho deep geologic repository. This new Agreement to Implement only requires DOE to exhume not less than 6,238 cm from the Radioactive Waste Management Complex Subsurface Disposal Area (RWMC/SDA).

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[1] Draft Supplemental Analysis for Two Proposed Shipments of Commercial Spent Nuclear Fuel to Idaho National Laboratory for Research and Development, June 2015, DOE/EIS-0203-SA-07, DOE/EA-1148-SA-01, DOE/EIS-0250F-S-1-SA-02.

[2] Public Service Company of Colorado v. Batt, CV-91-0035-S-EJL and CV-91-0054-S-EJL.

[3] Agreement to Implement U.S. District Court Order Dated May 25, 2006. Hereinafter referred to Implement Agreement.

[4] Ibid. pg. 2. A copy of the Agreement to Implement 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 . Appendix F pg. 5 states: "This Protocol may be amended by the mutual consent of the Deputy Director of Idaho Dept. Environmental Quality, the Deputy Manager [DOE] Idaho Operations Office, USDOE, to reflect field operation experience; provided , however, no amendment of the protocol shall alter or diminish the DOE's duties under any substantive provision of the 1995 Agreement or the Agreement to Implement U.S. District Court Order dated May 25, 2006."

[5] "Transuranic Waste: As defined and used by the U.S. Department of Energy (DOE Order 5820.2A), radioactive waste that, at the time of assay, contains more than 100 nano-curies per gram (nCi/g) of alpha-emitting isotopes with atomic numbers greater than 92 [uranium] and half-lives greater than 20 years." [DOE/RW-0006,Rev. 11] One nano curie = (10^{-9}) or (0.000000001) or one billionth curie of radioactivity. Elements that have a higher atomic number than uranium of 92 (and thus heavier) are elements such as plutonium, curium, americium, and neptunium. Transuranic elements are human made, though traces do occur naturally.

This is significantly less than the 1995 Agreement stipulating removal of "all transuranic waste now located at INL currently estimated at 65,000 cm in volume to WIPP." [pg.2] This TRU estimate was as at the time, a gross underestimate. [6] 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.

DOE's secrecy is common knowledge and its intent to keep its previous/current operations buried. But this Agreement goes further by stating that waste 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 obligation under this Agreement." [Implement Agreement pg. 8] Really, DOE is so scared that the public will find out what is dumped in those Pits and Trenches 50 years ago, that it's claiming "national security" primacy to leave it buried. To reinforce the secrecy, DOE resists requests to do comprehensive core sampling to characterize the waste. The problem is, DOE and its predecessor Atomic Energy Commission's secrets are contaminating Idaho's sole source aquifer.

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 new Agreement and the State of Idaho and EPA'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 and future generations. Technically, once any material that is hazardous is handled, it reenters the regulatory phase and cannot be returned to its original hole unless it qualifies as a licensed mixed hazardous/radioactive waste landfill. The RWMC/SDA could not even qualify as a municipal garbage dump under EPA's Subtitle D criteria. Former Governors Andrus and Batt are simply demonstrating the general public anger.

This report will explain the intersection between the spent nuclear fuel (SNF) issue and the burial of radioactive waste issue by showing the whole cycle at INL. By definition, this discussion must include the U.S. Navy's Nuclear Propulsion program because historically and currently the Navy generates most of INL's radioactive waste. DOE always has acted as the Navy's garbage collector thus allowing the Navy to maintain its pristine public image. Despite the fact that the current issue is over importing more commercial nuclear power reactor SNF, the reality is that the Navy's ongoing SNF shipments to its Naval Reactor Facility dwarfs the commercial volumes.

The Navy issued a new Draft Environmental Impact Statement for the Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel. [7] EDI issued comments on this EIS in August 2015 that is available on EDI's website.

As Governors Andrus and Batt rightly point out DOE never has owned up to its legal commitments to get ALL of the waste out of Idaho. DOE is still unwilling to resolve nearly a million gallons of liquid high-level tank waste at INL's INTEC tank farm. DOE and its lapdog coconspirator Nuclear Regulatory Commission continue to redefine/relabel categories of radioactive waste into new classes to avoid spending the money to properly manage/dispose of its waste that is protective the living environment. A few examples of this bait-and-switch are:

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6 Chuck Broscious, August 25, 1993 Motion to Intervene (Amicus Brief) in support of Governor Andrus.

7 Draft Environmental Impact Statement for the Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel, June 2015, DOE/EIS-0453-D, and Issued by U.S. DOE as primary waste manager for U.S. Navy Nuclear Propulsion.

1.) high-level liquid waste to sodium-bearing waste; 2.) high-level solid waste to greater-than-class C low-level waste; 3.) Transuranic (TRU) waste to remote-handled low-level waste or alpha low-level waste; 4.) Changing the definition of Transuranic from 10 uC/g to 100 uCi/g. In reality, DOE can only do what Congress provides policy and funding for, so the buck stops on Capitol Hill.

The Department of Energy, Idaho Department of Environmental Quality and the Environmental Protection Agency ("Agencies") issued their joint buried waste Plan for the INL Radioactive Waste Management Complex (RWMC); Operable Unit 7-13/14; October, 2007 ("Plan") as a requirement of CERCLA. 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" (other DOE documents show >20 rows) permanently in place with only grouting to "reduce mobility of Tc-99 and I-129 waste migration." [8] 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 individual shipments 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, unless WIPP reopens.[9] 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).

DOE's RWMC "Measurable performance objective [is] based on limiting the effective dose equivalent rate at the surface …in transition to long-term stewardship. The [Record of Decision] ROD identified EPA's recommended protectiveness criterion of 15 mrem/year effective dose equivalent rate (EPA 1997) as a measurable objective for future engineered surface barrier. Subsequently EPA reduced the recommended value to 12 mrem/yr. (EPA 2014)." [10] Why is this "dose value" three times the EPA regulations of 4 mrem/year for other radiation exposures?

The Environmental Defense Institute (EDI) believes that DOE's Remedial

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[8] DOE/ID-11513, pg. 10-29.

[9] The new INL Remote-Handled Waste dump is for newly generated greater-than-class-C radioactive waste.

[10] DOE/ID-11513, pg. 10-31.

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. [11]

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. [12] EPA consultants state; "The only technology that actually reduces the amount of actinide [TRU] in the pits and trenches is the Remove/Treat/Dispose option. This option requires sufficient characterization to determine where the principal threat wastes are located. " [13] The fact that the RWMC lies in a flood zone disqualifies it under Nuclear Regulatory Commission regulations any alternative that leaves waste in place in this shallow burial dump ; not to mention the tragic fact that this dump would not even qualify for a simple EPA Subtitle D municipal garbage landfill. The tragic irony is – this dump is (as of this writing) still accepting waste to bury.

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 1995 and the Settlement Agreement promised; because it would have removed at least 65,000 cubic meters of buried TRU, remove the rest of the buried plutonium identified in the Settlement Agreement as "low level alpha." DOE's concern continues to be overfilling WIPP TRU repository in New Mexico.

New Greater-Than-Class C Low-level Radioactive Waste Dump

The DOE issued an environmental impact statement (EIS) for the disposal of Greater-Than-Class C (GTCC) low-level radioactive waste (LLW) called Remote Handled Disposal Facility. Construction for this new dump, to be located between the Advanced Test Reactor Complex and Idaho Nuclear Technology and Environmental Complex (INTEC), is slated for 2015-16 to replace the current RWMC/SDA soil vaults for remote handled waste.

This EIS is significant because of the huge volumes and highly radioactivity (thus remote-handled) of GTCC legacy waste in storage and newly generated waste. Currently the Navel Reactor Facility (NRF) program waste is sent to RWMC/SDA Soil Vaults discussed in detail below.

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. [14] 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. [15] EDI believes both of this waste volume/curie content numbers are grossly understated. Regardless, 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 of only removing a small % of the waste just to save money. Legally, DOE is breaking the law because once any SDA waste is re-handled, technically it becomes a new waste that now must be disposed in a certified mixed

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

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

[13] Need for Physical Samples at Idaho National Laboratory Subsurface Disposal Area Pits and Trenches, December 2000, J. Roland, GF; V. Rhoades, GF; R. Poeton, EPA-10; Pierre, EPA-10.

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

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

radioactive/hazardous waste Subtitle C dump or other more restrictive dump for which the SDA does not qualify. This government policy error will compromise future generations of Idahoans. Think Idaho's "Detroit."

II. Site Description

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

The Radioactive Waste Management Complex (RWMC) is the largest of the numerous INL/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." [16]

The RWMC is divided into primarily two areas, the Subsurface Disposal Area (SDA), and the Transuranic Storage Area (TSA). The SDA was expanded from the original 13 acres to its current 96.8 acres, and as of 1992 contained 20 pits, an acid pit, 58 trenches, and after 1977 more than 20 rows of soil "vaults" for small volume highly radioactive waste requiring remote handling and shielding. Soil vault is a euphemism for a plain old hole in the ground. Prior to 1977, remote handled waste was dumped in pits and trenches with other waste. The ANL-W Hot Fuel Examination Facility, ICPP, and the Navy's ECF remote handled hot waste is buried here in these 600+ holes. [INL-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] 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.

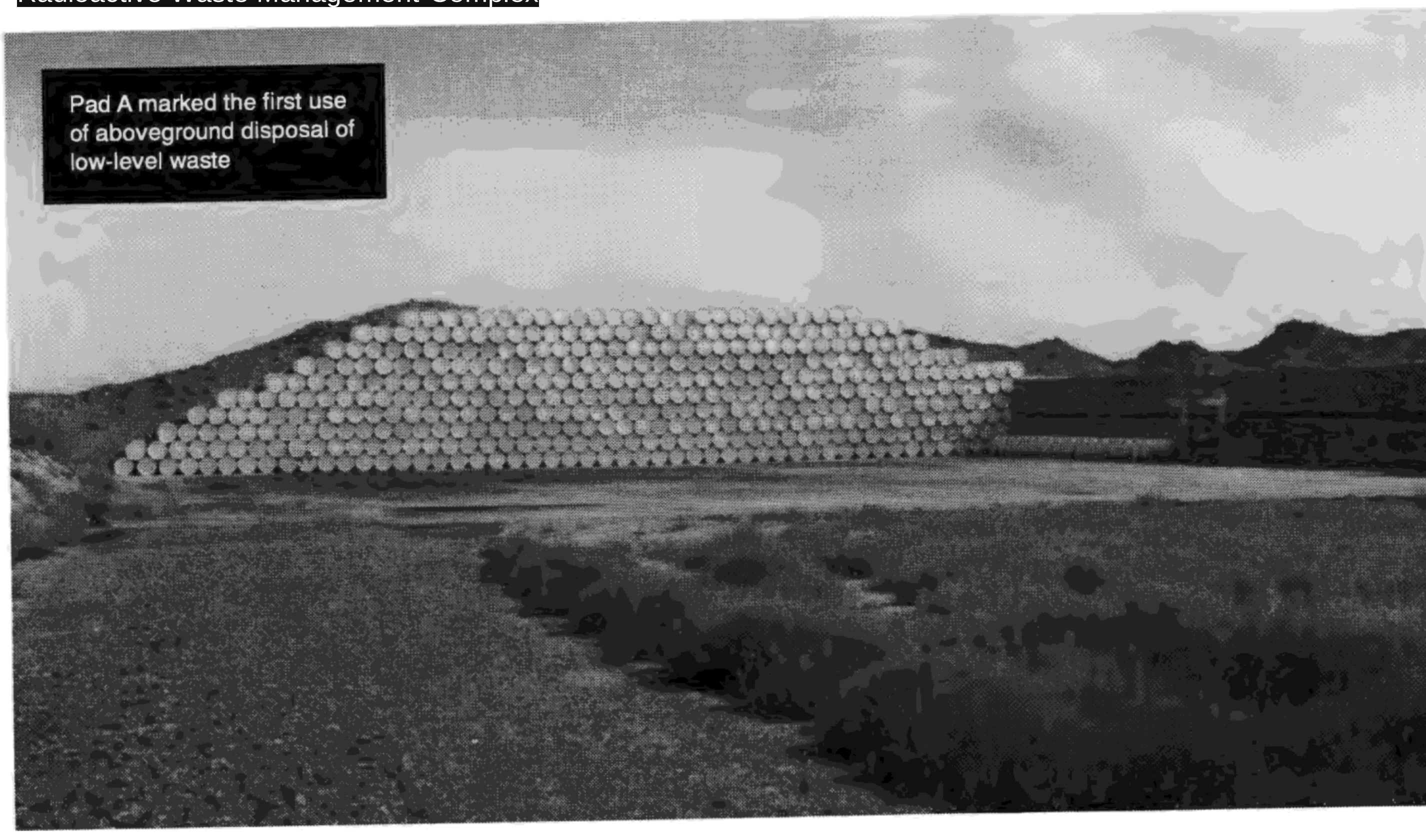
The Transuranic Storage Area (TSA) covers 57.5 acres, and is divided into four areas. TSA Pad-1 opened in 1970 and has Cells 1 through 9; TSA-R Pad immediately south of Pad-1 has 3 cells. These two above ground pads are covered with plastic and wood and soil.

Pad-1 and Pad-R measures 150 x 1,100 x 15 feet and 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

[16] PR-W-79-038 @27

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.

Radioactive Waste Management Complex



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 (DOE's predecessor) 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 (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: "1.) Considerations of long-range safety are in some instances subordinated to regard for economy or operation, and 2.) 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 fifty six 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 and the men who ran them.

The cleanup proposal for the Radioactive Waste Management Complex (RWMC) unfortunately is characteristic of DOE's shell game with its nuclear waste. Observers also call DOE's process "radioactive relocation" scoffing at the term "cleanup." Despite the fact that the RWMC is a Superfund cleanup site due to contamination from previous radioactive dumping, INL continues to bury radioactive waste at RWMC. The waste is dumped in unlined pits that would not even pass municipal garbage landfill regulations under Subtitle D.

Neither the State nor EPA has demanded permitting of the RWMC under the Resource Conservation Recovery Act (RCRA) because of non-compliance. DOE claims that RCRA does not apply because radioactive waste is not covered by the law. Court decisions in 1987 over-threw that argument whenever radioactive and hazardous chemical wastes are mixed (mixed waste). The RWMC has mixed waste and therefore must be held in compliance with RCRA. EPA's inability to promulgate radioactive waste disposal standards has further exacerbated the enforcement problem. The Nuclear Regulatory Commission and DOE have effectively kept previous administration pressures on EPA to shelve the standards.

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

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

Also US Nuclear Corp., General Atomics Corp., dumped at INL. [WMP 77-3 @ 14] In later years, DOE facilities at Mound, Battelle-Columbus, Argonne-east, and Bettis also dumped at INL. "Soon general 'low-level' and 'high-level' wastes were buried here. High level wastes in shielded containers continued to be buried there at least until 1957. Some readings were as high as 12,000 rads per hour. [17] 'Low-level' waste was buried in everything from cardboard boxes to steel drums and wooden crates. [Deadly Defense @ 50] Attempts were made to bury the most radioactive materials at the bottom of the trenches "to reduce the radiation level at the top of the trench to <25 R/hr. " [IDO-12085 @4]

Reactors and/or cores from the on-site Aircraft Nuclear Propulsion, SNAPTRAN, SL-1, Low-Power Reactor (ML-1), Portable Medium Nuclear Power Plant (PM-2A), and LOFT tests were also buried at the RWMC. Spent reactor fuel from the INL Aircraft Nuclear Propulsion (ANP) and other projects went to the burial grounds. "Information about the disposal of the insert material is uncertain based on discussions with personnel previously employed with the ANP Program. A check with personnel at ICPP indicated that no records available at ICPP existed to show that ceramic fuels had been received or were being stored at ICPP. In addition, the only fuel to be processed at ICPP, other than metallic fuel, was the graphite ROVER (nuclear rocket propulsion program) fuel. To date, no ceramic fuel has been processed at ICPP."[EGG-WM-10903 @2-14 & 2-21] Basically, there were three options, reprocess, storage, or dumping. If the spent reactor fuel was neither reprocessed or stored, then it was likely dumped at the RWMC.

Modifications to the EBR-II reactor at ANL-W in 1981 generated considerable radioactive waste that was buried at the RWMC. The large waste items included the old reactor vessel (16 tons), large reactor rotating plug (65 tons), and small reactor rotating plug (50 tons). The reactor-vessel cover contained about 270,000 curies of cobalt-60. These activity level results from activation of Stellite [sic] 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

[17] For perspective, radiation is so biologically hazardous, the regulatory limit is 0.004 rem/year (4 millirem/yr.).

mixed fission products (MFP). High-level, Transuranic (TRU), Greater-Than-Low-Level Class C Waste (GTLLW), 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.

RWMC Subsurface Disposal Area (Soil Vault)

Above Soil Vault photo shows typical Naval Reactors Facility waste placed in a trench in 1973. A structure called a "crib" was placed in the trench to hold this waste. (Photo 73-2345) 1,200 "Soil Vaults" aka holes in ground were later used in SDA for NRF remote handled waste.

Table 1: RWMC Subsurface Disposal Area (SDA) Trenches and Soil Vaults

Trenches [18] **Numbers (total 58)**	**Waste Type**
West-End SDA North to South	
1, 5, 7, 9, 10, 8, 6, 4,3 and 2	TRU
17	NON-TRU
North-East Center Road North to South	
29, 32,	TRU
21,22,24	NON-TRU
South-East Center Road North to South	
18, 36,34,16,31,28,37,26,23, 57, 56, 52 and 54	NON-TRU
51, 53, 49,47, 45, 42, 40, 28, 19, 16, 14, 12, 39,20,25, 50, 48, 46, and 43	TRU
Soil Vaults	
18 Rows >600 Vaults each w/2 Drums/hole	>Greater Than Class C LLW Remote Handled
Southwest corner of Pit 20 Array of concrete vaults for NRF remote handled waste	>Class C LLW Remote Handled
Acid Pit	
1954-1961 160,000 gallons	Rad/chemical Liquids

The above apparent random listing of pits, trenches and soil vaults is literally how they are shown (listing north to south) on the color coded DOE diagram titled "The RWMC (WAG-7) Has Been Divided into 14 Operable Units (OUs) # Z920576." In the Attachment color SDA plan coding is used to distinguish between non-TRU, TRU, and TRU Storage Area Release sites. See Attachment A color diagram of the SDA.

[18] IDO-22056, EG&G, RWMC Schematic Diagram No. 416511, 5/4/82 revised 3/19/92

Table 2: RWMC Subsurface Disposal Area (SDA) Pits and Inventory Prior 1988 and Any Waste Retrieval Operations

Pits	Waste Type	Years Used	Number Of Drums	Number Of Cartons/ Boxes
1	TRU	1957-59	7,551	2,526
2	TRU	1959-63	22,435	2,367
3	TRU	1961-63	5,511	100
4	TRU	1963-67	31,411	2,368
5	TRU	1963-64	18,486	1,350
6	TRU	1967-68	14,396	3,423
7	Non-TRU	1964-64	?	?
8	Non-TRU	1967	?	?
9	TRU	1968-69	3,921	2,029
10	TRU	1968-71	26,645	2,849
11 *	TRU	1970	13,542	90
12 #	TRU	1970-72	4,838	26
13	TRU	1971-74	?	?
14	TRU	1974	?	?
15	TRU	1975	?	?
16	Non-TRU	?	?	?
17	Rad-Beta Gamma	1984-?	?	?
18	TRU	1988-?	?	?

* Later emptied; # partly emptied

Notes for Table2:
References; [WMP-77-3 @2] [IDO-22056 @9] [Oversight(c), 1/6/96][INL-94/0241][EGG-WM-10903@2-7]
Acronyms; 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;
GTCC = Greater than Class C Low-level Waste requires deep geologic disposal.

"The disposal of TRU wastes continued up until 1970 when a new policy was initiated requiring segregated and retrievable storage for TRU wastes which prior to 1982 was defined as containing TRU concentrations greater than 10 nCi/g. The current threshold for defining TRU is set at 100 nCi/g." No comprehensive physical sampling has been done at SDA. [19]

[19] "Need for Physical Samples at the Idaho National Engineering and Environmental Laboratory Subsurface Disposal Area Pits and Trenches, December 2000, Prepared by, John Roland, GF; Victoria Rhoades, GF; Rick Poeton, EPA-10; Wayne Pierre, EPA-10.

II. A: Soil Sampling at RWMC

Subsurface 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. Also see "Nuclear Criticality Safety Issues Pertaining to the INL SDA." [20] DOE's Phase I RWMC Targeted Waste Report pg.49 shows sparks flying off the waste during retrieval operations.

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. This means that the Pad-A waste will be exposed in a hundred years. [EGG-WM-9967 @ 7-2]

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

[20] Nuclear Criticality Safety Issues Pertaining to the INL SDA, J.A. McHugh, R.A. Knief, and M.A. Bobkin, May 3, 2000. This report offers much more details about the chronic criticality issue.

Soil samples five feet below Pit 2 in the Subsurface Disposal Area contained the following concentrations: [TREE-1171 @29]

Table 3: RWMC Pit 2 Sub-surface Soil Samples

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

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 inter-beds. [IDO-22056@74] Forty-one % of the samples from the 240 foot inter-beds contained radionuclides. [Ibid.@87] Other literature confirmation of plutonium at 240 feet includes: "Radionuclides (including Pu-238.-239.-240, Am-241, Cs-137, and Sr-90) have been detected in soils and in sedimentary inter-beds to a depth of 240 feet beneath the RWMC, (Hodge et al, 1989)." "Positive values for Pu-238,-239,-240 were detected in samples obtained from the 240 foot inter-bed 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:
Summary of Analytes detected at reportable levels in RWMC Zone 1 and 2
during Fiscal Years 2010-2014 [DOE/ID-11513, Table 10-5 & 10-6, pg.10-16]

Zone 1			Zone 2		
Analyte	Maximum Concentration	Regulated MCL	Analyte	Maximum Concentration	Regulated MCL
Nitrate (nitrogen)	119 mg/L	10 mg/L	Nitrate (nitrogen)	88 mg/L	10 mg/L
Selenium	70.3 mg/L	50 ug/L	Chromium	930 mg/L	100 mg/L
Tc-99	15,700 pCi/L	900 pCi/L	U-233/234	85 pCi/L	?
Tritium	964,000 pCi/L	20,000 pCi/L	U-238	27 pCi/L	?
Uranium Total	67.1 mg/L	30 mg/L	Uranium Total	70.3 mg/L	30 mg/L

Table 4: Groundwater Sampling Data at 600 Feet Under RWMC
Units in PCi/L

Nuclide	**Concentration**	**Drinking Water Standard**
Cesium-137	400.00	119.00
Plutonium-238	9.00	7.02
Americium-241	15.00	6.34
Strontium-90	10.00	8.00

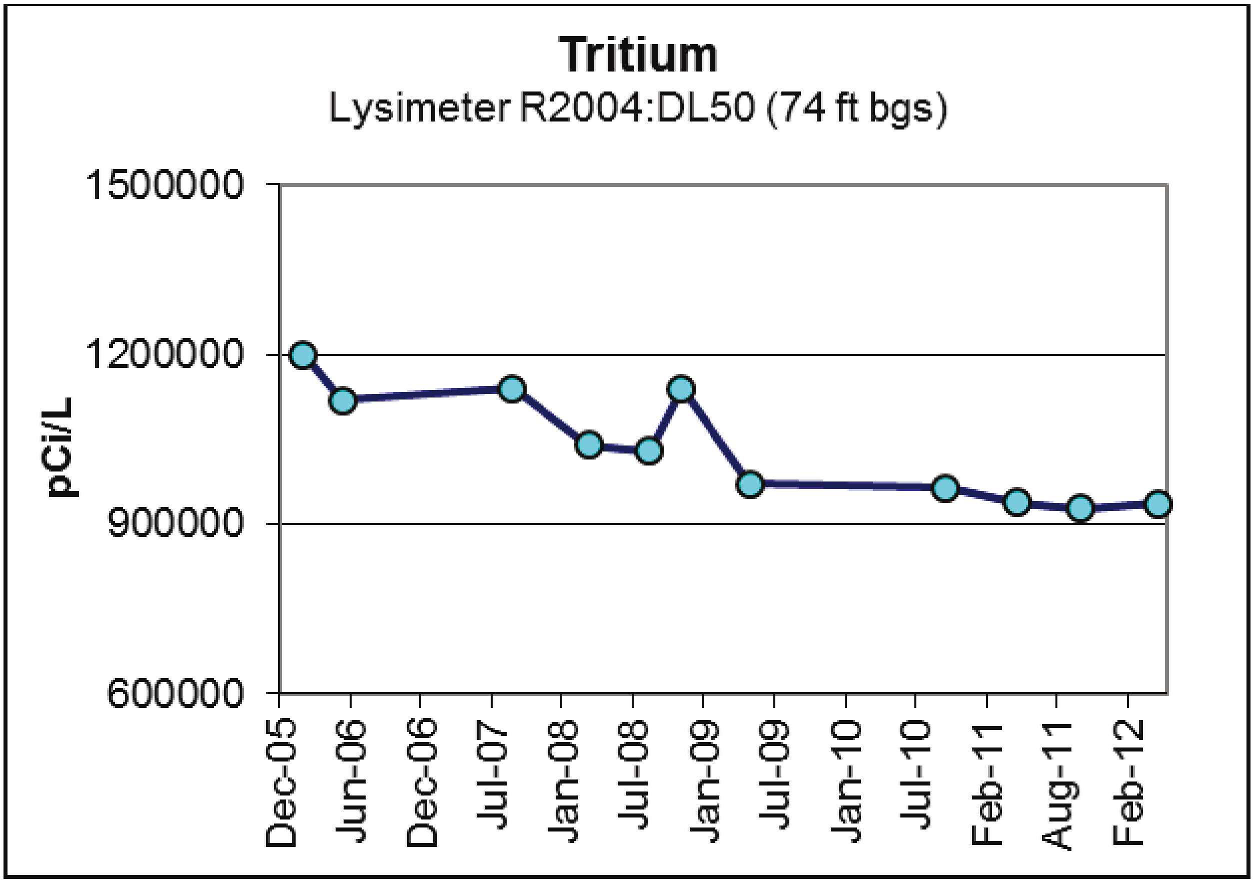
*[IDO-22056 @66] * The drinking water standard for gross alpha (total of all alpha emitters) is 15 pCi/l.*

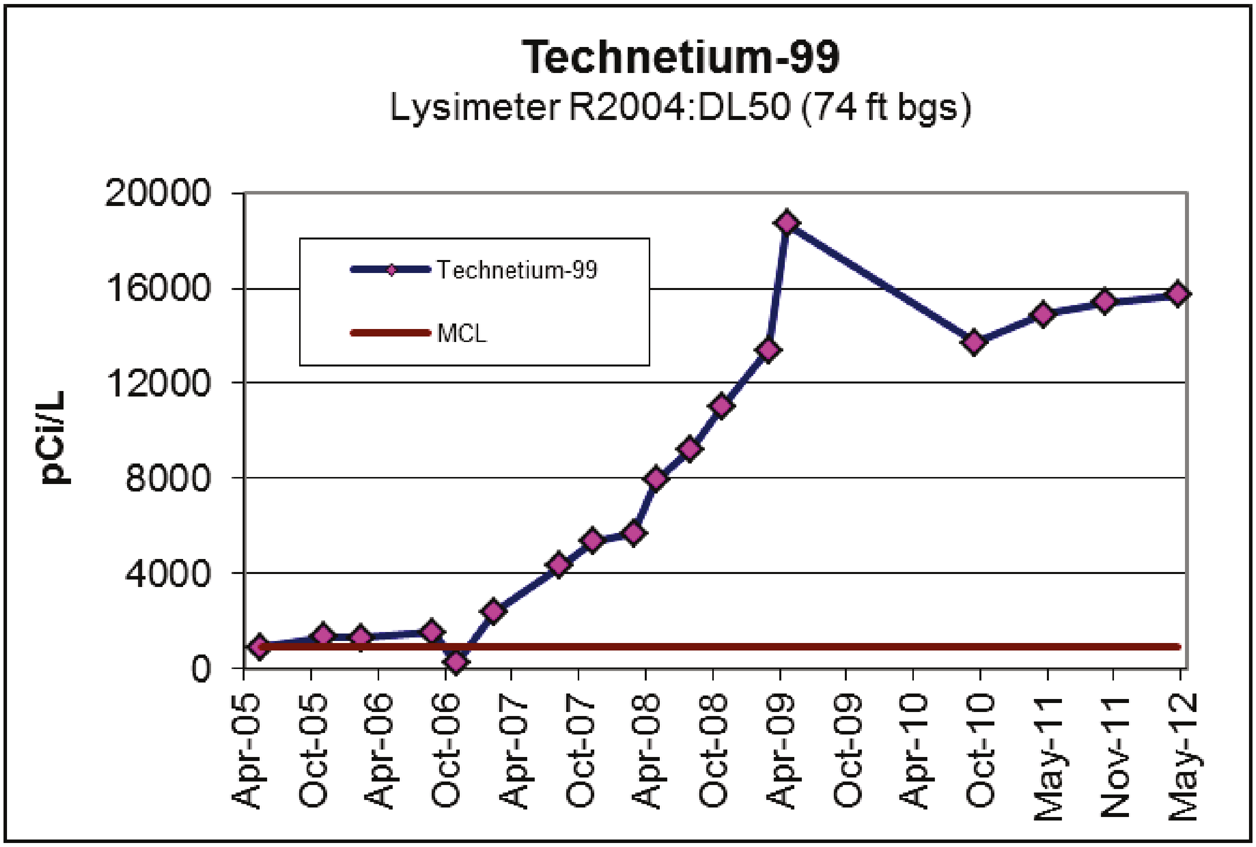
Notes for above RWMC photo: Waste in a disposal trench, 1962. Many of the waste containers have disintegrated, leaving lose waste scattered around the trench. (DOE-ID Photo 62-2134)

Table 5: RWMC Tritium and Technetium Contaminates

The MCL for Tritium is 20,000 pCi/L

DOE/ID-11513 page 10-17





Technetium-99
Lysimeter R2004:DL50 (74 ft bgs)
pCi/L
20000
16000
12000
8000
4000
0
Technetium-99
MCL
Apr-05
Oct-05
Apr-06
Oct-06
Apr-07
Oct-07
Apr-08
Oct-08
Apr-09
Oct-09
Apr-10
Oct-10
May-11
Nov-11
May-12

III. Flooding Issues at the RWMC

USGS Photo of RWMC
Area North-East of Big South Butte

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." [21]

Also see Phase I RWMC Remedial Action for picture of water in the backhoe bucket digging out waste.

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.

Table 4
Americium-241 at 600 foot level at RWMC

Well Number	Sampling Date	Concentration (pCi/L)
88	1992	0.40 +/- 0.02
89	1990	0.040 +/- 0.02
90	1988	0.06 +/- 0.03
90	1990	0.040 +/- 0.02
117	1987	0.06 +/- 0.03
119	1991	0.06 +/- 0.03
M-IF	1997	1.03 +/- 0.27
M-10-S	1993	0.3 +/- 0.1
M-3-F	1997	0.45 +/- 0.017

[Hain (a)]

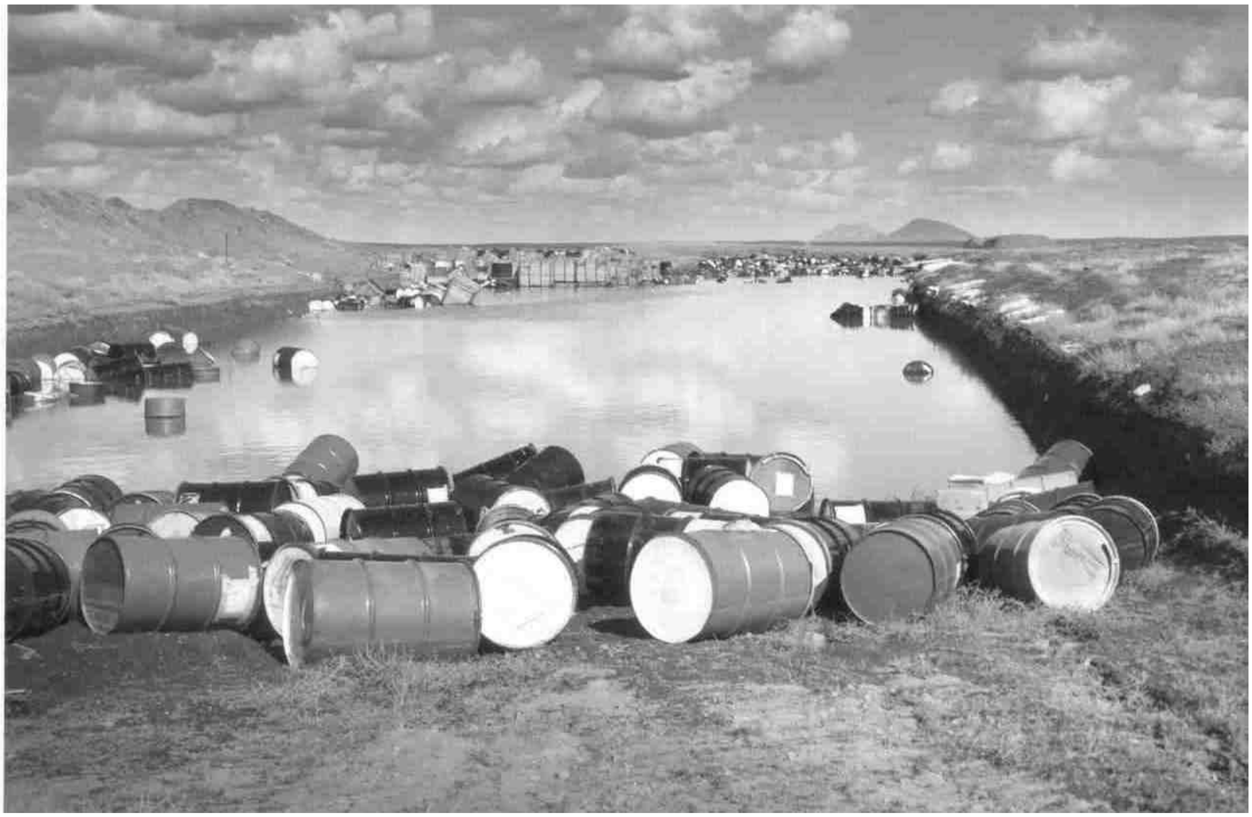
US Geological Survey (USGS) hydrologist Barraclough estimates that 100 acre-feet (32,492,910 gallons) of direct precipitation landed on the RWMC between 1952 and 1970. Additionally, due to the low depression of the RWMC local run off has entered the burial ground adding to direct surface water introduction. 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 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]

Gross Beta and Gross Alpha MCL: "The given value is derived from the MCL for gross beta

[21] IDO-22056@83; Also see Phase I RWMC Remedial Action for OU-7-13/14 Targeted Waste DOE/ID-11396.

of 4 mrem/yr. based on the concentration for a single isotope yielding a dose of 4 mrem/yr. to the total body or to any critical organ. 40 CFR 141 establishes an MCL of 4 mrem/yr. for beta particle and photon radioactivity, provides derived values for Sr-90 and tritium and indicates how derived values should be calculated." Gross Beta derived MCL for Sr-90 is 8 pCi/L and Gross Alpha MCL is 15 pCi/L. [DOE/ID-11513, pg. 10-16 & 10-18 & 10-20]



Flooding of the RWMC and its Subsurface Disposal Area (SDA) from the Big Lost River and precipitation 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 USGS 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 surface precipitation water to go. Currently, sump pumps are required to remove water out of the RWMC due to its lack of drainage. [IDO-22056 @10] This drainage problem begs the question of long-term institutional control to prevent flooding after DOE is gone.

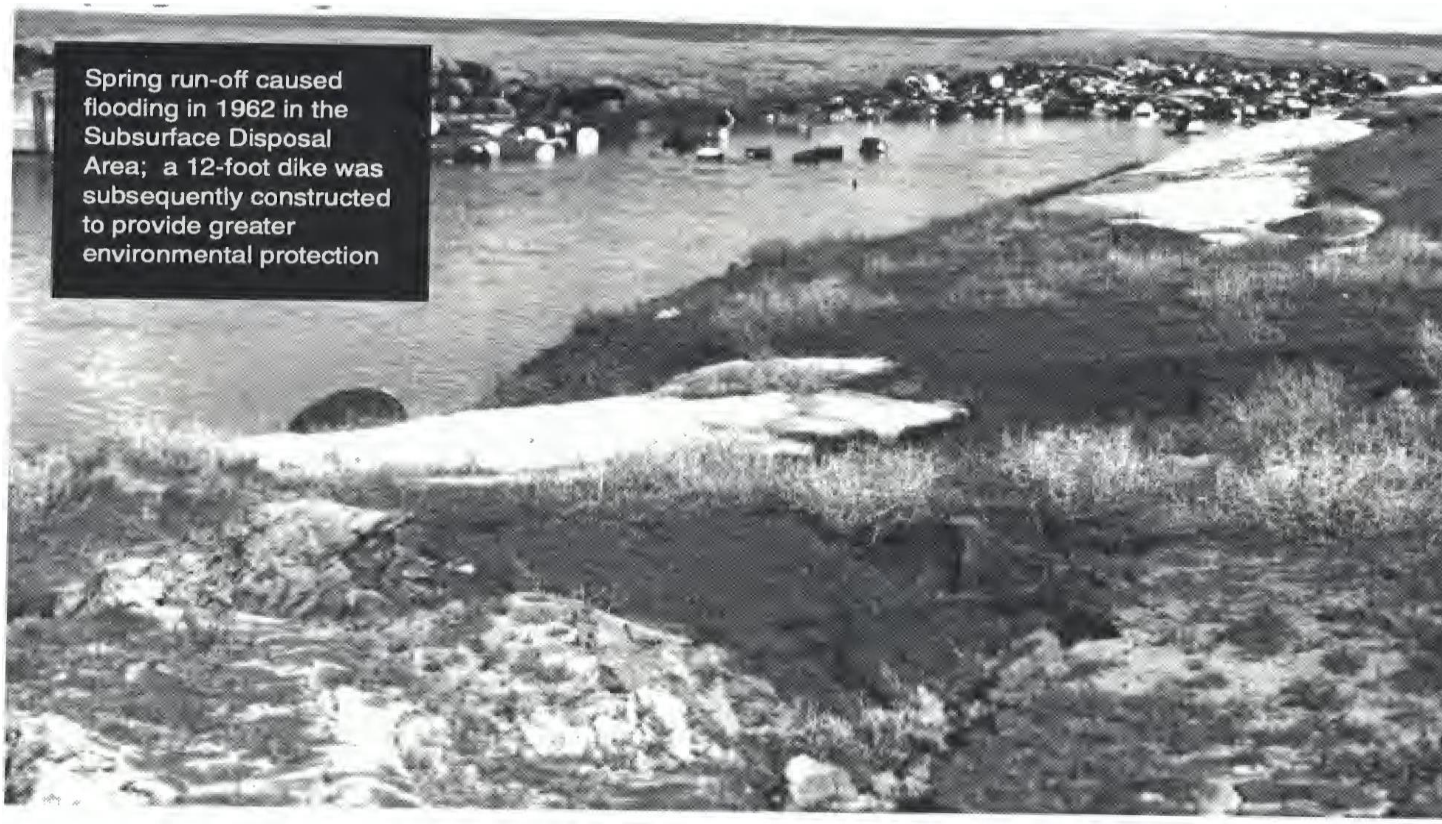
In 1984, the Big Lost River Diversion Dam height was raised several feet to prevent additional flooding of the RWMC and other INL facilities. These improvements are expected to divert a maximum of 9,300 cubic feet per second flow of the Big Lost River with the accuracy limits of the computational procedures in the order of plus or minus 10-15%. The theoretical capacity then could be as low as 7,905 (9,300 - 15%) cubic feet per second. "A sustained flow at or above this [9,300] discharge could damage or destroy the dike". [DOE/ID-22071 @ 24]

According to Larry Mann, former USGS Supervisory Hydrologist, "There is a USGS publication that is undergoing technical review which will update the 100-year flood for the Big Lost River and provide an estimate for the 500-year flood. Peak flows for the 100 and 500-year floods are estimated to be 7,260 and 9,680 cubic feet per second, respectively". [Mann 12/12/95]

Winter of 1996-97 brought record (188%) snow pack that feeds the Big Lost River coupled with record high Spring temperatures that again raise the flooding risks. Brandon Lommis, Idaho Falls Post Register reporter, found that in addition to the RWMC flooding hazard, the ICPP high-level waste tanks are also at risk.

Lommis reports that, "Mike Bennett, INL's water resources coordinator, said 'it would be foolish not to have some concerns,' and that dike failure could allow water to seep into the underground storage tanks under the chemical processing plant and possibly contaminate the Snake River Plain Aquifer, according to a recent study. INL officials this year asked the Army Corps of Engineers to help inspect the dam and dikes before the water peaks. Bennett said dirt graders and trucks are standing by to shore up any unexpected weak spots." [Post Register 5/7/97] The May 20, 1997 LMICO Star noted that:

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



Taken in January 1969, this photo of SDA Pit 9 shows material that "surfaced" when the area was flooded. (69-881) Some of the waste in Pit 9 was retrieved in 2004.

Geologic investigations are needed on the ground up stream of the INL diversion dam to see if there is evidence of historical 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, debris could collect and block the interconnecting channels to the spreading areas facilitating the failure of the dams, and thus flood the RWMC. The USGS believes this is a credible scenario in their 1976 report.

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

A hypothesis is needed of the upstream 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 INL EIS acknowledges that Mackey Dam "was built without seismic design criteria" and "additionally, it is not clear how resistant the dam structure is to seismic events" and the fact that "a fault segment runs within 6 kilometers of the Mackay Dam" [DEIS @ B-17] is significant.

One need only recall the catastrophic failure of the Idaho 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 INL diversion dam capacity of 9,300 cubic feet per second.

DOE's risk evaluation assumes non-conservative precipitation rates when calculating the leachate factors through the reinterred waste into Pit 9. "Heavy rainfall and melting snow within burial ground have also introduced water into the trenches and pits, especially where the soil cover has slumped or cracked." [IDO-22056@8]

"Between 1950 to 1963 the yearly precipitation at INL varied from 5.25 to 14.4 inches." "Between 1950 and 1965 the greatest daily precipitation rate was 1.73 inches in June 1954."

"The greatest monthly precipitation rate was 4.4 inches in May 1957." [Ibid.@45] This means that considerably more water can, and has, aided the migration of contaminates than DOE is saying.

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 Big Lost River 100-year peak flow of 11,600 cubic feet/second (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 INL 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 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 INL 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]

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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 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

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 INL boundary) to shunt major flood waters away from INL 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 INL*. 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.

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 INL 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.

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[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

Building dams around the proposed INL 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 - thus 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 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 INL 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 suspend ability 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 INL 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 INL 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 inter-beds under the RWMC. [IDO-22056@74] Forty-one % of the samples from the 240 foot inter-beds contained radionuclides. [Ibid.@87] Other literature confirmation of plutonium at 240 feet includes: "Radionuclides (including Pu-238.-239.-240, Am-241, Cs-137, and Sr-90) have been detected in soils and in sedimentary inter-beds to a depth of 240 feet beneath the RWMC, (Hodge et al, 1989)." "Positive values for Pu-238,-239,-240 were detected in samples obtained from the 240 foot interbed in bore hole DO2."[DOE/ID-10183@134-145][DOE/ID/12082(88) @14-16] Radionuclides are also confirmed in the aquifer under the RWMC. [EG&G-WTD-9438@25]

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)

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[15] USGS 76-471 page 68-69

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 an acid/solvent solution and therefore highly mobile. Flooding of the ICPP would therefore result in extensive migration of contaminates to the underlying aquifer.

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

DOE'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.

[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 .

Section IV.
A. Summary of Waste Dumped in the Subsurface Disposal Area

Table 7: Radioactivity of Waste Dumped at the Subsurface Disposal Area 1952-1983. These data are obviously ~33 years old and are listed here because DOE failed to make public the historical legacy waste at the RWMC.

Major Generator	RWMIS Shipping Roll-up Full Curies
Test Area North (TAN)	63,000
Advanced Test Reactor Complex formerly called Test Reactor Area (TRA)	460,000
INTEC formerly ID Chemical Processing Plant	690,000
Naval Reactor Facility (NRF)	4,200,000
Materials Fuel Complex (MFC) formerly Argonne National Laboratory -West	1,100,000
Rocky Flats Plant (RFF)	57,000
Other	55,000
Total	11,000,000
EG&G-WM-10903 @ 6-26	

The Table 7 above summary of radioactive content of waste dumped (1952-1983) 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 full curies.[22] 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]

Radioactivity of Waste Dumped at the Subsurface Disposal Area 1984-2014

Table 8 below total activity (Ci) for all radionuclides disposed of at the active LLW Disposal Facility Sub-surface Disposal Area (SDA) from 1984 through FY-2014 as reported in Waste Information and Location Database (WILD) & Integrated Waste Treatment System (IWTS) databases.

Table 8: units in full curies

DOE "WILD & IWTS" Databases [23]	Active Low Level Waste (counting only amounts > 1.0 curie)	Active Remote-Handled Low Level Waste
1952 to 1983	11,000,000 * [Table 7 above]	7,827,453 **[Table 3-4]
1984 to 2014	1,852,810 ** [Table 3-1]	2,023,323 **[Table 3-3]
Totals	12,852,810	9,850,776

* EG&G-WM-10903 @ 6-26, Tables 3-1, 3-3 and 3-4.

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22 Full curies are emphasized because this represents an enormous amount of radioactivity. Regulatory limits are expressed in units of pCi/g (1/trillionth of a curie) because radioactivity is so biologically hazardous.

23 Annual Performance Assessment and Composite Analysis Review for the Active Low-Level Waste Disposal Facility at the INL Radioactive Waste Management Complex, April 2015, RPT-1356, pgs. 3-5 to 3-12.

Table 9: 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]

Table 10: DOE "Plutonium: The First 50-Years" lists the following Plutonium in INL Waste Inventory: [24]

Location	Plutonium in KG	Description
Argonne-West currently Materials Fuels Complex	2	Plutonium embedded in irradiated reactor test loops and reactor blanket assemblies stored in dry storage tubes underground (scrap facility)
Idaho Waste Management	1,026	Solid waste in drums and boxes received primarily from Rocky Flats Plant is stored in above ground pads with earthen berms.
Idaho Chemical Processing Plant Now called INTEC	8 72	Solutions stored in tank farms Calcined waste stored in bins
Totals	1,108	

Another area of uncertainty is the radionuclide inventory of on-site waste in SDA. DOE acknowledges in the mailing that some Aircraft Nuclear Propulsion (ANP) wastes are in Pit 9. When asked at the Nov. 2 briefing if this may include ANP reactors, DOE emphatically denied that any ANP reactors were buried at INL yet the literature specifically acknowledges that jet engines are buried at the RWMC Subsurface Disposal Area (SDA). [EG&G-WM-10090@12]

One of the ANP series involved three reactor assemblies that were constructed at INL for the ANP program. "These three assemblies were designated HTRE No. 1, HTRE No. 2, and HTRE No. 3." [DOE/ID-12119@A-87] Though two ANP nuclear jet engine shells are on display at the ERB-I, the disposition of all of the other engines and reactor cores for these engines were to the RWMC.

The HTRE-2 and 3 were disassembled in the IET hot shop where the highly radioactive plug shield and core assembly were removed and shipped intact to the RWMC. Radiation levels (300 R/h) were too high to allow further disassembly of the reactor vessel and its shielding. Then the reactor vessels were moved back out to the IET test pad where the 200 ton HTRE-2 (with dollies) and the 90 ton HTRE-3 (w/o dollies) were jacked up off the rail tracks and a special 350 ton transporter was moved under for shipment to the RWMC.

Bridges between the IET and the RWMC had to be blocked up to take the heavy transporter, and special ramps made into the trench where they were buried. [PR-W-79-001 @4-3] 106,000 pounds of radioactive mercury used in a tank for shielding around the HTRE-3 as well as

[24] Plutonium: The First 50 Years" lists the following Plutonium in INL Waste Inventory, Table 16, 6/20/96. http://apollo.osti.gov/html/osti/opennet/documents/pu50yrs/tab16.html

considerable volumes of related radioactive parts were dumped at the RWMC.

Other reactor components including shielding weighing 36,000 pounds from Kelly Air Force Base, and a reactor heat exchanger 27 x 5 feet from Nuclear Engineering that were buried in Pit 2 in 1960 also may be part of the ANP program tests. The Hallam Nuclear Power Reactor from Lincoln Nebraska was also buried at the RWMC. [PG-WM-58-008 @2-3]

Three SPERT experimental reactors tested at INL [ERDA-1536, @II-244] as where two SNAPTRAN reactors and, two Modular Cavity reactors from the ANP program were also dumped at the RWMC.

At the Pit 9 hearing in Moscow, (11/10/92) the State representative maintained his position that there was no radioactive contamination below the 150 foot level below the RWMC. One can only conclude that the State Division of Environmental Quality is grossly ill-informed. DOE's mailing only offers one waste volume number (110,000) cubic feet from Rocky Flats in Pit 9. [Plan@3] Why is the total volume to be exhumed not stated? DOE's Pit 9 estimated volumes are: [EG&G-WTD-9438@5]

Waste containers	150,690	cubic feet
Contaminated Soil	191,726	"
Total Volume	342,416	"

DOE's risk evaluation not stated in the public mailing states that the air pathway (reparable) 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]

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 INL because no one knows for certain what is actually in the dump and the intensity of the radiation fields that may be encountered. This is the first time the government or anyone else has attempted cleaning up a highly radioactive dump site.

To further confound an already complicated situation, the DOE still has no permanent repositories for its high-level nuclear waste. Even if the transuranic Waste Isolation Pilot Plant (WIPP) dump in New Mexico reopen 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 INL, DOE has also limited public access to documents based on "procurement sensitive" document status. DOE's chosen successor as regulator of privatized operations, the Nuclear Regulatory Commission (NRC), has actively abetted this policy. These are the same short-sighted approaches to site management that created many of the nuclear problems now facing DOE and they have the potential to significantly increase the costs of cleanup now facing the US." [Weida]

B: Advanced Mixed Waste Treatment Project (AMWTP)

Another nuclear waste treatment plant called the AMWTP at INL was estimated by DOE in 1994 to cost $300 million. In January 1997, DOE awarded the AMWTF project, one of the largest privatization projects worth $1.18 billion, to British Nuclear Fuels Limited (BNFL) to treat mixed and transuranic waste at the INL. The team includes BNFL as the prime contractor with subcontracts with BNFL Engineering, CTS Duratek, Manufacturing Sciences, Morrison Knudsen, and Science Applications International. In the contract, BNFL has committed to treating at least 65,000 cm of waste at the INL, with the option to treat up to an additional 120,000 cm of waste generated by future INL cleanup and decontamination efforts, as well as some waste generated at other DOE sites. [Star 1/14/97] The AMWTP is another example of DOE's violation of the National Environmental Policy Act (NEPA) that requires the government to conduct an Environmental Impact Statement (EIS) of all major projects prior to commitment of resources. DOE did conduct a 1995 INL site wide EIS but only committed seven pages discussing the AMWTP which at that time was called the Idaho Waste Processing Facility. In those seven pages only the most cursory descriptions of the planned mixed transuranic treatment plant are offered. There is little characterization of waste throughput, emission control systems, or anticipated radioactive and chemical releases to the environment. [DOE/EIS-0203F@C-4.4.3-1]

If BNFL wanted to build a municipal garbage incinerator in Boise, they could not get away with a seven page plan let alone a mixed transuranic waste incinerator. Only after public interest organizations filed a law suit did DOE agree to comply with the legal requirements of NEPA. Even more incredible is the fact that the AMWTP is to be built only few hundred feet from the Pit-9 treatment facility. An analysis of DOE's cleanup mess by the Institute for Energy and Environmental Research (IEER) found that duplication of comparable waste processing plants makes no sense.

"One of the remarkable indicators of a lack of coordination and disarray in DOE's Environmental Management program is its failure to coordinate extraction and treatment of buried waste in Pit-9 with the Advanced Mixed Waste Treatment Project [AMTWP] that is supposed to treat the 'retrievably stored' TRU waste at the Idaho Lab; treatment of the 'retrievably stored' wastes is estimated to cost $880 million dollars. The buried and stored wastes contain similar kinds of wastes and it is likely that a large percentage will require similar treatment technologies. Whether or not they are stored under a few feet of dirt is relevant only to extraction and not to treatment technologies. Yet DOE is proceeding with the Advanced Mixed Waste Treatment Facility as a privatized project without yet having absorbed the issues of the pit-9 failure." "Perhaps the only success of the Pit-9 has been the development of remote retrieval technologies that can reduce risk to workers from radionuclides, chemicals, and explosives. However, even this success has a major flaw in that Lockheed Martin AES did not build a double confined structure as required by the Record of Decision and as described in Lockheed Martin AES' own Best and Final Offer." [IEER(g)@145-146]

Privatization of waste treatment plants has produced an accountability barrier that state and EPA regulators find intolerable. Kathleen Trever, then manager of the State of Idaho's INL Oversight program testified at a 1997 Congressional hearing stating: "The nature of Pit-9 subcontract allowed DOE subcontractor Lockheed Martin Advanced Environmental Systems (LMAES) to make design changes without consulting with the [regulatory] agencies, thus preventing the agencies from identifying and resolving concerns in a timely manner.

In addition, EPA and Idaho were not even officially informed of the extent of cost overruns and schedule delays until October 1996; months after project deadlines had already been missed." [IEER(g)@146-147] As of this writing, LMAES's Pit-9 project is completely shut down because of contract disputes with DOE. LMAES contends that "subsequent inventories indicate that types and quantities of other radioactive and hazardous contents in Pit-9 are far greater than originally thought. Technology used on the project has been proven in laboratory testing, but never used before on a large scale to treat the types of materials now believed to be present in INL's Pit-9."[Star7/15/97]

DOE's 1988 *Environmental Survey Preliminary Summary Report of the Defense Production Facilities* ranks INL first in its critical data category "A", and third in its ranking units of most concern from potential public hazard perspective, after Rocky Flats and Pantex. [DOE/EH-0072,p.ES-2]

An August 12, 1996 letter to the INL Health Subcommittee, from Eddie Chew, Health Physicist for DOE's Environmental Program states that "the total amount of uranium disposed at the RWMC is estimated 330 metric tons [330,000 kg]."

Considerable variation in the volume of buried transuranic (TRU) waste (and other waste types) exists between different source documents. For instance, INL contractor EG&G 1978 TRU management report acknowledges 65,136 cubic meters of buried TRU in the Subsurface Disposal Area (SDA). [Tree-1321] This EG&G report was the final report on the Early Waste Retrieval Project at the SDA; so the waste removed (4,397 cm) would have been factored into the buried TRU volume. DOE's 1996 Integrated Data Base acknowledges only 57,100 cubic meters of buried TRU at the SDA. In a January 1998 summary for the Idaho Forum on Remediation of Pits and Trenches presented by DOE's Kathleen Hain, Manager of their Environmental Restoration Program, puts the TRU volume at 78,000 cubic yards (59,660 cm).

Table 11 State's INL Oversight Program 1991 Summary of INL Wastes These Numbers are ~ a decade old and are here because DOE failed to make these legacy inventory data available to add to current inventories

Waste Type	Volume
Buried Transuranic	60,000 cubic meters
Buried Low-Level	240,000 cubic meters
Stored Transuranic - Contact handled	64,750 cubic meters
Stored Transuranic - remote handled	77 cubic meters
Stored High-Level Liquid	7,582 cubic meters
Stored High-Level Calcine	3,600 cubic meters
Spent Fuel	660 metric tons
Hazardous Mixed Radioactive / Chemical	224,694,168 pounds

[IDHW INL Oversight Program, "Wastes at the INL"11/06]

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

Spent fuel rods from over 40 reactors around the US and the world are being stored at various sites around INL. A 1994 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.

The above preliminary SNF 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 SNF 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.

DOE Report RWMC/WGAT/03 states; “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]

DOE Report RWMC/WGAT/04 states; “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 highly enriched uranium (HEU) inventories at INL noted in DOE’s Vulnerability Study that lists (2,797 kilo grams) because the exact inventory was “classified.” However, then DOE Secretary O’Leary‘s 1996 Openness Press Conference Fact Sheets acknowledges HEU at INL at 23,400 kilo grams (23.4 metric tons). [DOE-2/6/96] In March 1996 the Idaho Department of Environmental Quality issued 135 individual counts of environmental violations and a fine of $892,725. The violations were based on September 1995 and January-February 1996 investigations. [Star 9/2/97]

“**Human Remains**: Portions of the remains of three people killed in the SL-1 reactor accident that were too radioactive for burial in their respective cemeteries were placed in the SDA.

“Nuclear fuel and reactor parts : there is nuclear fuel material in the SDA. Around 200 kilograms of irradiated natural uranium associated with the first commercial nuclear power reactor, located in Shippingport, Pennsylvania were buried in the SDA in the 1960s. The Naval Reactors Program cooperated in the design of the reactor, and some of the reactor’s fuel came to INL for examination. Small amounts of other fuel materials from INL research activities were buried in the SDA from the late 1950s to early 1970s, ranging in size from small fragments to entire fuel rods.

“Spontaneously igniting waste: Small amounts of waste in the SDA may be pyrophoric, meaning they can spontaneously catch fire when exposed to air. Pyrophoric uranium metal in Rocky Flats waste has been recently uncovered in Pit 4. Plans call for the material to burn itself out under controlled conditions.

“Starting in 1977, unlined, vertical soil vaults with diameters of 1 to 7 feet and an average depth of 12 feet was used for disposal of waste with higher radiation levels. Soil vaults rows 1 to 18 were used concurrently with the trenches for disposal of high-radiation remotely handled waste until the use of burial trenches was stopped in 1981. From 1970 to 1985, amid concerns about the continued availability of burial space, several changes were made to disposal practices. Waste was now compacted prior to disposal and standard packaging criteria were established.

The pits were also made larger using heavy equipment and at times by blasting the bedrock with explosives to make the pits deeper. In 1982, DOE redefined transuranic waste instituting a ten-fold increase in the level of radioactivity required to meet the new definition. This definition change did not however result in any additional "alpha-contamination waste" being buried in the pits and trenches." [IDEQ INL Oversight 11/06, pg.3, emphasis in original text]

Table 12: Older DOE Summary of Radioactive Waste at INL

This data represents radioactive waste previously dumped but not publically acknowledged

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	81.0 cubic meters [A]	9,823,000 [A]
Solid Plutonium	6.0 metric tons [K]	?
Uranium (highly enriched)	23.4 metric tons [K]	?
Spent Fuel (total mass)	1,458.0 metric tons [D]	6,530,000,000 [D]*
Solid Calcine High-Level	3,800.0 cubic meters [D]	49,600,000 [D]
Liquid High-Level	7,200.0 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.

The reader can now appreciate that there are NO consistent radioactive waste inventory numbers from the DOE, EPA or the State of Idaho. There are no publically available detailed waste characterizations of SDA exhumed waste shipped to WIPP so as to conduct a crude mass balance of how much is left in the SDA after "cleanup." The only thing DOE can be counted on is to cut costs, minimize waste shipped to WIPP to save space, and claim that everything is copasetic. Tragically, the cognizant "regulators" are AOL. All we the public can do is keep the pressure on all the agencies to live up to the original spirit of the Superfund – CERCLA cleanup legislative mandate because it will be our children's, children's, children's, children's, children's, children's burden.

V. Conclusion

The RWMC CERCLA tri-agency agreement made in 2008 with DOE, IDEQ and the EPA says they are targeting the most egregious chemical waste buried at RWMC, and along with the chemical waste **some** buried transuranic waste will be removed. The most radioactive waste will be left in-place because of concerns for worker exposure and in some cases of "national security" exposure. Sixty year-old-secrets still are buried here in Idaho. They will attempt to retard specific radionuclides (Tc-99 and I-129) by grouting in 2,168 places. [25] But the effectiveness and life expectancy of the grout is unknown. The amount of the waste removed was largely based on the enormous cost of removal and on the limited capacity at WIPP, despite arguments made concerning worker risk versus limited public benefit. A key provision for protecting the aquifer is the installation of a soil cap, still to be designed, that has been assumed to provide perfect performance for perpetuity.

The soil cap is needed to keep the shallowly buried waste and above ground mound of Pad A uranium waste from blowing in the wind. It also limits water infiltration, slowing the leaching of radioactive waste into the aquifer.

The information graph presented to the public described the trough of radiation aquifer ingestion doses in about 10,000 years but inexplicably failed to describe the escalating radiation doses that rise, peak and remain elevated after 10,000 years.

The document analyzing the radiation ingestion doses after 10,000 years was completed in 2008 but only recently released to EDI by FOIA. The DOE went to great lengths to avoid referencing or making the document publically available. The CERCLA cleanup documentation went to great lengths to avoid discussing these post-10,000 year radiation doses which far exceed the EPA human health lifetime risk of cancer incidence that they so prominently discussed in the CERCLA documentation.

The lack of transparency borders on fraud. Prior to completion of the RWMC CERCLA analysis, the National Academy of Sciences recommended modeling radioactive waste releases until peak dose, rather than an arbitrary cutoff at 10,000 years. (2004, Yucca Mt.)

The DOE's analysis of radiation ingestion dose and aquifer contamination, up to 100 mRem/yr. for thousands of years, due mainly to Rocky Flats waste of Americium-241 (dumped directly as Americium-241 rather than decay after being dumped) and from plutonium from Rocky Flats weapons plant dumped at RWMC (which also decays to Americium and other radioisotopes). Through radiation decay ingrowth, the radiation levels from the Am-241, uranium (from INL and from Rocky Flats) and transuranic waste continue to climb and the level off slowly, leaching poison into the aquifer for millennia. The number of people who will be exposed is unknown.

In the DOE's estimate of radiation doses that you never saw, the doses, even with optimistic modeling assumptions are high: 100 mRem/yr. which is DOE's limit to the public for radiation from all sources. This estimate used a 1 centimeter/yr. infiltration rate. In an effort to further

[25] DOE/ID-11513, pg. 10-29

whittle down the high radiation doses, DOE decided that soil cap performance would remain perfect "forever" despite industry recognition that no one should assume that there are no societal or environmental (think floods) interruptions over such long time frames. DOE's final analysis used an indefensible 0.1 cm/yr. infiltration rate and yielded 30 mRem/yr. doses for millennia.

The model of radiation ingestion dose depends on the amount of waste disposed of which despite years of efforts to characterize remain highly uncertain due to the lack of record-keeping. Midpoint estimates of waste inventory were used rather than upper bound estimates. Chemical form and concentrations of waste can greatly affect the rate of migration of the contaminants to the aquifer. The transport parameters were based on test-tube rather than actual water, soil, and waste form conditions.

DOE never states how much of the transuranic Amercium-241 and Plutonium will be removed? The DOE's analysis assumes 6 percent was removed and how much more remains is an open question that may never be answered. It would appear that INL needs to ship about 40 percent more TRU to WIPP to finish up, or about 30,000 cubic meters.

No matter how, what is removed is measured, we won't know how much remains in pits through partial retrieval and trenches with no targeted waste. According to DOE, the best case appears that about 75%, of the TRU waste would be removed and 6 percent of this was already accounted for in DOE's analysis. So at best, Am and Pu would be reduced 70 percent from the analysis values. Realistically, it will be much less unless serious regulatory pressure applied.

While the dominant contribution to radiation ingestion dose is from Am-241 and Plutonium isotopes, high contributions from uranium will not be removed from the buried waste. Nor will other long-lived radioisotopes that affect radiation dose sooner: Tc-99 and I-129.

Why is it none of the CERLCA documents and none of DOE's presentations ever show the post-10,000 radiation dose ingestion estimates near the facility? Why was DOE's analysis kept out of public view? And if the public understood the significance of the thousands of years of contamination, would they accept the lame --- 5 years reviews into perpetuity excuse and the assumption of flawless soil cap performance for thousands of years that was assumed in order to whittle the radiation dose down to something less than 100 mRem/yr.? Note, the regulatory limit (MCL) for the public is 4 mrem/yr.

The shipments of waste from INL to WIPP are about 60 percent complete. But it is not clear when WIPP will reopen or whether WIPP's available space is overcommitted. [26]

Environmental Defense Institute (EDI) presents documentation above to authenticate waste characterization deficiencies that are contributing to serious misguided cleanup decisions. This is a tragic effort by DOE to put money needed for comprehensive cleanup ahead of Idaho's future generation's groundwater supply. Therefore, EDI's only support of the Agencies Plan "Buried Waste Environmental Investigation Feasibility Study is 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.

Attachment A:

1. Ariel photo of RWMC SDA
2. Diagram of SDA showing numbered Pits, Trenches and Soil Vaults (EG&G-WM-9638)
3. The RWMC (WAG-7) Has Been Divided into 14 Operable Units (OU's) Z92 0576
   Color Coded to show where TRU, non-TRU, Soil Vaults, Acid Pit are located.

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[26] Adapted from Tami Thatcher's memo to Broscious

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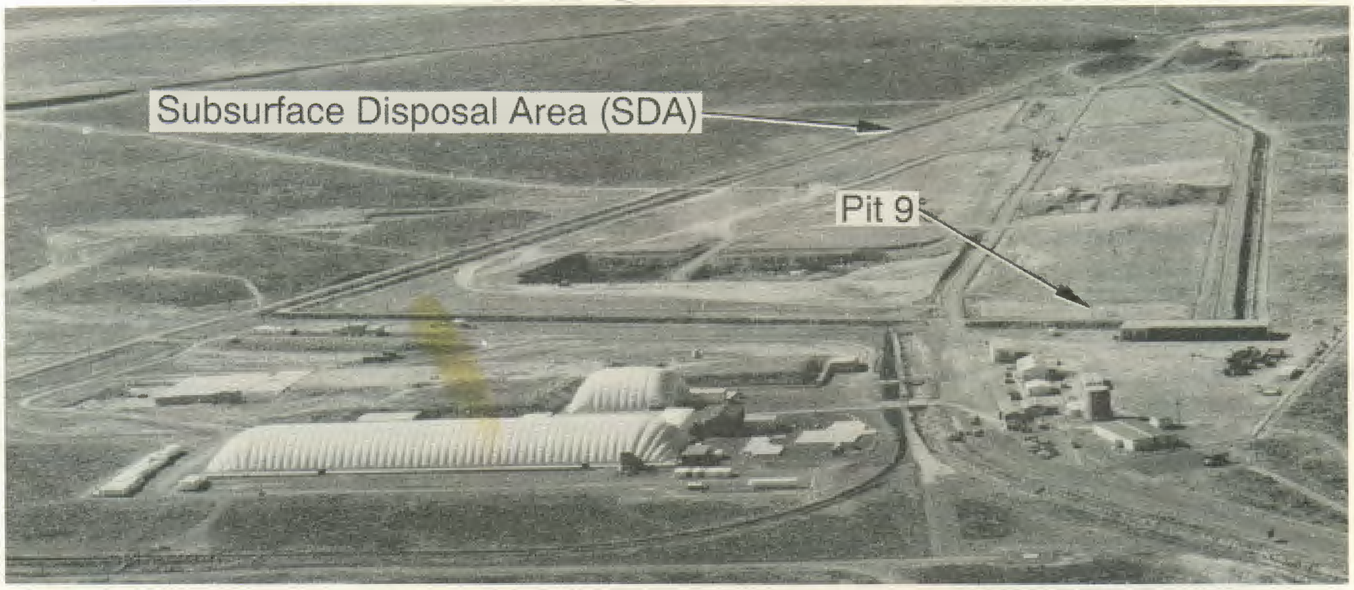


West view of Pit 9 in the Subsurface Disposal Area at the Radioactive Waste Management Complex.

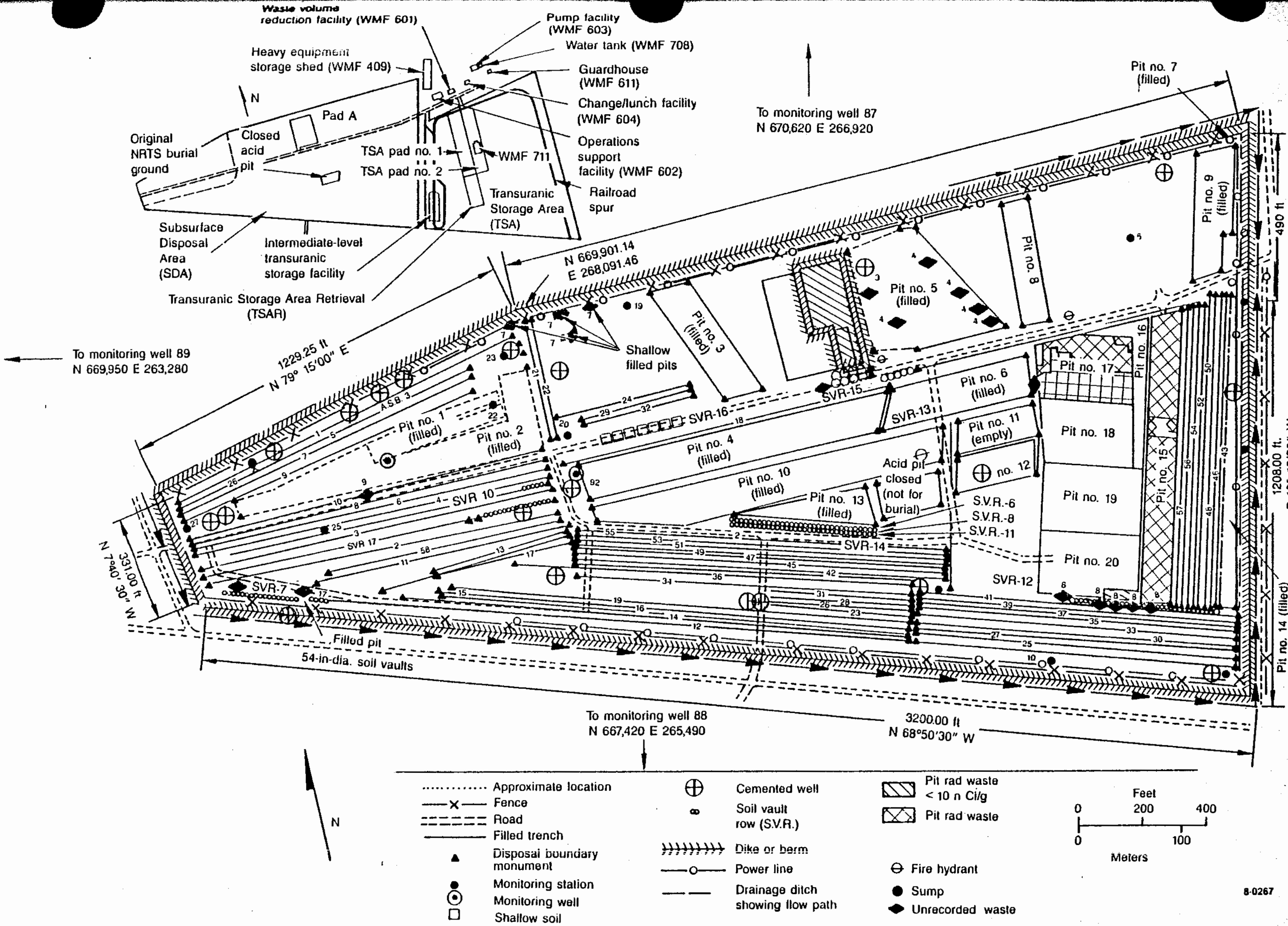
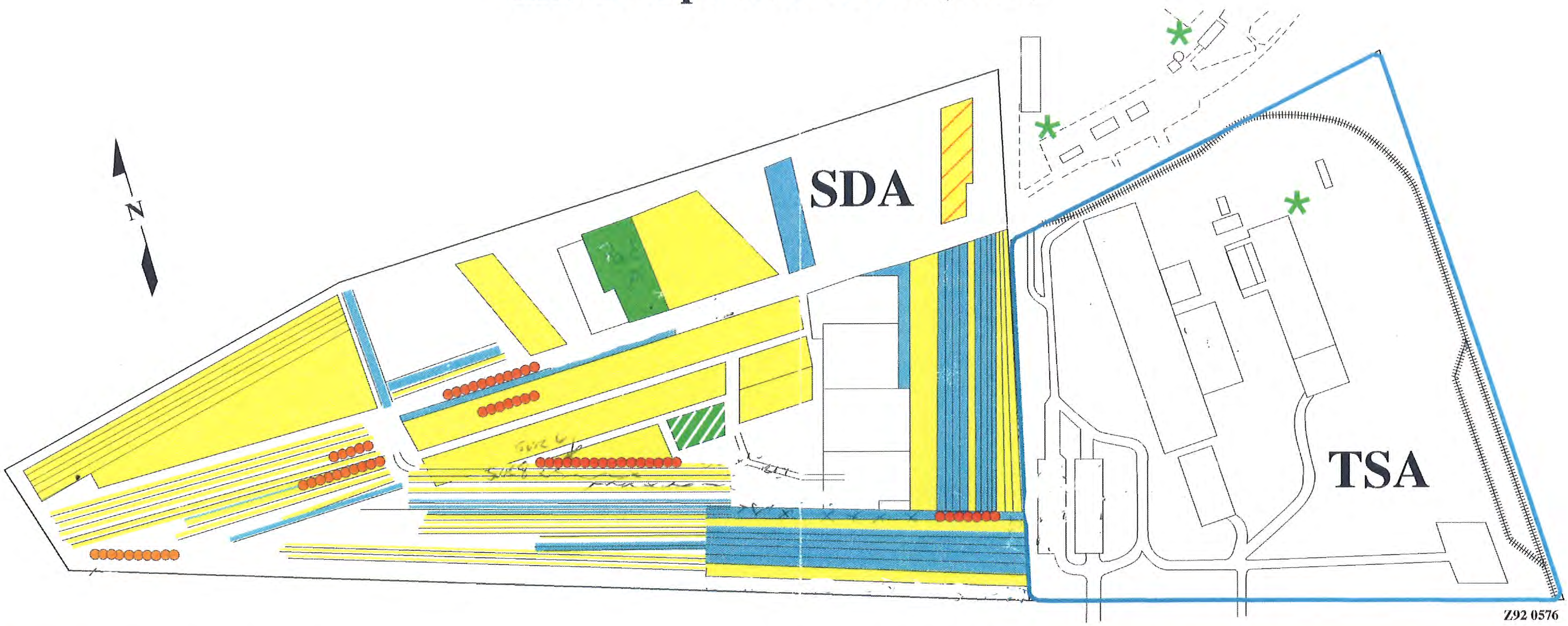


Figure 2-4. Location of the Acid Pit at the SDA.

The RWMC (WAG-7) Has Been Divided into 14 Operable Units (OUs)



- 7-01: SDA soil vaults
- 7-02: SDA acid pit
- 7-03: Non-TRU contaminated pits and trenches
- 7-04: Air pathway
- 7-05: Surface water pathways and surficial sediments
- 7-06: Groundwater pathway
- 7-07: Vadose Zone (rad/metals)
- 7-08: Organic contamination in the Vadose Zone
- 7-09: TSA releases
- 7-10: Pit 9 comprehensive demonstration
- 7-11: Septic tanks
- 7-12: Pad A
- 7-13: TRU-contaminated pits and trenches
- 7-14: WAG-7 comprehensive ROD