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TO: Theresa Kliczewski, US DOE, (EM-4.2), Washington, DC 20585.
Sent via email: *HLWnotice@em.doe.gov*.

RE: Supplementary Public Comments for the Record on U.S. Department of Energy Interpretation of High-Level Radioactive Waste [1]

Submitted by Chuck Broscious, President Environmental Defense Institute: edinst@tds.net

Abstract

The Environmental Defense Institute offers these Supplementary comments [2] to those submitted at the original deadline for the record on the proposed Department of Energy (DOE) interpretation of high-level radioactive waste (HLW). EDI advocates for environmentally sound nuclear policy at the DOE's Idaho National Laboratory (INL) where there are extensive inventories of HLW.

EDI rejects the DOE's proposal to re-interpret the definition of the statutory term "high-level radioactive waste" (HLW) as set forth in the Atomic Energy Act of 1954 and the Nuclear Waste Policy Act of 1982. Given INL's significant buried inventory of HLW, DOE's attempt to reclassify remaining HLW will result in leaving this most toxic/biologically hazardous waste in near surface dumps that have already contaminated soil/water with long-lived nuclides. The INL current total waste inventory is >45 million cm containing >49 million curies of radioactivity. This represents DOE's ongoing refusal to cleanup the enormous >60 yr. radioactive disaster and reneging on Agreements to Idahoans to remove all HLW and transuranic as well as US Federal District Court rulings (discussed more below). Idaho suffers from existing contamination and DOE wants to add more.

Comments Table of Contents

SECTION 1.	Background	
SECTION 2.	Calcined Mixed Hazardous High-level Waste Solids Facility	2
SECTION 3.	Idaho Nuclear Technology and Environmental Complex	14
SECTION 4.	Radioactive Waste Management Complex (RWMC)	39
SECTION 6.	Material Fuels Complex (MFC)	79
SECTION 7.	Remote-Handled Waste Disposition Project	118
SECTION 8.	Greater-Than-Class C Low-level Waste (GTCCW)	122
SECTION 9.	Naval Reactors Facility (NRF)	125
SECTION 10.	Test Reactor Complex (ATRC)	126

[1] Federal Register /Vol. 83, No. 196 /Wednesday, October 10, 2018 /Notices 50909

[2] EDI filed our original comments on the (12/7/18) deadline; the extension allowed us to access additional data to assist the process of developing the rational presented here.

SECTION 1. Summary

DOE's Idaho National Laboratory (INL) formerly National Reactor Testing Station (NRTS) is where the U.S. chose to build/test/operate over 52 reactors since its creation in 1949 by the Atomic Energy Commission. [3] INL has extensive inventories of high-level waste (HLW) along with the remains of those 52 reactors and the full range of HLW mixed RCRA hazardous radioactive waste produced by them and from the reprocessing of (irradiated) spent nuclear fuel (SNF) from military and commercial reactors. NRTS/INL is where Admiral Rickover (founder of the Nuclear Navy) chose to build Naval Reactors Facility (NRF) to build/test numerous reactors and train operators for its Naval Nuclear Propulsion Program (NNPP). NRF is where NNPP sends all of its fleet's SNF for processing and where the Advanced Test Reactor Complex [4] tests NNPP reactor fuel, materials and produces Pu-238 for NASA. See Sections 8 & 9 below for details on NRF/ATR SNF processing and waste management.

EDI's supplemental comments cover the eight INL facilities that handle HLW, transuranic waste (TRUW), and greater-than-class C low-level (GTCC) and what DOE euphemistically calls "greater-than-class-C-like" waste [5] because DOE implementing Order 435.1 and Section 3116 of the NDAA, [6] [7] in 2005 that's how they "managed" previously classified HLW. DOE's unique unilateral "ability" to change the name of radioactive waste is legionary for avoiding statutory definitions. [8] DOE is using Performance Assessments full of inadequately evaluated assumptions and inadequate technical basis to justify compliance with NDAA. We discuss how DOE's policies (since 1999) continue the mismanagement of these wastes and irrevocably [9] contaminate Idaho.

Between 1949 and 1995 there were few-if any restraints on DOE HLW waste management – they simply dug unlined pits and trenches and dumped it all in – reactors, spent nuclear fuel (SNF), [10] hazardous chemicals/highly radio-activated metals from SNF processing without any attempt to separate waste types. [11] The exception to this policy was segregating SNF that could be chemically reprocessed to extract highly-enriched uranium for DOE/Naval reactors. This waste dumping represents an existential environmental threat to all Idahoans due to the contaminated air [12] and migration into our sole source Snake River Aquifer designated by EPA in 1991. [13] [14]

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[3] INL holds the world record for the highest concentration of nuclear reactors.

[4] Advanced Test Reactor Complex is where the Materials Test Reactor, Engineering Test Reactor and other operations are co-located.

[5] DOE's GTCC-like waste apparently includes plutonium like sealed sources of Pu-238, etc..

[6] RADIOACTIVE WASTE MANAGEMENT MANUAL DOE M 435.1-1 Approved: 7-09-99 U.S. DEPARTMENT OF ENERGY Office of Environmental Management.

[7] In 2004, Congress passed legislation (the Ronald Reagan National Defense Authorization Act for Fiscal Year 2005) to facilitate progress toward tank waste disposal in South Carolina and Idaho, providing a framework for determining what wastes may remain on-site.

[8] Tami Thatcher comments on DOE reclassification of HLW. http://environmental-defense-institute.org/

[9] Once hazardous/radioactive waste migrates into the underlying aquifer, it's virtually impossible to cleanup.

[10] SNF (90.282 metric tons) dumped were typically damaged from reactor meltdowns or otherwise not usable for reprocessing. Radioactive Waste Management Information System Database (P61SH090, and P61SH070, Run Date 10/24/89) [RWMIS]. The RWMC dump would not even qualify as a EPA Sub Title D municipal landfill because it's in an active flood zone.

[11] SNF processing, as opposed to reprocessing {chemically dissolving SNF to extract plutonium/enriched uranium for bombs and/or new reactor fuel} is reference to cutting off SNF parts connected to the uranium fissile material in order to minimize the volume of waste requiring disposal in a deep geological repository. Some SNF processing contains some fissile material depending on the accuracy of the cutting of the assembly. The legal question: are the SNF assembly parts removed HLW as defined by NEPA statute or just low-level radioactive waste that DOE can be dumped in its landfill?

[12] INL's >60 yr. of reactor operations (including deliberate meltdowns to establish operating parameters) resulted in significant emissions that deposited radioactive contaminates in the Aquifer and on the soil that were later re-suspended by periodic wild fires.

[13] 40 CFR § 149.2 "Definitions. (d) Sole or Principal Source Aquifer (SSA) means an aquifer which is designated as an SSA under section 1424(e) of the SDWA. [54 FR 6843, Feb. 14, 1989] § 149.3 Critical Aquifer Protection Areas. A Critical Aquifer Protection Area is either: (a) All or part of an area which was designated as a sole or principal source aquifer prior to June 19, 1986, and for which an area wide ground-water quality protection plan was approved, under section 208 of the Clean Water Act, prior to that date; or (b) All or part of a major recharge area of a sole or principal source aquifer, designated before June 19, 1988, for which: (1) The sole or

Specifically, DOE illegally [15] changed the formerly HLW ~900,000 gal. sodium-bearing waste (SBW) generated from reprocessing spent nuclear fuel (SNF) to "waste incidental to reprocessing" (WIR) mixed hazardous TRU [16] and intends to change formerly HLW calcine (Bin inventory ~**41 million curies**) [17] and sodium-bonded SNF reprocessing (HALEU) HLW [18] to TRU [19] so it can be dumped at Waste Isolation Piolet Project (WIPP) in New Mexico. In keeping with the NWPA, NM Department of Environmental Quality has blocked bringing waste derived from reprocessing SNF (like calcine/SBW/HALEU) to WIPP. [20] [21] [22]

To implement this new HLW reclassification policy, DOE is relying on Public Law 108–375—Oct. 28, 2004 Section 3116 [23] to exclude any NRC/State regulation that states:

"SEC. 3116. DEFENSE SITE ACCELERATION COMPLETION.

"(a) IN GENERAL.—Notwithstanding the provisions of the Nuclear Waste Policy Act of 1982, the requirements of section 202 of the Energy Reorganization Act of 1974, and other laws that define classes of radioactive waste, with respect to material stored at a Department of Energy site at which activities are regulated by a covered State pursuant to approved closure plans or permits issued by the State, the term ''high-level radioactive waste'' does not include radioactive waste resulting from the reprocessing of spent nuclear fuel that the Secretary of Energy (in this section referred to as the ''Secretary''), in consultation with the Nuclear Regulatory Commission (in this section referred to as the ''Commission''), determines— [emphasis added]

a. "does not require permanent isolation in a deep geologic repository for spent fuel or high-level radioactive waste;
b. has had highly radioactive radionuclides removed to the maximum extent practical; and

(3)(A) does not exceed concentration limits for Class C low-level waste as set out in section 61.55 of title 10, Code of Federal Regulations, and will be disposed of—

(i) in compliance with the performance objectives set out in subpart C of part 61 of title 10, Code of Federal Regulations; and

(ii) pursuant to a State-approved closure plan or State- issued permit, authority for the approval or issuance of which is conferred on the State outside of this section; **or**

(B) exceeds concentration limits for Class C low-level waste 10, Code of Federal Regulations, but will be

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principal source aquifer is particularly vulnerable to contamination due to the hydrogeologic characteristics of the unsaturated or saturated zone within the suggested critical aquifer protection area; and (2) Contamination of the sole or principal source aquifer is reasonably likely to occur, unless a program to reduce or prevent such contamination is implemented; and (3) In the absence of any program to reduce or prevent contamination, reasonably foreseeable contamination would result in significant cost, taking into account: (i) The cost of replacing the drinking water supply from the sole or principal source aquifer, and (ii) Other economic costs and environmental and social costs resulting from such contamination. [54 FR 6843, Feb. 14, 1989] "

[14] Environmental Defense Institute Snake River Plain Aquifer at Risk 1, September 2012 Revision No. 30.

[15] B.Lynn Winmill, Chief Judge U.S. District Court for Idaho, July 2, 2003, Memorandum Decision in NRDC v. DOE, Civ. No. 01-0413-S-BLM, discussed more below.

[16] Notice of Preferred Sodium Bearing Waste Treatment Technology, Federal Register /Vol. 70, No. 148 /Wednesday, August 3, 2005 /Notices, DEPARTMENT OF ENERGY Office of Environmental Management.

[17] TANK WASTE RETRIEVAL, PROCESSING, AND ON-SITE DISPOSAL AT THREE DEPARTMENT OF ENERGY SITES F I N A L R E P O R T, Committee on the Management of Certain Radioactive Waste Streams Stored in Tanks at Three Department of Energy Sites Nuclear and Radiation Studies Board Division on Earth and Life Studies, Pg. 14, 2006 by the National Academy of Sciences. Hereinafter called NAS 2006.

[18] Pursuant to 10 CFR 1021.321, the U.S. Department of Energy (DOE) has prepared the Draft Environmental Assessment for the Use of DOE-Owned High Assay Low-Enriched Uranium Stored at INL, 10/31/18, DOE-EA-2087. Hereinafter called DOE-EA-2087.

[19] Chuck Broscious, Comments On U.S Department of Energy Draft Environmental Impact Statement for the Disposal of Greater-Than-Class C (GTCC) Low-Level Radioactive Waste and GTCC-Like Waste (DOE/EIS-0375-D) February 2011, Submitted by Chuck Broscious, May 12, 2011 on behalf of Environmental Defense Institute.

[20] Chuck Broscious, Review of U.S. Department of Energy Final Environmental Assessment Replacement Capacity for Disposal Remote Handled Low-Level Waste Generated at Idaho National Laboratory December 2011 DOE/FEA-1793, 3/30/17 [Rev12]. Also see EDI special report Unwarranted *Confidence in DOE's Low-Level Waste Facility Performance Assessment The INL Replacement Remote-Handled Low-Level Waste Facility Will Contaminate Our Aquifer for Thousands of Years.* by Tami Thatcher http://www.environmental-defense-institute.org/publications/rhllwFINALwithFigs4.pdf

[21] Chuck Broscious, Comments for the Record on U.S. Department of Energy the Draft Environmental Assessment for Use of DOE-Owned High Assay Low-Enriched Uranium Stored at INL, submitted on behalf of Environmental Defense Institute, 11/29/18.

[22] Tami Thatcher, Public Comment Submittal on the U.S. Department of Energy Draft Environmental Assessment for Use of DOE-Owned High-Assay Low-Enriched Uranium Stored at Idaho National Laboratory Comment submittal by Tami Thatcher, November 30, 2018.

[23] Public Law 108-375-OCT. 28, 2004, 118 STAT. 1811. https://www.gpo.gov/fdsys/pkg/PLAW-108publ375/pdf/PLAW-108publ375.pdf

disposed of—
(i) in compliance with the performance objectives set out in subpart C of part 61 of Federal Regulations;
(ii) pursuant to a title 10, Code State-approved closure plan or State- issued permit, authority for the approval or issuance of which is conferred on the State outside of this section; and
(iii) pursuant to plans developed by the Secretary in consultation with the Commission."

The National Academy of Sciences discusses the HLW policy background as:

"It is apparent from this text that Congress defined HLW in the AEA and the NWPA in terms of its source. Section 3116 of the NDAA provides an exception to this definition at the sites in South Carolina and Idaho. DOE Order 435.1 still applies to waste determinations at Hanford and potentially to other wastes at the Savannah River and Idaho sites to which Sect. 3116 does not apply. In 1993, the USNRC first set out criteria to determine which portions of certain Hanford nuclear fuel reprocessing waste are not HLW (the waste so determined is also called "waste incidental to reprocessing" in some documents)." [24]

"DOE, which regulates itself on most matters related to radioactive waste, developed Order 435.1 which contains provisions for determining that some wastes are not HLW and, thus, can be managed as low-level waste or transuranic waste (DOE, 1999a; 1990b; 2001b). According to DOE Order 435.1, waste can be determined to be incidental to reprocessing by two methods, "citation" or "evaluation." "The evaluation method is based on three criteria provided to DOE by USNRC in 1993 in its denial of a petition for proposed rulemaking concerning the definition of HLW (Bernero, 1993). [emphasis added]

"The [USNRC] Commission . . . has indicated . . . it would regard the residual fraction as "incidental" waste, based on the Commission's understanding that DOE will assure that the waste: (1) has been processed (or will be further processed) to remove key radionuclides to the maximum extent that is technically and economically practical; (2) will be incorporated in a solid physical form at a concentration that does not exceed the applicable concentration limits for Class C low-level waste as set out in 10 CFR Part 61; and (3) will be managed, pursuant to the Atomic Energy Act, so that safety requirements comparable to the performance objectives set out in 10 CFR Part 61 are satisfied. (Bernero, 1993).

"Thus, the tank waste that USNRC reviewed and that was destined for disposal on-site would not be considered HLW if it met the criteria. On this basis, DOE Manual 435.1 created in effect three implicit subcategories of waste: (1) high-level waste, (2) non-high-level waste that is managed as low-level waste, and (3) non-high-level waste that is managed as transuranic waste." [25] [pg. 28 & 29]

"Using the provisions of DOE Manual 435.1, DOE proposed to determine that certain wastes at the three DOE sites that are the subject of this report are not HLW, a step needed for DOE to carry out its separation strategy (high-activity and low-activity) for the tank wastes. This process came to an abrupt halt in 2003 when DOE was sued in Idaho by the Natural Resources Defense Council, Snake River Alliance, Confederated Tribes and Bands of the Yakama Nation, and the Shoshone Bannock Tribes. The plaintiffs argued that Order 435.1 exceeded DOE's authority under the AEA and the NWPA. In 2004, the court found that the standards DOE established by rule were too discretionary and offered no effective limitation on the agency's ability to determine which waste could be managed as low-level waste and disposed on-site. The federal district court in Idaho ruled in favor of the plaintiffs, finding that DOE could not continue with its management activities in reliance on Order 435.1. [26]

DOE claims INL Idaho Nuclear Technology and Engineering Center (INTEC) tank "Sodium-Bearing" (900,000 gal.) Wastes are:

"WASTE DOES NOT REQUIRE PERMANENT ISOLATION IN A DEEP GEOLOGIC REPOSITORY FOR SPENT FUEL OR HIGH-LEVEL RADIOACTIVE WASTE

"Section 3116(a) of the NDAA provides in pertinent part:

"[T]he term "high-level radioactive waste" does not include radioactive waste resulting from the reprocessing of

[24] TANK WASTE RETRIEVAL, PROCESSING, AND ON-SITE DISPOSAL AT THREE DEPARTMENT OF ENERGY SITES F I N A L R E P O R T, Committee on the Management of Certain Radioactive Waste Streams Stored in Tanks at Three Department of Energy Sites Nuclear and Radiation Studies Board Division on Earth and Life Studies, 2006 by the National Academy of Sciences. Hereinafter called NAS 2006, Pg. 28. " Foot note 16; The first official document referring to "waste incidental to reprocessing" is the provisions of DOE Manual 435.1 concerning determining whether DOE tank waste is not HLW. "Incidental" waste is mentioned in a March 4, 1993 Federal Register Notice in which the USNRC set forth criteria for determining that waste from Hanford double-shell tanks disposed of in a grout facility would not be HLW. USNRC found that the principles for waste classification are well established, endorsing the criteria DOE later used in Order 435.1 (NRC, 2005b; see also Bernero, 1993)."

[25] NAS 2006, Pgs. 28 & 29. It must be noted the NRC gave DOE a pass on tan HLW was by allowing grout dilution to meet the < GTCC waste category that is illegal by EPA prohibition of dilution in place of treatment – see section 3 below.

[26] NAS 2006, Pgs. 28 & 29.

spent nuclear fuel that the Secretary of Energy …, in consultation with the Nuclear Regulatory Commission …, determines—

"(1) does not require permanent isolation in a deep geologic repository for spent fuel or high-level radioactive waste." "Under Section 3116(a), certain wastes from reprocessing are not "high-level radioactive waste" if the Secretary, in consultation with the NRC, determines that certain criteria are met. Section 3116(a) sets out two specific criteria in Clauses (2) and (3). Clause (2) requires the DOE to remove highly radioactive radionuclides to the maximum extent practical. Clause (3) generally mirrors the criteria that the NRC has established for determining whether waste qualifies for land disposal as LLW (see 10 CFR 61.55 and 61.58). This clause provides that disposal of the waste must meet the NRC performance objectives of 10 CFR 61, Subpart C, and that the waste must not exceed the concentration levels for Class C waste in 10 CFR 61.55 or the Secretary must consult with NRC concerning DOE's disposal plans." [27] [emphasis added]

EDI documents in this comment/report how DOE is violating Nuclear Policy Act (NWPA), PL 108–375 Section 3116, 1995 Settlement Agreement and Consent Order, [28] subsequent Agreements with the State of Idaho [29] and other related environmental statutes at INL. Among DOE's violations are 10 CFR 61.50, [30] 40 CFR 268.3, [31] and 40 CFR 148.20. [32] DOE is clearly having a waste constipation problem that leaves onsite disposal and the Waste Isolation Pilot Project (WIPP) dump option their solution; as opposed to legally disposing HLW in a deep geological repository designed and permitted by NRC/EPA for HLW. This WIPP disposal option is however blocked. The WIPP Permit, issued by the New Mexico Environment Department, with legal jurisdiction has the following crucial provision:

"Section 2.3.3.8. Excluded Waste:
TRU mixed waste that has ever been managed as high-level waste and waste from tanks specified in Permit Attachment C are not acceptable at WIPP unless specifically approved through a Class 3 permit modification." Permit Attachment C lists all of the tanks at Hanford, INL, and SRS. Class 3 permit modifications include public hearing and judicial review." [emphasis added]

What Idahoans legitimately fear is this HLW will continue to be interned in Idaho in near-surface dumps/tanks – essentially a continuation of historical DOE waste miss-management. These comments discuss these issues in detail because they have been occurring since 1945 and re-implemented in 2005 thus resulting a cumulative (>60 yr.) environmental disaster.

Section 3116 states: "Notwithstanding the provisions of the Nuclear Waste Policy Act of 1982" thus acknowledging the ongoing Congressional validity of the Act. EDI poses the following questions with respect to DOE reclassification of high-level waste (HLW) that deserve consideration by DOE due to the significant violation of established governing statute but more importantly the resulting hazardous environmental health and safety consequences on Idahoans.

1. Is DOE exceeding its authority and violating the NWPA?

Judge B.Lynn Winmill, Chief Judge U.S. District Court for Idaho, July 2, 2003 states yes:

"While DOE has the authority to 'fill any gap left…by Congress,'…it does not have the authority 'to adopt a policy that directly conflicts with its governing statute.'…

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[27] Basis for Section 3116 Determination for the Idaho Nuclear Technology and Engineering Center Tank Farm Facility, November 2006, Revision 0, Pg. 45, DOE/NE-ID-11226

[28] 1995 Settlement Agreement, The State of Idaho, through the Attorney General, and Governor Philip E. Batt in his official capacity; the Department of Energy, through the General Counsel and Assistant Secretary for Environmental Management; and the Department of the Navy, through the General Counsel and Director, Naval Nuclear Propulsion Program, hereby agree on this 16th day of October, 1995, to the following terms and conditions to fully resolve all issues in the actions Public Service Co. of Colorado v. Batt, No. CV 91-0035-S-EJL (D. Id.) and United States v. Batt, No.CV-91-0065-S-EJL (D. Id.), Pgs. 2&3. Hereinafter, 1995 Settlement Agreement.

[29] See below: SECTION 4 below Radioactive Waste Management Complex (RWMC) for details on revisions to the 1995 Settlement Agreement.

[30] NRC 10 CFR 61.50 Land Disposal Restrictions of radioactive waste that is discussed in Section 3 below.

[31] EPA 40 CFR 268.3 Dilution Prohibition for Treatment of waste that is discussed in Section 3 below.

[32] EPA 40 CFR 148.20 requirement to demonstrate that, to a reasonable degree of certainty, there will be no migration of hazardous constituents from the disposal zone for as long as the waste remains hazardous. This demonstration requires a showing that: (1) The hydrogeological and geochemical conditions at the sites and the physiochemical nature of the waste stream(s) are such that reliable predictions can be made that: (i) Fluid movement conditions are such that the waste fluids will not migrate within 10,000 years.

DOE's Order 435.1 directly conflicts with the NWPA's definition of HLW. NWPA's definition pays no heed to techical or economic constraints in waste treatmet. Moreover, NWPA does not delegate to DOE the authority to estblish 'alternative requirements for solid waste.' Because Congress has spoken to that subject "that is the end of this matter,' leaving no room for 'alternative requirements'" [33] [[Pg. 12]

2. Does NWPA permit DOE to permanently intern HLW including tank sediments "heels" at INL? Again Judge Winmill states No:

"In this case, Congress defined HLW in NWPA as 'highly radioactive material resulting from the reprocessing of spent nuclear fuel.' Congress then used the word 'including' to signal that what followed were examples designed to illustrate the definition just given. The two examples designated to illustrate the definition just given. The two examples are (1) 'liquid waste produced directly in reprocessing'; and (2) 'solid material derived from such liquid waste that contains fission products in sufficient concentrations.'"

"These two examples neatly cover the manner in which the waste separates in the tanks over time. As discussed above, the solids sink to the bottom, forming a sludge, leaving the liquids on top. This physical separations is analogous to the NWPA's definitional separation: The liquid and solids are treated differently by the Act. While NWPA allows DOE to treat the solids to remove fission product, thereby permitting reclassification of the waste, NWPA does not offer the option of reclassification for liquid waste produced directly in reprocessing." [Pg.10]

"NWPA's definition of HLW considers the source of the waste and, in the case of solids derived from liquid waste, its hazard. It is undisputed that the waste stored at Hanford, INEEL, and Savannah River is highly radioactive and the result of reprocessing. No solids are yet been extracted from the liquid waste at those sites and treated to reduce fission products. Thus, the waste at issue in this case falls within NWPA's definition of HLW." [34] [Pg.11] [emphasis added]

3. Does Idaho allow DOE to leave HLW (including calcine [35]) permanently at INL? The Settlement Agreement/Consent Order between Idaho and DOE states NO:

Section "E. Treatment and Transfer of Existing Wastes at INEL: 1. Treatment Commitment. DOE agrees to treat spent fuel, high-level waste, and transuranic wastes in Idaho requiring treatment so as to permit ultimate disposal outside the State of Idaho." [36] [Settlement Agreement, Pg. 5]

4. DOE does NOT have the authority to consolidate HLW irradiated fuel because it is illegal and not allowed under federal law until there is a permanent repository operating. [37] Robert Alvarez's 6/9/12 report "D.C. Court of Appeals Overturns NRC's Waste Confidence Decision" states:

"The discussion on the risks of spent nuclear fuel (SNF) in commercial nuclear power facilities also applies to Department of Energy (DOE) SNF storage pools at the Idaho National Laboratory and other DOE sites where "re-racking" of SNF to conserve space has increased the risk of a major accident in Advanced Test Reactor SNF canal and INTEC CPP-666. DOE states: "This underwater storage facility (in Building 666) contains spent fuel from nuclear reactors. Almost all of the fuel stored here is from nuclear submarines and nuclear surface ships of the U.S. Navy. "There are 4 main storage pools (one is not visible in this photo). The individual fuel storage vaults can just be seen in the foreground. To the left and rear are transfer channels for moving the spent fuel in and out of the pools. This facility is the newest and most modern at INL. "This facility was designed to store spent fuel *temporarily* until the fuel rods could be reprocessed to extract residual uranium. The uranium was then reused for weapons programs. When reprocessing was halted in 1992, this facility became a de facto *permanent* storage facility. Spent fuel continues to come in from the Navy, but nothing leaves because there is no place for it to go. As a consequence, this pool is now filled to its design capacity and additional fuel vaults are being 'over-stacked'."

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[33] B.Lynn Winmill, Chief Judge U.S. District Court for Idaho, July 2, 2003, Memorandum Decision in NRDC v. DOE, Civ. No. 01-0413-S-BLM, pg. 12.

[34] B.Lynn Winmill, Chief Judge U.S. District Court for Idaho, July 2, 2003, Memorandum Decision in NRDC v. DOE, Civ. No. 01-0413-S-BLM, pg. 11.
Also see Settlement Agreement/Consent Order that states: "3. DOE shall treat all high-level waste currently at INEL so that it is ready to be moved out of Idaho for disposal by a target date of 2035." Pg.3

[35] Calcine is a granular solid; the product of incinerating (in the Waste Calcine Facility and the New Waste Calcine Facility) HLW liquid waste into a solid stored at INL in underground bins. The calcine waste is discussed in detail in Section 2.

[36] 1995 Settlement Agreement, Pg.5. Section III Radioactive Waste Management Complex below discusses the subsequent revisions to the 1995 Agreement all of which acknowledge the ongoing validity of the 1995 Agreement.

[37] Environmental Defense Institute's comment submittal on the Consent-based Approach for Siting Storage for the nation's Nuclear Waste, July 31, 2016. http://www.environmental-defense- institute.org/publications/EDIXConsentFinal.pdf

The Department of Energy's two repository approach announced in 2015 are rarely mentioned but it designates one repository for commercial spent nuclear fuel and another for DOE spent fuel and high-level waste. [38] DOE's consent-based approach for a new HLW repository has disappeared. [39]

This year, the administration proposed funding to attempt to revive Yucca Mountain, but a Senate bill put forth in July 2018 left out this funding. [40] Idaho should be paying attention to whether or not Yucca Mountain - even if attempts to revive it - survive, or would it actually accept spent fuel and high-level waste from INL since current inventory of commercial (that gets priority over DOE) SNF will nearly fill it today. Without a disposal pathway, HLW will continue to remain in Idaho regardless of Court Orders.

5. Can DOE be challenged in court on its HLW reclassifying policy?

US Federal District Court for District of Idaho ordered 3/6/06 states yes:

> "The National Resources Defense Council (NRDC) has filed a brief describing various actions of the Department of Energy (DOE). However, none of those actions are final as required by the Ninth Circuit in this case. If they become final, the NRDC retains the right to challenge them in a new lawsuit. However, this lawsuit is governed by the Ninth Circuit's decision that directed this Court to dismiss this action." [41] [42]

6. Can DOE be challenged in the Ninth Circuit Court on its HLW policy?

Judge B. Lynn Minmill, Chief Judge, US District Court, August 9, 2002 states **yes:**

> "This case was transferred to this Court by the Ninth Circuit. *See NRDC v. Abraham, 244 F.3d 742 (9th Cir. 2001).* In its opinion, the Circuit found that it lacked original or exclusive jurisdiction under 42 U.S.C. ss 10139 to entertain Plaintiffs' claims because the decision by the DOE in promulgating Order 435.1 was not made pursuant to the Nuclear Waste Policy Act 42 U.S.C. ss 10101 et seq. See is.at 747. However the Ninth Circuit expressly noted that issues relating to standing, ripeness, and the merits of the Plaintiff's claims must be decided by this Court. *See id.*" [pg2]
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> "Moreover, delaying review of Order 435.1 until the DOE makes a site specific decision conformance with the Order may cause substantial harm. Tank closures, once undertaken, aren't readily altered and future judicial review may therefore be foreclosed until it is too late. [FN 5] [emphasis added]
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> Foot note 5 "The Court notes that council for Plaintiffs suggested during oral arguments that the closure of two tanks at SRS occurred under circumstances in which they were unable to bring a timely action to obtain judicial review of that decision." [pg.7]
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> "The Court need not wait until a threatening injury comes to fruition before undertaking judicial review. This is particularly true where the DOE Order has the force of law and requires immediate compliance by DOE facilities as well as DOE contractors. In such a case, a justiciable controversy exists that is ripe for review, because the Court can 'firmly predict' the result that would occur through the application of Order 435.1. ('One does not have to await the consummation of threatened injury to obtain preventive relief. If the injury s certainly impending, that is enough.')" [pg.8] [emphasis added]
>
> "In short, the Court concludes that there is a clear indication of the hardship that plaintiffs and the intervenors will suffer if review is delayed, there is no indication that undertaking judicial review at this jucture would interfere

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[38] U.S. Nuclear Waste Technical Review Board, Management of U.S. Department of Energy Spent Nuclear Fuel, Report to the United States Congress and the Secretary of Energy, December 2017. "**Nuclear Waste Policy Act** The federal statute enacted in 1982 that establishes both the Federal Government's responsibility to provide a place for the permanent disposal of high-level radioactive waste and spent nuclear fuel, and the nuclear power generators' responsibility to bear the costs of permanently disposing of commercial spent nuclear fuel. Amendments to the Act in 1987 limited the Federal Government's site characterization activities to a possible geologic repository at Yucca Mountain, Nevada. The Act provides for extensive state, tribal, and public participation in the planning and development of permanent repositories." [Pg.180] "Finding: DOE's aging management programs are not fully implemented. Some DOE SNF storage facilities lack aging management programs to facilitate retrieving stored SNF and packaging it into multi-purpose canisters needed to transport it to either a centralized interim storage facility or a permanent repository." [Pg.7&8]

[39] EDI's 2016 comments on the consent-based siting of permanent and interim spent nuclear fuel storage and disposal facilities. http://www.environmental-defense-institute.org/publications/EDIXConsentFinal.pdf

[40] Brief overview of issues on H.R. 3053 on Donna Gilmore's website: https://sanonofresafety.org/

[41] US Federal District Court for District of Idaho in NRDC v. DOE, Case 1:01-cv-00413-BLW, Document 125 Filed 03/06/2006, Page 2 of 2

[42] High-Level Waste/Sodium-Bearing Waste Discussions -Keith Lockie/Arlin Olson, Baird McNaught, National Academy of Sciences, Review Meetings -Idaho Falls, Idaho, December 3, 2003

with subsequent agency action, and the Court perceives no benefit which would be obtained by allowing further factual development of the issues involved. Under such circumstaces, the Court concludes that Order 435.1 and its mandate that all DOE contractors and entities comply with its provisions, are ripe for jucicial review." [pg.8]

"Conclusion: Therefore, pursuant to its review authority under 5 U.S.C. ss 704 & 706, the Court will deny the Defendants' [DOE] Motion to Dismiss. However, indenying the Defendants' motion the Court makes no ruling as to the merits of Plaintiffs' [NRDC] claims." [43] [Pg.14] [emphasis added].

In 2005 when DOE announced its "Notice of Preferred Sodium Bearing Waste Treatment Technology" it stated:

"The Final EIS contains an evaluation of reasonable alternatives for the management of mixed transuranic waste/sodium bearing waste (SBW)…

"The Final EIS refers to SBW as mixed transuranic waste/SBW. However, a determination that SBW is transuranic waste has not been made."

"In the Final EIS DOE did not identify a preferred treatment technology for SBW from among the several technology options evaluated." [emphasis added]

"SBW is a liquid mixed radioactive waste (contains hazardous and radioactive constituents) produced primarily from INTEC decontamination and cleanup activities. SBW also includes approximately one percent (by volume) commingled 1st cycle reprocessing waste, approximately two percent 2nd cycle reprocessing waste, and approximately four percent 3rd cycle reprocessing waste. SBW contains large quantities of sodium and potassium nitrates; however, the radionuclide concentrations for liquid SBW are generally ten to 1,000 times less than for liquid HLW." [emphasis added]

"In 1992, DOE entered into a Notice of Noncompliance Consent Order with the State of Idaho Department of Environmental Quality and the Environmental Protection Agency that requires DOE to cease use of the tanks in which the SBW is stored by December 31, 2012.

"In 1995, DOE and the State of Idaho entered into a settlement agreement that resolved litigation and that established dates for the treatment of approximately 900,000 gallons of liquid SBW stored at INTEC." [44]

It is crucial to note in the above DOE Notice it states: "SBW is a liquid mixed radioactive waste (contains hazardous and radioactive constituents) produced primarily from INTEC decontamination and cleanup activities. SBW also includes approximately one percent (by volume) commingled 1st cycle reprocessing waste, approximately two percent 2nd cycle reprocessing waste, and approximately four percent 3rd cycle reprocessing waste." [45] See Section 3 below for more details on this issue. The State of Idaho got suckered into believing DOE estimates on the % of HLW sediments left in the tanks after being "emptied" (per Settlement Agreement) and that DOE would follow through with its promises to ship the treated SBW to WIPP and thus fulfill the Agreement with Idaho. and disregarded the Nuclear Waste Policy Act's definition of HLW. Again Judge Winmill states:

"In this case, Congress defined HLW in NWPA as 'highly radioactive material resulting from the reprocessing of spent nuclear fuel.' Congress then used the word 'including' to signal that what followed were examples designed to illustrate the definition just given. The two examples designated to illustrate the definition just given. The two examples are (1) 'liquid waste produced directly in reprocessing'; and (2) 'solid material derived from such liquid waste that contains fission products in sufficient concentrations.'"

"These two examples neatly cover the manner in which the waste separates in the tanks over time. As discussed above, the solids sink to the bottom, forming a sludge, leaving the liquids on top. This physical separations is analogous to the NWPA's definitional separation: The liquid and solids are treated differently by the Act. While NWPA allows DOE to treat the solids to remove fission product, thereby permitting reclassification of the waste, NWPA does not offer the option of reclassification for liquid waste produced directly in reprocessing." [Pg.10]

"NWPA's definition of HLW considers the source of the waste and, in the case of solids derived from liquid waste, its hazard. It is undisputed that the waste stored at Hanford, INEEL, and Savannah River is highly radioactive and the result of reprocessing. No solids are yet been extracted from the liquid waste at those sites and

[43] Judge B. Lynn Minmill, Chief Judge, US District Court, August 9, 2002

[44] Notice of Preferred Sodium Bearing Waste Treatment Technology, Federal Register /Vol. 70, No. 148 /Wednesday, August 3, 2005 /Notices, DEPARTMENT OF ENERGY Office of Environmental Management.

[45] Independent Oversight Review of the Sodium Bearing Waste Treatment Project-Integrated Waste Treatment Unit Contractor Operational Readiness Review June 2012,

treated to reduce fission products. Thus, the waste at issue in this case falls within NWPA's definition of HLW." [46] [Pg.11]

The State of Idaho again got fooled by DOE because WIPP's Waste Acceptance Criteria (WAC) specifically prohibits any waste derived from HLW [47] which by DOE's own definition is: "SBW also includes approximately one percent (by volume) commingled 1st cycle reprocessing waste, approximately two percent 2nd cycle reprocessing waste, and approximately four percent 3rd cycle reprocessing waste." [48] By definition $1^{st}/2^{nd}$ cycle sediment is HLW. DOE pumped out most of the 11 SBW tanks and grouted [49] the remaining waste permanently in place for ever. We discuss details about the contents of the liquid/solids grouted in the tanks and how inadequate the grout is in isolating the waste in Section 3 below. According to the Nuclear Regulatory Commission analysis of INL's SBW tank closure, [50] uses Performance Assessments (PA) full of inadequately evaluated assumptions and inadequate technical basis yet approved DOE Idaho's PA.

Table 1. Highly Radioactive Radionuclides Removed From 7 Tanks and Ancillary Equipment [51]

Total Liquid Waste Generated at INL Ci	Residual Waste Remaining in 7 Closed Tanks
3.59×10^{7} [**35,900,000**] Curies	2.48×10^{4} [**24,800**] Curies

The above SBW contains significant quantities of long-livedAm-241, Ba-137m, Np-237, Pu-238, Pu-239, Pu-240, Pu-241, Pu-242 from 1^{st} cycle HLW SNF reprocessing. INTEC soil and groundwater is already contaminated above EPA MCL, so adding more is unconscionable. "The estimated sludge volumes are 39 m3 (10,200 gal.) in tank WM-183, 20.4 m3 (5,400 gal.) in tanks WM-180, -181, -182, -184, -185, -186, and 2.3 m3 (600 gal.) in tanks WM-187, -188, and -189 for a total volume of 168 m3 (44,400 gal.). Radiochemical analysis of solids from tank WN-182 showed that the TRU nuclide total is 21,640 nCi/g and the total radionuclide activity is 2.6 MCi/g. Since the solid particles exceed the 100 nCi/g TRU limit; the waste must be retrieved." [52] That's not only HLW but also Greater-than-Class C waste that is still illegal to dump in near-surface! "The tank farm sludge is 25 volume % solids particles and 75 volume % interstitial liquid. The particle density is 2000 kg/m3; the liquid density is 1200 kg/m3; and the sludge bulk density is 1400 kg/m3." [53] [pg3.2] DOE can call it whatever it wants,

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[46] B.Lynn Winmill, Chief Judge U.S. District Court for Idaho, July 2, 2003, Memorandum Decision in NRDC v. DOE, Civ. No. 01-0413-S-BLM, pg. 11.
Also see Settlement Agreement/Consent Order that states: "3. DOE shall treat all high-level waste currently at INEL so that it is ready to be moved out of Idaho for disposal by a target date of 2035." Pg.3

[47] New Mexico WIPP Permit "Section 2.3.3.8. Excluded Waste: TRU mixed waste that has ever been managed as high-level waste and waste from tanks specified in Permit Attachment C are not acceptable at WIPP unless specifically approved through a Class 3 permit modification." Permit Attachment C lists all of the tanks at Hanford, INL, and SRS.

[48] Office of Safety and Emergency Management Evaluations Office of Enforcement and Oversight Office of Health, Safety and Security U.S. Department of Energy.

[49] Grouting is the process of adding a concrete-like material on top of the remaining HLW in the tanks after being pumped to the "maximum extent economically practical." The reality is the remaining sediments are extensive - as discussed below.

[50] U. S. NUCLEAR REGULATORY COMMISSION TECHNICAL EVALUATION REPORT FOR THE U.S. DEPARTMENT OF ENERGY IDAHO NATIONAL LABORATORY SITE DRAFT SECTION 3116 WASTE DETERMINATION FOR IDAHO NUCLEAR TECHNOLOGY AND ENGINEERING CENTER TANK FARM FACILITY, Table 3, October 2006. Hereinafter NRC, 2006. https://www.nrc.gov/docs/ML0624/ML062490142.pdf

[51] Closed/grouted tanks included in this table include 4 (30,000 gal)(VES-104 through 106) and 7 (300,000 gal)(WM-180 through 186) tanks in INL/INTEC Tank Farm as of 2018.

[52] Technical Review of Retrieval and Closure Plans for the INEEL INTEC Tank Farm Facility, September 2001, Prepared for the U.S. Department of Energy, Pg. 3.1, PNNL-13651 UC-721. Hereinafter PNNL-13651.

[53] PNNL-13651, Pg. 3.2.

but it is still HLW by Congressional NWPA Statute. See Section 3 below for details on tank sediments including independent analysis of how much of the sediments were left in the tanks.

7. Is NEPA and/or CERCLA working as intended to address DOE's HLW/TRU waste mismanagement and environmental degradation?

Ultimately DOE continues to abuse the National Environmental Policy Act (NEPA) process by routinely and repeatedly ignoring State/public comments, no matter how reasoned, and no matter how supported by science and facts because they are self-regulated. NEPA needs to require DOE and other agencies to directly answer with technical justification each question asked or challenge made. When they cannot, they must resolve the underlying issue or risk the health and safety of future generations.

The whole risk assessment and public process is irreparably broken. The risk assessment process is subject to fiddling and fudging in myriad ways (estimates, bogus assumptions in models, etc.). As a result, the agencies can bury their desires in a warped process to get any outcome they desire. It is not in any way an honest process. And it isn't a process that gets to truth. Thus, reclassifying HLW to lesser waste category (i.e. reclassify) waste has significant environmental consequences. Since DOE is able to leave it in INL's shallow dumps rather than shipping to the requisite (under the NWPA) HLW geologic repository it saves money. DOE claims CERCLA is not a requirement for implementing current policy:

> **"**Section 3116 is not dependent on the independent process under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 USC 9601 et seq. 1980) and does not provide a basis for any new authority, responsibility, or obligation for DOE or any other entity with respect to the CERCLA process or otherwise affect the CERCLA process. Decisions regarding past releases of contaminants and the impacts of contaminated soils associated with the [Tank Farm Facility]TFF will be addressed under the CERCLA process as specified in the Federal Facility Agreement and Consent Order among DOE, the State of Idaho, and the U.S. Environmental Protection Agency (EPA) (State of Idaho et al. 1991)." [54] [pg.3] [emphasis added]

DOE/INL's HLW INTEC tank closure plan using the new DOE Order 435.1 policy further compromised the CERCLA cleanup process by changing one word from – "maximum extent *technically to economically* practical." This seemingly minor change made a significant difference in the requirement to utilize the best technology available to clean the HLW tanks to a less expensive economical solution. [55] The implications of leaving the tank solids (heals) [56] are incalculable. DOE considers it too expensive [57] to remove - this most deadly waste – left permanently over Idaho's sole source Snake River Aquifer for millennia (the half-life of the residual tank waste radionuclides).

> "While prior NRC and DOE requirements for waste determinations called for removal "to the maximum extent *technically* and *economically* practical," Section 3116 omits these adverbs, thereby suggesting that a broad range of considerations, including but not limited to technical and economic practicalities, may appropriately be taken into account in determining the extent of removal that is practical." [58] [emphasis added]

8. Is DOE going to reclassify calcine HLW processed at INL's Integrated Waste Treatment Unit as mixed transuranic (MTRU)?

The Integral Waste Treatment Unit (IWTU) slated to treat calcine HLW (after first treating sodium-bearing liquid waste) will produce a granular waste form that will (as planned) be produced by "steam

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[54] DOE/NE-ID-11226, Pg.3.

[55] NRC offered tank sediment extraction solutions but DOE rejected them. See Section 3 below.

[56] "Tank heel" means the liquid/solid level remaining in each tank after lowering the level to the greatest extent possible by using existing transfer equipment, such as steam jets. See SECTION 3 below for more information on how much of the tank heels and the curie contents are left in the tanks.

[57] "At the Idaho National Laboratory, waste has been retrieved from seven 1136 m3 (300,000-gallon) tanks and four 114 m3 (30,000-gallon) tanks from 2002 to 2005 at a total (development plus operations) of $35 million. This yields an average cost of $7 million per tank." NAS 2006, Pg. 44. This literally is how much Idaho's future is worth to DOE.

[58] Basis for Section 3116 Determination for the Idaho Nuclear Technology and Engineering Center Tank Farm Facility, November 2006, Revision 0, Pg. 48.DOE/NE-ID-11226

reforming" at the IWTU may be reclassified by DOE as other than HLW. [59] The classification of the IWTU Steam Reform Product (1,078.00 cm) [60] is uncertain. According to the DOE supported Energy Communities Alliance:

> " [A]t Idaho, there are 4,400 cubic meters of calcined waste resulting from the reprocessing of spent nuclear navy fuel. This material was derived from the calcination of liquid HLW and converted to a powdery form and placed in the HLW binsets prior to the shutdown of the calciner facility. Today, this waste is considered orphaned because it is not in a borosilicate glass waste form required for disposal at the designated (or at least reference) deep geologic repository at Yucca Mountain. Also, it is currently not considered acceptable for WIPP under the WIPP Land Withdrawal Act (LWA) because it has been managed as HLW. However, as a waste form, it is well suited for WIPP. Current baseline plans call for the adjacent IWTU to be modified to package the waste for transportation to the yet-to-be-developed HLW repository. Development of a WIPP option for these two wastes would eliminate the need for future capital construction activities, regulatory and licensing changes related to the non-glass waste form and indefinite storage at Idaho. [61] [Pg.9] [emphasis added]

DOE will likely again unilaterally reclassified it as mixed hazardous transuranic (MTRU) waste waiting questionable disposal at WIPP. [62] DOE's plan to extract HLW calcine from 7 bin-sets "only to the extent practicable" and then grout the remainder in the tanks again violates the NWPA. Calcine and the IWTU waste products are derived from HLW and thus as the NWPA states: is also HLW. [63] Again Idaho got fooled by DOE because WIPP's Waste Acceptance Criteria (WAC) specifically prohibits any waste derived from HLW. DOE will attempt to show that the IWTU processed calcine has removed as much radioactivity as "practicable" to meet the new NDAA criteria declassifying criteria as MTRU. [64] It remains to be seen if the State Idaho will be able to exercise Section 3116 criteria of "State-approved closure plan or State- issued permit, authority for the approval or issuance of which is conferred on the State." Only former Governor Andrus and Batt - in 1995 - were willing to stand up to DOE's enormous economic and political power notwithstanding the State of Washington at Hanford resistance.

DOE knows full well this waste will remain in Idaho (for no other reason) there is no HLW geologic repository to send it to. The IWTU operability [65] (or its ability to treat both SBW and the calcine) remains-so-uncertain as to have no operational schedule. [66] EDI discusses this and DOE's missed 1995 Settlement Agreement milestones including preparing the calcine HLW for "road-ready" transport out of

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[59] CALCINED HIGH-LEVEL RADIOACTIVE WASTE, U.S. NUCLEAR WASTE TECHNICAL REVIEW BOARD, MARCH, 2016

[60] Idaho National Laboratory Site Treatment Plan, November 2016, INL-STP Rev. 36A, Pg. 4-10. Hereinafter called INL STP 2016, Pg. 4-10.

[61] Waste Disposition: A New Approach to DOE's Waste Management Must Be Pursued September 2017, Energy Communities Alliance, pg. 9.

[62] WIPP's waste acceptance code (WAC) prohibits any waste derived from reprocessing SNF.

[63] RCRA PART B PERMIT REAPPLICATION FOR THE IDAHO NATIONAL LABORATORY Volume 22 Idaho Nuclear Technology and Engineering Center Calcined Solids Storage Facility, Attachment 2 - Section C Waste Characteristics, May 2016

[64] "Section 3116(a) sets out two specific criteria in Clauses (2) and (3). Clause (2) requires the DOE to remove highly radioactive radionuclides to the maximum extent practical. Clause (3) generally mirrors the criteria that the NRC has established for determining whether waste qualifies for land disposal as LLW (see 10 CFR 61.55 and 61.58). This clause provides that disposal of the waste must meet the NRC performance objectives of 10 CFR 61, Subpart C, and that the waste must not exceed the concentration levels for Class C waste in 10 CFR 61.55 or the Secretary must consult with NRC concerning DOE's disposal plans." " The definition of practical will end up the big issue debated.

[65] Environmental Defense Institute, Preliminary Comments on U.S. Department of Energy Class 3 Modified Permit to the Volume 14 for the Idaho Nuclear Technology and Engineering Center (INTEC) at the Idaho National Laboratory, Permit Number EPA ID No. ID4890008952I INTEC Liquid Waste Management System and the Integrated Waste Treatment Unit. IDEQ Public Notice of Intent 6/28/13 to approve Class 3 Permit Modifications of Volume14, Docket Number 10HW-1320 August 2013.
http://www.environmental-defense-institute.org/publications/EDI%20Permit.Mod.Com.IWTU.A%20(6-Short)%20(Autosaved).pdf

[66] DOE contractor has been trying for over 7 years to get the IWTU operational without success and millions $ spent.

Idaho. See Section 2 below for more details.

9. What is DOE's plan for (formerly HLW) SNF reprocessing liquid waste in INL tanks?

DOE generated 53,900,000 Ci [67] of high-level liquid waste (HLLW) from reprocessing SNF stored in 11 tanks at INTEC underground Tank Farm Facility (TFF). DOE renamed ~900,000 gal. (3,222.14 cm) [68] of this tank waste as "sodium-bearing waste" (SBW); also called "waste incidental to reprocessing" (WIR) as the first step in reclassifying it as a MTRU for treatment at the INTEC/IWTU and disposal at WIPP. DOE's unilateral "illegal" decision to reclassify SBW generated the NRDC law suit discussed earlier that ended up in default in the US 9th Circuit Court of Appeals. Now that DOE has closed 11 previously HLW tanks at INL, (and many more at DOE Savannah River Site and Hanford) the issue is now "ripe" to re-litigate. NRDC and other environmental groups (including EDI) intend to go back to court and defend the NWPA. In other words, INL will continue to be a defacto HLW dump due to the 7 tanks already grouted and closed. But the waste from those 7 "cleaned" tanks got transferred to the remaining 4 open tanks (WM- 187 through WM-190) that DOE intends to grout and close after most of the waste is processed in the INTEC/IWTU assuming it ever operates. Given how much deadly waste was left in the 11 closed tanks, we can expect a repeat disaster for the remaining 4 tanks. [69] "The existing steam jets are used to remove slurry from the tanks. At the end of steam jet operation, a fluid heel remains in the tanks. Current tank transfer equipment leaves a heel approximately 7.6 to 25 cm (3 to 10 in.) in depth." [70] [pg3.2] Leaving this tank waste permanently in place violates "Subpart D—Technical Requirements for Land Disposal Facilities: 10 CFR 61.50 Disposal site suitability requirements for land disposal."

Additionally, PNNL's report discussed in Section 3 below shows the tank TRU heels have 21, 640 nCi/g represents the fact that this waste is not only HLW but also greater-than-class C waste that violates NDAA criteria for near-surface disposal and thus requiring deep geological burial. "Radiochemical analysis of solids from tank WN-182 showed that the TRU nuclide total is 21,640 nCi/g and the total radionuclide activity is 2.6 MCi/g [2.6 million Ci/g]. Since the solid particles exceed the 100 nCi/g TRU limit; the waste must be retrieved." [71] [PNNL-13651 UC-721, Pg. 3.1]

Robert Alvarez report shows: "The high Cesium-137 (half-life of 30 yr.) in INTEC tanks WM-180 (2,070 Ci), WM-181 (2,539 Ci) WM-182 (3,490 Ci), WM-183 (13,721 Ci), WM-187 (75,200 Ci), WM-188 (26,200 Ci) or a total of 123,220 Curies adds to the hazard. This waste falls into the Greater-Than-Class C Nuclear Regulatory Commission regulations (10 CFR Part 72.3) as low-level waste that exceeds the concentration limits established for Class C waste in (10 CFR Part 61.55)." [72]

The extreme differences between various technical reviews of the amount of tank residuals (heels) permanently left/grouted has significant impact on what will continue to migrate into the underlying aquifer and how regulators/public will prevent DOE from closing the remaining 3 tanks using the same illegal policy.

The Nuclear Regulatory Commission (NRC) generated a Technical Evaluation Report to assess whether DOE meet the National Defense Authorization Act (NDAA) criteria to grout/close the SBW tanks discussed in detail in Section 3 below. NRC dismisses outright the whole NWPA definition of HLW stating: "only DOE can define HLW requiring deep geological disposal."

NRC's Report shows how much the Commission relied on DOE's "estimates" without basis in

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[67] NRC 2006, Table 4, Pg. 47.

[68] INL-STP Rev. 36A, Pg. 4-10.

[69] Office of Safety and Emergency Management Evaluations Office of Enforcement and Oversight Office of Health, Safety and Security U.S. Department of Energy, Pg. 3.

[70] PNNL-13651 UC-721, Pg. 3.2.

[71] PNNL-13651 UC-721, Pg. 3.1

[72] Robert Alvarez, Institute for Policy Studies report; "It's been 26 years since the Chernobyl accident."

sampling data and how these estimates were then used in modeling assumptions – further distorting actual tank waste characteristics. Therefore the NRC's conclusions are based holly on unsupported DOE data. Congress, State regulators and the public must not rely on their conclusions. However to NRC's credit their report contains valuable assessments on the deficiencies of DOE's Tank Farm Performance Assessment (PA) closure policy and warnings not to repeat the same operations on the remaining 4 tanks yet operating. Below EDI highlights (underlines) issues NRC points out as deficient in DOE's PA justification for meeting the 3 NDAA criteria.

NRC has no official regulatory authority over DOE operations however Congress has given it consultation authorization on nuclear waste issues. In realty NRC is not an effective regulatory agency but rather a nuclear power proponent and its conclusions reflect the Executive Branches policy.

> "Large Tank Inventory: The highest measured radionuclide concentrations from tanks WM–182, WM–183, and WM–188, recently sampled at the time the PA [Performance Assessment] for the Tank Farm Facility (TFF) was written, were used for the worst-case inventory. Tank WM–188 had the highest radionuclide inventory out of these three tanks."
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> It was assumed (because DOE did not provide NRC direct sampling data) that the 7 closed/grouted tanks contain approximately **24,800** Ci. [73] "It was assumed that radionuclide concentrations in the solid materials would be unaffected by tank cleaning and that tank cleaning would only result in limited bulk mass removal (i.e., no removal from dissolution of solids into the large quantity of 'flush' water used to clean the tanks was assumed). Using this approach, tank WM–182 had the highest post-cleaning inventory of **2,394 Ci**." [Pg23] [74]
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> **"**Additionally, tank WM–187 is the holding tank for waste removed from tanks WM–180 through WM–186, so there may be additional challenges with cleaning tank WM–187 due to the accumulation of solids from multiple tanks. DOE Idaho should attempt to sample tanks WM–187 through WM–190 (particularly tanks WM–187 and WM–188) following cleaning operations to ensure that the inventory for these tanks is not significantly underestimated." [75] [pg34][emphasis added]
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> "The sand pads underlying two of the [large 300,000 gal.] tanks (WM–185 and WM–187) were contaminated with first-cycle extraction wastes in 1962 as a result of back-siphoning events with estimated **3,850 Ci** " [76] per tank for a total of 7,700 Ci.

For both the closed tanks and open tanks/Sand Pads sediment residuals of **38,219** curies are left permanently buried in shallow INTEC tanks over the Snake River Aquifer. [77] These issues are laid out in detail in Section 3 below.

DOE's proposed interpretation of HLW goes far beyond incidental wastes to reprocessing; And none of the provisions in that 3116 law will apply, like requiring state approval of the disposal, removing radionuclides to the extent practical, and there won't be any need for consultation with NRC (or the transparency that provided). [78]

Again, this is a violation NWPA that defines HLW (in addition to SNF) as: "(1) liquid waste produced directly in reprocessing; and (2) solid material derived from such liquid waste that contains fission products in sufficient concentrations."

10. Are there high-level waste (HLW) disposal options?

The mythical disposal option for HLW is the deep geological repository at Yucca Mt. in Nevada. The

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[73] NRC 2006, Table 4, Pg. 47

[74] DOE-2006, Pg. 22.

[75] DOE-2006, Pg. 34.

[76] DOE-2006, Pg. 27

[77] High-Level Waste/Sodium-Bearing Waste Discussions -Keith Lockie/Arlin Olson, Baird McNaught, National Academy of Sciences, Review Meetings -Idaho Falls, Idaho, December 3, 2003

[78] DOE-2006, Pg. 111. "OVERALL CONCLUSIONS: It should be noted that NRC staff is providing consultation to DOE as required by the NDAA, and the NRC staff is not providing regulatory approval in this action. DOE is responsible for determining whether the waste is HLW. This NRC staff assessment is a site-specific evaluation and is not a precedent for any future decisions regarding non-HLW or incidental waste determinations at INL or other sites."

big question is "will it ever open"? Nevada says NO! [79] WIPP permit, currently prohibits waste that has been HLW or "waste incidental to reprocessing, thanks to New Mexico's understandable resistance. The document DOE gave the Idaho Citizens Advisory Board, written by the Energy Community Alliance says that DOE wants to reclassify the calcine and the treated sodium bearing waste as TRU and ship it to WIPP in violation of WIPP's NM Permit. Idahoans predict – given DOE history at INL – the new Remote-Handled Waste Disposal Facility will get the HLW. See Section 6 below for details.

Congress refuses to address an alternative for HLW geological repository at Yucca Mt. and the state of Nevada –to date- justifiably refuses to accept the flawed EIS.

11. Ongoing HLW reprocessing of SNF waste at Materials and Fuels Complex and disposal at INL threaten Snake River Aquifer. [80] Tami Thatcher reports: *Past Waste Water Practices at INL Included Dumping Thorium and Uranium into the Aquifer:*

> "The acceptance of direct dumping of thorium and uranium related material following [HLW SNF] separations or examinations processes at the Department of Energy's Hanford facility gives important insight into the dumping practices at Idaho's Department of Energy site, now called the Idaho National Laboratory. There were many U-233 programs at the Idaho site at the Naval Reactors Facility, Test Reactor Area (now the ATR Complex), ANL-W (now the Materials and Fuels Complex), and the Radioactive Waste Management Complex.
>
> "In fact, the thorium and uranium in the Snake River Plain aquifer found by various US Geological Survey reports is not naturally occurring but is there because of radioactive waste disposal into the aquifer by the Department of Energy. [81] For an idea of the radioactive and chemical waste resulting from one DOE facility at the Idaho National Laboratory, see this CERCLA cleanup report and others at the administrative record. [82]
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> "The high levels of gross alpha from uranium and thorium radioactive wastes, along with hexavalent chromium, have long reached Idaho's Magic Valley. The state's drinking water monitoring program has done what is can to pretend this isn't from INL. Experts attending the INL Citizens Advisory Board continue to claim that only a few molecules of contamination can be found south of the INL. This frequently repeated falsehood along with inadequate state oversight ignores the elevated cancers in counties downgradient from the Idaho National Laboratory that are probably because of the chemical and radioactive contaminants in the aquifer from the INL.
>
> "One of the contaminants particular to U-233 production that does not occur otherwise in reactors is the production of contaminant europium-152. While highly enriched U-235 reactor produce europium-154, they do not produce Eu-152." [83]

SECTION 2. Calcined Mixed Hazardous High-level Waste [84] [85] [86]

[79] Gary Martin / Las Vegas Review-Journal Nevada officials brace for new attempt to revive Yucca Mountain October 31, 2018. "Former Sen. Harry Reid, Gov. Brian Sandoval and the current state congressional delegation have effectively blocked development of Yucca Mountain since it was designated by Congress in 1987 as the sole site for permanent nuclear waste disposal."

[80] See Section 6 Materials and Fuels Complex below for more details.

[81] LeRoy L. Knobel et al., US Geological Survey, "Chemical Constituents in the Dissolved and Suspended Fractions of Ground Water From Selected Sites, Idaho National Engineering Laboratory and Vicinity, Idaho, 1989," Report 92-51, March 1992. See Table 19 for USGS well 14 contamination including thorium-232 decay products lead-212 and radium-228. They were mystified by the variations in monitored contaminant levels in the same well. But the variations likely resulted from the stratified contamination levels and variation in mixing the stratified levels during well sampling. http://pubs.er.usgs.gov/usgspubs/ofr/ofr925

[82] See INL CERCLA Cleanup Administrative Record at https://ar.icp.doe.gov and See one report for an idea of contaminants in Department of Energy Idaho Operations Office, "Final Removal Action Report for CPP-601, CPP-602, CPP-627, CPP-630, and CPP-640," DOE/ID-11453, February 2012. See Table 3, p. 19 and 20. *https://ar.icp.doe.gov/images/pdf/201202/20120228007 68BRU.pdf*

[83] Tami Thatcher, Department of Energy Past Waste Water Practices at INL Included Dumping Thorium and Uranium into the Aquifer: They Keep Pretending It's There Naturally, EDI Newsletter December 2016

[84] See Permit (EPA ID No. ID4890008952) (Docket No. 10HW-1604)

[85] David B. McCoy, Preliminary Comments on Calcined Solids Storage Facility Draft Hazardous Waste Management Act Resource Conservation and Recovery Act Storage Facility Partial Permit Renewal for the Idaho Nuclear Technology & Engineering Center on the Idaho National Laboratory To Idaho Department of Environmental Quality Waste and Remediation Division RE: Draft Hazardous Waste Management Act/Resource Conservation and Recovery Act Storage Facility Partial Permit Renewal for the Calcined Solids Storage Facility at the Idaho Nuclear Technology & Engineering Center on the Idaho National Laboratory, EPA ID# ID4890008952 Submitted by Chuck Broscious and David B. McCoy on behalf of the

Calcine Summary

INL's calcite (calcine) waste is clearly high level waste as defined by statute. It is nothing more than solidified SNF reprocessing first cycle raffinate [87] - HLW by definition. DOE may add names to it like greater-than-class C low-level waste (GTCC). That does not change its character nor does it make it something else. DOE lacks regulatory authority to do that. Idaho Department of Environmental Quality (IDEQ) must force DOE (via the NWPA and Consent Order) to start calcine extraction - starting with the oldest Bins that Analysis of Alternatives (AoA) [88] claims may be problematic and to prevent DOE from permanently grouting in place in violation of RCRA and NWPA. The retrieval process must be done regardless of the treatment chosen. Why wait? Because DOE wants to reclassify calcine as GTCC waste not HLW and save money by avoiding the required disposal in a deep geological facility.

Idaho Department of Environmental Quality (IDEQ) and EPA (primary regulatory authorities with jurisdiction over INL) fail to offer the public "in one concise document" what the RCRA permit is required to cover and more importantly what is missing in the Permit. IDEQ must prevent DOE from grouting in-place and reject the 10 year extension of DOE's Calcine Storage Permit and replace it with an annual storage permit based on correcting the following regulatory non-compliance and Settlement Agreement/Consent Order requirements:

1. IDEQ/EPA fail to demand DOE initiate Calcine Retrieval Technology. Calcine waste is high-level Waste (HLW) by the definition given in NWPA and DOE Order 435.1 states in section 1: [89]

> "High-level waste is the highly radioactive waste material resulting from the reprocessing of spent nuclear fuel. High-level waste includes:
> * liquid waste produced directly in reprocessing;
> * any solid material derived from such liquid waste that contains fission products;
> * and other highly radioactive material that requires permanent isolation." (Emphasis provided.)

2. IDEQ has the duty under RCRA, 42 USC § 6901 (b) to avoid risking from the following:

"the placement of inadequate controls on hazardous waste management [that] will result in substantial risks to human health and the environment;

"if hazardous waste management is improperly performed in the first instance, corrective action is likely to be expensive, complex, and time consuming;

"certain classes of land disposal facilities are not capable of assuring long-term containment of certain hazardous wastes, and to avoid substantial risk to human health and the environment, reliance on land disposal should be minimized or eliminated, and land disposal, particularly landfill and surface impoundment, should be the least favored method for managing hazardous wastes."

> "These unaddressed hazards include:
> a. Inadequate flood analysis;

Environmental Defense Institute May 9, 2017 [Rev. S]
http://www.environmental-defense-institute.org/publications/EDI-CSSF-Permit-S.pdf

[86] Tami Thatcher, Public Comment for inclusion in the public record on US Department of Energy (DOE) Application to renew the Calcined Solids Storage Facility Mixed Hazardous Waste Permit (EPA ID No. ID4890008952) (Docket No. 10HW-1604) July 11, 2016. http://www.environmental-defense-institute.org/publications/EDICalcineComments.pdf

[87] Raffinate: The SNF reprocessing involves three cycles. "The second and third fuel reprocessing steps (called the second and third cycles) generated the smallest volumes of waste of the five major waste sources. The second- and third-cycle processes were uranium purification steps and were very similar to each other. The second- and third-cycle processes operated together (in series) and were closely coupled. The second cycle purified the uranium product from the first-cycle process in a liquid extraction system. The second-cycle process produced a purified aqueous uranium product and a waste stream (second-cycle raffinate) containing radioactive contamination. The third cycle was an additional purification step that provided further purification of the second-cycle uranium product in a liquid extraction system, similar to that of the second cycle. The third-cycle process produced a further purified uranium product and a waste stream (third-cycle raffinate) containing radioactive contamination." DOE/NE-ID-11226

[88] U.S. DOE-EM Independent Analysis of Alternatives for Disposition of the Idaho Calcined High-Level Waste Inventory Volume 1-Summary Report, Pg. 1. Hereinafter AOA

[89] **http://energy.gov/sites/prod/files/2013/06/f1/O-435-1_ssm-01.pdf** Page 3

b. Inadequate seismic qualifications;
c. Inadequate accident dose evaluation;
d. Inadequate contaminate migration in soil and aquifer;
e. Inadequate emergency/remediation response in the event of the above a, b, c, and d hazards;
f. Non-existent Current Calcine Bin Set Safety Analysis."

3. The DOE documents presented to IDEQ for RCRA floodplain review present misleading, incomplete, inconsistent facts and conclusions, and fail to comply with the state and/or federal requirements for information to be supplied under the Resource Conservation and Recovery Act (RCRA), the National Environmental Policy Act of 1969 (NEPA) and floodplain/ Wetlands Environmental Review Requirements of 10 CFR 1022 *et seq***.**

The Calcine Permit must be **rejected** until DOE/INL first addresses the immediate potential flood hazard and incorporates sufficient measures to protect the INTEC and other INL facilities as required by Idaho Code §39-4409(5). Specifically, corrective action is required prior to permit approval - as stated in IDEQ's Fact Sheet.

"Corrective Action Determination: Idaho Code §39-4409(5) requires, in accordance with IDAPA 58.01.05.008 [40 CFR § 264.l0l (a)], the owner/operator of a hazardous waste facility to institute corrective action as necessary to protect human health and the environment for all releases of hazardous wastes and hazardous constituents from any solid waste management unit at the facility, regardless of the time at which the waste was placed in the unit."

4. Historical Background

DOE/INL is a major generator of high-level (HLW) radioactive waste since its inception in 1949. DOE and its predecessor have never been willing to appropriately deal with this waste unless forced by Federal Court Order. This background is crucial in understanding this Permit. We discuss this long history of blocking every effort to force waste remediation described below in the RWMC Section.

Waste Stream ID	Waste Stream Name	Current Storage Volume (m^3)	5-Year Generation (m^3)
ID-TEC-173	Sodium-Bearing Waste	3,222.14	0.00
ID-TEC-174	High-Level Waste Calcine Solids	4,386.00	0.00
ID-TEC-176	IWTU Steam Reform Product	0.00	1,078.00
	Total	**7,608.14**	**1,078.00**

Table 4-3. Waste Calcine and Sodium-Bearing Waste (SBW). [90]

DOE's Permit Extension for INL Seven Calcined Solids Storage Facilities EPA/IDEQ must require DOE to follow through with 2002 Idaho High-level Waste & Facilities Disposition FEIS, [91] the 1995 Settlement Agreement Consent Order and its own State of Idaho's Preferred Alternative that States in Pertinent Part:

"The State of Idaho's Preferred Alternative for waste processing is the Direct Vitrification Alternative described in HLW EIS Section 3.1.6. This alternative includes Vitrification of mixed transuranic waste/SBW [formerly called HLW] [92] and Vitrification of the HLW calcine with or without separations. Under the option to vitrify the mixed transuranic waste/SBW and calcine without separations, the mixed transuranic waste/SBW would be retrieved from the INTEC Tank Farm and vitrified. Calcine would be

[90] Idaho National Laboratory Site Treatment Plan, November 2016, INL-STP Rev. 36A, Table 4-3.

[91] Idaho High-level Waste & Facilities Disposition Final Environmental Impact Statement, September 2002, DOE/EIS-0287F. Hereinafter called HLW FEIS.

[92] See Background History discussion below for how DOE used the Federal Circuit Court of Appeals to delay a decision on HLW.

retrieved from the bin sets and vitrified. In both cases, the vitrified product would be stored at INTEC pending disposal in a geologic repository.

"The option to vitrify the mixed transuranic waste/SBW and vitrify the HLW fraction after calcine separations would be selected **if separations were shown to be technically and economically practical.** Mixed transuranic waste/SBW would be retrieved from the INTEC Tank Farm and vitrified.

"In addition, under the Direct Vitrification Alternative, newly generated liquid waste could be vitrified in the same facility as the mixed transuranic waste/SBW, or DOE could construct a separate treatment facility for newly generated liquid waste." [93] [Emphasis added]

What Happened to the State of Idaho's Preferred Direct Verification Waste Processing?

The State of Idaho has allowed DOE to stall implementing "the Direct Vitrification Alternative" for over 40 years (based on the 1977 EISs preferred direct Vitrification) by allowing DOE to attempt to deploy various "separations/steam-reforming treatment" (~17 years) now under construction at the INTEC/Integrated Waste Treatment Unit (IWTU). The "separations" approach to treatment is designed to **maximize** the portion of the waste that can be dumped in the new Remote-Handled Disposal Facility (RHDF) located between INTRC and the Advanced Reactor Complex and **minimize** the portion that must go to a deep geologic repository. [94]

This IWTU process has failed (after numerous attempts) to perform thus far for the 900,000 gallons of formerly liquid high-level waste (LHLW) now illegally reclassified to a less stringent TRU/Sodium-Bearing liquid waste in the INTEC HLW Tank Farm or treating the Calcine. We discuss this legality issue later. DOE falsely claims calcine treatment is contingent on IWTU as a stalling technique to avoid calcine treatment to fulfill Settlement Agreement requirement milestone for "road-ready" material.

DOE's Stalling on Direct Vitrification Using IWTU as Pre-treatment is not Supported by its Own Analysis.

"The ability to re-use existing facilities (i.e., IWTU) will be limited (i.e., cost-prohibitive) for more complex processing technologies (i.e., high temperature and/or high pressure) that involve several steps, especially those that require complete decontamination, dismantlement, and removal of all existing processing equipment, while retaining the structure." [95]

This unnecessarily complicates the treatment process that as we see at both INL and Hanford –do not work and adds to the over-all cost of the project and more delays and millions $ wasted but profitable for INL contractors. [96]

DOE routinely makes one key mistake in treatment design by focusing incessantly on maximizing waste loading in the treated waste logs (i.e., cram as much waste into each log that it compromises its long-term durability). They do this to **minimize** the volume of waste logs and the ultimate disposal cost. They do that to the point of stupidity. If they cut the waste loading, the glass easily maintains consistency and properties. They simply focus on the wrong constraint. As a result they actually **maximize** not minimize the costs (that is good for DOE contractors on cost+ treatment agreement. They make the systems more complex and prone to >decade of failed results.

DOE's Hanford [97] "separations pre-treatment" of its HLLW is another decade's long boondoggle at huge taxpayer expense that is being repeated at INL. The whole "separations treatment" approach has always been about cost cutting and reducing DOE's HLW waste repository constipation crisis caused by

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[93] HLWFEIS, Section B.9.3.3.1

[94] INL/R-HDF is the Remote-Handled Waste Disposal Facility near INTEC also in a flood zone. See NRC 2006 analysis Section 4.2.8.9 Flooding Flow and Transport Simulation, Pg. 86,

[95] U.S. DOE-EM Independent Analysis of Alternatives for Disposition of the Idaho Calcined High-Level Waste Inventory Volume 1- Summary Report, Pg. 27. Hereinafter AoA.

[96] http://agportal-s3bucket.s3.amazonaws.com/uploadedfiles/Another/News/Press_Releases/Hanford-Timeline-V4.pdf

[97] HANFORD FEDERAL FACILITY Richland Operations Office,) AGREEMENT AND CONSENT ORDER Richland, Washington) (EPA Docket Number: 1089-03-04-120 Respondent) Ecology Docket Number: 89-54.

its own incompetence to do the job correctly the first time. [98] Instead of admitting going down the wrong treatment path and moving quickly to implement piolet plant scale "Direct Vitrification," "proof-of-process" projects DOE has wasted billions of scarce EM dollars on bogus separations treatment plants that don't work.

Now DOE is trying to use these self-imposed delays/cost over-runs to use illegal calcine grout-in-place "in-situ entombment" as a cheap solution. [99] DOE is making the same argument for INL HLW tanks that is discussed below in Section 3.

In EDI's view IDEQ must reject the Calcine Storage Permit and replace it with an annual Storage permit based on progress on development of a "Direct Vitrification" piolet plant scale and calcine retrieval development**.**

Idaho must incorporate "lessons-learned" so as not to repeat Hanford full scale rush on unproven designs. Some credible Vitrification studies have already been done but rejected by DOE. [100] Also IDEQ must force DOE (via the Consent Order) to start calcine extraction - starting with oldest Bins that the Analysis of Alternatives (AoA) study claim may be problematic and prevent DOE permanently grouting in place in violation of RCRA and NWPA land disposal restrictions of HLW. [101]

The INTEC Calcine HLW and SBW tanks have never been RCRA compliant, are >54 years old (long past design life) and therefore fail to meet land-disposal restriction in RCRA. DOE must get a variance from IDEQ for continuing Calcine storage. The law states in part:

> "In accordance with 40 CFR 264.193(g), a variance may be obtained from the secondary containment requirements if it can be demonstrated that the alternative design and operating practices, together with location characteristics, will prevent the migration of any hazardous waste or hazardous constituents into the ground water or surface water at least as effectively as secondary containment during the active life of the tank system." [102]

The Calcine Bin Sets fail on all of the 40 CFR 264.193(g), criteria for a variance for the land-disposal "grout-in-place" "in-situ entombment" restriction in RCRA. In fact, the soil and groundwater under INTEC is seriously contaminated after decades of leaks, spills, and waste mismanagement. [103] This chemical and radioactive contamination has migrated in the underlying Snake River Aquifer all the way to the Magic Valley along the Snake River. [104] A typical example of ~ 14 sample Tank Farm (**near Calcine Bins**) locations in Table B-B-1, A-65 summery of years 1954 through 2003 resulted in a total of 1,623.8 cm of recharge through the Tank Farm to the aquifer below. [105]

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[98] United States Government Accountability Office, HANFORD CLEANUP Condition of Tanks May Further Limit DOE's Ability to Respond to Leaks and Intrusions, November 2014 GAO-15-40, Report to the Honorable Ron Wyden, U.S. Senate.

[99] Opportunities Exist to Reduce Risks and Costs by Evaluating Different Waste Treatment Approaches at Hanford DOE Executive Branch GAO-17-306: Published: May 3, 2017. Publicly Released: May 3, 2017.

[100] See: Formulation Efforts for Direct Vitrification of INEEL Blend Calcine Waste Simulate: Fiscal Year 2000, J. V. Crum et.al., Pacific Northwest National Laboratory, Savannah River Technology Center, March 2001, PNNL-13483.

[101] U.S. DOE-EM Independent Analysis of Alternatives for Disposition of the Idaho Calcined High-Level Waste Inventory Volume 1- Summary Report, Pg. 22. Hereinafter AOA

[102] Calcine Permit at D-2f(3)(a)(ii) Proposed Alternate Design and Operation of the Containment System [IDAPA 58.01.05.012 and 58.01.05.008; 40 CFR 270.16(h) and 264.193(g)(1)(ii)]

[103] See EDI's Review of INTEC Tank Farm, Calciner and Groundwater CERCLA Cleanup Plan and Tank Farm Closure Plan, 7/14/16. http://environmental-defense-institute.org/publications/CERCLA.INTEC.pdf

[104] Tritium at 800 pCi/L in the Snake River Plain Aquifer in the Magic Valley at Kimama: Why This Matters by Tami Thatcher, Updated January 5, 2017 http://environmental-defense-institute.org/publications/kimamareport.pdf

[105] DOE/NE-ID-11227, Appendix B.

Table 2: 1995 INTEC (ICPP) Perched Water Well Sample Data [106]

ICPP Well No.		Gross Alpha	Gross Beta	Strontium-90
CPP-55-06	[A]	7,290	191,000	65,600
MW-2 4,	[A]	700	925,000	516,000
MW-5	[A]	520	211,000	110,000
MW-020	[B]	--	---	25,800
MW-010	[B]	-	--	320,000
MW-15	[B]	--	--	17,200

[A] [INEEL-95/0056@2-162] [INEEL-95/0056 @ 5-25]
[B] DOE/ID-10660, pg. 5-67, 5-68 All unites in pico curies/liter (pCi/L)

Table 3: 2002 INTEC Perched Ground Water Sample Data [107]

Contaminate	Concentration	Regulatory Std. (MCL) [108]
Gross Alpha	1,100.00	15
Gross Beta	590,000.00	4 millirem/yr.
Tritium	40,400.00	20,000.00
Strontium-90	136,000.00	8.00
Plutonium-238	0.0501	7.02
Americium-241	0.0374	6.34
Iodine-129	0.650	1.00
Technetium-99	476.00	3,790.00
Uranium-233/234	15.30	13.80
Uranium-235/236 0	0.142	13.80

Table 5 References: Units are pCi/L
* Beta particle/photon radioactivity shall not produce annual dose equivalent to the total body or internal organ greater than 4 mrem per year. If the dominate (gross) beta is strontium-90, the MCL of 8 pCi/L can be used.

The point of including this soil/groundwater contamination is that decisions on the Calcine Bin Storage Permit that **will permit residual post-closure calcine left in the bins** must consider the fact that INTEC is already seriously contaminated - so any new waste mismanagement, leaks, spills are cumulative and therefore must be included in the Permit extension. To use illegal calcine grout-in-place "in-situ entombment" is a violation of 40 CFR-§ 265.114 Disposal or decontamination of equipment, structures and soils that states:

> "During the partial and final closure periods, all contaminated equipment, structures and soil must be properly disposed of, or decontaminated unless specified otherwise in §§ 265.197, 265.228, 265.258, 265.280, or 265.310. By removing all hazardous wastes or hazardous constituents during partial and final closure, the owner or operator may become a generator of hazardous waste and must handle that hazardous waste in accordance with all applicable requirements of part 262 of this chapter."

In the words of former ID Governor Andrus: "The issues [ID] Governor Batt and I are focused on are bigger and far more important: ***what ultimately happens to the significant quantities of nuclear waste already in Idaho, what is DOE's plan to honor commitments already made, and what happens if we agree to take on even more waste?*** DOE and IDEQ owe all of us a real discussion about these questions, followed by real answers." [109] [Emphasis in original]

[106] INEL-95/0056; Waste Area Group 3 Comprehensive Remedial Investigation/Feasibility Study Work Plan (final) Volume 1, August 1995, Lockheed Idaho Technologies Co.; also Chapter 5 OU 3-14 "Nature and Extent of Soil Contamination."
[107] DOE/EIS-0287, Idaho HLW & FD EIS, page 4-52, 4-53 and 4-57.
[108] 40 CFR 140 and 141.
[109] Letter from Cecil D. Andrus, Governor of Idaho (1971-1977 and 1987-1995 and U.S. Secretary of the Interior under President Jimmy Carter from 1977 to 1981), letter dated October 13, 2015.

IDEQ/EPA Fail to Demand DOE Initiate Calcine Retrieval Technology Calcine waste is High-Level Waste by the definition given in DOE Order 435.1 [110]

Calcine Retrieval Technology is Difficult and must not be Delayed any Further

"To date, six [calcined solids storage facilities] CSSFs are being used to store the calcine. Each CSSF design is different in that each CSSF includes a range of three to seven composite bin and sub-bins. In addition to the design differences, each bin includes the following internal obstructions that may hinder the retrieval process: multiple thermos-wells, wall stiffeners, braces, and corrosion coupons. The calcine compositions in these CSSFs vary, depending on feed composition to the calcine. Therefore, the calcine types are layered in the bin-sets; thus, the compositions defined by CSSF are reported as composite composition." [111]

> "Calcine Bin Inventory: Approximately **41 [million curies**] MCi (1.52 x 1018 Bq) of waste,14 nearly all of the liquid waste from reprocessing of spent fuel at the Idaho National Laboratory, had been calcined by May 2000, when the calciner was shut down to comply with a 1999 modification to a notice of noncompliance consent order with the State of Idaho. The composition of the calcine varies depending on the composition of the fuel and its cladding, as well as any chemicals added during reprocessing and calcination. Aluminum- and zirconium-clad fuels yield calcines containing alumina (Al2O3) and zirconia (ZrO2) as major constituents. Hydrofluoric acid was used to dissolve zirconium-clad fuel. Aluminum nitrate was added to the liquid waste to complex the fluoride. Calcium nitrate was added to the waste at the calcining facility (not in the tank farm) to prevent fluoride volatility in the calcination process.
>
> "All of the bins can be accessed from the top through installed risers, except for those in bin set I, which has no access risers. The number of risers varies from one to five per bin. In general, the annular bins have more access risers than do the cylindrical bins. Bin set I is expected to be the most challenging for waste retrieval because there is no installed retrieval access. The bins also contain numerous internal obstructions, such as internally mounted wall stiffeners and bottom braces, which could hinder waste retrieval operations." [112] [pg. 25] [emphasis added]
>
> "It is not clear right now whether the Idaho calcine will be accepted in a deep geologic disposal as is or if it requires further processing. Some Hanford tank waste and the steam-reformed waste from the sodium-bearing waste at Idaho will undergo a waste determination to declare it defense transuranic (TRU) waste and ship it to the Waste Isolation Pilot Plant (WIPP)." [113] [Pg. 14]
>
> "Very few characterization data are available on the calcine at the Idaho National Laboratory because of the high dose levels and the difficulty of reaching the material in the bins. Some of the information that is of current interest, particularly the concentration of long-lived radioactive nuclides and RCRA metals, was not routinely collected at the time of waste generation. Information gaps were filled using process knowledge. The relative error bound for calcine inventory is 14 percent at a 95 percent confidence level.
>
> "A previous National Research Council report (NRC, 1999b) discusses calcine characterization in Idaho bins and points out both the discrepancies among characterization information and the heterogeneity of calcine properties potentially existing in the bins. Moreover, what is known today about the calcine appears to be based on pilot tests with cold surrogates and not on sampling information. For example, the only samples of actual calcine that have been retrieved from bins consist of two core samples collected from the second bin set in 1979. Another calcine sample from the output of the calciner was collected in 1993. The calcination heat source was changed from indirect liquid metal heating to in-bed combustion just around the time this waste was calcined. In-bed combustion generates both oxidizing and reducing chemical environments in different regions, which could affect calcine properties. To date, no samples of calcine produced by in-bed combustion have been retrieved from bins." [114] [Pg26] [emphasis added]

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[110] **http://energy.gov/sites/prod/files/2013/06/f1/O-435-1_ssm-01.pdf** Page 3

[111] Formulation Efforts for Direct Vitrification of INEEL Blend Calcine Waste Simulate: Fiscal Year 2000, J. V. Crum, J. D. Vienna, Pacific Northwest National Laboratory Savannah River Technology Center, Aiken, SC 29808, March 2001, PNNL-13483, Summary. http://www.pnl.gov/main/publications/external/technical_reports/PNNL-13483.pdf

[112] TANK WASTE RETRIEVAL, PROCESSING, AND ON-SITE DISPOSAL AT THREE DEPARTMENT OF ENERGY SITES F I N A L R E P O R T, Committee on the Management of Certain Radioactive Waste Streams Stored in Tanks at Three Department of Energy Sites Nuclear and Radiation Studies Board Division on Earth and Life Studies, 2006 by the National Academy of Sciences. Hereinafter called NAS 2006.

[113] NAS 2006, Pg 14.

[114] NAS 2006, Pg. 26.

Calcine retrieval for treatment is problematic according to the Nuclear Waste Technical Research Board assessment of the issue and thus must not be delayed.

> "However, whether the actual calcine will behave like the simulant after residing in the bins for several decades is uncertain. Information related to the effectiveness of this bulk retrieval technique, techniques for retrieval of residual calcine, and disposition of the emptied bins has not yet been developed. Moreover, the geometry of the bins and the configuration of the risers in the bins may also decrease the effectiveness of the vacuuming method. [pg178]
>
> "Idaho will have to manage the added risk from fine respirable powders that are intensely radioactive. A previous National Research Council (NRC, 1999b, p. 22) committee observed that, given the little characterization information about the Idaho calcine, it would be difficult to conclude that there would be no problem with pneumatic retrieval. Indeed the committee believes that there will be problems but that they can probably be handled. However, this eventually might require mechanical operations to aid particle flow and more elaborate retrieval methods (e.g., a manipulator arm) than simple pneumatic transfer." [115] [pg 179 &180] [emphasis added]

Here in Idaho we're stuck with DOE's continued obfuscation and stalling on what to do with INL's Calcine HLW despite Court rulings >16 years ago. DOE already is getting away with what amounts to shallow burial at the RWMC for HLW that requires permanent isolation in a deep geological repository. [116] DOE has developed no plan to show that grouted waste tanks are retrievable. After many decades and legal challenges, the only path forward DOE offers is – inaction via continuing studies (see list of ~21 EAs and EISs) hoping for a cheap remedy and continuing to "store" HLW that is de-facto disposal. So far DOE and the Navy have succeeded- saving billions $ at the expense of future generations of Idahoans and our collective environment, health and safety. [117]

"Currently, a preferred disposal option for DOE HLW has not been identified, and other options are being evaluated. Thus, the assumptions regarding disposal costs and drivers to reduce the waste form volume, may no longer be valid. Consequently, the uncertainty of the disposition path, and related final waste form requirements, resulted in an additional variable that had to be accounted for during the [Analysis of Alternatives] AoA." [118]

> ***"****Retrieval is required for all feasible options considered and is not a discriminator for this AoA. Retrieval of calcine represents a significant technical and engineering challenge." [119] As the Independent Analysis of Alternatives for Disposition of the Idaho Calcined Recommendations state:*
>
> *"a. The Calcine Disposition Project should be divided into two subprojects: a) Calcine Retrieval, and b) Calcine Processing. The project near-term priorities should focus on calcine retrieval activities, and limited technology maturation to better inform future processing decisions.*
>
> *"b. A final decision regarding the processing technology should be deferred until the disposal path is better defined, as well as its expected regulatory framework, and resulting waste form performance requirements.*
>
> *"c. An independent AoA should be conducted for the retrieval system. It should consider impacts of the as-retrieved calcine feed to downstream unit process steps, and how to optimally manage and subsequently condition these materials such that an acceptable feed is provided (particle size, physical uniformity, blending/chemical uniformity, etc.).*
>
> *"d. Efforts should be accelerated on development and testing of the most effective retrieval technologies and systems. Significant progress can be made in advance of processing and disposal to address key retrieval risks and uncertainties.*
>
> *"e. The Calcine Retrieval Subproject should consider the concept of a full-scale radioactive*

[115] NAS 2006, Pgs. 178 & 180.

[116] The INTEC HLW tank sediments "heals" were grouted in-place. See Nuclear Regulatory Commission 10 CFR Part 61 regulation excluding any near-surface TRU HLW or TRU LLW disposal.

[117] See EDI's website for numerous reports that document the ongoing migration of INTEC contamination from INL's miss-management of "stored" liquid and solid HLW waste into Snake River Aquifer. http://environmental-defense-institute.org/

[118] U.S. DOE-EM Independent Analysis of Alternatives for Disposition of the Idaho Calcined High-Level Waste Inventory Volume 1- Summary Report, Pg. 1. Hereinafter AOA.

[119] AoA, pg. 22.

demonstration of the retrieval and transport system, to include retrieval from CSSF #1 to CSSF #6. This would potentially allow for RCRA closure of CSSF #1, which is considered the most suspect CSSF from a structural integrity perspective due to its concentric tube bin configuration.

"f. Additional sampling of actual calcine should be considered, especially during retrieval demonstration efforts, to support development of processing options." [120]

All of the above essential calcine retrieval processes have been known for four decades and yet to be implemented by DOE and the Navy thus adding unnecessary delays. Additionally, there are crucial determinations of the actual condition of the calcine and how it will affect retrieval. Specifically, due to numerous INTEC flooding events, water could have infiltrated into the calcine requiring additional retrieval alternatives beyond the assumption of pneumatic vacuum extraction. Thus delays unnecessarily add risk of more flood water infiltrating the Calcine Bins. This flooding risk also must eliminate DOE s cost-cutting "In Situ Entombment" alternative offed by DOE. [121]

"10 CFR § 61.41 Protection of the general population from releases of radioactivity. Concentrations of radioactive material which may be released to the general environment in groundwater, surface water, air, soil, plants, or animals must not result in an annual dose exceeding an equivalent of 25 millirems to the whole body, 75 millirems to the thyroid, and 25 millirems to any other organ of any member of the public. Reasonable effort should be made to maintain releases of radioactivity in effluents to the general environment as low as is reasonably achievable." 10 CFR § 61.42 Protection of individuals from inadvertent intrusion. Design, operation, and closure of the land disposal facility must ensure protection of any individual inadvertently intruding into the disposal site and occupying the site or contacting the waste at any time after active institutional controls over the disposal site are removed."

"Interim decay storage (i.e., 100 years or less) of the calcine prior to retrieval and processing, while reducing the overall level of radioactivity, does not appear to provide any benefits related to reduction of [material at risk] MAR and/or hazard class of the facility, and will likely result in the same number of Safety Class systems for the future processing facility. Additionally, it may lead to increased difficulties in retrieval due to continued compaction and potential agglomeration of the calcined solids within the binsets." [122]

The DOE's own Independent Alternative Analysis Report states: "Key challenges related to [Calcine] retrieval includes the following:

- *"The size and number of access risers available for retrieval operations varies by bin. Additionally, the configuration of each binset requiring retrieval is different.*
- *"Clumping/caking of the calcine is expected, but is assumed to be a manageable problem. An exception would be extreme caking, resulting, for example, from large amounts of water entering a bin or sintered bonding due to the temperature and pressure environment over time.*
- *"The actual characteristics of the as-retrieved calcine will be uncertain due to differing chemical and physical properties, coupled with commingling during emplacement and retrieval."*

"The access challenges can likely be resolved through equipment development and testing. The retrieval activities also provide an opportunity to better understand the physical and chemical characteristics of retrieved calcine. This is important in the context of processing and waste form requirements. ***Until a disposal path is defined, and the related waste form/processing requirements determined, development of the most effective retrieval technology/system could proceed independently since it is a common need to virtually all processing options."*** [123] [Emphasis added]

[120] AoA pg. 24

[121] *In-Place Entombment/Disposal U.S. DOE-EM Independent Analysis of Alternatives for Disposition of the Idaho Calcined High-Level Waste Inventory Volume 1- Summary Report, pg.12*

[122] AoA, Pg. 27

[123] AoA, Pg. 4

The Calcine is a HLW by NWPA/EIS [124] definition and Settlement Agreement Court Order and must be road-ready for deep-geologic disposal out of Idaho. There is no dispute here except in DOE's obfuscation to follow Court Order that EPA and IDEQ are equally complicit with.

The Case for Direct Vitrification

> "The U.S. Environmental Protection Agency (EPA) has identified Vitrification, the process of converting waste into a glass, as the best demonstrated available technology (BDAT) for immobilizing wastes generated during the reprocessing of nuclear fuel. The Batt Settlement Agreement between the State of Idaho, the U.S. Department of Energy (DOE), and the Navy states that all HLW calcine must be treated and considered road ready for repository storage by 2035. New technologies are necessary to successfully design a waste-treatment facility that will meet these INEEL regulatory milestones. Two requirements are to develop (1) glass formulations and (2) integrated Vitrification flowsheets that will successfully immobilize INEEL HLWs. The definitions of these glass formulations and integrated flowsheets have been initiated by a cooperative testing program between INEEL, Savannah River Technology Center (SRTC), and Pacific Northwest National Laboratory (PNNL). One of the environmental impact statement (EIS) options being considered as the treatment process for immobilizing INEEL HLW is early Vitrification, which includes direct Vitrification (bypass pretreatment of waste) of INEEL calcine. This report documents the Fiscal Year 2000 (FY00) activities for developing glass forms to demonstrate the direct Vitrification of INEEL Blend pilot plant calcine." [125]

Vitrification: In the context of radioactive waste immobilization, Vitrification is the process by which glass forming chemicals (GFCs) or glass frit are combined with waste material and introduced into a vessel, either as a dry powder or slurry, which is heated in the vessel to an appropriate temperature such that a glass, glass-ceramic, or other glass-like product is formed. Several technologies can perform this process, and the efficacy of a specific technology depends on the application.

> *"Two primary categories of Vitrification technologies have been investigated and/or implemented for radioactive waste immobilization: 1) melters that use energized electrodes within the melt pool as the heat-generating energy source, often referred to as Joule-heated ceramic-lined melters (JHCMs); and 2) inductively heated melters that use an energized external coil to produce an electromagnetic field, which in turn provides the heat-generating energy source (e.g., cold crucible induction melters [CCIMs]). Multiple variants exist within each of these two broad categories, including in-can batch and continuous processes. These were all considered during the AoA. However, the two most promising includes the conventional JHCM and CCIM, which were considered during the detailed analysis."* [126]
>
> *"For the Vitrification option, this resulted in selection of the CCIM due to its greater flexibility in waste form chemistry, operational temperatures, and potentially improved waste loadings. For the low-temperature stabilization option, the [chemically bonded phosphate ceramics] CBPC variant was selected due to its potential for much higher waste loadings, as compared to a saltstone-like grout waste form, and thus lower final waste form volume. Additionally, the final waste form is more robust, in general. The combined results of the two screening steps are depicted in Figure 2*. [127]

Direct Vitrification is the most developed technology and meets all interim surface storage (like SNF currently in use) as well as deep geologic disposal waste acceptance criteria (WAC). DOE keeps stalling on doing the right thing hoping for regulatory relief from a more "flexible" Congress and Executive Branch.

> "Vitrification systems, regardless of the specific technology, are assumed to be more readily maintained than the [DOE preferred] HIP process due to operational experience within the DOE as well as internationally for these technologies. HIPing has never been deployed for remote, large-scale, radioactive ceramic production." [128]

Direct Vitrification also offers compliance with NWPA and the best treatment, interim storage and disposal solution for the 900,000 gal. Highly mixed hazardous TRU radioactive sodium bearing waste

[124] DOE/EIS-0287
[125] PNNL-13483, pg.1-1 &2.
[126] AoA, Pg. 5
[127] AoA, pg. 17
[128] AoA, pg. 28

SBW and related tank heels. Again, this avoids more tragic "in situ entombment" already used in the INTEC tank farm and Hanford for debacles.

Analysis of Alternatives (AoA) Operability Assumptions for Vitrification

"1. Start-up/Shutdown of low temperature stabilization processes is assumed to require the greatest operator interface due to the need to flush the systems, recycle water, etc.

"2. JHCMs are not amenable to thermal cycling due to refractory cracking concerns, while cold wall induction heating systems (e.g., CCIM, In-can melting) do not have this limitation. This makes start-up/shutdown for JHCMs more problematic, but procedures are well-established from West Valley and DWPF experiences.

"3. For a given processing option, disposal options that have less restrictive waste form requirements, will offer a higher confidence in meeting target production rates. This is primarily driven by the limited ability to perform reliable in-process sampling and analysis of the calcine solids. This will result in a greater likelihood that the waste loadings will have to be reduced to ensure an acceptable final waste form.

"4. Vitrification systems, regardless of the specific technology, are assumed to be more readily maintained than the HIP process due to operational experience within the DOE as well as internationally for these technologies. HIPing has never been deployed for remote, large-scale, radioactive ceramic production.

"5. Waste loadings, and thus final waste volume, for offsite treatment options represent significant risk due to uncertainty as to how the calcine feed would be processed (i.e., blended with existing HLW, processed separately after water/chemicals added to make it compatible with the existing system, fed directly as powder after significant facility modification, etc.)."

Why DOE's Preferred HIPing Treatment Alternative Fails

"The current [Calcine Disposition Project] CDP proposed path forward is to pneumatically retrieve the calcine from the CSSFs and transfer it to the Idaho Waste Treatment Unit (IWTU) for processing. There it will be blended with additives and processed in a hot isostatic pressing (HIPing) system to immobilize the material. The HIPing process was identified as the preferred calcine treatment technology by DOE through the National Environmental Policy Act process, and documented in the resulting High-Level Waste (HLW) Environmental Impact Statement (EIS) Amended Record of Decision (ROD), issued December 2009. As envisioned, the HIPing process will produce a glass-ceramic waste form deemed suitable for disposition of HLW in a geologic repository, ***although the waste form has not been qualified yet for this specific application.***

"The current baseline to immobilize the calcine via HIPing is technically immature, with significant challenges to overcome, which may represent unacceptable project risk. An important factor in the original selection of HIPing was its ability to provide the lowest volume of final waste, while producing a robust waste form.

"Currently, a preferred disposal option for DOE HLW has not been identified, and other options are being evaluated. ***Thus, the assumptions regarding disposal costs and drivers to reduce the waste form volume, may no longer be valid****. Consequently, the uncertainty of the disposition path, and related final waste form requirements, resulted in an additional variable that had to be accounted for during the AoA."* [129] [Emphasis added]

Note above highlights, DOE's obsession on costs and related volume reduction rather than long term waste forms that will survive the toxic life of the HLW and legal requirements of the NWPA deep geologic repository.

"**In general, while producing a very robust waste form, due to the combined pressure and temperature levels, HIPing is assumed to represent the greatest safety risk of all the processing**

[129] AoA, Pg. 1

options considered during the AoA." [130] [Emphasis added][pg.7]

Analysis of Alternatives (AoA) Safety Assumptions for HIPing DOE Preferred Treatment

"1. High temperature and high pressure processes (e.g., HIPing) represent the greatest safety risk.

"2. Low temperature stabilization processes (e.g., MgPO4) represent the lowest safety risk.

"3. Disposition strategies that require more frequent transportation or multiple transportation steps represent greater risk. This will be driven by final waste form volume and treatment location (i.e., offsite treatment).

"4. Processes that produce more robust waste forms represent lower risk during transportation than those that produce less robust waste forms (e.g., direct HIP versus direct packaging).

"5. Offsite processing options represent an increased safety risk because this disposition strategy will require two shipments: from Idaho to the treatment facility and from the treatment facility to the disposal facility.

"6. Introduction of dispersible powders into the operating Vitrification plants, which are designed to manage wet slurries only, will introduce new hazards that may significantly impact existing DSAs.

"7. Achieving acceptable levels (i.e., ALARA principles) of contamination and radiation to allow personnel entry into the IWTU cells for installation of new equipment will likely be cost prohibitive and is not feasible." [131]

AoAs "Alternative Analysis Conclusions:

"1. Selection of the most appropriate processing technology is highly dependent on the disposal path, and the associated waste form performance requirements. A fully informed final decision regarding processing of the calcine cannot be made until the disposal path is known along with the associated regulatory framework.

"2. In general, salt bed formation disposal of DOE-only HLW appears to provide the most flexible and cost-effective disposal path, regardless of processing technology.

"3. Package for direct disposal offers the best alternative for all disposal scenarios, when the baseline criteria weightings are used. ***However, if regulatory or stakeholder concerns have a greater influence, the process options that produce more robust waste forms are preferred.***

"4. Cold crucible induction melter CCIM Vitrification provides the best processing option if a robust waste form is preferred.

"*5. The current baseline of HIPing appears to represent the least preferable processing technology for all disposal options based on the assumptions and supporting criteria.* ***HIPing represents the highest operational safety risk (e.g., high pressures and temperatures) of all the processing options.***

"6. [Deep bore hole] DBH disposal is technically feasible, ***but represents much more uncertainty related to the regulatory framework and overall waste form requirements that will be established****. Additionally, the DBH configuration does not appear to be cost effective for calcine disposal due to the volume of waste. Calculation estimate that approximately 80 boreholes would be required.*

"7. Package for Direct Disposal is the lowest cost and most technically mature option." [132]
[Emphasis added]

The above AoAs (Alternative Analysis) conclusions show how DOE's policy makers are constantly revealing how their arbitrary regulatory interpretation and disposal site short-cuts are deliberately slowing the treatment decision. For instance, DOE tried to convince North Dakota on accepting deep bore hole for HLW and were immediately rebuffed with their statement:

[130] AoA, Pg. 7
[131] AoA, pg.27
[132] AoA, pg. 22

*" However, **if regulatory** or stakeholder concerns have a **greater influence**, the process options that produce more robust waste forms are preferred," their utter disregard for the law, regulations, states, environmental groups, and Tribes legitimate environmental concerns, is made clear. DOE's primary driver above all is cost savings – not long term environmental stewardship. Idahoans cannot allow this policy to compromise our future sole source aquifer*." [Emphasis added]

HLW EIS Accident Analysis Tank-Bin Sets

"CPP-729 Bin set 1; Maximum plausible accident is: Rupture or break in the calcine transfer lines during Calcine Retrieval and Transport operations. Bounding operations accident is: An external event results in: An external event results in 0.50 rem (MEI), 34 rem (NIW), **5,900 rem** (OSP), and 3.0 LCF." [133]

The accident doses for all 7 Calcine Bin Sets are the same. The same HLW EIS Table C.4-7. Facility disposition accidents summary for CPP-713 Vault for Tanks VS-WM-187, 188,189, and 190 for Bounding Operations accident, External event results in 0.34 rem (MEI), 23 rem (NIW), **3,500 rem** (OSPP, and 1.8 LCF. See comparison table below. [134]

Comparison of SBW Tank Vault and Calcine Bin accident doses

CPP-713 vaults for SBW tanks (VES-WM-187, 188, 189, and 190)	**Calcine Bin Set # 1**
An external event results in 0.34 rem (MEI), 23 rem (NIW), **3,500 rem** (OSP), and 1.8 LCF.	An external event results in 0.50 rem (MEI), 34 rem (NIW), **5,900 rem** (OSP), and 3.0 LCF.

LCF = latent cancer fatality; MEI = maximally exposed individual; NIW = noninvolved worker;
OSP = offsite population;

The above dose table shows that dose from accidental release from only Calcine Bin Set #1 is significantly higher than 4 highly radioactive sodium-bearing waste tanks which like the Calcine Bins use ridiculous statements like: "Materials at risk is low levels of radioactive and hazardous materials." The 34 rem NIW is a very serious dose to other workers, but DOE would conclude that it wouldn't be lethal. DOE has a long history of not giving workers adequate protection as seen at the recent MFC plutonium exposures.

The tables below listing all the hazardous chemicals and the radionuclides show just how dangerous this material is. These doses don't tell the whole story. These analyses do not look at crop losses, unusable land, continued contamination that blows in the wind (remember calcine is in fine granular form) what DOE calls "contaminate mobility" or (as a soluble) that will easily migrate in the aquifer.

The "external event accident" that they chose looks very unlikely -- implausible. So DOE chose the worst consequences, made the probability look very small without acknowledging that the Calcine Bins were built ~ 1963 (54 years) without adequate seismic consideration. The probability of a very serious event is probably much higher than they made it look which is not apparently stated. The types of initiating events (flooding) that the calcine bins are vulnerable to and the fact that these initiating events are not remote possibilities, but could be 1 in 150 year events depending on the particular analysis of flooding depth and likelihood and seismic hazard curve and bin set fragility.

"10 CFR § 61.44 Stability of the disposal site after closure.

"The disposal facility must be sited, designed, used, operated, and closed to achieve long-term stability of the disposal site and to eliminate to the extent practicable the need for ongoing active maintenance of the disposal site following closure so that only surveillance, monitoring, or minor custodial care are required.

[133] DOE/EIS-0287 Table C.4-7. Facility disposition accidents summary, Pg. C.4-55 &56

[134] DOE/EIS-0287 Table C.4-7, Pg. C.4-55. See this section for more information on the doses.

"Subpart D—Technical Requirements for Land Disposal Facilities
"10 CFR 61.50 Disposal site suitability requirements for land disposal
(5) The disposal site must be generally well drained and free of areas of flooding or frequent ponding. Waste disposal shall not take place in a 100-year flood plain, coastal high-hazard area or wetland, as defined in Executive Order 11988, ``Floodplain Management Guidelines."
(8) The hydrogeologic unit used for disposal shall not discharge ground water to the surface within the disposal site.
(9) Areas must be avoided where tectonic processes such as faulting, folding, seismic activity, or vulcanism may occur with such frequency and extent to significantly affect the ability of the disposal site to meet the performance objectives of subpart C of this part, or may preclude defensible modeling and prediction of long-term impacts."
(10) Areas must be avoided where surface geologic processes such as mass wasting, erosion, slumping, landsliding, or weathering occur with such frequency and extent to significantly affect the ability of the disposal site to meet the performance objectives of subpart C of this part, or may preclude defensible modeling and prediction of long-term impacts."

Where is the Calcine Bin Set Safety Analysis?

INTEC like other INL facilities has probably conducted safety analysis bordering on the ridiculous to try to minimize the appearance of a safety problem. These are reasons why DOE won't let the public see their Documented Safety Analysis --- they probably don't want to release it and expose how inadequate the safety analysis is. Without the DOE's documented safety analysis and supporting documents, it just isn't realistic to evaluate the hazard issues. The DOE has never included aquifer contamination migration is safety analysis and tends to exaggerate the length of time to reach community wells once in the aquifer.

Flood Hazard Analysis is Required by RCRA

IDEQ fails to offer the public "in one concise document" what the permit covers. In EDI's view, the subject permit must be rejected until DOE/INL first addresses the potential flood hazard and incorporates sufficient measures to protect the INTEC (Calcine Bin Sets) and other INL facilities as required by Idaho Code §39-4409(5).

Specifically, corrective action is required prior to permit approval - as stated in DEQ's Fact Sheet:

"Corrective Action Determination: Idaho Code §39-4409(5) requires, in accordance with IDAPA 58.01.05.008 [40 CFR § 264.l0l (a)], the owner/operator of a hazardous waste facility to institute corrective action as necessary to protect human health and the environment for all releases of hazardous wastes and hazardous constituents from any solid waste management unit at the facility, regardless of the time at which the waste was placed in the unit."

The Calcine Permit incorrectly claims that "The hydrology conditions at the INL are addressed in the *DOE Programmatic Spent Nuclear Fuel Management and INEEL Environmental Restoration and Waste Management Programs Final Environmental Impact Statement.* [135] A copy of this document has already been provided to DEQ." [136] Hydrogeology is discussed but RCRA **disallows** disposal in a flood zone. DOE cherry-picked what it wanted to use from the Koslow report and deliberately chose NOT to use the results of higher flood PMF-Induced Overtopping Mackay Dam failure. [137] [138] We discuss this issue below in Section 3 in the adjacent Tank Farm.

Flood Issues Not Fully Analyzed in the Calcine Storage Permit

DOE offers no emergency INTEC flood plan, (i.e., what response plan will handle a flood that

[135] DOE/EIS - 0203F, Volume 1, Appendix B.

[136] Calcine Permit at D-2f(3)(a)(iii) Hydrogeologic Setting of the Facility [IDAPA 58.01.05.012 and 58.01.05.008; 40 CFR 270.16(h) and 264.193(g)(1)(iii)]

[137] Engineering Design File, Hydrostatic and Hydrodynamic Forces on the INTEC CSSF During a 100-year Flood, ID-EDF-33996, 10/31/03, pg.2. "The binsets have been identified as Safety Significant per PC-2 per SAR-104 [8] and SAR-106 [9]." "However, the performance category is not used in this analysis since the design basis flood event and scope of the analysis are governed by RCRA regulations." But it was not accurately done.

[138] NRC 2006, Section 4.2.8.9 Flooding Flow and Transport Simulation, pg. 86.

"floats" the calcine bins and severs the riser pipes)? [139] Again, "Subpart D—Technical Requirements for Land Disposal Facilities. 10 CFR 61.50 Disposal site suitability requirements for land disposal. (5) The disposal site must be generally well drained and free of areas of flooding or frequent ponding. Waste disposal shall not take place in a 100-year flood plain, coastal high-hazard area or wetland, as defined in Executive Order 11988, ``Floodplain Management Guidelines."

The Calcine Storage Permit should be denied on this flood issue alone.

Previous analyses of INL's flood hazard posed by a probable maximum flood (PMF) generated by high seasonal runoff coupled by overtopping/failure of Mackay Dam clearly document an immediate hazard not only for downstream residents but also INL facilities. The capacity of various improvements to the INL Diversion Dam designed to shunt flood water away from INL facilities are also in question in addition to questions about long-term institutional maintenance for the 10s of thousands of years of the half-life of the nuclides/hazardous materials.

The US Geological Survey (USGS) released a 1998 report that modeled the **median** 100-year flow rates in the Big Lost River (that flows by the ICPP now called INTEC) downstream of the INL Diversion Dam (6,220 cf/s). The USGS report cross section number 22 at the ICPP puts the median flood elevation at 4,912 feet.[140] Again, this is only the mean flow rate (as opposed to the maximum rate of 11,600 cf/s) of just a 100-year flood, and **not** including any additional cascading events like the failure of Mackey Dam. See NRC 2006 Figure 19. Location of INEEL Diversion Dam and Mackay Dam map that shows the flood water covering INTEC where the underground calcine bins are located.

The USGS flood map show the northern half of the INTEC under water. The USGS flood map shows the INTEC elevation of 4,917 feet and the USGS predicted elevation of 4,912 feet through the middle of the ICPP. The USGS study also employed current modeling technics and plotted 37 separate cross sections on the INL site. The INTEC as a whole is about as flat as a table top with only a couple feet change in elevation north to south.[141] See the NRC's flood map in Section 3 below that shows INTEC inundated.

Given the significance of flooding issues on all INL facilities and the risk flooding poses for the **continued** migration of hazardous and radioactive contaminates into the underlying Snake River Plain Aquifer, IDEQ must require that a new independent three dimensional flood study using current modeling methods be conducted as a permit extension requirement.

DOE's Calcine Storage Permit acknowledges "The design basis flood is a 100-year flood coincident with a Mackey Dam failure. The flood water elevation for the postulated flood is 4916 ft. and the flood water depth at INTEC is approximately **4 ft**." [142]

This report notes the bottom of Bin Set 3 (CPP-746) at 4865 ft. above sea level which means it will be ~50.5 ft. underwater in a probable maximum flood (PMF).

Idaho Department of Water Resources (IDWR) clearly warns that Mackey Dam could have a problem this year. However, the following issues remain uncorrected.

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[139] The HLW/EIS [pg. 4-54] states that "... in the event of a design basis flood with sufficient magnitude and duration, it may be possible that one or more buried [high-level] 300,000 gallon waste tanks could float." Another potential effect could be the failure of high-level waste calcine bin sets. Shearing of service lines and the release of radioactive liquids is another potential hazard in addition to lack of access to tanks needed to receive flood waters pumped from inundated waste facilities.

[140] Preliminary Water-Surface Elevations and Boundary of the 100 Year Peak Flow in the Big Lost River at the Idaho National Engineering and Environmental Laboratory, Idaho, US Geological Survey, Water-Resources Investigations Report 98-4065, DOE/ID-22148

[141] Topographic Map of Block 21, National Reactor Testing Station (now called INL) showing works and structures, U.S. Atomic Energy Commission, Idaho Operations Office, shows three feet change in elevation between the north and south end of the ICPP.

[142] Engineering Design File, Hydrostatic and Hydrodynamic Forces at INTEC CCSF During a 100-Yeat Flood, [ID-EDF-3996, 10/31/03, pg. 1]

1.) What IS the Emergency Plan other than the people for contact? Why is it not publically available even using a Public Records Request?
2.) Were corrections from prior years' inspections made? What was done?
3.) Also it seems like more than one inspection might be necessary given the potential for over topping and the fact Mackay Dam is "high risk".
4.) There's an issue as to whether Mackey Dam owners can dump the necessary amount of water to be protective. Where's the analysis for that?
5.) IDWR 3/14/17 letter to Big Lost River Irrigation District, RE: Mackey Dam 2017 snow water equivalent that states in pertinent part:

"The purpose for this letter is to encourage you to release as much water as possible from the Mackay Reservoir without flooding downstream properties. ***The reason for my concern is that the runoff forecast volume of 350,000 acre-feet (NRCS-30%) is more than seven times the entire capacity of the reservoir, and the current rate of release(± 400 cfs) is too small to prevent the emergency overflow spillway from discharging uncontrollably to pass all of this expected runoff****. This year, the near record volume of water that presently exists in the snowpack may combine later with unseasonably warm temperatures to create near record maximum flow through the spillway."*

"As you are aware, the maximum spillway capacity is approximately 4,370 cfs measured at the top of the concrete training wall. Exceeding this rate of flow may result in severe erosion of adjacent fill materials. Consequently, the sooner you are able to controllably release the maximum quantity of water from the reservoir, the more likely you will be able to reduce peak discharges through the spillway; I am aware that you intend to increase releases from the outlet as soon as the Big Lost River channel downstream from the dam is clear of ice and other potential obstructions."

Despite this clear warning, there is no indication that Mackey Dam owners will act; or even if they did belatedly respond, that the capacity of either the outlet gates (400 cf/s) could lower the reservoir enough to keep the emergency spillway from overflowing in the potential flood.

The State of Idaho has experience ignoring disasters waiting to happen. In 1976, the earthen Teton Dam began eroding due to a leak at its base, then burst, resulting in 11 deaths and over a billion dollars in property damage. Teton Dam, built during the same era and of similar design, was only 125 miles away from Mackay Dam. News reports at the time mentioned that the Teton Dam owners were warned but refused to release water because their agriculture needs required the water later in the summer.

The State of Idaho only has authority to take control of dams in an emergency condition. EDI has written letters to Governor Otter and Attorney General Wasden about the Mackey Dam RE: "Preventable Disaster" however there has been on response. EDI even requested a copy of the Emergency Plan from IDWR required of the dam owners, and were improperly denied. [143]

The DOE documents presented to IDEQ for RCRA floodplain review present misleading, incomplete, inconsistent facts and conclusions, and fail to comply with the state and/or federal requirements for information to be supplied under the Resource Conservation and Recovery Act (RCRA), the National Environmental Policy Act of 1969 (NEPA) and Floodplain/Wetlands Environmental Review Requirements of 10 CFR 1022 *et seq*.

The Calcine Storage Permit offers no apparent actions for protection to be taken in the eventuality of a flood. DOE/INL and IDEQ have been cognizant of this problem for decades, and should have decades ago dealt with the problem. Rejection of this permit as presented is an opportunity for IDEQ to correct this imminent hazard that threatens Idaho's sole source aquifer, public health and safety, and the environment when the calcine leaches out during a flood.

IDEQ must consider what additional terms and conditions that should be taken for the flood dangers posed by Mackay Dam, up to and including eminent domain proceedings, relevant to the omnibus provision of RCRA since this is a RCRA Permit proceeding. Section 3005(c) (3) of RCRA (codified at 40 CFR 270.32(b) (2)) requires that each hazardous waste facility permit contain the terms and

[143] John Falk, PE, Idaho Department of Water Resources, Email to Broscious, 3/2/17

conditions necessary to protect human health and the environment. This provision is commonly referred to as the "omnibus authority" or "omnibus provision." It is the means by which additional site-specific permit conditions may be incorporated into RCRA permits should such conditions be necessary to protect human health and the environment.

Incomplete Calcine Storage Permit Information

1. Permit calls for removal of calcine and closure but there is no apparent time-line or explanation of how the calcine will be removed and what DOE plans to do with the calcine left in the bins and removed from the bins. Why the decades-long delay?
2. There appears to be a distinction between calcine bin sets in terms of land disposal restrictions that suggests different disposition for different bin sets; (i.e., calcine generated from SNF reprocessing and calcine produced from "sodium-bearing waste"). What are DOE's plans?
3. Is any of this removed calcine destined for the Remote-Handled Waste Disposal Facility and/or WIPP? If so, no clear waste acceptance criteria (WAC) is offered for these facilities and if the calcine meets their WAC.
4. Previously, INTEC calcine was classified as high-level mixed waste. The permit has no apparent statement on this calcine radioactive waste class, direct Vitrification treatment requirement, or restrictions to disposal in a deep geologic repository per NWPA requirements.
5. The permit section on flooding only analyzes a 100-year PMF which is grossly inadequate.
6. There are no apparent plans on what to do when the INTEC is flooded, and what affect compromised Calcine Bin leached contents will have on the retrieval, the aquifer and the human environment.
7. The closure plan has no apparent explanation for how the contents of the earlier bin sets (without retrieval piping) will be extracted. Will they be grouted in place like DOE did the high-level waste tanks creating an illegal HLW shallow disposal in violation of Nuclear Regulatory Commission 10 CFR Part 61 regulation, NWPA, RCRA and CERCLA any near-surface disposal?
8. What chemical reaction will flood water contact have on calcine, and treatment?
9. What impact will wet calcine have on retrieval during closure?
10. Why hasn't DOE/INL started transferring calcine from the problematic Bin Sets 1, 2, and 3 to the other Bin Sets with unused capacity? See table below.
11. The Settlement Agreement Consent Order has had little impact on forcing DOE to implement treatment of the huge Liquid HLW and HLW Calcine inventory. Why?
12. DOE provides no Calcine Bin Set Safety Analysis.

DOE <u>1983</u> Calcine Treatment Preferred Alternative was not implemented

> *"The Decision Management Team's recommended Preferred Alternative for calcine was to retrieve the calcine presently stored in the six bin sets at INTEC, vitrify it, and place it in a form to enable compliance with the current legal and regulatory requirement to have HLW road ready by a target date of December 31, 2035. Concurrent with the program to design, construct, and operate the Vitrification facility for mixed transuranic waste/ SBW, DOE would initiate a program to characterize the calcine, and develop methods to construct and install the necessary equipment to retrieve calcine from the bin sets. DOE would focus technology development on the preferred calcine treatment technology of Vitrification, and the feasibility and merits of performing calcine separations as well as refine cost and engineering design."*[DOE/EIS-0287, Pg. B-2]

The above **1983** Calcine Vitrification plan is the most realistic because it appropriately links both the INTEC HLW tank waste and the Calcine and provided estimates of HLW volumes to be generated through **2015**. Subsequently, the DOE Idaho Operations Office completed the study (DOE 1983) in 1983. That was >34 years ago and DOE is no closer today to offering a solution. What does it take for DOE to move - another law suit and Court Order?

The Permit states: "The [INTEC] area is relatively flat and receives little rainfall. However, poor drainage patterns can produce localized flooding during periods of rapid snowmelt and/or heavy rainfall." [144]

The Engineering Design File used in the Permit acknowledges: "The floodwater elevation for the

[144] INL CSSF HWMA/RCRA Permit Reapplication Attachment 1 - Section B, Facility Description Volume 22 –INTEC May 2016, pg. iii.

postulated flood is 4,916 ft. and the flood water depth at INTEC is approximately 4 ft." [145] Also stated is the elevation of Bin Set # 1 is 4,867. That means the Bin Set # 1 will be ~**56 ft. below the flood water** which will add significant hydrologic pressure on the non-water tight concrete casing with the potential of floating the bins, severing connecting coolant piping and exposing workers to unshielded radiation.

The Permit states: "Since a 100-year flood with a Mackay Dam failure is the maximum credible flood associated with a 100-year peak flow in the Big Lost River (exceeding RCRA requirements for a design basis flood event), load factors for floodwater forces and soil pressure were set equal to one.

> "A structural evaluation of the bin set vaults was used to check whether the vault walls are able to withstand hydrostatic and hydrodynamic forces resulting from the postulated 100-year flood. The concrete walls of bin sets 1 to 7 meet the structural requirements given in ACI-318 [4]. The structural capacity of the walls ensures that washout of hazardous waste from these bin sets will be prevented." [146]
>
> "The only pathway for floodwater infiltration into a bin set vault is at pipe penetrations, which are sealed and watertight.
>
> "The floodwater elevation for the postulated 100-year flood coincident with a Mackay Dam failure is 4916 ft. in reference to NGVD29 (Koslow and Van Haaften, [2]). Since the elevation at grade level is approximately 4912 ft., the floodwater depth is 4 ft.
>
> "The wave height of shallow water waves generated by a 60 mph wind with a water depth equal to 4 ft. is approximately 2 ft. from crest to trough (Fig. 10-16 in Brater and King [3]). The maximum water level during the postulated 100-year flood is 4917 ft. (still water level + 1/2 wave height).
>
> "WCF Bin Sets 1 -3 were built from 1959 to 1969 and NWCF Bin Sets 4-7 were built from 1976 to 1985." [147] [Pg. 3]

Despite the above false assurances that the Calcine Bin Sets will structurally not collapse in the postulated flood, there is no apparent detailed analysis of whether floodwater will infiltrate the concrete enclosure and float the tanks inside and sever the piping. This is important given the age stated as: "WCF Bin Sets 1-3 were built from 1959 to 1969 and NWCF Bin Sets 4-7 were built from 1976 to 1985." There is no apparent confirmation of how reliable this old "water-tight" sealant data is given its age. **There is no analysis for how regional earthquakes have affected Calcine Bin Sets piping and seals over time.**

> *"Although the Calcined Solids Storage Facility (CSSF) bins are not currently receiving any waste, this permit reapplication allows for the continued use of Bin Sets 1, 2, 3, 4, and 5 for storage and Bin Sets 6 and 7 for storage and to receive future waste transfers.*
>
> *"From December 1963 to June 2000, the calciners at the INTEC were used to convert approximately **7,920,000 gal of liquid mixed waste** into approximately 155,600 ft3 of granular calcine solids. In the calciner processes liquid wastes were injected into a high-temperature (400 to 600o C) air fluidized bed of granular solids. The liquid portion of the waste evaporated and the solids adhered to the granular material-producing calcine. Exhibit D-1 provides a diagram of the typical calciner process flow." [148]*

IDEQ has the duty under RCRA, 42 USC § 6901 (b) to avoid risking from the following:

> "[T]he placement of inadequate controls on hazardous waste management will result in substantial risks to human health and the environment;
>
> "[I]if hazardous waste management is improperly performed in the first instance, corrective action is likely to be expensive, complex, and time consuming;
>
> "[C]certain classes of land disposal facilities are not capable of assuring long-term containment of certain hazardous wastes, and to avoid substantial risk to human health and the environment, reliance on land disposal should be minimized or eliminated, and land disposal, particularly landfill and surface impoundment, should be the least favored method for managing hazardous wastes."

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[145] Hydrostatic and Hydrodynamic Forces on the INTEC CSSF During a 100-yr Flood, EDF File 3996, Pgs. 1, 3 and 4.

[146] ENGINEERING DESIGN FILE, Hydrostatic and Hydrodynamic Forces on the INTEC CSSF During a 100-Year Flood, EDF No. 3996, pg. 5.

[147] Ibid. EDF No. 3996, and pg. 3.

[148] INL CSSF HWMA/RCRA Permit Reapplication Attachment 1 - Section B, Facility Description Volume 22 –INTEC May 2016, pg. 1

Calcine Storage Facility Inventory [Part A Permit Application Vol.22, pg. 3a]

Bin Set No.	Inventory cm	Capacity in gallons	Capacity in cubic feet
Bin Set No 1	217	62,086	7,800
Bin Set No 2	856	236,459	30,000
Bin Set No 3	1,092	299,388	39,500
Bin Set No 4	488	132,628	17,100
Bin Set No 5	992	270,805	35,600
Bin Set No 6	741	412,944	25,600
Bin Set No 7	0	471,322	63,000
Total [149]	4,396	1,885,595 gallons	

To that purpose, IDEQ must immediately enforce and implement the DOE/INL Settlement Agreement Consent Order to put the Calcine into "road-ready" containers for ultimate disposal in a geologic repository. Additionally, the first step must be to transfer the Calcine from the problematic Bin Sets 1 and 2 into the empty Bin Set #7 and not continue stalling on the four decades long failure to operate the Integral Waste Treatment Facility.

Table 4. Summary of High-Level Waste Calcination and Storage at the INL [150]

Calcined Waste Production	Operating	Volume of Liquid HLW	Volume of Calcined Waste	Storage Facilities
Waste Calcine Facility	1963–1981	4,091,000 gal (15,490,000 L)	77,300 ft.^{3} (2,190 m^3)	CSSFs I, II, III
New Waste Calcine Facility	1982–2000	3,642,000 gal (13,790,000 L)	78,000 ft.^{3} (2,210 m^3)	CSSFs IV, V, VI

Bin set total chemical inventory (fission and activation species decayed to 2016). [151]

Constituent	Total mass (kg)	Constituent	Total mass (kg)
Actinium	1.2×10^{-6}	Molybdenum	2.9×10^{4}
Aluminum	9.7×10^{5}	Neodymium	1.4×10^{3}
Americium	4.4	Neptunium	46
Antimony	10	Nickel	2.6×10^{3}
Arsenic	3.7	Niobium	2.6
Astatine	8.5×10^{-20}	Palladium	110
Barium	770	Plutonium	1.3×10^{3}
Beryllium	3.6	Polonium	2.8×10^{-9}

149 National Academy of Sciences, Treatment and Disposal of Calcine, 12/3/03.

150 U.S. NUCLEAR WASTE TECHNICAL REVIEW BOARD CALCINED HIGH-LEVEL RADIOACTIVE WASTE, (Staiger and Swenson, 2011)

151 HLW & FD EIS, DOE/EIS-0287, Table C.7-2

Bismuth	2.7×10^{-9}	Potassium	2.8×10^{4}
Boron	4.0×10^{4}	Praseodymium	380
Bromine	29	Promethium	5.7×10^{-3}
Cadmium	4.7×10^{4}	Protactinium	2.4×10^{-3}
Calcium	1.1×10^{6}	Radium	2.7×10^{-5}
Californium	1.0×10^{-12}	Rhodium	140
Cerium	850	Rubidium	170
Cesium	740	Ruthenium	1.9×10^{3}
Chlorine	4.5×10^{3}	Samarium	280
Chromium	8.8×10^{3}	Selenium	51
Cobalt	1.6	Silver	8.3
Curium	3.6×10^{-3}	Sodium	1.3×10^{5}
Dysprosium	3.3	Strontium	2.6×10^{3}
Erbium	1.8	Technetium	280
Europium	20	Tellurium	140
Fluorine	8.4×10^{5}	Terbium	0.94
Francium	3.1×10^{-14}	Thallium	0.36
Gadolinium	15	Thorium	6.1
Gallium	14	Thulium	0.14
Germanium	1.2	Tin	43
Holmium	1.1	Uranium	1.7×10^{4}
Indium	4.0	Ytterbium	1.8
Iodine	1.4×10^{3}	Yttrium	260
Iron	2.2×10^{4}	Zinc	71
Lanthanum	440	Zirconium	5.6×10^{5}
Lead	360	NO_3	2.5×10^{5}
Lithium	18	PO_4	2.4×10^{4}
Manganese	1.2×10^{3}	SO_4	5.3×10^{4}
Mercury	1.2×10^{4}		

Why is there is no definition for "chemical inventory (fission and activation species)" because when this waste is incinerated in the IWTU emissions will be significant.

Table C.7-3. Bin set total inventory of radionuclides (decayed to 2016). [152]

Constituent	Total activity (Ci)	Constituent	Total activity (Ci)	Constituent	Total activity (Ci)
H-3	15	Sm-148	9.0×10^{-9}	Th-227	0.085
Be-10	0.033	Sm-149	2.9×10^{-9}	Th-228	1.6
C-14	0.038	Sm-151	4.5×10^{5}	Th-229	1.4×10^{-4}
Co-60	1.5×10^{3}	Eu-150	5.3×10^{-3}	Th-230	1.4
Ni-63	6.8×10^{4}	Eu-152	430	Th-231	5.0
Se-79	9.9×10^{4}	Gd-152	5.3×10^{-10}	Th-232	2.3×10^{-7}
Rb-87	9.1×10^{-3}	Eu-154	2.9×10^{4}	Th-234	5.0

[152] Idaho HLW & FD EIS, Table C.7-C

Sr-90	7.9×10^{6}	Eu-155	3.9×10^{3}	Pa-231	0.11
Y-90	7.9×10^{6}	Ho-166m	0.014	Pa-233	690
Zr-93	680	Tm-171	1.1×10^{-9}	Pa-234m	5.0
Nb-93m	630	Tl-207	0.085	Pa-234	6.3×10^{-3}
Nb-94	270	Tl-208	0.16	U-232	1.6
Tc-98	7.3×10^{-4}	Tl-209	1.9×10^{-6}	U-233	0.057
Tc-99	4.6×10^{3}	Pb-209	1.4×10^{-4}	U-234	130
Rh-102	9.1×10^{-3}	Pb-210	0.013	U-235	3.2
Ru-106	4.4×10^{-3}	Pb-211	0.085	U-236	11
Rh-106	0.029	Pb-212	1.6	U-237	1.5
Pd-107	9.1	Pb-214	0.027	U-238	3.1
Ag-108	1.1×10^{-5}	Bi-210m	5.2×10^{-17}	U-240	1.6×10^{-7}
Ag-108m	1.3×10^{-4}	Bi-210	0.013	Np-235	5.1×10^{-17}
Ag-109m	3.8×10^{-17}	Bi-211	0.085	Np-237	470
Cd-109	3.8×10^{-17}	Bi-212	1.6	Np-238	0.017
Cd-113m	1.6×10^{3}	Bi-213	1.4×10^{-4}	Np-239	50
In-115	2.7×10^{-8}	Bi-214	0.027	Np-240m	1.6×10^{-7}
Sn-121m	68	Po-210	0.013	Pu-236	0.027
Te-123	1.3×10^{-10}	Po-211	1.7×10^{-4}	Pu-238	1.1×10^{5}
Sb-125	130	Po-212	0.29	Pu-239	4.8×10^{4}
Te-125m	38	Po-213	1.4×10^{-4}	Pu-240	2.0×10^{3}
Sn-126	310	Po-214	0.027	Pu-241	4.8×10^{4}
Sb-126	43	Po-215	0.085	Pu-242	130
Sb-126m	310	Po-216	1.6	Pu-243	1.1×10^{-13}
I-129	1.6	Po-218	0.027	Pu-244	1.6×10^{-7}
Cs-134	67	At-217	1.4×10^{-4}	Am-241	1.2×10^{4}
Cs-135	360	Rn-219	0.085	Am-242m	6.1
Cs-137	8.8×10^{6}	Rn-220	1.6	Am-242	5.8
Ba-137m	8.5×10^{6}	Rn-222	0.027	Am-243	50
La-138	6.8×10^{-8}	Fr-221	1.4×10^{-4}	Cm-242	4.8
Ce-142	9.4×10^{-3}	Fr-223	0.018	Cm-243	5.0
Ce-144	8.6×10^{-5}	Ra-223	0.085	Cm-244	250
Pr-144	1.4×10^{-3}	Ra-224	1.6	Cm-245	0.071
Pr-144m	1.7×10^{-5}	Ra-225	1.4×10^{-4}	Cm-246	4.6×10^{-3}
Nd-144	4.6×10^{-7}	Ra-226	0.027	Cm-247	5.2×10^{-9}
Pm-146	2.3	Ra-228	2.3×10^{-7}	Cm-248	5.5×10^{-9}
Pm-147	5.3×10^{3}	Ac-225	1.4×10^{-4}	Cf-249	4.0×10^{-9}
Sm-146	8.6×10^{-5}	Ac-227	0.085	Cf-250	1.7×10^{-9}
Sm-147	3.0×10^{-3}	Ac-228	2.3×10^{-7}	Cf-251	6.3×10^{-11}

a. Source: Valentine (2000).

Manual counting of above Total Table C.7-3 [153] Bin set total inventory of radionuclides (decayed to 2016) only counting >2 Ci = **33,987,941 Ci.** This represents an important factor requisite for appropriate evaluation of the subject Permit.

[153] Table C.7-4. Calculated radionuclide activities for SBW (curies per liter) decayed to 2016 can be found at Idaho High-Level Waste & Final EIS, D0E/EIS-0287 Appendix C. 7, pg. C.7-4.

Table C.7-4. Calculated radionuclides activities for SBW (curies per liter) decayed to 2016.[a]

Radionuclide		Radionuclide		Radionuclide	
Hydrogen-3	1.2×10^{-4}	Samarium-147	2.9×10^{-11}	Thorium-227	8.1×10^{-10}
Beryllium-10	3.1×10^{-10}	Samarium-148	8.5×10^{-17}	Thorium-228	1.5×10^{-8}
Carbon-14	3.6×10^{-10}	Samarium-149	2.8×10^{-17}	Thorium-229	1.3×10^{-12}
Cobalt-60	8.1×10^{-6}	Europium-150	5.0×10^{-11}	Thorium-230	1.3×10^{-8}
Nickel-63	6.0×10^{-4}	Samarium-151	4.2×10^{-3}	Thorium-231	4.7×10^{-8}
Selenium -9	2.2×10^{-5}	Europium-152	4.0×10^{-6}	Thorium-232	1.9×10^{-15}
Rubidium-87	8.6×10^{-11}	Gadolinium-152	5.0×10^{-18}	Thorium-234	4.1×10^{-8}
Strontium-90	0.15	Gadolinium-153	3.1×10^{-31}	Protactinium-231	1.1×10^{-9}
Yttrium-90	0.15	Europium-154	5.5×10^{-5}	Protactinium-233	6.4×10^{-6}
Zirconium-93	6.5×10^{-6}	Europium-155	5.4×10^{-5}	Protactinium-234m	4.1×10^{-8}
Niobium-93m	6.0×10^{-6}	Holmium-166m	1.3×10^{-10}	Protactinium-234	5.3×10^{-11}
Niobium-94	1.2×10^{-4}	Thulium-171	1.0×10^{-17}	Uranium-232	1.5×10^{-8}
Technetium-98	6.9×10^{-12}	Thallium-207	8.1×10^{-10}	Uranium-233	5.4×10^{-10}
Technetium-99	1.7×10^{-4}	Thallium-208	1.5×10^{-9}	Uranium-234	1.8×10^{-6}
Rhodium-102	8.7×10^{-11}	Thallium-209	1.8×10^{-14}	Uranium-235	2.2×10^{-8}
Ruthenium-106	2.6×10^{-10}	Lead-209	1.3×10^{-12}	Uranium-236	7.4×10^{-8}
Rhodium-106	2.6×10^{-10}	Lead-210	1.2×10^{-10}	Uranium-237	1.4×10^{-8}
Palladium-107	8.6×10^{-8}	Lead-211	8.1×10^{-10}	Uranium-238	2.0×10^{-8}
Silver-108	1.1×10^{-13}	Lead-212	1.5×10^{-8}	Uranium-240	1.5×10^{-15}
Silver-108m	1.2×10^{-12}	Lead-214	2.5×10^{-10}	Neptunium-235	4.8×10^{-25}
Silver-109m	3.6×10^{-25}	Bismuth-210m	4.9×10^{-25}	Neptunium-237	2.0×10^{-6}
Cadmium-109	3.6×10^{-25}	Bismuth-210	1.2×10^{-10}	Neptunium-238	1.6×10^{-10}
Silver-110	6.2×10^{-31}	Bismuth-211	8.1×10^{-10}	Neptunium-239	4.8×10^{-7}
Silver-110m	4.8×10^{-29}	Bismuth-212	1.5×10^{-8}	Neptunium-240m	1.5×10^{-15}
Cadmium-113m	1.5×10^{-5}	Bismuth-213	1.3×10^{-12}	Plutonium-236	2.5×10^{-10}
Indium-115	2.5×10^{-16}	Bismuth-214	2.5×10^{-10}	Plutonium-238	7.1×10^{-4}
Tin-119m	1.9×10^{-29}	Polonium-210	1.2×10^{-10}	Plutonium-239	1.6×10^{-4}
Tin-121m	6.4×10^{-7}	Polonium-211	1.6×10^{-12}	Plutonium-240	2.3×10^{-5}
Tellurium-123	1.2×10^{-18}	Polonium-212	2.7×10^{-9}	Plutonium-241	5.8×10^{-4}
Antimony-125	6.0×10^{-6}	Polonium-213	1.3×10^{-12}	Plutonium-242	4.7×10^{-8}
Tellurium-125m	3.6×10^{-7}	Polonium-214	2.5×10^{-10}	Plutonium-243	1.0×10^{-21}
Tin-126	2.9×10^{-6}	Polonium-215	8.1×10^{-10}	Plutonium-244	1.5×10^{-15}
Antimony-126	4.0×10^{-7}	Polonium-216	1.5×10^{-8}	Americium-241	7.4×10^{-5}
Antimony-126m	2.9×10^{-6}	Polonium-218	2.5×10^{-10}	Americium-242m	5.7×10^{-8}
Iodine-129	1.3×10^{-7}	Astatine-217	1.3×10^{-12}	Americium-242	5.5×10^{-8}
Cesium-134	1.9×10^{-6}	Radon-219	8.1×10^{-10}	Americium-243	4.8×10^{-7}
Cesium-135	3.4×10^{-6}	Radon-220	1.5×10^{-8}	Curium-242	4.5×10^{-8}
Cesium-137	0.084	Radon-222	2.5×10^{-10}	Curium-243	4.7×10^{-8}
Barium-137m	0.081	Francium-221	1.3×10^{-12}	Curium-244	2.4×10^{-6}
Lanthanum-138	6.5×10^{-16}	Francium-223	1.7×10^{-10}	Curium-245	5.9×10^{-10}
Cerium-142	8.9×10^{-11}	Radium-223	8.1×10^{-10}	Curium-246	3.6×10^{-2}
Cerium-144	1.2×10^{-11}	Radium-224	1.5×10^{-8}	Curium-247	4.9×10^{-17}
Praseodymium-144	1.3×10^{-11}	Radium-225	1.3×10^{-12}	Curium-248	5.2×10^{-17}
Praseodymium-144m	1.6×10^{-13}	Radium-226	2.5×10^{-10}	Californium-249	3.8×10^{-17}
Neodymium-144	4.3×10^{-15}	Radium-228	2.1×10^{-15}	Californium-250	1.6×10^{-17}
Promethium-146	2.2×10^{-8}	Actinium-225	1.3×10^{-12}	Californium-251	5.9×10^{-19}
Samarium-146	8.1×10^{-13}	Actinium-227	8.1×10^{-10}	Californium-252	7.7×10^{-30}
Promethium-147	4.9×10^{-5}	Actinium-228	2.1×10^{-15}		

a. Source: Valentine (2000).

Why is this crucial chemical/radiological information NOT in the IDEQs Fact Sheet or in the Calciner Permit but is found in the Idaho High-level Waste Management EIS? Is it because the public would be shocked to know how lethal the calcine actually is and treatment delays are very risky for Idaho?

"Radionuclides that contribute the majority of the activity for wastes managed in the CSSF include Sr-90, Y-90, Ba-137m, and Cs-137. Activity of typical calcine is approximately 10 mCi/g. The exposure rates associated with the calcine routinely exceed 10 rem/h on a 15-mL sample and can pose a potentially serious hazard to workers at the INL, if appropriate protective measures such as time, distance, and shielding are not applied." [154]

Why is this data not in the Calcine Storage Permit to remind everyone how radioactively/ chemically hazardous it is?

The below Table C.7-4. Calculated radionuclide activities for SBW (curies per liter) decayed to 2016 can be found at Idaho High-Level Waste & Final EIS,[155] is crucial information because it will end up as calcine yet it's NOT in the Permit! Idaho High-level Waste EIS calculated facility disposition summary Table C.4-7 showed a comparison of CPP-713 vaults for sodium-bearing waste tanks with Calcine Bin Set #1. [156]

> "Calcine Bin Inventory: Approximately **41 MCi** [**41 million Ci**] (1.52 x 10^{18} Bq) of waste, nearly all of the liquid waste from reprocessing of spent fuel at the Idaho National Laboratory, had been calcined by May 2000, when the calciner was shut down to comply with a 1999 modification to a notice of noncompliance consent order with the State of Idaho. The composition of the calcine varies depending on the composition of the fuel and its cladding, as well as any chemicals added during reprocessing and calcination. Aluminum- and zirconium-clad fuels yield calcines containing alumina (Al2O3) and zirconia (ZrO2) as major constituents. Hydrofluoric acid was used to dissolve zirconium-clad fuel. Aluminum nitrate was added to the liquid waste to complex the fluoride. Calcium nitrate was added to the waste at the calcining facility (not in the tank farm) to prevent fluoride volatility in the calcination process." [157] [Pg. 25]

Are Calcine and Treatment Bi-products High-level Waste?

1) The calcine waste is by definition HLW. See definition above in DOE O 435.1 section. DOE cannot take the "high level waste components" out of it. HLW is NOT the high activity portion, i.e., Cs-137 and Sr-90 as DOE staff seems to want to believe. HLW is defined in NWPA based on what it came from. Separations are unproven and useless exercise in search of cheap remedies as the Hanford experience demonstrates**.** Judge Winmills tentative ruling (stayed) on DOE Order 435.1 reclassification of Hanford HLW is instructive.

U.S District Court Judge Winmill concluded that the separations process at Hanford matches what is described in statute. The liquid waste that DOE calls low activity waste (in 1995 - when they tried and failed to call it low level waste) is high level waste. Accordingly it must go to deep repository. DOE still plans to try to reclassify it under Order 435.1 as LLW and bury it at Hanford/INL in the near surface. With the Trump administration in charge they might well succeed so IDEQ must get pro-active.

2) The legislative history of the atomic energy and nuclear waste policy acts makes it clear that the reason for deep disposal is the long half-life of the waste. That is the technetium, iodine and actinides. DOE thinks these are low hazard. They are exactly wrong.

3) The calcine can NOT be safely stored for 300-500 years to allow the cesium 137 and Strontium-90 to decay away and take the bulk of the heat with them because**,** as discussed earlier in the AoA discussion**,** the Calcine composition due to compaction, water infiltration**,** and future flooding**,** it may be too late for extraction. Just what DOE is hoping for – so it can be grouted in place and/or the policy makers will not be around to answer for their actions.

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[154] DOE/EIS HLW & FD EIS, DOE/EIS-0287

[155] D0E/EIS-0287 Appendix C. 7, pg. C.7-4. Table C.4-7

[156] Table C.7-4. Calculated radionuclide activities for SBW (curies per liter) decayed to 2016 can be found at Idaho High-Level Waste & Final EIS, D0E/EIS-0287 Appendix C. 7, pg. C.7-4.

[157] NAS 2006, Pg. 26.

IDEQ should not allow the accomplishment of what clearly constitutes illegal disposal of HLW under NRC 10 CFR part 61.

Background History is a Huge Factor in Understanding this Permit

DOE/INL is a major generator of high-level (HLW) radioactive waste since its inception in 1949. DOE and its predecessor have never been willing to appropriately deal with this waste even when forced by Federal Court Order. From December 1963 to June 2000, 2 Calciners [158] at the INTEC were used to convert approximately **7,920,000** gal of liquid mixed hazardous (HLW) into approximately 155,600 ft3 of granular calcine solids containing (according to NRC) **53,900,000** Ci. [159] [160]

This huge volume of high-level liquid waste (HLLW) was the product from chemical/acid reprocessing of irradiated reactor fuel for the production of highly enriched uranium/plutonium for nuclear bombs and other military applications. Eleven underground tanks were used to store this highly toxic/radioactive waste in INTEC Tank Farm that also – like the Calciner Bins never could be RCRA compliant as hazardous waste storage units. The Calcine Bins cannot meet RCRA compliance as any hazardous materials waste storage unit much less used for some 54 years for some of the most deadly man-made toxic material; thanks to complicity of State regulators who actively sought authority from EPA to administer RCRA. [161]

As previously noted, the 7 Calcine Bin Sets total mixed hazardous HLW inventory of radionuclides (decayed to 2016) only counting >2 Ci = ~ **33,987,941 Ci.** [162] See the above Table C.7-3. National Academy of Science puts the total calcine inventory at 31 million curies. [163] The extreme difference between calcine radioactive inventory assessments (NRC at **53,900,000** Ci.; EIS at **33,987,941** Ci; NAS at **31 million curies**) is critical due to the implications for appropriate management of this huge amount of radioactivity. What confidence can the public have with such radical (~23 million Ci.) data discrepancies? This is evidence enough of the calcine lethality and critical role regulations must start playing in protecting the public the need for public involvement and access to information.

"Radiation exposure at Calcine Bin Set #1 from an external event (i.e., earthquake) results in 0.50 rem [minimally exposed individual] (MEI), **34 rem**; [noninvolved worker] (NIW), **5,900 rem**; [offsite population] (OSP), and [latent cancer fatality] 3.0 LCF." [164] In other words, it's deadly radioactive! Now DOE wants to extend its Calcine Storage Permit for another 10 years for a total of ~64 years; long past binsets design life. Given this history, it's a good bet that another extension will be requested in 2027. This delay is an avoidable risk imposed on Idahoans. Basically, Congress is to blame because it

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[158] The first calciner was called the Waste Calcine Facility; the second was the New Waste Calcine Facility. Both were high-temperature incinerators that were finally forced to close because of Clean Air Act violations delineated by EDI Notice of Intent to Sue and followed up by IDEQ's Notice of Violation.

[159] HWMA/RCRA Part BPermit Reapplicatication for the Idaho National Laboratory Volume 22 - Calcine Solids Storage Facility (CSSF) EPA ID NO. ID4890008952, Revision O - May 2016- Book 1 office Idaho Cleanup Project, Pg.1.Hereinafter Calcine Permit

[160] NRC 2006, Table 4, Pg. 47.

[161] Federal Register Volume 77, Number 40 (2/29/12),Proposed Rules],[Pages 12228-12231] [http://www.gpo.gov/] [FR Doc No: 2012-3916] ENVIRONMENTAL PROTECTION AGENCY, 40 CFR Part 271,[EPA-R10-RCRA-2011-0973; FRL-9633-8]Idaho: Proposed Authorization of State Hazardous Waste Management, Program; Revision, ACTION: Proposed rule, 40 CFR Part 271, [EPA-R10-RCRA-2011-0973; FRL-9633-8], Idaho: Proposed Authorization of State Hazardous Waste Management Program; Revision.

[162] Idaho HLW & FD EIS Table C.7-3. Bin set total inventory of radionuclides (decayed to 2016), pg. C.7-3, D0E/EIS-0287 Appendix C.7, pg. C.7-4. Hereinafter D0E/EIS-0287.

[163] NAS 2016 puts the calcine volume at 4,400 cm and 160,000 cubic feet. Researchers find the inconsistency between official DOE/INL and "independent" (i.e., NAS NWTRB) waste data extremely frustrating.

[164] DOE/EIS-0287 Table C.4-7. Facility disposition accidents summary, Pg. C.4-55. "Calcine Bin Set #1 Bounding operations accident; An external event results in 0.50 rem (MEI), 34 rem (NIW), 5,900 rem (OSP), and 3.0 LCF. MEI = maximally exposed individual; NIW = noninvolved worker; OSP = offsite population." The exposure rate is the same for all 7 Bin Sets.

refuses to face up to the funding requirements needed to develop a new HLW geologic repository.

The Laws Intended to Force Action on the Legacy of Federal Government's Resistance to Deal with its Waste Generation

The U.S. Congress passed numerous laws starting in the 1970s in an attempt to force federal agencies to be accountable for their actions that include National Environmental Policy Act (NEPA), Federal Facilities Compliance Act (FFACO), Federal Facilities Agreement and Consent Order (FFA/CO), CERCLA, RCRA, [165] and Nuclear Waste Policy Act of 1982 (NWPA) [166] to name only the lead legislative Acts.

As result there have been no less than 21 [167] Environmental Impact Statements or Environmental Assessments directly related to INL's nuclear waste programs that all promised to address the mixed/radioactive waste treatment and resulting contamination remediation. To date, there has been very limited accomplished except a lot of reports, talk, promises and court battles. Now comes DOE with yet another policy to kick the can further down the pre-viable >60 yr. road by requesting that Idaho extend this Calcine high-level waste (HLW) permit another decade.

In addition to the above Congressional legislation specifically designed to reign-in the federal government we see one of the better local examples of push-back on DOE and its predecessors. His name is former ID Governor Cecil Andrus; who initially filed suit in 1991 against DOE and later supported by both Governor Phil Batt and Governor Dirk Kempthorne into the Ninth Circuit Court of Appeals that ultimately produced the Settlement Agreement Consent Order in 1995. It took three successive Idaho Governors to see this process through based in part on what they read in the first INL EIS in 1977. [168] It's a shocking read about the highly secretive INL and more candid than the current variety of EISs.

Our recent Idaho Governors saw how the federal governments' (Congress and DOE) promises are hollow. The issue being; when does perpetual storage become "de-facto" dumping? The result is that Idaho is de-facto nuclear waste dump and Idahoans future is compromised. Andrus had the political will to – as he said – send the biggest – meanest looking State Troopers out to block a spent nuclear fuel (SNF) shipment from Public Services Colorado reactor from crossing the border. Governor Andrus continues his efforts by filing a suit against DOE for denying FOIA documents on its SNF shipment plans at INL which is a significant testament to his long held view of DOE **actual policy is to leave nuclear waste in Idaho**. [169] This Calcine Permit extension is only the most recent example to DOE's "MO." [170]

ID Attorney General Alan Lance was forced in 2002 to go back to Court to force DOE to comply with all the terms of the 1995 Settlement Agreement. Lances' office asked the U.S. District Court to issue an order declaring that the 1995 agreement includes nuclear waste buried at INL. Lance stated:

> *"The agreement requires the federal government to remove all INL transuranic waste no later than 2018 and all SNF by 2035. Although the court-enforceable agreement clearly states that all transuranic waste must be removed, the DOE has taken the position that buried waste is not covered by the agreement. This is extremely important because DOE maintains that the agreement does not require removal of an estimated 30,000 cubic meters of buried*

[165] Comprehensive Environmental Response, Compensation, and Liability Act, 1999.

[166] NWPA 42 U.S.C. 10101 *et seq.*

[167] See attached list of 32 EIS/EA related to DOE's INL operations in EDI's Calcine Permit Comments.

[168] ERDA-1536; Waste Management Operations, INEL Final Environmental Impact Statement, US Energy Research & Development Administration, September 1977; and ERDA-1552; Final Environmental Impact Statement, Safety Research Experiment Facilities, INEL, September, 1977, US Energy Research & Development Administration.

[169] Case 1:15-cv-00453-BLW Document 24 Filed 08/08/16

[170] Another example is EDI's Notice of Intent to Sue Over DOE's Failure to Comply with the Resource Recovery and Conservation Act, 42 U.S.C. § 6901 et seq. and the Clean Air Act in operation of the New Waste Calcining Facility at the Idaho National Engineering \ Laboratory, April 11, 2000. EDI's legal action prompted the IDEQ to force DOE to close the NWCF.

transuranic waste. Regrettably, the department is unwilling to accept that the agreement means what it says. Since the day Governor Batt and I signed the agreement the State of Idaho has been clear and consistent in stating that the agreement will be vigorously enforced." [171]

What the previous ID Governors realized was – once nuclear waste is allowed in it's nearly impossible to get it out regardless what the federal government pledges to do in court. They lie because there's no accountability. The long history of litigation attests to the fact that the federal government is playing a long game of "catch me if you can," because no judge will put us in jail.

Since the US Nuclear Navy's Naval Reactors Facility is a major contributor to INL's nuclear HLW waste problem, they are also battling Idaho's Settlement Agreement in Court because it restricts shipment of the Navy's reactor spent nuclear fuel (SNF). The Navy even fought and lost Idaho's demand for an EIS on the impact on Idaho's environment, health and safety. [172] Again, the Navy tried to violate a court enforceable agreement that they and DOE originally signed. The bottom line is the federal agencies don't care about the law or Idahoans; they just need a place to cheaply dump their nuclear waste.

Current Idaho Attorney General Laurence Wasden is doing his part by rejecting DOE's requests to send more SNF to INL in violation of the Settlement Agreement. Credible – even heroic – as these actions are, they still have only stalled the process of protecting Idahoans. Decade after decade, the federal government lies, obfuscates accountability.

Calcine Comment Conclusion

In EDI's view**,** IDEQ must reject the Calcine Storage Permit and replace it with an annual storage permit based on progress in development of; 1.) retrieval technology; 2.) "Direct Vitrification" piolet plant scale so as not to repeat Hanford full scale rush on unproven designs. Also IDEQ must force DOE (via the Consent Order) to start calcine extraction - starting with the oldest Bins that AoA claims may be problematic and to prevent DOE from permanently grouting in place in violation of FFCA, CERCLA, RCRA and NWPA. The retrieval process must be done regardless of the treatment chosen. Why wait? Since Bin Set 7 (the newest of the 7) is empty it can be used to develop retrieval systems by transferring calcine from the Bin Set 1 (the oldest and most vulnerable) to Bin Set 7.[173]

Also, the permit must be **rejected** until DOE/INL first addresses the immediate potential flood hazard and incorporate sufficient measures to protect the INTEC and other INL facilities as required by Idaho Code §39-4409(5). Specifically, corrective action is required prior to permit approval - as stated in DEQ's Fact Sheet.

> "Corrective Action Determination: Idaho Code §39-4409(5) requires, in accordance with IDAPA 58.01.05.008 [40 CFR § 264.l0l (a)], the owner/operator of a hazardous waste facility to institute corrective action as necessary to protect human health and the environment for all releases of hazardous wastes and hazardous constituents from any solid waste management unit at the facility, regardless of the time at which the waste was placed in the unit."

EDI agrees with former ID Governor Andrus when he stated:

> "As you know, I have happily spent many years of my life serving Idaho and her citizens. As your 4-term governor elect, one of my proudest achievements was opposing efforts by the federal Department of Energy to use Idaho as a dumpsite for nuclear waste – laying the groundwork for my successor and friend, Governor Phil Batt, to negotiate the historic 1995 Batt Agreement." [174]

[171] State of Idaho Office of Attorney General Alan G. Lance, press release, 4/18/02.
[172] Civil No. 91-0035-S-HLR (Lead case) Civil No. 91-0054-S-HLR, Order Modifying Order of June 28, 1993.
[173] DOE/NE-ID-11227, Appendix B.
[174] October 13, 2015 Letter from Cecil D. Andrus, former Governor of Idaho.

SECTION 3. Idaho Nuclear Technology and Engineering Center HLW Tank Farm Waste, Soil and Groundwater [175] [176]

Background

"Between 1953 and 1992, the Idaho Chemical Processing Plant (now called INTEC) reprocessed 44 metric tons of heavy metal of U.S. government spent nuclear fuel primarily to recover highly enriched uranium (NRC, 1999b). The processing of spent fuel at the Idaho National Laboratory was similar to processing carried out at the Savannah River Site and the PUREX facility at Hanford. Spent nuclear fuel was dissolved in nitric acid and other strong mineral acids and then sent through further processing steps to recover uranium, neptunium, krypton, barium, and xenon. The highly radioactive waste from the first cycle of the solvent extraction system, containing most of the fission products, was piped to the underground tanks. The 4 (30,000 gal) w/o vaults; 7 stainless steel tanks, each with a typical capacity of 1,136 m3 (300,000 gallons), are located within concrete vaults. There are annular spaces between the outside of the tanks and the vault walls. Some of the tanks have cooling coils along their bottoms and walls. Three of the tanks were designed for use with less radioactive wastes and, thus, did not receive first-cycle waste from the reprocessing facilities.

"Unlike waste at Hanford and the Savannah River Site, sodium hydroxide was not added to the liquid tank waste, thus reducing the volume of storage space needed. Because the tank farm components were made of stainless steel that was compatible with the waste, there was no need to neutralize the waste streams. In fact, the waste streams sent to the tank farm were purposely kept acidic to minimize waste precipitation, to simplify later waste retrieval, transfers, and processing. Maintaining acidic waste streams also reduces the possibility of accidental nuclear criticality in the tank farm. Most of these wastes were removed from the tanks and sent to the calciner for processing." [177]

This Section 3 review primarily focus on the Idaho Nuclear Technology and Engineering Center INTEC Tank Farm Facility (TFF) HLW/SBW waste tanks (Operable Unit 3-14). EDI's Review includes:

1: INTEC Tank Farm CERCLA cleanup problems that document the massive contamination that demonstrate the impact of using the tanks as a permanent disposal site for tank solids [heels] is grossly misguided and adds to the risk of additional hazardous/radioactive contaminates migrating to the Snake River Aquifer below forever.

2: INTEC tank closure plan coved the waste in 11 tank solids/heels closed with grout; DOE's has grouted 7 tanks; the remaining 4 tanks will be grouted with sediments wastes left in place as a permanent disposal operation in violation of EPA/NRC land disposal restrictions and standards requiring deep geological disposal elaborated below. [178] [179]

3. Disposition of the remaining ~900,000 gal. sodium-bearing HLW waste transferred from the

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[175] Chuck Broscious, Supplemental Comments on Department of Energy Idaho National Laboratory Idaho Nuclear Technology and Environmental Center Cleanup Plan Revised November 2018. INTEC Tank Farm Soil and Groundwater Cleanup Plan, Operable Unit 3-14, Idaho Department of Environmental Quality, Notice of Intent to Approve Plan for Closure of Hazardous Waste Units at INL, Docket # 10HW-0706. http://www.environmental-defense-institute.org/publications/CERCLA.INTEC.pdf

[176] U. S. NUCLEAR REGULATORY COMMISSION TECHNICAL EVALUATION REPORT FOR THE U.S. DEPARTMENT OF ENERGY IDAHO NATIONAL LABORATORY SITE DRAFT SECTION 3116 WASTE DETERMINATION FOR IDAHO NUCLEAR TECHNOLOGY AND ENGINEERING CENTER TANK FARM FACILITY, October 2006. Hereinafter NRC 2006. https://www.nrc.gov/docs/ML0624/ML062490142.pdf

[177] Tank Waste Retrieval, Processing, and On-site Disposal at Three Department of Energy Sites: Final Report, Committee on the Management of Certain Radioactive Waste Streams Stored in Tanks at Three Department of Energy Sites Nuclear and Radiation Studies Board Division on Earth and Life Studies, National Academy of Sciences, Pg. 24, 2006. Hereinafter NAS 2006 http://nap.edu/11618

[178] DOE Initiative Technology Summary Report, "Gunite Scarifying End Effect," Tanks Focus Area, DOE/EM- 0610, 9/01, offers demonstration on techniques for removing significant quantities of waste from tank walls.

[179] See Attachments in EDI's report that include: **Attachment A:** EDI's compellation of the ~ 136 INTEC Liquid Waste Management System Tanks that are not being evaluated in DOE's cleanup plans; **Attachment B:** Institute for Energy and Environmental Research Report, "Why Grouting Does Not work" articulates the problems related to DOE's tank closure plans using grouting. Also see related EDI reports: http://www.environmental-defense-institute.org/publications/EDI%20Com.IWTU.fin.11.3.06.pdf http://environmental-defense-institute.org/publications/INTEC%20tank%20clousure.review.5.htm

previous 7 closed/grouted tanks to the remaining 4 (300,000 gal) tanks will be processed in the INTEC IWTU. See table below that shows the list of tanks.

DOE's Charles Anderson, Principal Deputy Assistant Secretary for Environmental Management statement: "DOE will proceed to complete grouting the Tank Farm Facility components that have been cleaned to remove highly radioactive radionuclides **to the maximum extent practical** and for which the State of Idaho has approved a closure plan." [180] [Emphasis added]

This plan to leave the tank solids and grout the tanks remains in effect today along with Idaho's concurrence. National Academy of Sciences analysis of INL's SBW tanks states:

> "Sodium-Bearing Waste in Tanks: The roughly 500 kCi [**500,000 Ci**] (1.85 x 10^{16} Bq) of radioactivity in the liquid radioactive waste remaining at the INTEC tank farm is called sodium-bearing waste. DOE describes sodium bearing waste as "a liquid mixed radioactive waste produced from the second and third cycles of spent nuclear fuel reprocessing and waste calcination, liquid wastes from INTEC closure activities stored in the Tank Farm, solids in the bottom of the tanks, and trace contamination from first cycle reprocessing extraction waste" (DOE-ID, 2002).
>
> "Sodium bearing waste has high concentrations (more than 2 moles per liter) of sodium nitrate salts, resulting from the addition of sodium hydroxide to the washing solution to enhance its effectiveness in removing some residues. Some of this liquid waste was sent through the calciner to produce calcine waste. Figure II-11 shows how much waste is stored in each of the roughly 1,100 m3 (300,000 gallon) tanks. DOE is now cleaning seven tanks, and one tank is a clean spare." [181] [Pg26]
>
> "Idaho Tank Inventories: The vast majority of Idaho tank waste is in a liquid form, but a small amount of insoluble solids can be found at the bottoms of the tanks. DOE has sampled waste from several tanks. In a typical tank, the cesium-137 and strontium-90 (and their short-lived decay products borium-137m and yttrium-90) account for most of the radioactivity in both the solids and the liquids. In tank WM-187, for example, strontium and cesium together contribute 97 percent of the total radioactivity of 0.22 Ci per liter (8.1 x10^{9} Bq per liter).
>
> "Isotopes of plutonium (mostly plutonium-241 and plutonium-238) constitute 1.9 percent (Barnes et al., 2004)…. More than 187 samples have been retrieved from the tanks at the Idaho National Laboratory since 1987. Most of the samples are obtained via steam jet pump from the tanks. Some samples were obtained directly via a Light Duty Utility Arm (Olson, 2005). The uncertainty in quantities is generally within 10 percent for most chemical constituents; less than 20 percent for most radionuclides; and about 30 percent for solids; however, many organics were not able to be detected during sample analysis. The tanks are currently sampled for steam reforming processing needs." [182] [emphasis added]

Inventory of Radioactive Waste by Type at the Idaho National Laboratory [183] [Pg.28]

Type of Waste	Volume (m^3)	Radioactivity (Ci)
Total tank and bin waste[a]	~5,000	35-36 million
Comprising		
Treated Sodium-bearing waste in tanks	~ 500-800	~520,000
Calcine waste in bins	4,400	35 million
Waste leaked into environment from pipes and valves[b]	107	37,000
Service wastewater injected to aquifer[c]	45 million	22,000
Stored transuranic waste[d,e]	65,000	343,000
Buried transuranic-contaminated waste and soil[d,e]	37,000	297,000
Low-level waste (including mixed) stored	2,200	Not available
Low-level radioactive waste in disposal cells [d]	158,000	12 million
TOTAL	>45 million	>49 million

NOTE Above table: Shaded entries are wastes that ultimately are expected to remain on-site. These data are from different sources, are measured or estimated at different times, and did not indicate quantified uncertainties. This table does not include spent nuclear fuel stored on-site (i.e., from naval and test reactors as well as from Fort St. Vrain and Three Mile Island) or contaminated soil at the evaporation ponds, which have been remediated.

[180] Department of Energy, Dear Interested Party letter, 11/20/06, Charles E. Anderson, Principal Deputy Assistant Secretary EM.
[181] NAS 2006, Pg. 26.
[182] NAS 2006, Pg. 26.
[183] NAS 2006, TABLE II-3 Pg 28

Above "Service wastewater injected to aquifer [c"] represents the apparent continued illegal [184] use of multiple injection wells to dispose of INTEC reprocessing waste water directly into the aquifer until 1982 when former Governor Andrus forced DOE to close/grout for violation of the Clean Water Act..

Table 5. Residual "Heels" Inventory in Grouted/Closed INTEC Tank Farm Facility

Grouted Tanks	**sludge volumes** (PNNL) **gal./m 3 (cm)** [185]	**Residual Inventory** WSRC **Giga/Becquerel (GBq)*** [186]	**Residual Inventory DOE Curies** [187]	**Residual Inventory Cs-137**
4 (WM-103-WM-106) (30,000 gal)	10,200 gal/ 39 m3	5,300	36.50	?
WM—180 (300,000 gal)	600 gal / 2.3 m3	39,000	1,046.56	2,070
WM—181 (300,000 gal)	600 gal / 2.3 m3	28,000	475.40	2,539
WM—182 (300,000 gal)	600 gal / 2.3 m3	89,000	2,354.00	3,490
WM—183 (300,000 gal)	5,400 gal / 20.4 m3	50,000	1,363.00	13,721
WM—184 (300,000 gal)	600 gal / 2.3 m3	40,000	1,077.00	?
WM—185 (300,000 gal) Sand-Pad	600 gal/ 2.3 m3	51,000	1,391.00 3,850.00	?
WM—186 (300,000 gal)	600 gal / 2.3 m3	24,000	645.80	?
Incomplete Total Curies	19,200 gal.	**281,300 G/Bq (Billion Bq) or 7,602.7027 Curies**	**12,239.26**	**21,820**
NRC 2006, Table 4 Pg. 47			**2.48×10^4 [24,800]**	

Notes for above table: The huge difference between the Ci totals above represents DOE totals opposed to NRC totals and Pacific Northwest National Laboratory (PNNL) totals. The 21, 640 nCi/g represents the fact that the tank heels are not only HLW but also greater-than-class C waste that violates NDAA criteria for near-surface non-HLW and thus requiring deep geological burial. Discussed more below.
1 Giga Becquerel (GBq) = 1 Billion Becquerel (Bq); 1 Curie = 37 billion Becquerel; 281,300 GBQ = 7,602.7027 Curies; For reference EPA MCL Cs-137 = 119 pico curies/liter; 40 micro (millionth) curies inhalation (total dose); NCRP occupational dose exposure limit, Pg. B-456 and EPA MCL Dose limit all radionuclides = 4 mrem/year.

Robert Alvarez reports: "The high Cesium-137 (half-life of 30 yr.) in INTEC tanks WM-180 (**2,070 Ci**), WM-181 (**2,539 Ci**) WM-182 (**3,490 Ci**), WM-183 (**13,721 Ci**), WM-187 (**75,200 Ci**), WM-188 (**26,200 Ci**) or a total of **123,220 Curies** adds to the hazard. This waste falls into the Greater-Than-Class C Nuclear Regulatory Commission regulations (10 CFR Part 72.3) as low-level waste that exceeds the concentration limits established for Class C waste in (10 CFR Part 61.55)." [188]

[184] 40 CFR § 144.12 Prohibition of movement of fluid into underground sources of drinking water. (a) No owner or operator shall construct, operate, maintain, convert, plug, abandon, or conduct any other injection activity in a manner that allows the movement of fluid containing any contaminant into underground sources of drinking water, if the presence of that contaminant may cause a violation of any primary drinking water regulation under 40 CFR part 142 or may otherwise adversely affect the health of persons.

[185] PNNL-13651 UC-721, Pg. 3.1

[186] Recent Progress in DOE Waste Tank Closure, WM Symposium 2008 Paper 8396, 2/24-28, 2008, Phoenix, AZ, WSRC-STI-2007-00686, 1/31/08, Pg.8-9.

[187] Appendix A, INTEC Tank Farm Facility Closure Supporting Tables and photographs, Pgs. A-6 to A-12

[188] Robert Alvarez, Institute for Policy Studies report; "It's been 26 years since the Chernobyl accident."

Table 6: INTEC Tanks In Use Radioactive Solids/Heels Transuranic Contents

INTEC SBW Tanks in-use	Cs-137 Curies [189]	Solids Quantity (kg) [190]	Sand-Pads cushion under tanks Ci	Total Curies [191]	Total nCi/g [192]	No. Times Over Reg. Limit [193]
WM-187	75,200	160,000	3,850	5,432	543.2	5
WM-188	26,200	10,000	?	286.98	28,698.0	286
WM-189	?	20,000	?	?	?	?
WM-190 Empty *	?	?	?	?	?	?
Totals in-use	101,400	190,000	?	5,719	>29,241.2	>291
Totals in-use + Closed [194]	101,400	190,000	3,850	5,719	?	?
Table 5	21,820	3,815	3,850	7,700		
Total All	**123,220**	**193,815**	**7,700**	24,800 **38,219**		

Units: 1 kilo-gram (kg) = 1000 grams (g); 1 curie (ci) = 1 billion nano-curies (nCi)

* "Tank WM-190 is an emergency spare tank and has never been used to store waste. However, this tank was contaminated with a small volume of first-cycle extraction process waste when the waste passed inadvertently through a transfer valve. As noted previously, Tank WM-182 contains the largest amount of residual radioactivity of the cleaned tanks." [pg.36]

The huge difference between the above Table 5 &6 Ci totals represents DOE totals opposed to NRC totals and WM Symposium 2008 Paper totals referenced in the table. This is a crucial issue due to the fact that this significant amount of radioactivity is now permanently buried in these 7 closed tanks. Additionally, the PNNL report shows the tank heels have 21, 640 nCi/g [195] represents the fact that the tank heels are not only HLW but also greater-than-class C waste that violates NDAA criteria for near-surface non-HLW and thus requiring deep geological burial. "Radiochemical analysis of solids from tank WN-182 showed that the TRU nuclide total is 21,640 nCi/g and the total radionuclide activity is 2.6 MCi/g [2.6 million Ci/g]. Since the solid particles exceed the 100 nCi/g TRU limit; the waste must be retrieved." [196] [Pg.3.1]

DOE thus violated even the TRU waste disposal regulation on near surface burial when the tanks were grouted/closed in place. "The tank farm sludge is 25 volume % solids particles and 75 volume %

[189] Ibid. Robert Alvarez

[190] INEEL/EXT-2000-01378 Table 24, pg. 53 and pg. 54

[191] DOE/NE-10-11226, pg. 34 &37

[192] Unit conversion example: 0.028698 ci/kg X (nCi/g/1 billionth [1.0E-9]) X 1 kg/1000 = 28,698 nCi/g; or 0.028698 ci/kg X 1,000,000 (1.0E6) = 28,698 nCi/g; (1.0 E-9 is the same as 1.0×10^{-9}). Ci/g and nCi/g are concentration unit ratios for quantifying radioactivity per unit quantity.

[193] Transuranic (TRU) waste is radioactive waste that is not classified as high-level radioactive waste and that contains more than **100 nano-curies** (3700 Becquerel's) per gram of alpha-emitting transuranic isotopes with half-lives greater than 20 years. DOE previously classified these tanks as high-level waste but recently "reclassified" them as Sodium-Bearing Waste (SBW) incidental to reprocessing uranium reactor fuel with higher amounts of uranium-235 ("highly- enriched") to extract U-235 and Pu-239 for new reactor fuel and military purposes.

[194] NRC 2006, Table 4, Pg. 47.

[195] PNNL-13651 UC-721, Section 3.3 Tank Closure Process Overview, Pg. 3.2

[196] PNNL-13651 UC-721, Pg. 3.1

interstitial liquid. The particle density is 2000 kg/m3; the liquid density is 1200 kg/m3; and the sludge bulk density is 1400 kg/m^3. The bulk density of the sludge is slightly greater than the bulk density of the surrogate sludge simulant. Comparison between the density of INTEC sludge and the densities of other fluids at INEEL are shown in [PNNL rpt.] Figure 3.2." "The existing steam jets are used to remove slurry from the tanks. At the end of steam jet operation, a fluid heel remains in the tanks. Current tank transfer equipment leaves a heel approximately 7.6 to 25 cm (3 to 10 in.) in depth." [197] [pg3.2] DOE claims only <1" sediments left in tanks.

Table 6 INTEC Tank Farm Soil Contamination Problems

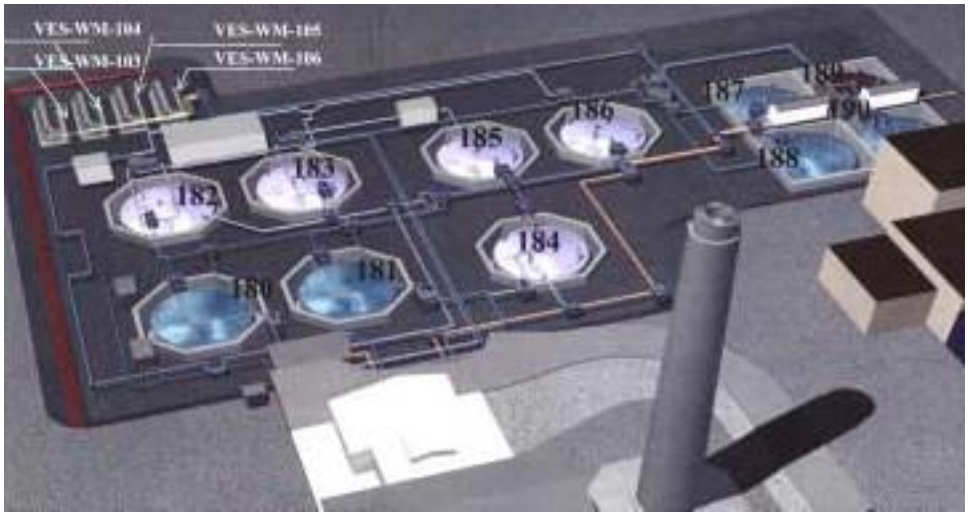
Summary of Tables Table 5-42, 5-43 analytical results for CPP-79 INTEC tank farm soil samples

Depth feet	Cs-137 pCi/g	Sr-90 pCi/g	Pu-238 pCi/g	Pu-239-240 pCi/g	Tc-99 pCi/g	Am-241 pCi/g	Em-154 pCi/g	Pu -241 pCi/g	Zirconium mg/kg
32-36	3,350,000	219,000	34,300	34,300	182	2,330	2,860	18,700	32
56-60	1,350,000	34,700	10,700	14,600	13	773	773	613	18

Table 7 Bore hole soil sample results

Radionuclides pCi/g	Borehole CPP-79-1 (14-16 ft.) below tank surface	Borehole CPP-79-1 (32-16 ft.) below tank surface	Borehole A-61 (28-30 ft.) below surface	Borehole A-62 (2-4 ft.) surface
Gross Alpha	22.2	809,000	1,230	21
Gross Beta	158	18,900,000	20,500	1,100
Cesium -137	20.9	33,700,000	25,000	730
Sr-90	54.4	5,410,000	3,360	305
U-234	5.55	ND [a]	2.10	1.42
U-238	1.38	ND	1.50	1.67
Pu-238	0.13	276,000	326	1.14
Pu-239-240	0.10	89,900	319	0.13
Am-241	0.33	16,600	46	R [b]

Source for above tables 6 & 7: Operable Unit 3-14 Tank Farm Soil and Groundwater Remedial Investigation/Baseline Risk Assessment, April 2006, Idaho Cleanup Project, Pg. 5-151, Table 5-42 &43, DOE/NE-ID-11227. [a. ND=non-detect] [b. R= result rejected because of out-of-control quality control parameter or just too high to report]



[197] PNNL-13651 UC-721, Section 3.3 Tank Closure Process Overview, Pg. 3.2.

Above Figure shows INTEC Tank Farm overview showing the (7) 1136-m3 (300,000-gal.) and (4) (VES-30,000 gal.) tanks and vault types. VES-WM-103, through 106, and WM-180 through 186 grouted/closed (total 11 tanks). Tanks WM-187 and WM-188 received the contents (44,400 gal 168 m3) in the 11 closed tanks and are in use - planed for grouting when "emptied." Tank WM-190 is mostly empty as a spare in case of a major leak. [198]

Tank Stabilization-Residual andTank Grout Filling

Tank residual radioactivity in amounts of solids and contaminated flush water that was not removed from the tanks by the cleaning process were stabilized in the tank with cement based grout**.** The residual inventories that will remain forever as a permanent dump - leaching contaminates into the soil/aquifer for millennia. Each of the "cleaned" closed tank data are given in Table 5 above.

According to the Nuclear Regulatory Commission (NRC) assessment of the INTEC HLW tanks: "It should be noted that NRC staff is providing consultation to DOE as required by the National Defense Authorization Act (NDAA), and the NRC staff is not providing regulatory approval in this action. DOE is responsible for determining whether the waste is HLW. This NRC staff assessment is a site-specific evaluation and is not a precedent for any future decisions regarding non-HLW or incidental waste determinations at INL or other sites." [199] [200] NRC's interpretation of DOE meeting the NDAA three Criterions in order to get previously HLW reclassified as low-level transuranic waste are:

> "Section 2. CRITERION ONE: The waste does not require permanent isolation in a deep geologic repository for spent fuel or HLW (NDAA).
>
> "2.1 Waste Disposal Criterion One: allows for the consideration that waste may require disposal in a geologic repository even though the two other criteria of the NDAA may be met. Consideration could be given to those circumstances under which geologic disposal is warranted in order to protect public health and safety and the environment; for example, unique radiological characteristics of waste or non-proliferation concerns for particular types of material.
>
> "2.2 NRC Review and Conclusions: Given the analysis in the following sections of this [Technical Evaluation Report] TER, which indicates that DOE can meet the applicable criteria in the [National Defense Authorization Act] NDAA, and the fact that there is no indication that other considerations would warrant disposal of the waste in a geologic repository, the NRC staff concludes that Criterion One can be met by DOE. [201] [Pg21]

NRC dismisses outright the whole NWPA definition of HLW requiring deep geological disposal based on its own Technical Evaluation Report that EDI shows specifically below how much NRC relied on DOE's "estimates" without basis in sampling data and how these were then used in modeling assumptions – further distorting actual waste characteristics.

> "CRITERION TWO: The inventory remaining in the tanks: (i) must be developed to demonstrate that the waste has been processed to remove [highly radioactive radionuclides] HRRs to the maximum extent practical (see Section 3.7), (ii) is needed to determine if the waste is greater than Class C (see Section 4.1), and (iii) is used to develop the source term in the PA (see Sections 4.2.6 and 4.2.7). DOE Idaho used historical waste management information, coupled with post-cleaning sampling and analysis and PA results, to demonstrate that the TFF waste residuals and associated ancillary equipment will meet criterion 2 and 3 of Section 3116 at closure." [202] [Pg 22]

NRC analysis of DOE's qualification to meet the NDAA criteria 2 has the same problematic fundamentals as Criteria 1 noted above where NRC to its credit did identify where DOE failed to show reliable data to support DOE Idaho/INL's conclusions. The previous discussions by other credible analysts on the tank sediments (ie., being 3-10 in. deep and <90 % removed) are instructive. Below, EDI highlights (underlines) NRC's statements of concerns that are relatively buried in the lengthy text.

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198 PNNL-13651 UC-721, Section 3, Figure 3.1

199 NRC 2006, Pg. 111.

200 All emphasis in NRC report quoted in [**bold**/underline] is added from the original text.

201 NRC 2006, Pg. 21.

202 NRC 2006, Section 3, Pg. 22.

"Large Tank Inventory: The highest measured radionuclide concentrations from tanks WM–182, WM–183, and WM–188, recently sampled at the time the PA for the TFF was written, were used for the worst-case inventory. Tank WM–188 had the highest radionuclide inventory out of these three tanks (see worst-case inventory description below).

"It was assumed that each tank would initially (before grouting) contain approximately 3 cm [~1 in] or 2,317 kg [5,108 lbs] of tank solids. These solids were estimated to have a bulk density of 1.4 g/cm3 (with 25 percent solids and 75 percent free interstitial liquid by volume). In addition, each tank was assumed to contain 4,989 L [1,318 gal] of liquids, which corresponds to approximately 3.2 cm [1.3 in] of total material remaining in the bottom of the tank." [203] [pg22]

"It was assumed that radionuclide concentrations in the solid materials would be unaffected by tank cleaning and that tank cleaning would only result in limited bulk mass removal (i.e., no removal from dissolution of solids into the large quantity of "flush" water used to clean the tanks was assumed). Using this approach, tank WM–182 had the highest postcleaning inventory of **2,394 Ci** (DOE Idaho, 2005)." [pg 23]

"DOE Idaho stated it was only able to report one solid sample result due to the inability to collect enough solid material from the tanks (DOE Idaho, 2005). In its response to [request for additional information] RAI 2, DOE Idaho stated that for solid analysis the [sampling and analysis plan] SAPs require 15-percent solids by volume and that this requirement was not met for any of the tank sampling activities. Only the samples collected from WM–183 contained any visible solids. All of the WM–183 liquid samples were filtered to composite the solids into a single solid sample of a few grams for analysis (DOE Idaho, 2006a). The solid results for WM–183 were used to estimate the residual solid inventories for all tanks. For radionuclides that were not sampled or not detected (most of the radionuclides that are not HRRs), the remaining inventory was estimated using ORIGEN2 ratios and the mean Cs-137 concentration from sampling conducted prior to cleaning tank WM–188, because this tank had the highest pre-cleaning concentration for Cs-137. For liquid samples, the 95 percent upper confidence level of the Cs-137 liquid samples for each tank is used to estimate the concentrations of radionuclides that were not sampled in that tank. Using this approach, tank WM–182 had the highest postcleaning inventory of **2,394 Ci** (DOE Idaho, 2005). [204] [PG24]

"The final inventory for each tank was estimated using the concentrations obtained from sampling as discussed above. An assumed density of 1.4 g/cm3 was used with estimated volumes of the residual solids in each tank to determine the mass of solids. With this information, the total solid heel inventory could be calculated (product of concentration and mass of solids). The tank volumes were estimated by viewing videotapes of the tanks taken before, during, and after the final cleaning and sampling events and estimating depths from reference points in the tanks (e.g., cooling coil support brackets and associated welds. … The residual solid heel volume was estimated using simple kriging methods (e.g., point-kriging with linear interpretation) in the computer code Surfer 8 to create the surfaces. Residual solid volume estimates were also made with Surfer 8 using a lower 0 cm [0 in] surface boundary, the kriged upper surface boundary, and the trapezoid rule to estimate the residual solid volume. …..See Table 1 below for the final estimated inventory for a single tank (WM–182). DOE Idaho used the dose results from the PA and scaled those results to the ratio of the estimated final inventory at closure based on sampling (Table 1) to the "conservative" PA inventory (also shown in Table 1) to compare final estimates of radiological risk against performance objectives (see Section 4.2). [PG24]

"Table 1. Maximum Expected Residual Waste Inventory of a Single Tank at Closure (Tank WM–182) and DOE PA (DOE Idaho, 2003a) Conservative Single Tank Inventory (modified from Table 1, DOE Idaho, 2005) Radionuclide Total Residuals (Ci)*Total Ci all radionuclides 2.4×10^3 [2,400 Ci] DOE PA uses 2.41×10^4 " [**24,000 Ci].** [205] [pg26]

• The realistic-case inventory assumed a 25-percent reduction in the solid residual mass and an 80-percent reduction in the radionuclide concentrations in liquid.

• The best-case inventory predicted a 50-percent reduction in solid residual mass and a 95-percent reduction in the radionuclide concentrations in liquid.

"It should be noted that the reductions stated in the bullets above refer to further reductions in the tank waste inventory after the existing transfer equipment already removed as much bulk liquid and solid heel as possible prior to cleaning. In addition, the total volume of liquid waste for each of the four inventories was assumed to remain the same. [PG23]

[203] NRC 2006, Pg. 23.
[204] NRC 2006, Pg. 24.
[205] NRC 2006, Pg. 26.

"The estimated residual waste inventory at closure was updated to reflect the results of recent TFF cleaning activities which occurred from 2002 to early 2005.

"DOE Idaho attempted to sample all HRRs (see Section 3.3). The results of the sampling are presented in data quality assessments (see DOE Idaho, 2005, Chapter 8 for a bulleted list of references). Limited or no analytical data are available for most radionuclides; therefore, the ORIGEN2 model is used to predict inventories of these radionuclides. Input parameters to the ORIGEN2 model include (i) fuel types, based on fuel-cladding type (e.g., stainless steel, zirconium, and aluminum); (ii) cooling time; and (iii) burnup level. Model parameters are calibrated to analytical data to allow the model to estimate SBW radionuclide inventories based on a weighted average of the different fuel types processed at INTEC. Radionuclide-to-Cs-137 ratios, called the ORIGEN2 ratios, are estimated for each radionuclide to provide relative activities, which are useful for those radionuclides that are difficult to detect. Analytical ratios based on analytical data (in lieu of ORIGEN2 modeling) are also calculated. [PG23]

Table 7. Percentage of HRRs Removed From All Tanks and Ancillary Equipment (modified from Table 6, DOE Idaho, 2005) Source: NRC-2006, Table 4, pg. 47

Radionuclide	Total Ci Generated at INTEC	Residual Ci* in Tanks at Closure†	Percent Removed at Closure‡
Am-241§	9.28×10^{3}	6.97	99.92%
Ba-137m§	8.95×10^{6}	1.19×10^{4}	99.87%
C-14	$2.91 \times 10^{!2}$	3.85×10^{-5}	99.87%
Cm242	1.51×10^{1}	1.00×10^{-2}	99.93%
Co-60	1.67×10^{3}	4.79×10^{-1}	99.97%
Cs-137§	9.46×10^{6}	1.19×10^{4}	99.87%
I-129§	6.01	5.87×10^{-3}	99.90%
H-3	7.13×10^{3}	5.43	99.92%
Nb-94	1.54×10^{3}	1.60	99.90%
Ni-59	3.71×10^{3}	1.90×10^{-1}	99.99%
Ni-63	4.36×10^{5}	2.17×10^{1}	99.99%
Np-237§	7.53×10^{1}	3.57×10^{-1}	99.53%
Pu-238§	1.07×10^{5}	9.08×10^{1}	99.92%
Pu-239§	2.83×10^{3}	2.90×10^{1}	98.98%
Pu-240	1.46×10^{3}	1.09×10^{1}	99.25%
Pu-241	4.73×10^{4}	1.52×10^{2}	99.68%
Pu-242	3.94	7.60×10^{-3}	99.81%
Sr-90§	8.42×10^{6}	6.78×10^{2}	99.99%
Tc-99§	3.67×10^{3}	5.79	99.84%
Y-90§	8.42×10^{6}	6.75×10^{2}	99.99%
Total (Ci)2	**3.59×10^{7} 53,900,000**	**2.48×10^{4} 24,800**	99.93%

Notes for above table: *1 Ci = 3.7×10^4 MBq.†Total Ci at closure includes Ba-137m and Y-90 and radionuclide decay to 2012 based on: (i) heel residuals that are estimated using remote video inspection of cleaned tank internals to map out estimates of depth of remaining residual solids and liquids across tank bottoms using tank internal reference points of known height, (ii) best estimated radionuclide concentrations from past and recent samples, and (iii) radioactive decay to 2012.
‡The removal efficiencies are based on a baseline inventory that included all waste generated at INTEC and stored in the TFF.
§Radionuclides that are significant contributors to dose calculations in the 2003 TFF PA (DOE Idaho, 2003a).
2 Radionuclides shown are contributors to the dose calculations or regulated by concentration limits in 10 CFR 61.55.
The totals are based on the entire inventory of radionuclides.

"3.1.2 Small Tank Inventory: The inventories for each 100-m3 [30,000-gal] tank vary from **36.2 to 36.7** Ci. Tank WM–106 has the highest remaining Ci content of the 100-m3 [30,000-gal] tanks 300k tanks." [206] [pg. 27]

"Additionally, tank WM–187 (300,000 gal.) is the holding tank for waste removed from tanks WM–180 through WM–186, so there may be additional challenges with cleaning tank WM–187 due to the accumulation of solids from multiple tanks. DOE Idaho should attempt to sample tanks WM–187 through WM–190 (particularly tanks WM–187 and WM–188) following cleaning operations to ensure that the inventory for these tanks is not significantly underestimated." [207] [pg34]

"Additionally, long-term groundwater concentrations for Pu-241, Am-241, and Np-237 estimated with GWSCREEN showed that the peak groundwater concentrations for these constituents was not expected to occur until after the period of performance of 10,000 years. Although uncertainty in transport parameters was not considered in the screening analysis, NRC staff attempted to reduce the uncertainty in the transport of Pu-241, Am-241, and Np-237 as discussed below.

"Furthermore, Pu-241, Am-241, and Np-237 were already included as HRRs by default, as they are included in Tables 1 and 2 in 10 CFR 61.55, although they were not specifically targeted for detailed groundwater analysis.

"The list of [highly radioactive radionuclides] HRRs developed by DOE Idaho for the groundwater all-pathways dose did not consider the uncertainty of key transport parameters in the screening process. The NRC staff was concerned that if DOE Idaho had performed sensitivity or uncertainty analyses on transport parameters during the screening process, [pg40]

"Finally, HRRs for worker doses were not specifically identified in the Draft Section 3116 Determination (DOE Idaho, 2005). In response to clarifying [request for additional information] RAI 18 (NRC, 2005), which specifically asked DOE Idaho to list key (or highly radioactive) radionuclides for worker dose and clarify whether short-lived radionuclides were screened out in the identification process, DOE Idaho stated that the screening methodology used in the PA (DOE Idaho, 2003a) was for post-closure public (including inadvertent intruder) doses and not for worker evaluations. However, DOE Idaho did not communicate which worker evaluations had been performed, if any, or any screening for these evaluations. [PG40]

"NRC staff also thinks that radionuclides that pose an inhalation risk are potential HRRs for worker dose (e.g., Pu-238, Pu-239, Pu-240, and Am-241). [208] [pg41]

"NRC [Tank Focus Area] TFA technical team coordinated with all DOE sites to develop cleaning processes based on site needs. The equipment developed had to fit inside the tanks, be compatible with the tank environment, and be able to clean the specific tank waste. Tank cleaning could be accomplished using either chemical or mechanical processes.

"Chemical processes the TFA Team considered included the following (DOE Idaho, 2002d):

• Caustic Recycle—An electrolytic process that selectively separates sodium ions from a waste stream to reduce the overall quantity of waste that must be treated for disposal.

• Sludge Washing—A chemical process for washing with Fenton's Reagent (a mixture of hydrogen peroxide with an iron catalyst) that destroys ion-exchange resin to release waste absorbed on the resin and allow it to be treated for disposal.

• Saltcake Dissolution—A process for dissolving crust level growth in the Hanford SY-101 tank.

206 NRC 2006, Pg. 27.

207 The issue of underestimating yet to be "cleaned" tanks must be noted in the real likelihood that DOE will again apply the same problematic estimating waste characteristics to get around the NDAA criteria. This is especially relevant give that DOE got NRC's qualified endorsement on the first 7 tank closures.

208 DOE may have included HRR's but the fact remains these concentrations are "estimated."

• Chemical Cleaning—A process using various organic acids, possibly combined with caustic leaching, to remove aluminum compounds and dissolve portions of dense heel solids. By breaking up the solid mass, the resulting slurry can then be pumped out of the tank.
• Enhanced Sludge Washing—A chemical process that involves a series of washes where tank waste is mixed with aqueous solutions containing sodium hydroxide. The waste solution is heated and cooled. Then, the liquid containing the nonradioactive elements is decanted. [PG41]

"DOE Idaho determined that chemical treatment processes were not practical for cleaning the TFF tanks. Caustic recycle, solids washing, and saltcake dissolution were developed for the neutralized waste at other DOE sites and did not apply to the TFF acidic waste, because volume reduction is not a concern for removing HRRs to the maximum extent practical in TFF waste, ion exchange resin is not present in TFF tanks, and waste does not adhere strongly to TFF tank surfaces. An acid strong enough to dissolve the existing solids could also cause tank corrosion. Washing the solids in a basic solution could cause more precipitates, which would further aggravate the solids problem. Based on this evaluation, DOE Idaho concluded that chemical treatment processes were not appropriate for the TFF. [209]

"Most pumping systems were developed to remove large quantities, rather than small quantities of liquids with small amounts of suspended solids, and thus were not technically practical for INTEC waste. Because these technologies were determined not to be technically practical, they were not retained for evaluation of economic practicality.) [PG42]

DOE's resistance to include NRC knowledge and experience from other "lessons-learned" at other HLW tank remediation projects as noted above represents a crucial warning about DOE's priorities – namely- it's not willing to invest funding in new technologies that would be more effective in removing the extremely long-lived radioactive sediments "heels" from the tanks. These grouted heels in the already closed 7 tanks will continue as in the past to allow deadly contaminates to migrate into Idaho's sole source aquifer. DOE must not be allowed to apply the same "cleanup" to the remaining 4 tanks. As NRC states below: "Therefore the actual effectiveness of the cleaning technology is uncertain." That defies the very principals the NWPA regulations are based on – "Protection of the general population from releases of radioactivity."

"3.7 Removal to the Maximum Extent Practical

"However, because compliance with performance objectives does not necessarily obviate the need for additional cleaning, it would have been inappropriate for DOE Idaho to establish goals that met the performance objectives with no further analysis of the practicality of additional removal. [PG44]

"Therefore, the actual effectiveness of the cleaning technology is uncertain. DOE Idaho estimates that approximately 90 percent of the tank solids were removed and the efficiency in removal of highly soluble radionuclides such as Sr-90 is expected to be significantly higher (DOE Idaho, 2006a). Almost the entire remaining inventory in the tanks is in the solid heels, and liquid heel concentrations were substantially diluted in the flush water.

"The concerns (expressed in Section 3.2) that Cs-137 concentrations in tank WM–188 are expected to be much higher than the concentration of Cs-137 in tank WM-182 used to estimate the inventory for the uncleaned tanks and that tank WM–187 may contain a much larger quantity of solid residual heel to be removed are mitigated by the likely overestimation of the inventory of a relatively clean tank used as a spare (tank WM–190). [pg45]

"DOE Idaho provided a table (see Table 4) that showed the percentage of removal at closure (2012) of all HRRs identified for the TFF. It is important to note that the cleaning technology did not target particular radionuclides and only attempted to achieve bulk mass removal. However, Sr-90 concentrations decreased significantly in the solid residual heels due to the apparent preferential removal of Sr-90 by dissolution in the large quantity of flush water used to clean the tanks. Removal efficiencies exceeded 99 percent for most HRRs. It is also significant to note that DOE Idaho was not able to provide an estimate of the actual removal efficiency following deployment of the washball and directional nozzle technology due to lack of development of an inventory prior to cleaning operations for each tank. Therefore, the actual effectiveness of the cleaning technology is uncertain. DOE Idaho estimates that approximately 90 percent of the tank solids were removed and the efficiency in removal of highly soluble radionuclides such as Sr-90 is expected to be significantly higher (DOE Idaho, 2006a). Almost the entire remaining

[209] INL's refusal to incorporate NRC (together with other DOE site managers dealing with similar issues) methods is more a financial decision because of the costs required to implement new technologies that NRC explains in this report.

inventory in the tanks is in the solid heels, and liquid heel concentrations were substantially diluted in the flush water. [210] [pg46]

NRC's above statement: "Therefore, the actual effectiveness of the cleaning technology is uncertain" is crucial when the implications of leaving 24,800 curies imbedded in untested /unproven tank/grout that will disintegrate in <100 years long before the long-lived radionuclides decay to safe levers 10s of thousands in the future. With so much uncertainty over the literal future of Idaho's sole source aquifer that most of us and future generations will depend on for millennia. "40 CFR § 61.42: Protection of individuals from inadvertent intrusion" requires "Design, operation, and closure of the land disposal facility must ensure protection of any individual inadvertently intruding into the disposal site and occupying the site or contacting the waste at any time after active institutional controls over the disposal site are removed."

Table 4. Percentage of HRRs Removed From All Tanks and Ancillary Equipment (modified from Table 6, DOE Idaho, 2005) [PG47]

Total Ci Tanks at Closure† Total (Ci)	Generated Total Ci Generated at INL	Residual Ci* in Tanks at Closure
	3.59×10^7 [**35,900,000**]	2.48×10^4 [**24,800**] Ci [211]

"3.1.3 SAND PADS UNDER TANKS [Pg. 27]

"The sand pads underlying two of the tanks (WM–185 and WM–187) were contaminated with first-cycle extraction wastes in 1962 as a result of back-siphoning events the estimated **3,850 Ci.** Because the first-cycle extraction waste in the vault sump overtopped the vault sump and curb (or dike) which holds the sand in the sand pad, radionuclides were expected to be transported radially into the sand pads underneath the tanks (see Figure 12a and 12b). Before and after these releases, water from precipitation, spring runoff, and irrigation infiltrated the tank vaults to the sumps and sand pads and was pumped out at least semi-annually, removing contaminants from the sand pad in liquids that drained to the vault sump through drain tubes in the curb (or dike)." [212] [pg27]

"The residual inventory in the sand pads was developed by DOE based on an analytical, one-dimensional diffusion model with thirty-eight pumping events (pumping of contaminated water that drains from the sand pad into the vault sump). The actual number of water transfers from the sand pad likely exceeds 130 for each vault to date (DOE Idaho, 2003a). [213]

NRC's acknowledgement above of the "actual number of water transfers from the sand pad likely exceeds 130 for each vault to date" is significant because it exposes the inadequacy of the DOE's "analytical" process to exclude the other 92 (130-33=93) contamination events and the unwillingness to get direct samples (noted below) of the Sand Pads to accurately determine the contaminates left permanently disposed in shallow burial.

"In the absence of direct sampling, sand pad inventories have been difficult to evaluate with confidence." [pg27]

"An inventory was calculated by DOE Idaho for the 100-m3 [30,000-gal] tanks and presented in the PA. A comparison of the activity calculated for the 100-m3 [30,000-gal] tanks with the activity in the 1,000-m3 [300,000-gal] tanks indicates that the contamination levels in the 1,000-m3 [30,000-gal] tanks are insignificant. DOE Idaho reasoned that the inventory for the 1,000-m3 [300,000-gal] tanks would bound any releases from the 100-m3 [30,000-gal] tanks (DOE Idaho, 2003a). [Pg. 27]

NRC's willingness to accept DOE's unsampled/calculated inventory of the 4 (30,000 gal.) tanks is significant since these tanks were the tanks where the 1st cycle rafinate from SNF reprocessing was first sent prior to additional extraction processes. This has huge consequences in calculating the overall tank closure effectiveness to protect the public from future chemical/radiation contamination.

"Additional sensitivity analysis was performed by DOE Idaho (2006a) to address the uncertainties with the sand pad inventory (addressed in {request for additional information}RAIs 3 and 4 of NRC, 2006a), which could dominate the predicted dose from short-lived radionuclides assumed by DOE Idaho to be released from the vaults after 100 years, prior to substantial decay. The corrected sand pad inventory is presented in Table 2 (the sand pad inventory in Table 3 of DOE Idaho, 2005, has incorrect values, which were corrected in response to clarifying RAI

[210] NRC 2006 Pg. 46.

[211] NRC 2006 Pg, 47.

[212] The fact that precipitation and/or groundwater gets into the tank vault that "exceeds 130 for each vault to date" clearly indicates how badly qualified these tanks/vaults qualify as permanent repository for high-level waste because as the tanks/vaults/grout disintegrate over ~100 years – contaminates with half-lives of 10s of thousands of years will continue to migrate into the aquifer.

[213] NRC 2006, Section 3.1.3 SAND PADS UNDER TANKS, Pg. 27.

19, DOE Idaho, 2006a). [PG28]

"3.1.4 Auxiliary Equipment

"In addition to residual waste remaining in the tanks and sand pads, process piping contains residual waste. The inventory calculated for the contaminated piping in the PA (DOE Idaho, 2003a) was updated for the Draft Section 3116 Determination based on post-cleaning sampling data. [PG 28]

"Estimates of the waste remaining in the process piping were developed from characterization of process waste piping sections associated with tank WM–182 that were decontaminated and removed from the system. To account for the uncertainty in how the data were collected and the limited amount of piping sampled, DOE Idaho stated that a safety factor of 500 was applied to the piping inventory (DOE Idaho, 2005). [Pg 30]

"The total inventory in the piping was estimated to be approximately 1.11 × 106 MBq **[30 Ci**][Pg 31]

"Table 2. Sand Pad Residual Waste Inventory at Closure (Ci Per Sand Pad) (Modified From Table CR–19–1, DOE Idaho, 2006a) Total Ci 3.85×10^3 **(3,850).** [pg30]

"The apparent overestimation of removal efficiency in the PA (DOE Idaho, 2003a) for certain HRRs in many cases was actually a result of updated ORIGEN2 ratios or sampling in 2005 which increased the relative concentrations of these radionuclides. Using ORIGEN2-based models designed for liquid and calcined waste to estimate the activity of the TFF solids results in comparatively large uncertainties, because the solid residuals are not derived directly from the TFF liquid SBW, nor do they have the same relative amounts of various constituents. There is a high degree of uncertainty in the inventory estimation when the relative activity of radionuclides in the undissolved solids is assumed to be the same as in the liquid waste (Millet, et al., 2005). [Pg32]

"Thus, use of ORIGEN2 ratios for estimating the solid residual inventory of HRRs is not recommended in the future. For the uncleaned tanks, DOE Idaho should continue to sample HRRs to ensure adequate inventory estimates for the purposes of demonstrating compliance with the NDAA criteria. [214]

"Nevertheless, specifically for Sr-90, the most important potential risk driver for the sand pad considering both the uncertainty and potential magnitude of this radionuclide contribution to the peak dose . Furthermore, the additional sand pad modeling shows that the Sr-90 inventory can be eight times higher than the conservative or compliance case inventory assumed in the DOE PA (DOE Idaho, 2003a)." [215] [pg36]

"3.2 NRC Review and Conclusions—Waste Inventory and Sampling

"The NRC staff had many concerns associated with tank and sand pad inventory development for the TFF. One of the most significant concerns was with the lack of solid sample results for the cleaned tanks.

"Issues such as the representativeness of the samples obtained and the homogeneity of the population sampled were addressed in these SAPs. The DQO process is used to design sampling plans to support decisionmaking.[Pg31]

"Cm-244 Contamination

"Based on NRC staff's review of the list of radionuclides in Table A-12 of the Draft Section 3116 Determination (DOE Idaho, 2005), NRC identified one alpha-emitting, transuranic radionuclide with a half-life greater than 5 years that was present in significant enough activity {5.9×10^2 MBq [1.6×10^2 Ci]1,000}, to potentially pose a risk to human health or to affect the waste classification." [emphasis added]

"3.2.3 Evaluation of Estimated Tank Inventory for Demonstrating Removal of HRRs to the Maximum Extent Practical

"The Draft Section 3116 Determination did not discuss the very significant differences between expected versus actual inventory for specific radionuclides presented in Appendix A of the document.

"Based on a review of this limited information, it appears that there is significant variability (an order of magnitude or higher) in the solid concentrations from tank to tank (e.g., Sr-90 and Cs-137). There is also significant variability in concentration from pre- and post-cleaning sampling for certain radionuclides (e.g., Sr-90 concentrations vary over an order of magnitude). The variability in concentrations of HRRs between tanks is important when estimating the expected removal efficiency of HRRs for tanks that have not been cleaned, because uncleaned tank WM–188 appears to have a significantly higher concentration of the relatively insoluble constituent Cs-137 that is present in cleaned tanks. [PG32]

"DOE Idaho did not list any short-lived radionuclides with half-lives less than 5 years (a category of radionuclides listed in 10 CFR 61.55, Table 2) The acceptability of this screening approach is based on the expectation that controls will be in place to limit exposures to workers and members of the public during the 100-year institutional control period after closure when short-lived radionuclides are potentially present in significant

[214] NRC gave DOE a pass on using ORIGEN 2 on the previously closed tanks but warned about using this failed model on the yet to be closed 4 300,000 tanks closure NDAA criteria.

[215] NRC 2006, Pages 27, 30 and 36.

enough quantities to pose a human health risk. [216] [pg39] [emphasis added]

"It is important to note that NRC is not endorsing the sole use of 10 CFR 61.55, Tables 1 and 2, as the most appropriate method of identifying HRRs. However, NRC staff recognizes that the dual use of the HRR list, both to identify those radionuclides that must be removed to the maximum extent practical and to determine those radionuclides to be targeted for sampling for waste classification purposes, makes this approach appealing, as it may help facilitate demonstration of compliance with NDAA criteria."

"Additionally, tank WM–187 is the holding tank for waste removed from tanks WM–180 through WM–186, so there may be additional challenges with cleaning tank WM–187 due to the accumulation of solids from multiple tanks. DOE Idaho should attempt to sample tanks WM–187 through WM–190 (particularly tanks WM–187 and WM–188) following cleaning operations to ensure that the inventory for these tanks is not significantly underestimated. [PG34]

The above NRC warning relates to the significant solids accumulated from the first "cleaned" 7 tanks (containing 1st cycle rafinates) transferred to the WM-187 and WM-188 tanks cannot be remediated the same way as the first 7 grouted/closed tanks "to ensure that the inventory for these tanks is not significantly underestimated." This does not support NRC's conclusions.

"3.2.4 Evaluation of Estimated Tank Inventory for Waste Classification Calculations. [PG34]

"In response to NRC staff's RAI 17, DOE Idaho demonstrated that for highly radioactive radionuclides, the solid samples are quite comparable (DOE Idaho, 2006a) with respect to the sum of fractions calculations for waste classification (e.g., Pu-238 and 239). DOE Idaho identified (with the exception of Cm-244) and provided the inventory for each radionuclide identified in 10 CFR 61.55 that is necessary to review DOE Idaho's waste classification (see Section 4.1). [217]

"3.2.5 Evaluation of Estimated Tank Inventory for Establishing Compliance with Performance Objectives

"However, the use of the tank WM–182 postcleaning inventory scaled to the PA (DOE Idaho, 2003a) bounding tank inventory to predict doses for the intruder scenario may underestimate the predicted dose. For example, Cs-137 is a major dose contributor for Intruder scenarios, and concentrations for relatively insoluble Cs-137 are much higher in uncleaned tank WM–188 than in cleaned tank WM–182. [Pg. 34]

3.2.6 Evaluation of Estimated Sand Pad Inventory

"The NRC staff was also concerned about the lack of direct sampling of the sand pad and the fairly uncertain modeling approach and parameters used to estimate the sand pad inventory (RAIs 1, 3, and 4; NRC, 2006a).[PG34]

"Therefore, DOE Idaho's analysis of vault samples to support the conservatism of the sand pad inventory is inconclusive.

"Because the Cs-137 inventory was initially higher and much less Cs-137 is removed following each jet pumping campaign (about 1x10-3 versus 1x10-2), the relative concentration of Cs-137 to Sr-90 increases in the pore water over time and the actual liquid concentrations of Cs-137 should currently be higher than Sr-90.

"It is significant to note, however, that DOE Idaho's indirect method of evaluating the sand pad inventory is fairly uncertain. Uncontaminated cleaning water was used to clean the vaults prior to sampling, and the vault liquid concentrations may not be representative of the liquid concentrations from the sand pad. Therefore, the vault sampling data should only be used as an indicator regarding the conservatism of the estimated Sr-90 concentration in the sand pad. Furthermore, the additional sand pad modeling shows that the Sr-90 inventory can be eight times higher than the conservative or compliance case inventory assumed in the DOE PA (DOE Idaho, 2003a). [PG.35&36]

"3.3 Identification of Highly Radioactive Radionuclides [Pg.36&37]

"Although not specifically discussed in the waste determination (DOE Idaho, 2005), this would also entail correctly identifying the group of radionuclides that would fit into the category of alpha-emitting, transuranic nuclides with halflives greater than five years (10 CFR 61.55, Table 1) in DOE Idaho's list of HRRs. Additionally, DOE Idaho did not include short-lived radionuclides with half-lives less than 5 years as HRRs, although this group of radionuclides is also specifically identified in 10 CFR 61.55, Table 2.

"DOE Idaho also performed calculations in its PA to determine those radionuclides that contribute most significantly to the expected inadvertent intruder dose. DOE Idaho did not identify any additional HRRs as a result of these calculations. [pg37]

"3.4 NRC Review and Conclusions–Identification of HRRs [pg38]

"The NRC staff does have some concerns regarding DOE Idaho's implementation of this approach, however, as

[216] NRC 2006, pg39. DOE's stated 100 yr. institutional control is ludicrous on its face considering the State of Idaho is barely that old. Who will be around in even 50 years to maintain the tank farm cover when DOE as an agency is not that old.

[217] Why did DOE leave out Cm-244? Was it intentional to meet NDAA criteria to meet <class C waste?

discussed next. [Pg39]

"Based on NRC staff's review of the list of radionuclides in Table A-12 of the Draft Section 3116 Determination (DOE Idaho, 2005), NRC identified one alpha-emitting, transuranic radionuclide with a half-life greater than 5 years that was present in significant enough activity {5.9×10^{2} MBq [1.6×10^{-2} Ci]}, to potentially pose a risk to human health or to affect the waste classification. Although Cm-244 was present at a high enough activity to remain in the list of radionuclides after the initial screening.

"Section 4.1. Although DOE Idaho did not list any short-lived radionuclides. [pg39]

"It is significant to note that all of the HRRs identified by DOE Idaho, including those radionuclides found to be most significant to public and inadvertent intruder doses based on DOE's PA results, are listed in 10 CFR 61.55 with two exceptions. These exceptions are two radionuclides that are daughter products of radionuclides listed in 10 CFR 61.55, Table 2 (i.e., Y-90 and Ba-137m, daughter products of Sr-90 and Cs-137, respectively). Several HRRs were listed simply because they were found in 10 CFR 61.55, Tables 1 and 2, although they were not expected to contribute significantly to the dose based on the performance assessment results (e.g., Cm-242, Co-60, Ni-59, Ni-63, Pu-241, and Pu-242). [PG39]

"However, NRC staff recognizes that the dual use of the HRR list, both to identify those radionuclides that must be removed to the maximum extent practical and to determine those radionuclides to be targeted for sampling for waste classification purposes, makes this approach appealing, as it may help facilitate demonstration of compliance with NDAA criteria. These exceptions are two radionuclides that are daughter products of radionuclides listed in 10 CFR 61.55, Table 2 (i.e., Y-90 and Ba-137m, daughter products of Sr-90 and Cs-137, respectively).

"However, DOE Idaho recently performed additional sensitivity modeling for the sand pad inventory in response to NRC's RAIs 3 and 4 (NRC, 2006a). Based on the results of this modeling, some radionuclide inventories could be significantly (order of magnitude) higher than the base case sand pad inventory assumed in the PA (DOE Idaho, 2003a). Of these radionuclides, Np-237 had a high enough activity in the sand pad to be a potential HRR for the groundwater pathway. NRC staff requested additional clarifying information (NRC, 2006c) regarding the Np-237 screening analysis at the June 1, 2006, meeting to discuss DOE Idaho's RAI responses. [pg. 39 &40]

"Additionally, long-term groundwater concentrations for Pu-241, Am-241, and Np-237 estimated with GWSCREEN showed that the peak groundwater concentrations for these constituents was not expected to occur until after the period of performance of 10,000 years. [218]

Although uncertainty in transport parameters was not considered in the screening analysis, NRC staff attempted to reduce the uncertainty in the transport of Pu-241, Am-241, and Np-237 as discussed below.

"Furthermore, Pu-241, Am-241, and Np-237 were already included as HRRs by default, as they are included in Tables 1 and 2 in 10 CFR 61.55, although they were not specifically targeted for detailed groundwater analysis. The list of HRRs developed by DOE Idaho for the groundwater all-pathways dose did not consider the uncertainty of key transport parameters in the screening process. The NRC staff was concerned that if DOE Idaho had performed sensitivity or uncertainty analyses on transport parameters during the screening process." [Pg40]

NRC's above warning of "long-term groundwater concentrations for Pu-241, Am-241, and Np-237 estimated with GWSCREEN showed that the peak groundwater concentrations for these constituents was not expected to occur until after the period of performance of 10,000 years" is significant given DOE's misguided assumption that the grouted tanks/vaults will protect the public – especially when the tanks will completely disintegrate in <100 years. NRC also challenges DOE's assumption on the soil sorption rate (Kds) has no basis. This means contaminates will migrate faster and therefore the soil's ability to filter is much less than DOE claims.

"However, DOE Idaho did not communicate which worker evaluations had been performed, if any, or any screening for these evaluations. NRC staff also thinks that radionuclides that pose an inhalation risk are potential HRRs for worker dose (e.g., Pu-238, Pu-239, Pu-240, and Am-241). [Pg40 &41]

"3.7 Removal to the Maximum Extent Practical

"However, because compliance with performance objectives does not necessarily obviate the need for additional cleaning, it would have been inappropriate for DOE Idaho to establish goals that met the performance objectives with no further analysis of the practicality of additional removal.[p44]

NRC's above concerns that DOE will <u>not</u> include "additional tank cleaning" and "with no further analysis of the practicality of additional removal" is an exemplar of how dangerous the public's reliance on

[218] NRC 2006,Pg 40. NRC shows "the peak groundwater concentrations for these constituents was not expected to occur until after the period of performance of 10,000 years" is crucial to understand the impact of contaminate migration when the tanks/vaults/grout will begin denigrating after 100 years involving nuclides with much longer half-lives.

DOE's tank remedial process is. This is no ordinary hazardous/radioactive dump - this is permanent forever illegal dump. Below, NRC fails to challenge DOE's reliance on monitoring gamma, in flush solutions when alpha emitting TRU nuclides are very difficult to detect without having the monitoring probe right up against the waste - thus failing an important credibility test on determining radiation left in the tank.

"3.7.1 Cleaning Process and Criteria for Termination of Cleaning Operations

"After tens of thousands of gallons of water are flushed through the system, essentially no measurable level of radioactivity is removed with the wash water. [219]

3.7.2 Explanation of Differences in Cleaning Effectiveness for Individual Tanks

"Eight of the eleven 1,000-m3 [300,000-gal] tanks that contain cooling coils are similar in design, but differences exist in the exact location of cooling coil routing and the number of cooling coil supports. These differences present slightly different challenges in terms of the ability to move tank solids around the tank floor. DOE Idaho stated that these obstructions explain the higher amount of solid residuals in WM–182 (DOE Idaho, 2006a). [45]

"Removal efficiencies exceeded 99 percent for most HRRs. It is also significant to note that DOE Idaho was not able to provide an estimate of the actual removal efficiency following deployment of the washball and directional nozzle technology due to lack of development of an inventory prior to cleaning operations for each tank. Therefore, the actual effectiveness of the cleaning technology is uncertain.[46]

"The concerns (expressed in Section 3.2) that Cs-137 concentrations in tank WM–188 are expected to be much higher than the concentration of Cs-137 in tank WM-182 used to estimate the inventory for the uncleaned tanks and that tank WM–187 may contain a much larger quantity of solid residual heel to be removed are mitigated by the likely overestimation of the inventory of a relatively clean tank used as a spare (tank WM–190).

Table 8. Highly Radioactive Radionuclides Removed From 7 Tanks and Ancillary Equipment [220]

Total Liquid Waste Generated at INL Ci	Residual Waste Remaining in 7 Closed Tanks
3.59×10^{7} [**35,900,000**] Ci	2.48×10^{4} [**24,800**] Ci

3.7.3 Costs—Worker Dose [46]

'Twenty-three personnel involved directly with tank cleaning received a radiation dose from TFF closure activities. The maximum exposure for any worker to date is 1.17 mSv [117 mrem].

"Based on the information above, the following is concluded:

• The average radiation exposure that will be experienced for cleaning and closing each TFF tank is expected to total about 6.5 mSv [650 mrem] for all occupational exposure.

• The exposure per person for cleaning a TFF tank will be about 6.5 mSv [650 mrem] divided by 23 people, which is about 0.3 mSv [30 mrem] per person.

• Maximum radiation exposure for an individual worker is estimated to be 1.2 mSv [120 mrem] for cleaning a single TFF tank.

• Worker dose for tank cleaning is minimal because all cleaning is accomplished remotely.

• A total exposure of about 7.15×10^{-2} Sv [**7.15 rem**] is expected for cleaning eleven large tanks. [PG48]

"If stabilizing grout in the amount of ten times the volume of waste is assumed in the waste classification calculations for all radionuclides, including transuranics that have Class C concentration units expressed in activity per unit mass (see Table 7, column 2), the range of sum of fractions is even lower, from 0.3 to 1.5 (see Table 7, column 5). [pg59]

"However, NRC cannot confirm that all large tanks contain waste that is within Class C limits due to the uncertainty in the residual waste inventory. Section 3116(a)(3)(B)(iii) requires DOE to consult with the NRC in its development of disposal plans in cases where the waste exceeds Class C concentration limits." [pg59]

NRC's acknowledgement that "stabilizing grout in the amount of ten times the volume of waste is assumed in the waste classification calculations for all radionuclides, including transuranics that have Class C concentration units" admits DOE's violation of EPA "Prohibition of Dilution as a Substitute for

[219] NRC 2006, Sec. 3.7.1. DOE is relaying on monitoring gamma, however alpha emitting nuclides that are difficult to detect without having the probe right up against the waste thus failing an important credibility test.

[220] NRC 2006, Table 4 Pg. 47.

Treatment." See: "40 CFR Section § 148.3 - Dilution prohibited as a substitute for treatment" that lays out why dilution as an attempt to avoid treatment especially in 40 CFR Part 149 - SOLE SOURCE AQUIFERS discussed earlier. NRC above statement: "However, NRC cannot confirm that all large tanks contain waste that is within Class C limits due to the uncertainty in the residual waste inventory" is evidence enough to disqualify the Commissions conclusions that DOE meet NDAA criteria.

"However, compliance demonstration with simple deterministic models can be difficult for evaluations that assess compliance over periods that span tens of thousands of years in complex, and unique engineered and natural systems that are hard to represent conceptually, with models that have many interdependent parameters with large or unknown uncertainty, and models that have results that respond in a non-linear or unpredictable fashion within a reasonable range of parameter space. [pg63]

Table 5. Estimated Cost of TFF Technology (Modified From Table 7, DOE Idaho, 2005)*

"*The actual cost for cleaning seven large tanks to date is $35 million. The four large, uncleaned tanks are expected to cost an additional $1 million/tank or $4 million total for four large tanks. Thus, the total expected cost of cleaning all eleven large tanks is $39 million. [221] [Pg. 64]

"3.7.6 Benefits of Additional Removal

"The most obvious benefit of additional radionuclide removal is risk reduction to members of the public. However, DOE Idaho notes that for those tanks with sand pads, the benefit of additional radionuclide removal is limited by the fact that approximately 43 percent of the inventory is expected to be in the sand pads, which cannot be easily treated. The sand pads may contain most of the Cs-137 and Sr-90 activity, and development and deployment of a new tank cleaning system could only decrease the total inventory by about 60 percent. [PG.49 &50]

"DOE Idaho stated that development of a new technology may not be practical because: (i) the new technology is not yet developed and would most likely delay the 2012 closure date and lead to the incursion of additional maintenance costs, (ii) the performance objectives can be achieved with conservative assumptions in key models or parameters, and (iii) removal efficiencies for HRRs are high for the preferred system. Complete tank removal has a very large economic impact, as well as a large radiological impact to workers." [Pg. 64]

DOE's claim above that "development of a new technology may not be practical" (due to the $39 million cost) pails in view of DOE's recent announcement that DOE/INL spent $85 million on a supercomputer for cybersecurity. NRC's analysis above "The most obvious benefit of additional radionuclide removal is risk reduction to members of the public" demonstrates a warped priority that does not include protecting the public. NRC warning below about using "(the GM detector is located on the outside of the piping and thus, would only be able to detect high energy gamma emitters) fails (as previously discussed) to include essential long-lived alpha emitting TRU nuclides.

"While use of a radiation detector is expected to be a valuable tool, the efficiency of the instrument is unknown and is expected to be low (the GM detector is located on the outside of the piping and thus, would only be able to detect high energy gamma emitters). Consequently, the use of visual tools to ensure that all areas where significant solid residuals remain are targeted for cleaning is an important part of the demonstration that HRRs have been or will be removed to the maximum extent practical at INL. Additionally, optimization of the operational parameters for the cleaning system provides additional confidence that HRRs have been removed to the maximum extent practical. [PG50 & 51]

"3.8.2 Evaluation of [high-level radioactive radionuclides] HRR Removal Efficiencies

"Because almost the entire remaining inventory is in the residual solid heels, the removal efficiency is estimated as 90 percent or higher for more soluble radionuclides. The concern expressed in Section 3.2 about using tank WM–182 Cs-137 concentrations to estimate the inventory in uncleaned tanks, particularly WM–188, is mitigated by using the same assumption for a relatively clean tank that has been used as a spare during TFF operations (tank WM–190).

"The metric DOE Idaho used to quantify the costs of additional radionuclide removal in the tanks (e.g., cost per reduction in dose to the individual expected to receive the peak annual dose over a 50-year time period) may not be appropriate.

"Groundwater is also currently contaminated above applicable regulatory requirements established by the EPA (maximum contaminant levels (MCLs)), and the risk to the public is expected to continue beyond the institutional control period (beyond 2095 evaluated in the CERCLA risk assessment). The costs of additional remediation of soil and groundwater are in most cases lower than the costs associated with TFF cleaning using the current technology, while the benefit of additional soil and groundwater remediation is expected to be higher and more certain. It is

[221] NRC 2006, Pg. 64. NRC is pointing out the literal value in dollars, what little value the federal government puts on Idaho's water future.

significant to note that these costs and benefits are associated with final actions related to soils and groundwater at the TFF. These costs do not include the costs of interim actions currently in place, nor do they consider additional source areas at INTEC that are addressed separately…. Complete tank removal would essentially eliminate potential annual doses to the public, including inadvertent intruders. [222] [PG54]

"Approximately 90 percent of the solid residual heels are estimated to have been removed using the washball and directional nozzle technology. Removal efficiencies considering the cumulative historical inventory stored at the TFF of 3.2 million TBq (87 million Ci) and a final inventory of approximately 955 TBq **[25,800 Ci]** estimated at closure are over 99.9 percent. [PG. 55]

"DOE must determine whether the waste that is the subject of the waste determination exceeds concentration limits for Class C LLW that are provided in 10 CFR 61.55 to determine whether Criterion 3(A) or Criterion 3(B) provided above is applicable.

"The performance objectives of 10 CFR Part 61, Subpart C, require assessment of protection of the general population from releases of radioactivity, protection of individuals from inadvertent intrusion into the waste, protection of individuals during operations, and evaluation of the stability of the disposal site after closure. Protection of the general population (including inadvertent intruders) is typically evaluated through a PA calculation that takes into account the relevant physical processes and the temporal evolution of the system. [223] [PG56]

"4.1.1 Waste Classification

"Because the waste is not expected to be well mixed in the engineered grout and "encapsulation" pours, it is not appropriate to use the total volume of grout needed for these pours to determine the waste classification (applying Category 1 of the draft guidance). Sufficient justification for why 118 m3 [4.2 × 10^3 ft3] of grout is needed to simply stabilize the waste under Category 2 of the draft guidance was also not provided. The estimated 85 m3 [3 x 10^3 ft3] of grout for the engineered pour is just slightly higher than the volume of grout needed to meet Class C concentrations (see Figure 15).

"The NRC staff is concerned that DOE Idaho used an approach that could support the use of an excessive amount of grout for the purpose of waste classification without sufficient justification. In the case of the large tanks at INL, DOE Idaho did not exhaust all acceptable methods provided in the draft guidance for averaging the waste inventory over a larger volume of grout (10 times the mass or volume of the waste) in its calculation of the sum of fractions which resulted in a value of 14 for all tanks. Most significantly, DOE Idaho did not take credit for the volume or mass of liquid residuals which contributes most of the residual waste volume (about 80 percent) in calculating an acceptable volume of stabilizing grout. Consideration of the liquid residual waste volume increases the allowable amount of stabilizing grout by up to a factor of five if ten times the volume of residual waste is used. [PG59] [224]

NRC's concerns about the tank grout is crucial: "Because the waste is not expected to be well mixed in the engineered grout and "encapsulation" pours, it is not appropriate to use the total volume of grout needed for these pours to determine the waste classification (applying Category 1 of the draft guidance." Again the grouts' performance as a treatment to stabilize the waste for millennia depends on how well it is mixed with the waste. Otherwise the long-lived radionuclides will migrate once the tanks/vaults disintegrate in <100 years. Additionally, the ongoing precipitation infiltration into the vaults/sand pads has been occurring for decades.

"4.2.1 Summary of Performance Objectives and Results

"The uncertainty in model parameters was propagated through the series of computational models (e.g., the uncertainty in the inventory, transport parameters, and infiltration rate was propagated through the series of models to determine the impact of these parameters on the dose metric, peak dose to a member of the public for a groundwater all-pathways scenario). The paragraphs that follow discuss each of the major process models or calculations used in this study. [pg66]

"A conclusion from this analysis is that the infiltration rate at and near the tank farm is larger than previously thought. The new value of 18 cm/yr [7.1 in/yr], used in recent modeling analyses related to TFF (DOE Idaho, 2006e), constitutes 85 percent of the average annual precipitation rate of 22 cm/yr [8.7 in/yr]. This infiltration rate is

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[222] NRC's acknowledgement that: "Groundwater is also currently contaminated above applicable regulatory requirements established by the EPA (maximum contaminant levels (MCLs)), and the risk to the public is expected to continue beyond the institutional control period (beyond 2095 evaluated in the CERCLA risk assessment) is important because additional contamination from the tanks will exercisable the hazard to the public.

[223] NRC, 2006, Pg. 56.

[224] NRC encourages using more grout as a dilution which helps DOE meet NDAA criteria. Dilution is the solution to pollution. Again a violation to 40 CFR 148.3 Prohibition on Dilution in Place of Treatment.

more than four times the infiltration rate used in the conservative or compliance case PA model

"4.2.4 Climate and Infiltration

"Rain and snowmelt periodically infiltrate the gravelly alluvium in and around the INTEC facility. Even though average annual precipitation (22.1 cm/yr or 8.7 in/yr) is much less than the pan evaporation rate (109 cm/yr or 43 in/yr), water from snow melt or heavy rains can infiltrate rapidly prior to evaporation. Coarse surficial sediments and lack of vegetation permit a significant fraction of precipitation to enter the subsurface as infiltration. Infiltration may actually be greater due to impervious areas at INTEC which focus much of the surface runoff into gravelly areas or unlined drainage ditches (DOE Idaho, 2005e). [pg. 67]

"Several infiltration tests support high estimates of the fraction of precipitation that infiltrates the subsurface at INTEC (DOE Idaho, 2006e). Additionally, neutron moisture logging data was used to refine estimates of precipitation infiltration rates near TFF using the UNSAT-H computer model to assess soil moisture profiles and the downward wetting front associated with the 1994 spring snow melt (DOE Idaho, 2006e). A conclusion from this analysis is that the infiltration rate at and near the tank farm is larger than previously thought. This infiltration rate is more than four times the infiltration rate used in the conservative or compliance case PA model (DOE Idaho, 2003a), in which rates were based on a range of values available in the literature at the time. Infiltration was expected to range from 0.41 to 12 cm/yr [0.16 to 4.9 in/yr] (DOE Idaho, 2003a. [pg72]

"However, during the years following its installation the tank farm cover reportedly has been repeatedly damaged during construction activities. It is generally believed that the cover is no longer effective in preventing infiltration (DOE Idaho, 2006e). More recently, surface water drainage system management activities have included grading activities, construction .

"4.2.5 NRC Evaluation—Climatology and Infiltration

"However, as noted above, recent modeling suggests that infiltration rates could be higher than expected even under the worst-case scenario evaluated in the sensitivity analysis. A value of 18 cm/yr [7.1 in/yr] was used in the latest groundwater modeling analysis under the CERCLA program (DOE Idaho, 2006e). Therefore, the NRC staff concludes that the impact of increased infiltration rates or alternatively, an evaluation of infiltration controls following issuance of a final Record of Decision for TFF soils, is necessary. Recommendations related to infiltration and infiltration controls are provided in Appendix A. The impact of increased infiltration rates is also discussed further in Sections 4.2.8 and 4.2.9." [pg76] [225]

The NRC warning above to IDEQ/EPA who regulate INL CERCLA cleanup process must take into account the "impact of increased infiltration rates must be taken into consideration in "evaluation of infiltration controls following issuance of a final Record of Decision for TFF soils, is necessary." It remains to be seen if IDEQ will take heed of this significant warning by going along with DOE's bogus reliance on defective Tank Farm Cover to protect after the tanks turn to rubble long before the long-lived TRU nuclides decay as discussed below.

"4.2.6.1 Engineered Barrier Degradation Modeling

"Degradation of the various engineered barriers (i.e., grout, tanks, vaults, and piping) affects the permeability along, and the release of radionuclides through, groundwater pathways. Potential degradation mechanisms and factors that can affect permeability include initial cracks and voids; sulfate and magnesium attack; calcium hydroxide leaching; alkali-aggregate reaction; carbonation; acid attack; and corrosion of the tanks, pipes, and concrete steel reinforcement. [pg76]

"The results of the degradation analysis indicated that the concrete vaults turn to rubble approximately 500 years after closure, and the grout between the vault and the tank turns to rubble after 5,000 years. The analysis also indicated that the tank and the grout in the tank completely degrade and turn to rubble at approximately 40,000 years after closure. The grout associated with the piping turns to rubble after approximately 500 years if the stainless steel piping is conservatively assumed to corrode instantaneously.

"4.2.6.2 Engineered Barrier Degradation Assumptions for Source Term

"The concrete vault and the grout between the vault wall and the tank were assumed to be completely degraded at 100 years, at which time infiltrating water was assumed to contact the radionuclides present in the sand pad and to transport these radionuclides through the sand pad and degraded vault floor to the vadose zone. At 500 years, the stainless steel tanks were assumed to have totally corroded and the grout inside the tank was assumed to have completely degraded. Also at this time, infiltrating water was assumed to contact the radionuclides in the grouted waste form and to transport radionuclides through the degraded grout, the sand pad, and the degraded vault floor to the vadose zone. Piping releases were assumed to occur in the same manner as releases from the tanks, starting at

[225] NRC 2006, pg76.

500 years after postclosure.

"The uncertainty in the time of failure of the engineered barriers is large. To provide support for the failure times assumed in the PA. Modeling, considering the limited sitespecific data (e.g., properties of the concrete and grout; chemistry of the soil moisture and water entering the vault) and the unvalidated degradation models. [pg.78 &88]

NRC is thankfully candid with: "The uncertainty in the time of failure of the engineered barriers is large. To provide support for the failure times assumed in the PA. Modeling, considering the limited sitespecific data (e.g., properties of the concrete and grout; chemistry of the soil moisture and water entering the vault) and the unvalidated degradation models" though who will wade through 80+ pages to find these buried comments find out that DOE was using "unvalidated degradation models." But this again invalidates NRC's approval of DOE's claims.

"4.2.7.1 Evaluation of Sorption Coefficients and Sorption Model

"As discussed in more detail in clarifying RAI 17 (NRC, 2006a), this was not consistently the case. The conservative values used for the grout and concrete in the compliance case were typically chosen from the middle of a literature range without support for the specific value. In addition, values defined by DOE Idaho as worst case were typically equivalent to values defined in the literature as conservative Conservative Kd values, when used for a compliance demonstration, should be demonstrably bounding at the low end of reasonably expected values or the uncertainty of model results assessed and bounded. In many cases, DOE Idaho has used such lower bounds for worst-case values, with little explicit basis for conservative values, but insufficient technical basis was provided by DOE Idaho for its assumption that the grout will provide a reducing environment. [pg. 79-80]

"However, DOE Idaho has not demonstrated that a Kd approach is appropriate for this situation. Release from the grouted wasteform is a leaching process, and sorption is only one chemical process that may be affecting grout pore water radionuclide concentrations. Wasteform leaching experiments that are directly applicable to TFF grouted tank conditions would obviate the reliance on potentially conservative literature values in modeling release." [pg. 80]

NRC's critique that DOE has not demonstrated that a valid Kd sorption approach is appropriate for this situation. Release from the grouted wasteform is a leaching process, and sorption is only one chemical process that may be affecting grout pore water radionuclide concentrations." This issue is critical in evaluating the sorption rate and how long it will take –especially for soluble chemicals/nuclides to reach the aquifer. DOE's overestimation of the soil's ability to absorbed contaminates can be clearly seen with the contamination already in the aquifer that must not be additionally contaminated by inadequate remediation actions.

"4.2.7.3 Summary

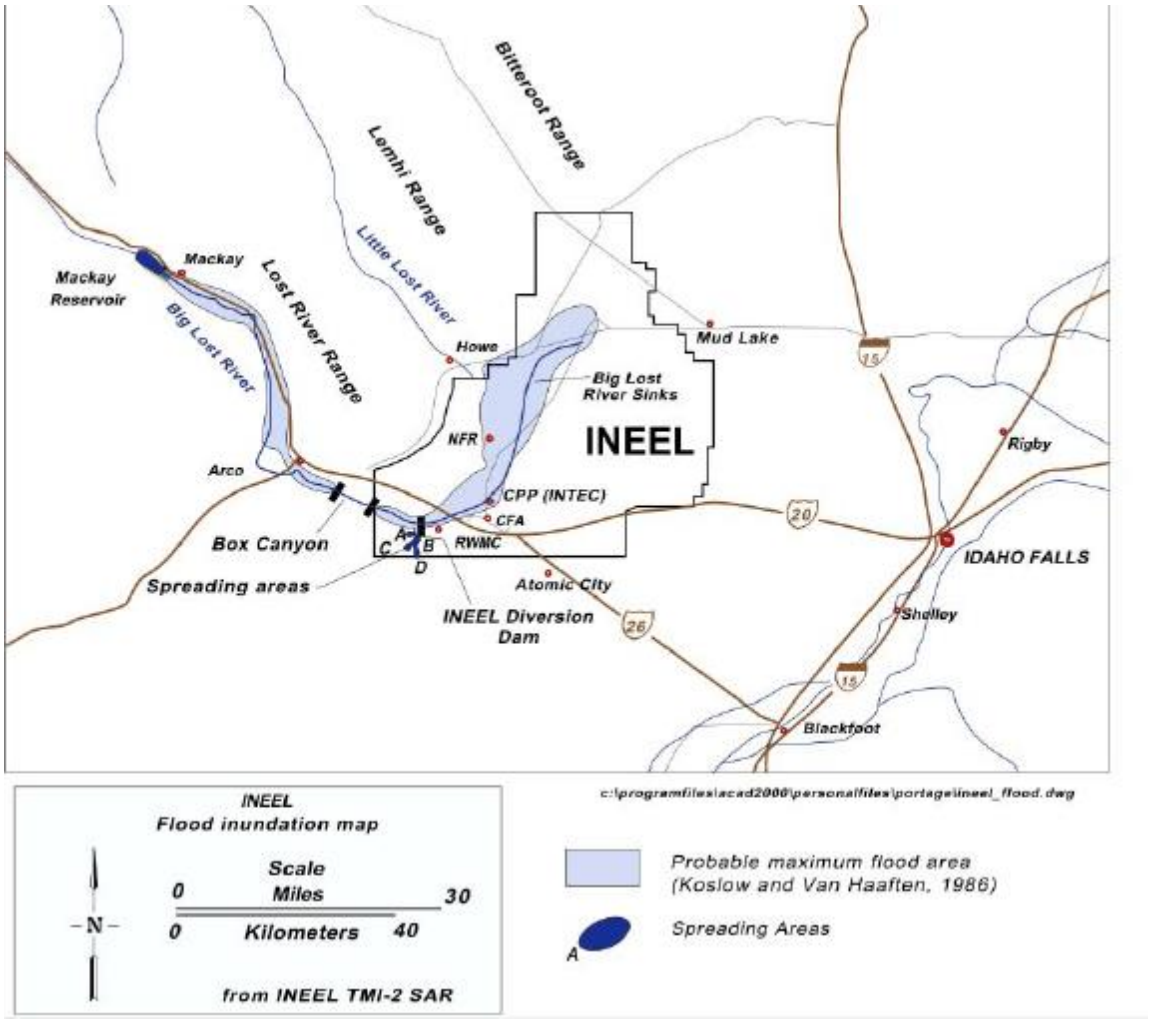
"However, as discussed in Sections 4.2.9 and 4.4, DOE Idaho will need to demonstrate that the grout formulation used in disposal actions will impose a robust reducing environment to manage uncertainty in the hydrogeologic model. The worst-case value was chosen as a lower bound to available data. In the sensitivity analyses, when worst-case Kds were used in combination with conservative inventory and infiltration parameters, modeled drinking water and all-pathways doses were below performance objectives (DOE Idaho, 2006a, 2003b).

" However, when worst-case infiltration rates and transport parameters were used, the dose was predicted to be 85 mrem/yr, above the performance objective limit of 25 mrem/yr. Because the worst-case peak dose is a result of Sr-90 released from the sand pad and sensitivity of model results to sand pad inventory was not investigated in the PA (DOE Idaho, 2003a), the worst-case dose predicted by DOE Idaho is same for all inventory cases. [pg77]

"4.2.8.9 Flooding Flow and Transport Simulation

"The [probable maximum flood] PMF represents the hypothetical flood considered the most severe flood event reasonably possible based on hydrometeorological application of maximum precipitation and other hydrologic factors. The probable maximum flood is assumed to result from an overtopping failure of the 24-m [79 ft]-high earth-filled Mackay Dam caused by a general storm probable maximum precipitation (PMP) event (Idaho National Engineering and Environmental Laboratory, 1999; Koslow and van Haaften, 1986).

"The inundation map from this probable maximum flood was given in Figure 2-18 of the PA (DOE Idaho, 2003a) and in higher resolution (see Figure 19) in DOE Idaho's response (DOE Idaho, 2006a) to NRC staff's RAIs (NRC, 2006a). The resulting peak flow from the probable maximum precipitation-induced dam failure is 8,685 m3/s [306,700 cfs] in the reach immediately downstream of the Mackay Dam, approximately 2,035 m3/s [71,850 cfs] at the INL Diversion Dam, and 1,892 m3/s [66,830 cfs] at INTEC. [pg. 86 & 87]



Location of INEEL Diversion Dam and Mackay Dam [NRC 2006 Figure 19 pg. 87]

"The flood wave is expected to reach INTEC in 13.5 hours after dam failure. Flood water velocities are estimated to range from 0.3 to 0.9 m/s [1 to 3 ft/s] near the Flood Diversion Facility, and the model result for peak water velocity at INTEC is 0.8 m/s [2.7 ft/s] (Koslow and van Haaften, 1986). [pg. 87] [226]

"The TFF site elevation is approximately 0 to 1 m [0 to 3 ft] below the estimated peak flow from the probable maximum precipitation-induced dam failure is 8,685 m3/s [306,700 cfs] in the reach immediately downstream of the Mackay Dam, approximately 2,035 m3/s [71,850 cfs] at the INL Diversion Dam, and 1,892 m3/s [66,830 cfs] at INTEC.

"4.2.9.1 Evaluation—Conceptual Model Development, Model Construction, and Model Support

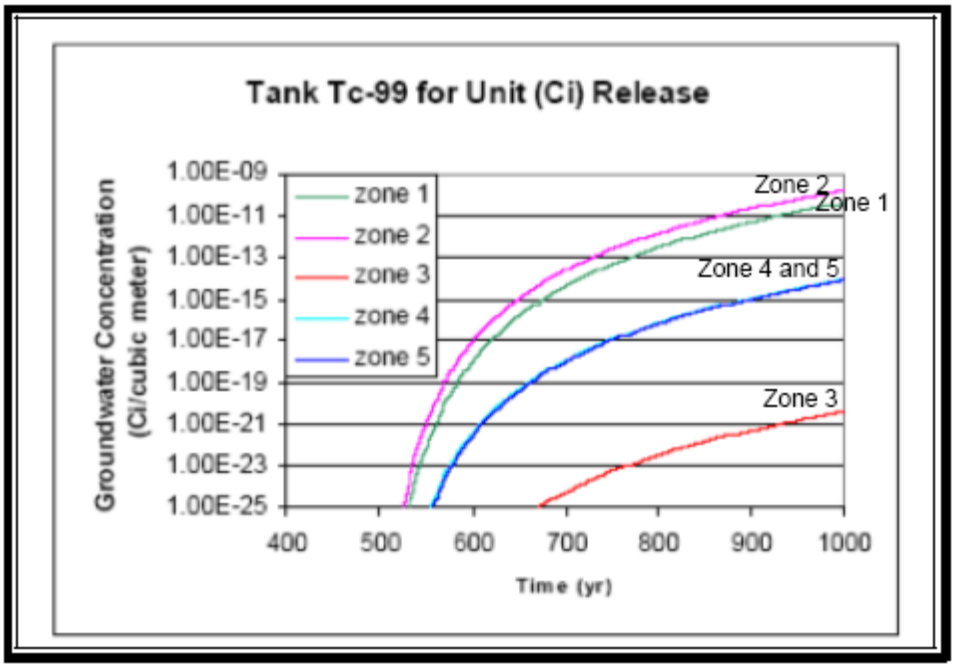
"The selected USGS cross section used to construct the PA model runs from north to south across INTEC, consistent with the expected regional groundwater flow direction. However, the local direction of vadose zone flow underneath the TFF is not necessarily consistent with the model orientation. The BLR channel trends approximately 31 degrees north of east at the location where its recharge most directly affects flow in the vadose zone below the TFF.

"Recharge waters will tend to flow in the vadose zone vertically down and laterally away (in a southeasterly direction within the model domain) from the [Big Lost River] BLR channel. At INTEC, perched water contours below the TFF show a propensity to shed water to the southeast. The orientation of the model and discretization of sedimentary interbeds (discussed further below) may affect the flow paths, distances, and thus, the travel time of [highly radioactive radionuclides]HRRs. [pg. 88 & 89]

[226] NRC 2006, pg. 87.

"The location of a newly installed monitoring well (ICPP-MON-A-230 located north of the TFF, see Figure 7) where elevated Tc-99 groundwater concentrations were detected, suggested that Tc-99 contamination linked to a TFF piping release (see CPP-31 release site on Figure 6) may have entered the [Snake River Plane Aquifer] SRPA significantly closer to the TFF.

"Additionally, a newly constructed well located 1,500 ft from ICPP-MON-A-230 also indicates that the extent of the Tc-99 plume is more widespread than originally thought (DOE Idaho, 2006e).



Tc-99 Concentrations Over Time at Various Monitoring Well Locations [NRC, 2006, Figure 21a Pg. 95]

"There is also some uncertainty with respect to the extent to which the [Big Lost River] BLR affects the perched zone. More recent [Remedial Investigation/Basis Risk Assessment] RI/BRA modeling suggests that the BLR has minimal impact on the perched zone, as evidenced by the lack of response in wells screened in the upper perched zone following flow in the BLR in 2005 (DOE Idaho, 2006e). Furthermore, the [Big Lost River] BLR did not flow from 2000 to 2005, yet the perched zone persisted during this time period, suggesting that other sources (e.g., precipitation infiltration and service water leakage) are responsible for the persistence of the northern perched zone (DOE Idaho, 2006e). The DOE PA (DOE Idaho, 2003a) suggests that perched water causes lateral spread of the plume in the final calibrated model. Thus, the influence of BLR seepage on the creation of the perched zones is emphasized in the PA. However, DOE Idaho provided a cross-section (DOE Idaho, 2006c, see Figure 20) of the final calibrated model in response to an NRC information request (NRC, 2006c), which shows a small areal extent of the perched water close to the BLR (within a few hundred feet) above the upper sedimentary interbed. That information indicates that the pressure gradient caused by the BLR boundary condition in the model is actually responsible for the lateral spread of the plume." [Pg. 89]

"The uncertainty in BLR seepage was not investigated in the uncertainty and sensitivity analysis. Considering the effect BLR seepage has on the flow field at TFF in the PA model (see Figure 18), the conservatism of this assumption was not fully supported. [pg89]

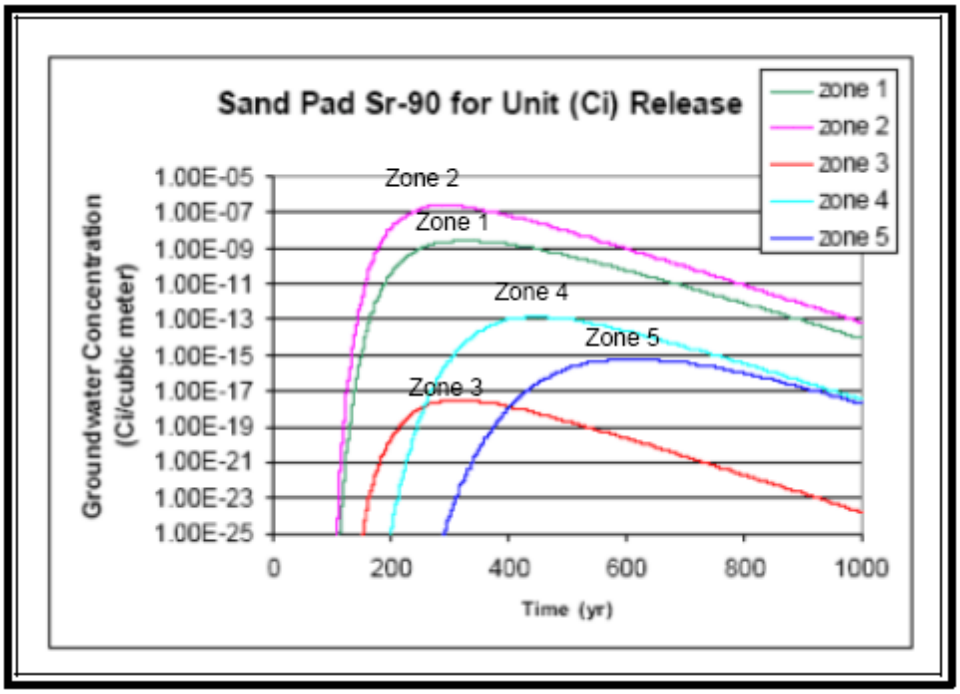
"Discretization and parameterization of hydrostratigraphic units in the DOE PA model (DOE Idaho, 2003a) may also significantly impact predicted flow paths, transport distances, and resultant model predictions. NRC staff has noted the following potential limitations with the "PORFLOW model:

• Delineation and material property assignment of geologic features present at INTEC such as volcanic vents, dikes, and basaltic rubble zones may have a significant impact on contaminant flow and transport, e.g., rubble zones could quickly transport radionuclides to an interbed discontinuity located much closer to the TFF.

• Disturbed alluvium (from operations at INTEC) and historical BLR channel deposits may have much higher hydraulic conductivities than represented in the modeling.

• Unrealistic discretization, both horizontally and vertically, of discontinuous sedimentary interbeds may have a significant effect on travel distance and travel time to the saturated zone (e.g., combining discontinuous interbeds

into longer, thicker, or continuous interbeds can affect travel distances and time, and therefore sorption and decay along the flow path).



Sr-90 Concentrations Over Time at Well Locations [227]

"The uncertainties associated with DOE Idaho's hydrologic modeling identified above have the most impact on Sr-90 contaminant flow and transport. Sr-90 has a relatively short half-life (30 years) relative to DOE Idaho PA (DOE Idaho, 2003a) model-predicted transport time to the aquifer, approximately 30 yr for non-sorbing constituents (approximately 550 years for sorbing Sr-90 due to attenuation of Sr-90 in the sand pad, concrete vault, and 600 m [2,000 ft] of lateral transport path in the vadose zone). The uncertainty identified by NRC staff in Sr-90 contaminant transport is addressed by multiple lines of evidence that consider the likely bounding inventory for Sr-90 in the sand pad (Section 3.2); the likely pessimistic performance assumed in the PA model for the grouted vault (Section 4.2.6 and 4.2.7); and observations of contaminant flow and transport from monitoring data related to historical releases that provide a basis for the expected attenuation of Sr-90 in the subsurface at INTEC. [pg90]

"4.2.9.2 Evaluation—Transport Parameters

"Dispersion of contaminants was only assumed to occur in the longitudinal and vertically transverse directions. While DOE Idaho suggests this is a conservative approach to the prediction of downgradient contaminant concentrations because horizontally transverse dispersion (dispersion in the direction perpendicular to the two-dimensional model) is neglected, NRC staff does not agree that this treatment is strictly conservative, because the modeled tanks are located in-between two other tanks in the horizontally transverse direction. Any loss of mass due to dispersion in the horizontally transverse direction away from one tank can be assumed to be gained through dispersion from an adjacent tank. Only the tanks on the periphery and contamination from the sand pads would tend to lose mass in the horizontally transverse direction without a comparable gain. As discussed in more detail by NRC (2006a, clarifying RAI 17), this was not consistently the case.

"The impact of hydrologic model construction uncertainty is expected to be more severe for Sr-90 than for Tc-99 and I-129, which are relatively non-sorbing (in the vadose zone). This is consistent with the RI/BRA modeling that shows Sr-90 concentrations are extremely sensitive to the assumed adsorptive capacity of the interbeds that strongly affect travel time and decay (DOE Idaho, 2006e). [pg93]

"4.2.9.3 Evaluation—Model Calibration

"As discussed above, in response to NRC staff's clarifying RAI 16 (NRC, 2006a), DOE Idaho provided (DOE Idaho, 2006a) chloride analytical data from monitoring wells in the vicinity of the percolation ponds to show that the

[227] NRC 2006, Figure 21b Sr-90 Concentrations Over Time at Well Locations Pg. 96.

flow model was well calibrated (chloride is a conservative tracer). However, a closer comparison of the data provided by DOE Idaho reveals that the spatial distribution of contamination predicted by the PA model suggests more contamination flows north of the decommissioned percolation ponds, whereas the site data suggest the contamination primarily flows to the south. Therefore, the tracer data does not support the flow direction predicted by the PA model.

"The final calibrated model (DOE Idaho, 2003a, see Figure 20) results are inconsistent with the current extent of the perched zone based on recent monitoring data (DOE Idaho, 2006d). The northern, shallow perched zone has persisted even in the absence of the percolation and wastewater treatment seepage ponds (see Section 4.2.4). Thus, the final calibrated PA model does not appear to be well-calibrated with respect to present-day perched water-levels. The source of current perched water may be both precipitation infiltration and service water leakage and thus, the effects of perched water on contaminant flow and transport over long time periods after operations at INTEC cease is uncertain.

"Additionally, DOE Idaho did not incorporate recent data into its analysis (i.e., Tc-99 monitoring well data) that show that the conceptual model for contaminant flow and transport may be flawed. The potential ramifications of the hydrogeological conceptual model uncertainty are discussed in Section 4.2.9.1. However, it is significant to note that the RI/BRA modeling for TFF (Rodriguez, 1997), from which the PA model draws heavily, was recently updated (April 2006) following discovery of the Tc-99 plume in the SRPA north of the TFF.. [pg94]

"Groundwater monitoring data provides a basis to evaluate DOE model predicted attenuation. The relative concentrations of Sr-90 and Tc-99 in the SBW and in the perched water provide information from which the concentrations of Sr-90 and Tc-99 predicted by the PA model can be assessed. Based on a simplified comparison, the following observations can be made: [pg. 96]

• The concentration of Sr-90, Tc-99, and I-129 in the 1972 release from TFF piping into the near-surface alluvium is expected to be approximately 2.3×10^{11} pCi/L [**230,000,000,000**], 4.5×10^{7} pCi/L [**45,000,000],** and 3.6×10^{3} pCi/L [**3600**], respectively, assuming 70,400 L [18,600 gal] of SBW and the undecayed activities reported in DOE Idaho (Table 5-2, 2006d). [228]

• The current, maximum concentration of Sr-90 detected in monitoring wells screened in the upper perched zone is 2×10^{5} pCi/L [**200,000**] (due to attenuation and decay in the alluvium, fractured basalt, and shallow sedimentary interbed located directly underneath the TFF), and maximum concentration of Tc-99 in monitoring well ICPP-MON-A-230 screened in the SRPA is 3×10^{3} pCi/L [**3000]**.

• The concentration of Sr-90, Tc-99, and I-129 in SBW in the year 2012 is expected to be approximately 2.5×10^{10} pCi/L [**2,500,000 pC/L**], 9.9×10^{6} pCi/L [**9,900,000**], and 1.7×10^{4} pCi/L [**17,000**], respectively (Wenzel, 2005).

• The maximum, conservative or compliance case concentrations of Sr-90, Tc-99, and I-129 released from the tanks and sand pad (for Sr-90) at closure are expected to be 7×10^{5} pCi/L [**700,000**](sand pad), 7×10^{4} pCi/L **[70,000**] (tank), and 2×10^{3} pCi/L [**2,000**] (tank), respectively (assuming the infiltration rate and annual Ci release rates provided in the PA; Tables 3-5 and 4-1, DOE Idaho, 2003a).

• The total inventory of Sr-90, Tc-99, and I-129 released in the 1972 event are 5.9×10^{8} MBq [**15,900 Ci**], 1.2×10^{5} MBq [**3.2 Ci**], and 9.3 MBq [2.5×10^{-4} Ci), respectively.

• The total inventory remaining in the tanks (or sand pad for Sr-90) are 2.5×10^{7} MBq [**678 Ci],** 2.2×10^{5} [**6 C**i], and 222 MBq [6×10^{3} Ci) [**6,000**], respectively. [229] [pg 96& 97]

"Additionally, an attenuation factor of 10 to 100 in the unsaturated and saturated groundwater is reasonable based on calculated flow rates through the aquifer and based on observed dilution of non-sorbing Tc-99 in a saturated zone monitoring well (5×10^{7} pCi/L [**50,000,000**]in SBW release compared to 3×10^{3} pCi/L **[3,000 pCi/L]** in saturated groundwater). The dilution factor based on monitoring data is expected to exaggerate the attenuation capacity of the SRPA, since the monitoring well is not expected to be located in the maximum point of exposure in space and time (the monitoring well data is from a well that was not expected to produce elevated concentrations from historical releases). Thus, the expected Sr-90 concentration in groundwater using a dilution factor of 100 would be 7,000 pCi/L with no credit for sorption and decay. [230]

"The I-129 release concentration from the grouted tank is expected to be approximately the same concentration as the 1972 release and the total inventory twice as high. The concentration in saturated groundwater should reasonably

[228] NRC 2006, Pg. 96

[229] NRC 2006, Pg. 96.

[230] NRC and DOE reliance on dilution of contaminates in the aquifer to meet NDAA/EPA regulations even though it is prohibited. See EPA 40 C Section § 148.3 - Dilution prohibited as a substitute for treatment. Thus dilution is further prohibited over sole source aquifers; see 40 CFR PART 149—SOLE SOURCE AQUIFERS Sub-part 149.3 SUBCHAPTER D Critical Aquifer Protection Areas.

be less than 10 pCi/L using a dilution factor of 100 and an attenuation factor of 2 due to sorption in the vadose zone. This concentration would lead to a 4 mrem/yr all-pathways dose from I-129.

"While Sr-90 concentrations in the perched zone from the historical release are currently extremely high (2×10^5 pCi/L) [**200,000 pCi/L**] and could pose risks even after the end of the institutional control period (assumed to be 2095 in the CERCLA analysis). [231] [pg97]

NRC is giving DOE illegal dilution credit by allowing: "The concentration in saturated groundwater should reasonably be less than 10 pCi/L using a dilution factor of 100 and an attenuation factor of 2 due to sorption in the vadose zone." NRC must be held accountable for going along with incorrect sorption Kd rates and dilution in violation of 40 CFR 148.3 when above they were critical for DOE's use of the same above analysis. Is this in the interest of protecting the general public as they claim?

"4.2.9.4 Evaluation—Flooding Scenario

"The impact of a Mackay Dam failure-induced flood on radionuclide transport was analyzed by DOE Idaho. The flood was assumed to occur at tank failure (500-year postclosure). Infiltration was increased by 100 times over the 12.4 cm [4.9 in] per year worst-case scenario infiltration rate. The transport simulations are very sensitive to infiltration rate because it affects not only the transport rate through the vadose zone, but also the release rate from the wasteform (DOE Idaho, 2003a). [232] [233]

"4.2.9.5 Overall Conclusions

"In summary, with respect to hydrology NRC staff has several concerns regarding the DOE Idaho selected conceptual model, including assumptions about the principal direction of vadose zone flow, the BLR boundary condition, and important hydrological features that are thought to be present in the INTEC area but that were not explicitly accounted for in the hydrology model. At the same time, however, staff were concerned that the implementation of the hydrology model, including the model orientation and methods used to discretize the mapped sedimentary interbeds and basalt flow groups and the BLR and recharge boundary conditions were potentially resulting in an optimistic level of performance by laterally diverting and diluting radionuclides along the flow path to the SRPA. Sensitivity analyses performed by DOE Idaho do not currently address all of these specific concerns. Recommendations related to consideration of recent and future monitoring data and modeling activities are discussed in Appendix A. [234] [pg98]

"4.2.10 Dose Methodology

"The key uncertainties were residual radionuclide inventory, infiltration rate, transport parameters, and grout distribution coefficients.. [Pg. 99, 100, 101]

"Contaminant concentrations are not diluted as a result of extraction of contaminated water with the well. However, contaminant concentrations are averaged over a 10-m [33-ft] well-screen length. Over 99 percent of the dose was from I-129 and Tc-99, with much smaller contributions from Sr-90. [pg99]

NRC (above) states: "Contaminant concentrations are not diluted" statement is literally contradicting its previous statements on acceptance of DOE's 100 times dilution of contaminates in order comply with NDAA criteria. Half-lives of I-129 and Tc-99 are 16,000,000 yr.; 210,000 yr. respectively. [235] "Only Sr-90, Tc-99, and I-129 contributed significantly to the expected ground-water all-pathways dose (expected to contribute more than 99 percent of the peak dose)." [236]

"DOE should indicate how it has resolved issues that have historically plagued analytical sampling of Tc-99 and I-129 in this assessment (Sections 3.1 and 3.2). DOE Idaho should continue to stay abreast of cleaning technologies for potential use in any future activities related to waste determinations (Sections 3.5 and 3.6).

• Use of ORIGEN2 ratios for estimating the solid residual inventory of highly radioactive radionuclides (HRRs) is not recommended for the reasons stated in Section 3.2.1. DOE Idaho should continue to sample HRRs to ensure adequate inventory estimates for the purposes of demonstrating compliance with the NDAA criteria. [237] [pg. 100]

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[231] NRC 2006, Pg. 97.

[232] NRC's acceptance of DOE analysis of flooding of tanks occurring "(500-year post-closure)" is absurd given that it already acknowledged current < 100 flood impact on the tanks.

[233] NRC 2006, Pg. 98.

[234] NRC 2006 Pg. 98.

[235] NRC 2006 Pg. 38.

[236] NRC 2006 Pg. 35.

[237] NRC 2006 Pg. 99 & 100.

NRC's above statement on NRC guidance provides : "Contaminant concentrations are not diluted as a result of extraction of contaminated water with the well" again contradicts its previous acceptance of DOE use of dilution. [238]

"4.4 Monitoring to Assess Compliance with 10 CFR Part 61, Subpart C

"The short-term performance of the grouted vault is especially important to mitigate the release of short-lived radionuclides such as Sr-90 from the contaminated sand pads that could potentially dominate the predicted doses from the TFF within the first few hundred years (DOE Idaho, 2003a). [239] [pg109]

"5 OVERALL CONCLUSIONS

"It should be noted that NRC staff is providing consultation to DOE as required by the NDAA, and the NRC staff is not providing regulatory approval in this action. DOE is responsible for determining whether the waste is HLW. This NRC staff assessment is a site-specific evaluation and is not a precedent for any future decisions regarding non-HLW or incidental waste determinations at INL or other sites. [pg. 111]

Agency's conclusion above: "NRC staff is providing consultation to DOE as required by the NDAA, and the NRC staff is not providing regulatory approval in this action." The general public will not likely go through this lengthy report to find just how numerous times NRC reveals it "cover my ass" qualifiers where they admit there is no sampling data to support DOE assessments and the estimates flowing from unsupported assumptions as EDI has underlined above. DOE will broadcast that NRC approved of the tank closure plan required by Congress.

The public will never see the buried statement: "The NRC staff is not providing regulatory approval in this action;" or "DOE is responsible for determining whether the waste is HLW" because this report's conclusions virtually concur.

Additionally, "This NRC staff assessment is a site-specific evaluation and is not a precedent for any future decisions regarding non-HLW or incidental waste determinations at INL or other sites" is equally misleading.

"APPENDIX A RECOMMENDATIONS

"The following recommendations are noted with respect to meeting Criterion Two:

"DOE Idaho should identify a sampling strategy that has the highest probability of success of obtaining representative samples of the waste (e.g., use of a small submersible pump moved across the bottom of the tank to collect residual heel samples to capture a representative collection of residual materials from a larger portion of the tank) (Section 3.2).

• Using information provided to NRC in response to requests for additional information (RAIs) 2 and 17, DOE Idaho should consider assessing the quality of the solids sample retrieved from tank WM–183 in a revised data quality assessment. DOE should indicate how it has resolved issues that have historically plagued analytical sampling of Tc-99 and I-129 in this assessment (Sections 3.1 and 3.2). [PG. 112]

"**The following recommendations are made with respect to Criterion Three**:

• DOE Idaho should continue to evaluate and enhance radionuclide release models for grouted systems, which may include assessing (i) the applicability of the Kd approach, (ii) the appropriateness of using cementitious material Kds for waste that may not be thoroughly mixed with the poured grout, (iii) the need for leaching experiments on expected wasteforms in the potential range of physical and chemical conditions, and (iv) grout pore water chemistry effects on future releases from the Tank Farm Facility (TFF).

• DOE Idaho should consider updating/revising the performance assessment (PA) model to consider recent monitoring data and modeling activities performed for the TFF under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) program (e.g., DOE Idaho, 2004, 2006d,e) to ensure hydrogeological conceptual model uncertainty is appropriately addressed. This would include (i) effects of historical releases on future contaminant transport, with consideration of the work in DOE Idaho (2006e); (ii) additional data to support a hydrology model oriented in the principal vadose zone flow direction (i.e., generally to the southeast) if a two-dimensional model is retained for modeling contaminant flow and transport in the PA; (iii) additional data on Big

[238] The TEDE all-pathways predictions are based on diluted sample data to lower dose. Also the ~ 890 years is ridiculous! What would it be in 50 or 100 years post institutional control for the farmer drilling a well over the tanks? As stated on page 99 ""The short-term performance of the grouted vault is especially important to mitigate the release of short-lived radionuclides such as Sr-90 from the contaminated sand pads that could potentially dominate the predicted doses from the TFF within the first few hundred years."

[239] NRC 2006 Pg. 109.

Lost River seepage rates and underflow rates; and (iv) more realistic parameterization of natural (stratified) alluvium with a representative property set that is separate and distinct from the property set used to model anthropogenically disturbed (homogenized) alluvium (this should provide more realistic, spatially variable infiltration rates). DOE Idaho should consider the effects of infiltration controls and any future cap on contaminant flow and transport at the TFF.

• DOE Idaho should enhance quality assurance controls of documentation in future waste determinations and supporting documentation. This TER and NRC staff's RAI (NRC, 2006a) note several errors in waste determination, PA documentation, and RAI responses. [240] [pg. 113]

The fact that DOE failed to apply the above extensive NRC critique on Tank Closure and went ahead and grouted the 7 HLW Tank Farm Tanks anyway dramatically shows how little the DOE cares/or is willing to follow NRC "consultation" and how Congress' misguided confidence that DOE would apply the NRC's guidance. Now the public is left with no alternative than to take this case back to court for some application for environmental justice since NRC failed to give Congress the conclusions DOE deserved.

EDI's Review of DOE's Administrative Record shows Data NRC Missed

Review of DOE's Administrative Record documentation shows the total source term release of RCRA mixed hazardous and radioactive contaminates from major leaks in the INTEC tank farm states: 32,700 curies from of leaks. [241] [242] This is an enormous amount of contamination that has already ended up in the Idaho's sole source Snake River Aquifer under INL.

In other words, this contamination - if not adequately cleaned up as NRC advises above and isolated from the environment will be a health hazard for every-living-thing for millennia.

Table 9: INTEC Tank Soil Sampling Summary Samples; only 3 of 5 Sampling Sites. [243]

Isotope	Sample Site CPP-31 Contaminate level (pCi/g)	Sample Site CPP-28 Contaminate level (pCi/g)	Sample Site CPP-79 Contaminate level (pCi/g)
Cesium-137	8,990,000	2,540,000	3,500,000
Strontium-90	20,700,000	379,000	219,000
Plutonium- 238	41,800	12,600	21,100
Pu-239/240	8,530	8,160	23,600
Pu-241	?	13,700	18,700
Am-241	8,970	2,000	2,330

[240] NRC 2006 Pg. 113. We must take note of these NRC recommendations so special attention will be put on DOE's next tank closure plan for the last 4 HLW/SBW tanks.

[241] Cahn, L. S. et. al. April 2006, Section 5, Nature and Extent of Soil Contamination, Operable Unit 3-14 Tank Farm Soil and Groundwater Remedial Investigation-Baseline Risk Assessment, DOE/NE-ID-11227, Rev. 0, USDOE, Idaho Operations Office, Table 5-2, page 5-4, hereinafter referred to DOE/NE-ID-11227.

[242] A curie of radioactive material is relatively a lot. By comparison regulatory maximum contaminate levels are expressed in pico curies – or 1/trillionth of a curie due to its extreme biological hazard.

[243] DOE/NE-ID-11227, Table 5-7, page 5-12

Eu-154	9,620	3,770	2,860
Rad/Hour [244]	11.2	2.867	4.1

Table 1: Units; pico-curies, a unit of radiation measurement (one-trillionth of one curie) is used in EPA regulations because radiation exposure is so biologically hazardous to humans because of increased risk of cancer. For example the EPA Maximum Concentration Level for Cesium-137 is 119 pCi/L, Strontium-90 is 42 pCi/L and alpha particles like plutonium, is 15 pCi/liter.

Table 10: INTEC Tank Source Terms for all 3-14 release sites in curies (Ci). [245]

Cesium-137 19,100 FULL Curies
Strontium-90 18,100 FULL Curies

Table 11: INTEC Tank Farm Leaks

Leaks listed below of 100 gallons or more. DOE lists ~ 13 leaks in cited report.

Leak Site	Citation (pg.) *	Leak quantity (gallons)	Leak Site	Citation (pg.) *	Leak quantity
CPP-15	5-17	120	CPP-58	5-135	20,000
CPP-16	5-30	3,000	CPP-58W	5-140	1,000
CPP-20	5-36	100	CPP-79	5-142	400
CPP-27/33	5-62	540	WM-181 Tank Vault	5-47	20,000
CPP-28	5-81	227			
CPP-31	5-101	18,600	**Totals ****		**64,014**

Above Table 3: * * Totals include 5 leaks (less than 100 gal.) with a total of 27 gallons.

Additionally, the INTEC Process Waste Percolation Ponds add 700 Mgal/yr. (700,000,000) to the lateral ground water recharge to the Tank Farm that forces contaminates into the aquifer below. [246] [247]

INTEC High-level Waste Tank Contribution to Soil Contamination Hazard

The INTEC underground high-level waste Tank Farm, consisting of eleven 300,000-gallon tanks with a 1999 volume of about 1.4 million gallons, is only part of a large complex of an additional 127

[244] End of Well Reports for the OU-3-143 2004 Tank Farm Soil Investigation at the INTEC, April 2006, Appendix D, Gamma Logging Data, Pg.D-3, Appendix C, pg. C-4.

[245] Ibid. This curie level is an enormous amount of radioactivity. Source term: The amount of radioactive materials or chemicals released from a site, facility or point source of emissions to the environment over a given period of time. The source term is commonly used in dose reconstruction and radio nuclides, is expressed in terms of particular radio nuclides and measured in curies.

[246] DOE/NE-ID-11227, Table 5-7, page 5-12

[247] Operable Unit 3-14 Tank Farm Soil and Groundwater Remedial Investigation-Baseline Risk Assessment, DOE/NE-ID-11227, USDOE, Idaho Operations office. DOE attributes leaks to Tank Farm service lines and not to tanks. Hereinafter referred to DOE/NE-ID-11227.

high-level waste tanks that are part of the INTEC high-level waste operations.[248] EDI has listed these 127 tanks, their location and what process they are attached too, however the waste actual volume of their sediment contents is uncertain. Some of these tanks are a significant criticality hazard due to the high concentration of fissile isotopes (uranium and plutonium) solid material content of the tanks. [249]

We must assume these other smaller tanks were quietly some-what emptied and grouted? The quantity of HLW sediments buried must be disclosed especially since NRC never included them in their review. If DOE's new attempt to obfuscate the legal requirements and allow **permanent** disposal in these already leaking waste tank units is not stopped, more pollution will migrate to the aquifer, further putting the general public at risk. DOE's own reports show radioactive groundwater contamination under INTEC greater than 60,000 times, and at nearby Reactor Technology Center (RTC) formerly called the Test Reactor Area 176,000 times, the EPA-regulated maximum radionuclide concentration level for drinking water. [250] Citing the RTC contamination is germane because of their close proximity and the fact that these contaminate sources must be considered collectively in making cleanup decisions that will impact the aquifer underlying INL.

The hazard (as noted by NRC above) is intensified by the fact that the U.S. Geological Survey report shows that the top ground level of the INTEC high-level Tank Farm is within the Big Lost River 100-year flood plain, which means the bottom of the tanks are some 50 feet **below** the flood levels. [251] Flooding of these tanks and the related HLW processing buildings will flush pollutants into the aquifer and endanger the general public, since these radionuclides are toxic for tens of thousands of years.

INL contractor reports show significant groundwater intrusion into INTEC below grade operations. This data includes "sumps" that collect either leaks or other groundwater contributions to the waste accumulation outside of the "original" containment unit. These "sumps" are accumulating some 36,633 gallons per year. [252] This data (not disclosed by DOE or IDEQ) clearly indicates either serious leaks or an equally serious surface/groundwater contributor to Tank Farm contaminate dispersion into the underlying Snake River Aquifer.

Another DOE INTEC Baseline Risk Assessment studied the surface precipitation contribution to flushing Tank Farm contamination to the aquifer. It states:

> *"DOE steadfastly claims the tanks do not leak, however no credible data is provided distinguishing surface infiltration into the tank vaults from leaks. Regardless, the presence of water in the tank vaults should disqualify leaving the tank sludge/heals in place as a RCRA hazardous waste landfill as planned.*
>
> *A typical example of ~ 14 sample Tank Farm locations in Table B-B-1, A-65 summery of years 1954 through 2003 resulted* ***in a total of 1,623.8 cm of recharge through the Tank Farm to the aquifer below****." [253]*

[248] Idaho High-Level Waste and Facilities Disposition Draft Environmental Impact Statement, December 1999, DOE/EIS-0287D, page C.9-10, herein after called HLW/EIS.

[249] Environmental Defense Institute Amicus Curiae Brief filed in federal court 8/2/02, Natural Resources Defense Council et al. vs. Department of Energy, Case No. 01-CV-413 (BLW).

[250] INEEL Test Reactor Area Record of Decision, Perched Water Systems, December 1992, OU-2-12, pg. 14 - 16.

[251] Preliminary Water-Surface Elevations and Boundary of the 100 Year Peak Flow in the Big Lost River at the Idaho National Engineering and Environmental Laboratory, Idaho, US Geological Survey, Water-Resources Investigations Report 98-4065, DOE/ID-22148.

[252] Tripp, J.L. et al., INEEL Radioactive Liquid Waste Reduction Program, Presented to theWM'99 Conference, 2/29-3/4/99. http://www.wmsym.org/wm99/pqsta/43/43-6.pdf

[253] DOE/NE-ID-11227, Appendix B

Table 12: 1995 INTEC (ICPP) Perched Water Well Sample Data [254]

ICPP Well No.		Gross Alpha	Gross Beta	Strontium-90
CPP-55-06	[A]	7,290	191,000	65,600
MW-2 4,	[A]	700	925,000	516,000
MW-5	[A]	520	211,000	110,000
MW-020	[B]	--	---	25,800
MW-010	[B]	-	--	320,000
MW-15	[B]	--	--	17,200

[A] [INEEL-95/0056@2-162] [INEEL-95/0056 @ 5-25]
[B] DOE/ID-10660, pg. 5-67, 5-68
All Unites pico curies/liter (pCi/L)

Table 13: 2002 INTEC Perched Ground Water Sample Data [255]

Contaminate	Concentration	Regulatory Std. (MCL) [256]
Gross Alpha	1,100.00	15
Gross Beta	590,000.00	4 millirem/yr.
Tritium	40,400.00	20,000.00
Strontium-90	136,000.00	8.00
Plutonium-238	0.0501	7.02
Americium-241	0.0374	6.34
Iodine-129	0.650	1.00
Technetium-99	476.00	3,790.00
Uranium-233/234	15.30	13.80
Uranium-235/236 0	0.142	13.80

Tables 12 & 13 Above References: Units are pCi/L; * Beta particle/photon radioactivity shall not produce annual dose equivalent to the total body or internal organ greater than 4 mllirem per year. If the dominate (gross) beta is trontium-90, the MCL of 8 pCi/L can be used.

Radionuclides dumped in INTEC Waste Injection Well

Total Injected = **22,200** Full Curies; Total remaining in Well = **3,920** Full Curies (decayed to 1995 values) [257] DOE/ID-10660, pg. 5-71

Table 14: 2006 Tank Farm Soil Downhole Gamma Log Data [258]

Probe 31-1	4,856	mR/hr.	4.856 R/hr.	@14 ft.
Probe 31-1	11,220	mR/hr.	11.22 R/hr.	@17 ft.
Probe 79-2	4,100	mR/hr.		@34 ft.
Probe 79-4	>4,000	mR/hr.		@41 ft.
Probe 81-7	>4,000	mR/hr.		@15 ft.
Probe 81-13	>4,000	mR/hr.		@10 ft.
Probe 81-14	>4,000	mR/hr.		@17 ft.
Probe A53-19	>4,000	mR/hr.		@15 ft.

[ICP/EXT-04-00706, Appendix A to D]

Contaminates under Tanks WM-185 and WM-187 shown in "Table 3 presents a conservative residual inventory at closure for the sandpads based on the analysis of the two contaminated sandpads. This

[254] INEL-95/0056; Waste Area Group 3 Comprehensive Remedial Investigation/Feasibility Study Work Plan (final) Volume 1, August 1995, Lockheed Idaho Technologies Co.; also Chapter 5 OU 3-14 "Nature and Extent of Soil Contamination."
[255] DOE/EIS-0287, Idaho HLW & FD EIS, page 4-52, 4-53 and 4-57.
[256] 40 CFR 140 and 141
[257] DOE/ID-10660, pg. 5-71
[258] End of Well Reports for the OU 3-14 2004 Tank Farm Soil Investigation at INTEC, April 2006, Appendix A to D, Final Downhole Gamma Logs, ICP/EXT-04-00706.

inventory represents the sandpad assumed under Tanks WM-185 and WM-187 in the PA. Sandpad residual inventory at closure (Ci per sandpad). Total Ci all radionuclides 3,850." So at total for both Tanks WM-185 and WM-187 is X 2 = **7,700 Ci.** [259] [Pg. 40]

It's crucial to take into consideration how much HLW has already contaminated the soil and groundwater at INTEC when considering intentionally leaving more of this waste to remain in the Tank Farm when DOE grouts/closes the remaining 3 HLW tanks.

DOE's Modeling is Flawed

DOE's computer modeling of contaminates fate and transport is fundamentally and deliberately flawed. DOE's own report states "The modeling results indicated that actions on Tank Farm Soil alone will not meet Snake River Plane Aquifer Remedial Action Objectives." Below is National Academy of Sciences view:

> 'The 1982 Nuclear Waste Policy Act (NWPA) defined the term "high-level waste" (HLW) and officially adopted deep geologic disposal as the nation's long-term strategy for managing this waste. The definition of HLW, as set out in the Nuclear Waste Policy Act (42 U.S.C. Section 10101), is:
> (A) the highly radioactive waste material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains fission products in sufficient concentrations; and (B) other highly radioactive material that the [Nuclear Regulatory] Commission, consistent with existing law, determines by rule to require permanent isolation.
>
> "It is apparent from this text that Congress defined HLW in the AEA and the NWPA in terms of its source. Section 3116 of the NDAA provides an exception to this definition at the sites in South Carolina and Idaho. DOE Order 435.1 still applies to waste determinations at Hanford and potentially to other wastes at the Savannah River and Idaho sites to which Sect. 3116 does not apply. In 1993, the USNRC first set out criteria to determine which portions of certain Hanford nuclear fuel reprocessing waste are not HLW (the waste so determined is also called "waste incidental to reprocessing" in some documents). [Pg.16[260]]
>
> "**DOE, which regulates itself on most matters related to radioactive waste, developed Order 435.1** which contains provisions for determining that some wastes are not HLW and, thus, can be managed as low-level waste or transuranic waste (DOE, 1999a; 1990b; 2001b). According to DOE Order 435.1, waste can be determined to be incidental to reprocessing by two methods, "citation" or "evaluation." The citation method simply lists certain wastes, such as resins and clothing, that DOE identifies as incidental to reprocessing. The evaluation method is based on three criteria provided to DOE by USNRC in 1993 in its denial of a petition for proposed rulemaking concerning the definition of HLW. (Bernero, 1993).
>
> "The Commission . . . has indicated . . . it would regard the residual fraction as "incidental" waste, based on the 16The first official document referring to "waste incidental to reprocessing" is the provisions of DOE Manual 435.1 concerning determining whether DOE tank waste is not HLW. "Incidental" waste is mentioned in a March 4, 1993 Federal Register Notice in which the USNRC set forth criteria for determining that waste from Hanford double-shell tanks disposed of in a grout facility would not be HLW USNRC found that the principles for waste classification are well established, endorsing the criteria DOE later used in Order 435.1 (NRC, 2005b)." [261] [pg.28]
>
> "Using the provisions of DOE Manual 435.1, DOE proposed to determine that certain wastes at the three DOE sites that are the subject of this report are not HLW, a step needed for DOE to carry out its separation strategy (high-activity and low-activity) for the tank wastes. This process came to an abrupt halt in 2003 when DOE was sued in Idaho by the Natural Resources Defense Council, Snake River Alliance, Confederated Tribes and Bands of the Yakama Nation, and the Shoshone Bannock Tribes. The plaintiffs argued that Order 435.1 exceeded DOE's authority under the AEA and the NWPA. In 2004, the court found that the standards DOE established by rule were too discretionary and offered no effective limitation on the agency's ability to determine which waste could be managed as low-level waste and disposed on-site. The federal district court in Idaho ruled in favor of the plaintiffs, finding that DOE could not continue with its management activities in reliance on Order 435.1.17
>
> "DOE appealed the district court's decision. The U.S. Court of Appeals for the Ninth Circuit did not rule on the legal merits of the district court's ruling. It reversed the district court on the procedural ground that the case was not yet "ripe" for judicial determination. *[Foot Note18*] In other words, the Ninth Circuit expressed no opinion on the

[259] Basis for Section 3116 Determination for the Idaho Nuclear Technology and Engineering Center Tank Farm Facility, November 2006, Revision 0, Table 3, DOE/NE-ID-11226, Pg. 40.

[260] NAC,2006, Pg.16

[261] NAS 2006, Pg. 28

legality of Order 435.1, but put off the question for a later time, when DOE actually takes action under the authority of Order 435.1. Although the decision that struck down Order 435.1 was vacated, the Order could be contested at its first use. This leaves Order 435.1 in some degree of legal limbo in Idaho, where the only existing opinion (albeit vacated) is negative and in Washington state, which is also in the Ninth Circuit. DOE saw the rulings as a major impediment to its pursuit of a separation strategy at the Hanford and Savannah River Sites and to tank closure at all three sites. So, even before the Ninth Circuit rendered its decision on the appeal, DOE sought a statutory remedy from Congress. In Section 3116 of the Ronald Reagan National Defense Authorization Act of 2005, Congress established criteria for determining that some waste from spent fuel reprocessing is not high-level waste and may be disposed of on-site at the Savannah River Site and the Idaho National Laboratory.

"The Hanford Site, however, was not included in the provisions of Section 3116 because the state of Washington explicitly is not covered or bound by the section. In its criteria, Congress implicitly divided the non-high-level waste from spent fuel reprocessing destined for on-site disposal into two subclasses, depending on the concentrations of radionuclides in the waste in relation to Class C concentration limits in 10 CFR 61.55 although the differences are only procedural (NRC, 2005a). Therefore, under Section 3116, at the Savannah River Site and the Idaho National Laboratory (but not Hanford), there are essentially three subclasses or categories of tank waste from reprocessing: HLW, non-HLW Class C or less, and non-HLW greater than Class C. Section 3116 is similar to Order 435.1 in many ways, most importantly in the standard for removal of radionuclides to the maximum extent practical and in the use of the performance objectives in 10 CFR 61 as benchmark criteria for on-site disposal. However, there are some critical differences.

"First, Section 3116 addresses only wastes that are to be disposed of on-site and which are subject to a state compliance agreement whereas the provisions of DOE Manual 435.1 could encompass any waste and its planned destination. Section 3116 does not say that waste disposed on-site is low-level waste, although it is implied that such wastes will be managed by near-surface disposal like other low-level waste disposed on-site. Section 3116 was intended to resolve the legality of the overall separation strategy at the Savannah River Site and of tank closures at the Savannah River Site and Idaho (but not, of course, at Hanford). Unlike Order 435.1, however, Section 3116 does not provide authority or guidance on tank waste determinations for retrieved non-high-level waste to be managed as transuranic waste, probably because defense transuranic waste is slated for geologic disposal at the Waste Isolation Pilot Plant in New Mexico and Section 3116 only applies to waste that stays on-site. Foot Note 19

"Second, Section 3116 sets out roles for the host states and USNRC, which are absent from Order 435.1. DOE requested informal USNRC input on waste determinations performed before 2004 under Order 435.1 (Camper, 2005; Flanders, 2005). However, the USNRC did not have any official regulatory role in that capacity and provided general and nonbinding comments on DOE's waste determinations." [emphasis added]

Foot Notes 18. That is, DOE had not yet actually applied Order 435.1 in the Idaho case. NRDC, Inc. et al. v. Abraham, 388 F.3d 701 (9th Cir. 2004).

Foot Note 19 See definition of transuranic waste in Appendix K." [262] [pg.29]

Tank Grouting Issues

The DOE's own internal INL documents indicates comments by INL officials that show grouting cannot be appropriately accomplished because (1) the tanks sit on a sand bed; (2) grouting under the tanks will be necessary, but the grouting of the non-RCRA compliant concrete tank vault containment structures will float the tanks and bend and distort the tank bottoms so that the grouting may bend or break the wastes grouted inside the tanks so that the waste will not be immobilized; and (3) there will not be any homogenous mixture formed within the tanks between the grout and the wastes; (4) the side panels and side walls and floors of the vaults are contaminated with radioactive and mixed (RCRA) wastes; (5) Vessel Off-gas Systems (VOG) problems are avoided as "outside the scope of this study"; (6) nine out of eleven tanks do not meet seismic criteria. [263]

The DOE report shows that mixing of the grout and the tank sediments will not occur. The displacement grout will simply "roll over" the solids, leaving potential High-Level Waste, Transuranic, and/or Greater than Class C Low Level Waste at the tank bottoms which is not immobilized. Reports indicate that adequate hydraulic studies have not been performed. [264]

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[262] NAS 2006, Pg 29.

[263] INTEC RI/FS, DOE/NE-ID-11227, page 4-1.

[264] Basis for Section 3116 Determination for the Idaho Nuclear Technology and Engineering Center Tank Farm

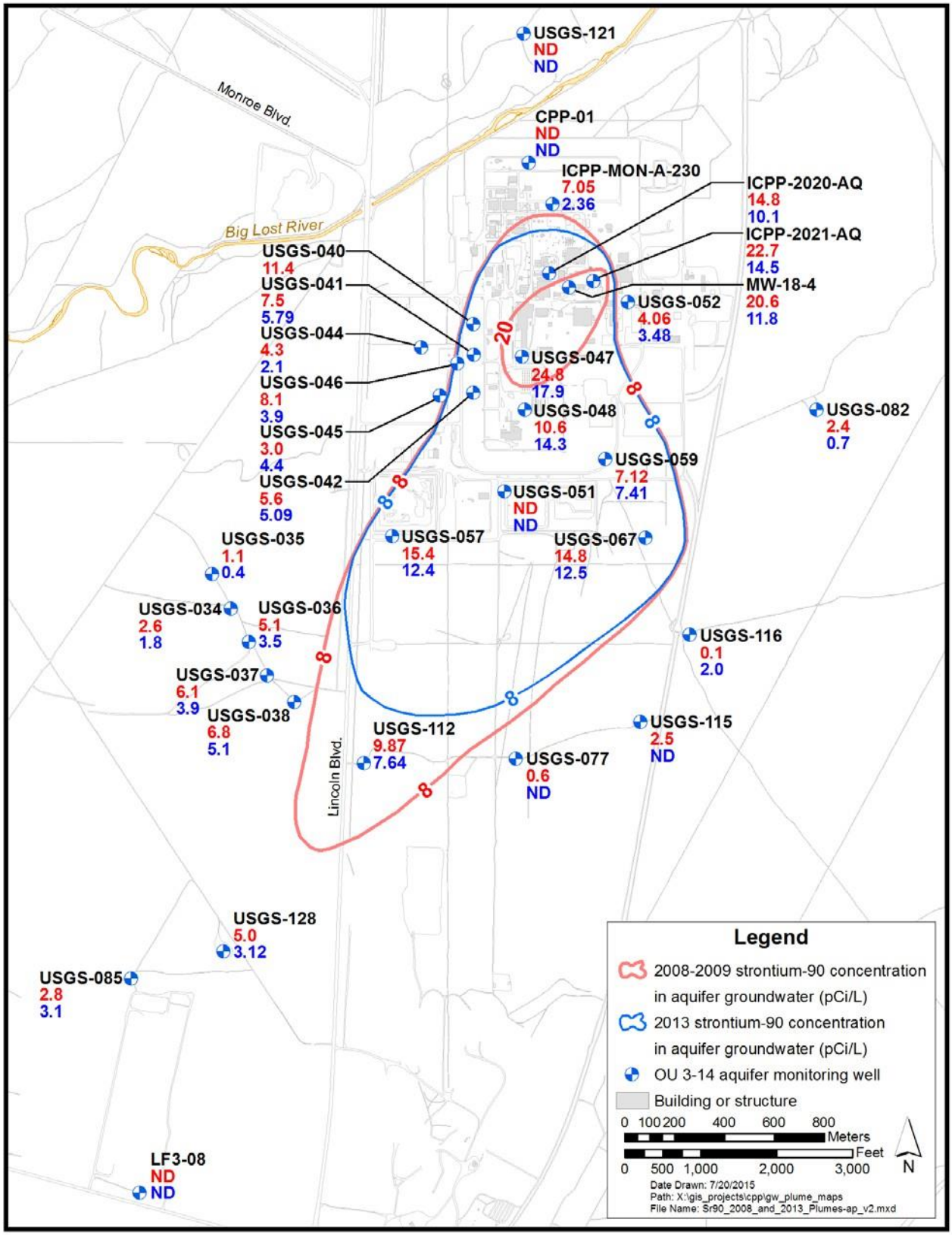
INTEC Groundwater Monitoring Data (2009 and 2014) [265]

Maximum concentrations in groundwater and perched water samples (2009 and 2014) INTEC.

Constituent or Analyte	MCL	Unit	Snake River Plain Aquifer Groundwater		Shallow Perched Water	
			2009 Maximum Value[a]	2014 Maximum Value[b]	2009 Maximum Value[a]	2014 Maximum Value
Gross alpha	15	pCi/L	4.68	2.59	**20.1**[c]	2.7
Gross beta	NA	pCi/L	1,290	628	311,000	439,000
Cs-137	200[d]	pCi/L	ND	ND	ND	ND
Sr-90	8[d]	pCi/L	**24.8**	**14.5**	**130,000**	**192,000**
Tc-99	900[d]	pCi/L	**2,220**	**1,060**	263	264
I-129	1[d]	pCi/L	0.614UJ	0.836	**1.77J**	ND
Tritium	20,000[d]	pCi/L	6,470	3,400	**20,500**	1,910
Pu-238	15[e]	pCi/L	ND	ND	ND	ND
Pu-239/240	15[e]	pCi/L	ND	ND	ND	ND
U-233/234	15[e]	pCi/L	2.86	2.24	6.19	4.77
U-235	15[e]	pCi/L	0.183J	0.106J	0.24J	0.149
U-238	15[e]	pCi/L	1.34	1.12	3.76	2.49
Nitrate (as N)	10	mg/L	**15.6**	**14.1**	**24.1**	5.0

Facility; November 2006, DOE/NE-ID-11226, Revision 0. Hereinafter DOE/NE-ID-11226.

[265] DOE/ID-11513; Five-Year Review of CERCLA Response Actions at the Idaho National Laboratory Fiscal Years 2010-2014, December 2015, Table 6-6, pg. 6-8. Next page Figure 6-13. Idaho Nuclear Technology and Engineering Center Sr-90 groundwater plume in 2008 and 2013. [DOE/ID-11513; Five-Year Review of CERCLA Response Actions at the Idaho National Laboratory Fiscal Years 2010-2014, December 2015.]


USGS-121
ND
ND
Monroe Blvd.
CPP-01
ND
ND
ICPP-MON-A-230
7.05
2.36
ICPP-2020-AQ
14.8
10.1
ICPP-2021-AQ
22.7
14.5
MW-18-4
20.6
11.8
Big Lost River
USGS-040
11.4
USGS-041
7.5
5.79
USGS-044
4.3
2.1
USGS-046
8.1
3.9
USGS-045
3.0
4.4
USGS-042
5.6
5.09
USGS-052
4.06
3.48
USGS-047
24.8
17.9
USGS-048
10.6
14.3
USGS-082
2.4
0.7
USGS-059
7.12
7.41
USGS-051
ND
ND
USGS-035
1.1
0.4
USGS-057
15.4
12.4
USGS-067
14.8
12.5
USGS-034
2.6
1.8
USGS-036
5.1
3.5
USGS-116
0.1
2.0
USGS-037
6.1
3.9
USGS-038
6.8
5.1
USGS-112
9.87
7.64
USGS-115
2.5
ND
USGS-077
0.6
ND
Lincoln Blvd.
USGS-128
5.0
3.12
USGS-085
2.8
3.1
LF3-08
ND
ND
Legend
2008-2009 strontium-90 concentration in aquifer groundwater (pCi/L)
2013 strontium-90 concentration in aquifer groundwater (pCi/L)
OU 3-14 aquifer monitoring well
Building or structure
0 100 200 400 600 800
Meters
0 500 1,000 2,000 3,000
Feet
N
Date Drawn: 7/20/2015
Path: X:\gis_projects\cpp\gw_plume_maps
File Name: Sr90_2008_and_2013_Plumes-ap_v2.mxd

INTEC SNF Reprocessing and Liquid Waste Processing

"Between 2002 and 2005, TFF tank contents were evaporated to less than one million gallons and consolidated into three 300,000-gal tanks. This SBW remains in storage in Tanks WM-187, WM-188, and WM-189. The current SBW inventory is a mixture of wastes from various sources, including:

• Decontamination solutions from past spent fuel reprocessing maintenance activities

• Solids and liquids from the bottom of the TFF tanks, which include some first-cycle waste

• Liquid wastes from ongoing maintenance and closure activities at INTEC

• Second- and third-cycle spent fuel reprocessing extraction wastes." [pg.18]

Tank WM-187—Placed into service in 1959, **Tank WM-187 was used to store Al and Zr fuel reprocessing wastes. The first-cycle extraction process waste was calcined between 1990 and 1993, and then SBW was added to the heel.** [pg20]

Tank WM-188—This tank was placed into service in 1959 and **was used to store Al and Zr fuel reprocessing wastes. The tank was emptied to heel level** when the waste was calcined in 1998.

Tank WM-189—Placed into service in 1966, Tank WM-189 was **used to store Zr fuel reprocessing wastes. The first-cycle extraction process waste was emptied to heel level in 1996**. Since then, the tank has been used to store a variety of SBW solutions from continuing operations (high-fluoride decontamination wastes, bottoms from the evaporator tank system, and other SBW). [266] [pg21] [emphasis added]

A legitimate question on Tank WM-190 is; how can DOE be sure the 7,000 gal is not from a leak in the tank? Even if it's from groundwater it's indicative of how insufficient the vault is as a permanent waste dump (RCRA/Land Disposal Regulations) for huge quantities of MTRU that will continue to migrate to the underlying aquifer!

" Tank WM-190—Tank WM-190 was designated as a spare tank for use in emergencies and was never placed into service. This tank was never used to store any waste, including first-cycle extraction process waste, although the tank has been contaminated with this waste. By 1980, approximately 7,000 gal of liquid had accumulated in the tank from two sources: (1) rainwater that collected in the vault sump was jetted into the tank and (2) a small quantity (less than 50 gal total) of first-cycle extraction process waste was passed inadvertently through the transfer valve. The transfer valve was opened slightly and closed (to confirm valve closure) prior to starting waste transfers to tanks that shared a common transfer line." [267]

"Thirty-eight events correspond with each year from the back-siphoning events in 1962–2000. Water was jetted from the tank vault sumps at least twice yearly and will continue until each tank is closed. The actual number of water transfers from the tank vaults and associated leaching of radionuclides from the sandpad likely exceeds 130 for each vault to date." [268] [PG. 38][emphasis added]

Contaminates under Tanks WM-185 and WM-187 shown in "Table 7 above presents a conservative residual inventory at closure for the "sand-pads" based on the analysis of the two contaminated sand-pads. This inventory represents the sand-pad assumed under Tanks WM-185 and WM-187 in the PA. Sand-pad residual inventory at closure (Ci per sand-pad). Total Ci all radionuclides 3,850." So a total for both Tanks WM-185 and WM-187 is x 2 = **7,700 Ci.** [269] [Pg. 40]

"The INTEC (ICPP) mission since 1952 has been reprocessing spent reactor (SNF) fuel to extract fissile material (primarily uranium) for military programs. Spills, leaks, and releases over the years resulted in significant contamination of the surface soils and underlying groundwater. **INTEC releases 979,486,072 gal/year in system leaks to flush contaminates to aquifer."** [270] [emphasis added] Tank or Vaults leak every Spring:

"A drain-sump system removes liquid (the liquid that accumulates is mostly rainwater; a small amount of liquid from secondary containments does enter vault sumps if a valve leaks or during some maintenance activities) that accumulates in the vaults. Typically, the vault area receives an accumulation of rainwater and snowmelt in the spring each year." [271] [pg37]

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[266] DOE/NE-10-11226, pg. 18 through 21.
[267] DOE/NE-10-11226, pg. 21.
[268] DOE/NE-10-11226, pg. 38.
[269] DOE/NE-ID-11226, Pg. 40.
[270] DOE/ID-10660, pg. 5-4
[271] DOE/NE-10-11226, pg. 37

Evaluating the SBW Tanks must keep in mind that they were previously used for 1st cycle raffinate from reprocessing SNF and when converted to SBW Tanks considerable 1st cycle waste remained in the tanks:

> "By February 1998, the liquid first-cycle extraction waste was removed from the TFF. Only small (1,000–15,000 gal) heels in eight of the eleven 300,000-gal storage tanks remained, which could not be removed with existing equipment. Reuse of the first-cycle waste storage tanks to store SBW has resulted in the mingling of the first-cycle waste heels with SBW." [272] [Pg.17][emphasis added]

Additionally, CPP- 02 released 3,698,408 gal. /yr. [273] A Remedial Investigation/ Feasibility Study Final Work Plan, [274] for the ICPP was completed in August 1995. The three party INTEC cleanup Record of Decision was released in 1999 [275] [referenced below as B] was issued. The following table shows surface soil sample excerpts from these studies.

Table 8: INTEC CERCLA Cleanup Sites and Contaminate Concentrations

INTEC CPP Cleanup Site	Contaminate	Concentration pCi/g
CPP-15 Solvent Burner [B]	Am-241 Cs-137 Eu-154 Sr-90 Pu-238 Pu-239-240 Pu-241 U-235	16,600 102,000,000 565,000 56,800,000 276,000 12,600 106,000 9,000
CPP-89 Soil Storage Area [A]	Cs-137 Sr-90	7,730 10,800
CPP-34 Soil Storage Area [A]	Cs-137 Sr-90	2,000 6,000
CPP-26 Tank Farm Soil Steam Flush [A]	Cs-137 Sr-90	11,000 4,900
CPP-28 Tank Farm Soil South WM-108 [A]	Co-60 Sr-90 Cs-134 Cs-137 Eu-154 Pu-239 Pu-240 Pu-241 Am-241	23,000 57,000,000 76,000 100,000,000 570,000 13,000 12,000 1,100,000 1,500,000
CPP-31 Tank Farm South WM-183 [B]	Co-60 Sr-90 Cs-137 Eu-154 U-235	120 140,000 900,000 1,500 6,400

[272] DOE/NE-ID-11226, Pg. 17.
[273] DOE/ID-1066002, pg. 5-16
[274] INL-95/0056
[275] DOE/ID-10660, Section 5,

	Pu-239 Pu-240	1,100 1,000
CPP-35 Tank Farm Soil [B]	Cs-137 Sr-90 Gross Beta	8,643 3,240 12,100
CPP-36 Tank Farm Soil [B]	Am-241 Cs-137 Eu-154 Pu-238 Sr-90 Gross Alpha	763 408,500 4,740 8,180 51,300 27,500
CPP-79 Tank Farm Valve Box A-2 12 meters or 40 feet below surface [A page 5-4]	Sr-90 Cs-137 Am-241 Pu-238 Pu-239	5,410,000 33,700,00 16,600 276,000 89,900
CPP-91 Tank Farm Soil Boring [B pg.5-25]	Gross Alpha Gross Beta	190 20,900
CPP-01 Tank Farm Soil [B pg.5-26]	Gross Alpha Gross Beta	3,323 43,200
CPP-04/05 Soil around CPP-603 Settling tank [A]	Cs-134 Cs-137 Ce-144 Co-60 Eu-152 Eu-154 Eu-155	1,450 26,500 2,390 2,390 35,000 32,200 7,600
CPP-19 CPP-603 to CPP-404 SNF Storage Pool Line Leak [A]	Cs-137 Co-60 Eu-152 Eu-154 Eu-155 Sr-90 Gross Alpha Gross Beta	408,000 21,600 87,600 53,500 9,620 125,000 16,100 548,000

* The Radiological Release Criteria for Cesium-137 is 10 pCi/gram. [EG&G-WM-8804] INL-95/0056 pg. 2-115

Sources:

[A] A Remedial Investigation/ Feasibility Study Final Work Plan, October 1998, Volume 1, DOE/ID-1066002, pg. 5-16; also see INL-95/0056, August 1995.

[B] INTEC cleanup Record of Decision [DOE/ID-10660, Section 5] 3 party (DOE/EPA/IDEQ) agreement released 1999.

The ICPP Remedial Investigation/Feasibility Study lists 100 chemical/radiological release sites. Of the 100 release sites, 13 are related to the tank farm. The estimate of radioactivity in decayed values in the surface soils within the ICPP compound is 50,000 curies plus 22,200 curies released to the aquifer. [276] Contaminates migrating from the ICPP are found in the following perched water sample data.

Total Tank Farm contaminated soil originally was (111,835 cm) or (146,275 cu. ft.) but later

[276] DOE's INL Environmental Management Site Specific Advisory Board. See at EMSSAB @ 5.

investigations designated as "additional soils" is (84,606 cu m) or (110,660 cu yds.) down to 40 ft. were added. [277] [INTEC-RI/FS, 1998, pg.5-4]

DOE *Feed Composition For The Sodium-Bearing Waste Treatment Process* **report states:**

> **"[Tank] WM-188 has since been filled with HLLWE [High-level Liquid Waste Evaporator] concentrate**. A sample from WM-189, which was filled with much the same evaporator concentrate, showed significantly more solids than a similar sample from WM-180. However, other high solids waste, i.e., New Waste Calcine Facility (NWCF) flushes and off-gas scrub, were added to WM-189 and not to WM-188. Thus Tank WM-189 should have more solids than WM-180, and WM-188 likely has fewer solids than WM-189. For lack of additional data, the amount of solids WM-188 was assumed to be equal to that in WM-180 and the amount in WM-189 twice the amount in WM-180. The estimated expected amount of settled solids in WM-189 and the maximum amount in WM-188, 10,000 kg, is approximately equivalent to 20,000 gallons of sludge with a solids content of 7 vol. % and a solids density of 2 g/cm3." [278] [emphasis added]
>
> "Spent nuclear fuel reprocessing was curtailed in 1992, and the first-cycle extraction process wastes stored in the TFF were removed and solidified (by calcination) by February 1998 (DOE 2002). Since that time, the tanks used for storing the first-cycle wastes have been reused to store SBW. Because of the design of the tank's originally installed waste removal system, a tank emptied using this system still contains several thousand gallons of waste on the bottom. Thus, the reuse of the TFF tanks that were used to store first-cycle extraction process wastes to store SBW, along with the various historical transfers of wastes among TFF tanks to manage TFF volumes, has resulted in the current volume of SBW containing a small percentage (about 1% by volume) of first-cycle extraction process wastes (Loos 2004)." [279]

The Resource Conservation Recovery Act (RCRA) listed hazardous waste in the INTEC tank solids/heels is significant both in fact and from a regulatory perspective.

The RCRA listed hazardous waste in the INTEC tank solids is significant because of their high concentration level and from a regulatory perspective because EPA and IDEQ have more authority to regulate hazardous waste than radioactive waste. **Both agencies have been avoiding exercising that authority for decades despite the fact that mixed hazardous/ radioactive falls under RCRA with respect to INL disposal decisions.**

Table 9 RCRA listed hazardous waste in INTEC waste tank solids [280]

Tank	Total (mg/kg)	Tank	Total (mg/kg)
WM-180	1,148,196	WM-187-1	786,112
WM-181	518,623	WM-187-3	745,154
WM-182	537,778	WM-188-1	519,452
WM-183	484,801	WM-188-2	509,130
WM-186	1,000,000	Total	6,249,246

[281]

[277] INTEC-RI/FS, 1998, pg.5-4

[278] *Feed Composition For The Sodium-Bearing Waste Treatment Process*, INEEL/EXT-2000-01378, Revision 3. Idaho National Engineering and Environmental Laboratory, Bechtel BWXT Idaho, September 2003, page 54.

[279] DOE/NE-ID-11226, Pg. 2.

[280] Feed Composition for Sodium-Bearing Waste Treatment Process, 6/04, INEEL/EXT-2000-01378, Table 30, pg. 50. Table 30 "Comparison of Tank Solids Composition" lists ~45 hazardous materials with a total at the bottom of the listed tanks. See 40 CFR-264 Subpart 0 or 40 CFR 265 Subpart O for Universal Treatment Standards for each of the above Table 30 hazardous materials.

[281] DOE INTEC Remedial Investigation/Feasibility Study**,** INTEC RI/FS, DOE/NE-ID-11227, page 4-1.

Table 10: Summary Radioisotopic Results from INTEC SFE-20 Tank Characterization

(pCi/smear) (pCi/L liquid) (pCi/g wet solids) [282]

Sample Location	Co-60	Cs-137	Cs-134	Eu-152	Eu-154	Eu-155	Sb-125	Sr-90	Pu	U
Pipes Access (pCi/smear)	ND	7.7E+02	ND	ND	ND	ND	ND			
Pump Pit (pCi/smear)	ND	9.0E+03	ND	ND	ND	ND	ND			
Walls Floor (pCi/smear)	55.4	1.4E+04	59.2	584	570	121	ND			
Vault Wall (pCi/smear)	--	2.2E+03	---	-----	-----	-----	-----	-----	-----	-----
Sample Location	Co-60	Cs-137	Cs-134	Eu-152	Eu-154	Eu-155	Sb-125	Sr-90	Pu	U
Tank Exterior (pCi/smear)	1.51	5.8E+04	98.4	1.2E+03	770	204	ND	-----	-----	-----
Seepage Vault Walls (pCi/smear)	95.1	4.2E+04	ND	ND	ND	ND	ND	-----	-----	-----
Floor South End Vault (pCi/L)	5.8E+03	9.1E+05	1.4E+03	ND	ND	ND	ND	-----	-----	-----
Floor Center (pCi/L	1.1E+05	2.5E+08	1.6E+03	ND	ND	ND	ND	1.7E+08	1.0E+05	0.2
SFE-20 Tank Interior pCi/L	7.4E+04	2.1E+06	7.8E+03	ND	ND	ND	7.3E+04	9.7E+06	1.8E+07	0.2
Floor North (pCi/g)	2.2E+04	8.9E+06	1.1E+04	1.5E+05	1.3E+05	4.7E+04	ND	1.7E+06	7.9E+04	--
Tank Sludge (pCi/g)	3.3E+05	5.5E+07	1.6E+05	1.4E+05	1.2E+05	ND	ND	4.7E+06	9.4E+04	8.4 E+04
Pump Pit Sludge (pCi/g)	2.4E+04	2.3E+06	1.3E+04	5.7E+04	4.6E+04	2.1E+04	4.7E+04	5.9E+06	3.0E+03	--

CPP-VES-SFE-20 Hot Waste Tank System (Group 7)

The above table for just one ancillary tank (SFE-20), not even listed as one of the high-level waste tanks, still contain significant radioactive contamination that puts the underlying aquifer at risk. "In 1984, liquid and sediment samples were taken from the tank interior, vault floor, and pump pit.

[282] Comprehensive Remedial Investigation Feasibility Study (RI/FS) for the Idaho Chemical Processing Plant OU-3-13 at the INEEL – Part B, FS Supplemental Report, Volume 1, October 1998, Table 5-28,DOE/ID-10619 Revision 2, page 5-106.

The reported concentrations of Cs-137, total strontium, and plutonium isotopes in the single tank liquid sample were 2,050,000; 9,700,000; and 17,600,000 pCi/L respectively (WINCO 1984).[283] **For the same radionuclides, the concentrations in the tank sediment sample were reported at 55,400,000,000; 4,700,000,000; and 93,500,000 pCi/L respectively.**

The three samples were collected from the floor (two liquid and one sediment). The reported concentrations in the two liquid floor samples for Cs-137 9 analysis for total strontium and plutonium isotopes were not requested) taken from the south and center vault floor locations were 905,000 and 248,000,000 pCi/L respectively. The reported concentrations in the two liquid floor samples for Cs-137, total strontium and **plutonium isotopes in the sediment sample** collected on the north end of the vault were 8,920,000; 1,720,000; and 79, 200 pCi/g respectively. For the same radionuclides, the concentrations in the pump pit sediment sample were 2,290,000; 9,890,000 and 3,010 respectively." [284]

There are ~ 136 INTEC tanks listed in EDI's report [285] that equally pose a risk if the cleanup process is not through. None of the regulators (IDEQ or EPA) show any interest in enforcing the law and forcing DOE to do a comprehensive cleanup. This represents significant violations to the 1995 Settlement Agreement/Consent Order discussed more in RWMC Section below.

Professor Peter Santschi discusses Iodine-129 and how the issues around the disposal of the highly radioactive risk radioisotope states:

> "Iodine-129 (^{129}I), with a half-life of half-life of 16 million years, is commonly considered the single greatest risk driver in high-level and low-level nuclear repositories. This risk stems from several basic properties of ^{129}I, and under many geochemical conditions, it can move as an anion at nearly the rate of water through the subsurface environment. ^{129}I is also extremely radiologically toxic because over 90% of body burden accumulates in the thyroid, which weighs only about 14g in an adult. There is also a large worldwide inventory of radioiodine as a result of its high fission yield and this inventory is rapidly increasing as a result of nuclear energy production. Radioiodine is produced at a rate of 40 GBq (1 Ci) per gigawatt of electricity produced by nuclear power. To illustrate how the properties of ^{129}I magnify its risk, ^{129}I accounts for only 0.00002% of the radiation released from the Savannah River Site in Aiken, South Carolina, but contributes 13% of the population dose, a six orders of magnitude magnification of risk with respect to its radioactivity."
>
> **"Reducing environmental impact**
>
> **"**Iodine-129 from low-level waste is commonly disposed of in cementitious materials. Grout, a dense cementitious fluid, mixed with a reducing slag, is often used to immobilize radionuclides. However, the reducing environment might not be conducive to immobilize iodine. In earlier studies to test this hypothesis, iodine speciation in grout samples with slag ($Grout_{slag}$) and without slag ($Grout_{-slag}$), and its impact on iodine immobilization, were determined. Irrespective of whether iodide (I^-) or iodate (IO_3^-) was amended to the aqueous phase, there were no significant differences in iodine uptake K_d values as defined by the iodine ratio in the grout versus in solution (K_d values, $[I_{solid}]/[I_{aq}]$; K_d = 3 mL/g). Desorption K_d values (6.1 to 121.8 L/kg) were significantly greater than uptake K_d values, and the grout-amended iodine speciation (I^-, IO_3^-, organo-I) and grout formulation had a significant impact on desorption-K_d values. Rankings of desorption K_d values by iodine species were I^- <<organo-I $\leq IO_3^-$ and by grout formulation were $Grout_{+slag}$ < $Grout_{-slag}$. After 28 days of equilibration, organo-I comprised >40% of the iodine in the leachate. The organo-I formed from organic carbon (OC) that originated from the grout material (~0.1% OC). Iodine in the solid and aqueous phases were found to be not in equilibrium. More than 50% of the solid phase iodine was strongly bound and could not be extracted with a strong acid (0.1M HCl), suggesting that a mobile and much less mobile iodine grout fraction were present."
>
> **"Immobilizing iodine**
>
> **"**If one would want to immobilize iodine more effectively, different engineering approaches would need to be

[283] WINCO 1984

[284] INTEC Record of Decision, DOE/ID-10660, 1999, pg. 5-77.

[285] Chuck Broscious, Supplemental Comments on Department of Energy Idaho National Laboratory Idaho Nuclear Technology and Environmental Center Cleanup Plan Submitted by Chuck Broscious May 9, 2012. Public Comments on INTEC Tank Farm Soil and Groundwater Cleanup Plan, Operable Unit 3-14, Idaho National Laboratory, Idaho Department of Environmental Quality, August 22, 2007, Notice of Intent to Approve Plan for Closure of Hazardous Waste Units at INL, Docket # 10HW-0706.

used to promote binding of I^-, IO_3^-, or organo-I. For example, the silver based immobilization technologies (e.g., AgCl, Ag-impregnated granular activated carbon, Ag-mordenite) [sic] remove iodine from the aqueous phase by promoting the formation of Ag-iodide precipitates. The solubility of AgI is eight orders of magnitude lower than it is for $AgIO_3$. Similarly, co-precipitation of iodine into calcium carbonate phases occurs only with IO_3^- and not with I^- and org-I. It is anticipated that increased attention directed at understanding and quantifying the speciation of radioiodine, as opposed to simply total radioiodine, will lead to improved remediation results to be used for long-term radioiodine disposal in cementitious waste forms." [286]

SECTION 4. Radioactive Waste Management Complex/Subsurface Disposal Area and Advanced Waste Management Project Disposal Spent Nuclear Fuel High-level Waste [287]

RWMC Comment Summary

DOE continues to demonstrate a consistent pattern of violations of environmental laws, hazardous waste regulations and the 1995 Settlement Agreement Federal Court Consent Order. The following are examples:

1. Changed the definition of what waste is to be removed from the RWMC/SDA from "all TRU and Low-level Alpha" (*a*LLW) * to only "stored TRU" and continuing to allow *a*LLW (formerly TRU) to remain buried at the SDA stipulated in the 1995 Settlement Agreement and Consent Order for removal;
2. Even the *a*LLW "stored" on Pad A originally classified in as TRU (>10 nCi/g) * is left in place;
3. Offers no independent data confirming what waste left in the SDA is not SNF/TRU and that the alpha detection methods used in ARPS can accurately detect TRU and missing high-level waste in the form of SNF, enriched uranium, plutonium;
4. Violates Land Disposal Regulations (LDR) in: IDAPA 58.01.05.009 and 58.01.05.011; 40 CFR 265.13 and 268.7; and NRC under 10 CFR part 61 to include:
    a. Leaving SDA surface waste pile on Pad A waste in place;
    b. Leaving 90% of SDA buried mixed hazardous/radioactive waste in place;
    c. Once a waste dump is remediated, all the contaminated material –including soil – is considered a new waste and thus must be managed according to RCRA/NRC Land Disposal Regulations;
5. Continues SDA burial in the "Active LLW" in a flood zone in violation of Land Disposal Regulations;
6. Use economic leverage as largest employer to capture current State leadership, EPA and IDEQ to compromise policy and commitments to former Governors' Andrus, Batt 1995 Settlement Agreement and the public to cleanup buried nuclear waste that continues to contaminate the underling Snake River Aquifer.

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[286] Peter Santschi, How do we dispose Iodine-129 long-term? November 1, 2018, Peter H. Santschi Regents Professor Department of Marine Sciences, Texas A&M University – Galveston, Galveston, TX 77554, USA **https://www.openaccessgovernment.org/iodine-129-disposal/53932/**

[287] Chuck Broscious, "Review of the Mixed Hazardous Radioactive CERCLA Waste Cleanup Policy at the Radioactive Waste Management Complex Subsurface Disposal Area Department of Energy's Idaho National Laboratory Submitted by Chuck Broscious on behalf of Environmental Defense Institute August 2018 Rev. 4.0 www.environmental-defense-institute.org/publications/

* Alpha Low-Level Waste (αLLW): Waste that was previously classified as transuranic (TRU) waste but has a transuranic concentration lower (>10 nCi/g) than the currently established limit for transuranic waste (>100 nCi/g). Alpha low-level waste requires additional controls and special handling (relative to low-level waste). This waste stream cannot be accepted for onsite disposal under the current waste acceptance criteria; therefore, it is special-case waste. Plutonium-238, 239, 240, 241, Amercium-241and 243 and Neptunium are examples of transuranic elements that can be present in alpha Low-Level waste. Radiation exposures caused by inhalation of plutonium are 6.7 million times greater than equivalent exposures of depleted uranium—internal exposure of only 1 microgram of plutonium exceeds the allowable exposure limits established by DOE.

DOE/INL Document No. Z920576 shows the 14 new Radioactive Waste Management Complex Subsurface Disposal Area (SDA) and Transuranic Storage Area (TSA) for INL CERCLA Waste Area Group 7 cleanup Operable Units that separate the various remediation units 1 through 14. **It's important to notice (in the above map) the extent of the TRU distribution within the SDA most of which will not be exhumed contrary to the 1995 Settlement Agreement.**

Important Long-Lived Contaminants at INL's RWMC Not Remediated [288]

Table 2: Radionuclide and chemical contaminants at RWMC for 1000 year and 10,000 year groundwater ingestion peak risk estimates and groundwater concentrations, un-remediated.

Radionuclide (half-life)	Inventory Curies (Ci) g = grams	Source[a]	Peak Risk	Calendar Year	Peak Aquifer Concentration (Percent of MCL)*	EPA Maximum Contaminant Level *
Am-241 (432 yr)	243,000 Ci [h]	RFP	3E-3 [b]	3010	6.8E-8 (< 1 percent)	15 pCi/L
C-14 (5,730 yr)	731 Ci [h]	INL	1E-5	2133	186 **9.3 percent**	2000 pCi/L
Cl-36 (301,000 yr)	1.66 Ci [h]	INL	2E-6	2395	21.2 3 percent	700 pCi/L
I-129 (17,000,000 yr)	0.188 Ci [h]	INL	4E-5	2111	13.1	1 pCi/L
Tc-99 (2213,000 yr)	42.3 Ci [h]	INL	3E-4	2111	2710	900 pCi/L
Np-237 (2,144,000 yr)	0.141 Ci [h]	INL	1E-4	12000	86.8 **579 percent**	15 pCi/L[c]
U-238 (4,470,000,000 yr)	148 Ci [h]	RFP [a]	9E-5	12000	47.1 **472 percent**	1.01E1 pCi/L [d]
Total Uranium[c]			NA	12000	1.44E-1mg/L **480 percent**	3.00E-2 mg/L [e]
Carbon Tetrachloride	7.9E8 g	RFP	5E-4	2133	3.07E-1 mg/L **6,140 percent**	5.0E-3 mg/L
1,4-Dioxane	1.87E6 g 4.24E4 g	RFP INL	2E-5	2111	1.69E-01 mg/L **5,633 percent**	3E-3 mg/L

[288] Tami Thatcher EDI special report, *Important Long-Lived Contaminants at INL's RWMC Not Remediated* http://environmental-defense-institute.org/publications/RWMCunrem.pdf

Methylene chloride	1.41E7 g	RFP	5E6	2245	5.85E-2 mg/L **1,170 percent**	5E-3 mg/L
Nitrate	4.06E8 g 4.97E7 g	RFP INL	(Hazard index 1)	2094	66.7 mg/L **667 percent**	10 mg/L
Tetrachloro-ethylene	9.87E7 g	RFP	7E-7	2145	6.64E-2 mg/L **1,328 percent**	5.0E-3 mg/L
Trichloroethylene	8.92E7 g	RFP	9E-4	2130	3.8E-2 mg/L **760 percent**	5.0E-3 mg/L

Table 2 above: Sources: Remedial Investigation and Baseline Risk Assessment for Operable Unit 7 13/14, May 2006, sections 4 and 7, DOE-ID-11241.
* MCL= maximum concentration levels allowed by EPA regulations.
(a. Rocky Flats Plant (RFP); Idaho National Laboratory (INL); (b. The peak risk for Americium-241 is due to external exposure, soil ingestion, inhalation and crop ingestion. The risk for the other contaminants is primarily groundwater pathways); (c. The limit is 15 pCi/L for total alpha (40 CFR 141); (d. The limit is 3.0E-2 mg/L (30 microgram/L) for total uranium. To compare concentrations of uranium isotopes, 3E-2 mg/L is converted to the equivalent activity for each isotope; (e. Total uranium is presented for comparison to the maximum contaminant limit; (f. Table 4-4 of the RI/BRA shows that most of the U-238 waste is from Rocky Flats. Of this, 24.9 curies of U-238 was placed on SDA Pad A which is not currently planned to be removed; (h. the curie amounts are the amounts assumed to remain buried based on the available performance assessments for the migration of contaminants.

1995 Settlement Agreement and Consent Order

It is crucial to review the RWMC cleanup issue context prior to 1995, when then Governor Cecil Andrus came to the understandable conclusion that DOE/INL was using "Idaho as a nuclear waste dump." [289] The predecessor agency to DOE – Energy Research & Development Administration (ERDA) had released in 1977 the first INL Environmental Impact Statement required under the newly passed National Environmental Policy Act. [290] This EIS documented the massive extent of nuclear operations and accumulation of significant hazardous/radioactive waste. This EIS however failed to "consider various health and safety factors." In 1992 DOE planned to ship used spent reactor fuel from the Public Service of Colorado's Fort St. Vrain that was closing to INL as they had been doing for decades since INL[291] opened in 1949.

Then Governor Cecil Andrus [292] and the Shoshone-Bannock Tribes [293] filed law suits in Federal District of Idaho under the clean air laws to block the shipment of nuclear waste from the closed power

[289] Associated Press, "Idaho accuses feds of hiding INEL info, Boise-The State of Idaho is accusing the Energy Department of illegally concealing documents and evidence in its attempt to avoid conducting a full-scale environmental investigation into nuclear waste operations at the Idaho National Engineering Laboratory." "Evidence known to the Department of Energy but which it did not disclose publicly, establishes that substantial questions surrounding the proposal's impacts on the quality of human environment." Lewiston Tribune, August 1, 1992.

[290] ERDA-1536; Waste Management Operations, INEL Final Environmental Impact Statement, US Energy Research & Development Administration, September 1977. ERDA-1552; Final Environmental Impact Statement, Safety Research Experiment Facilities, INEL, September 1977, US Energy Research & Development Administration.

[291] The INL site was first named in 1949 the National Reactor Testing Station that subsequently built/tested 52 reactors for Naval, Army and commercial power. See EDI's Citizens Guide to INL for an operating history of the site and documented types/volumes and locations of waste dumped at the site based on FOIA receipts.
http://www.environmental-defense-institute.org/publications/GUIDE.963.pdf

[292] US District Court for the District of Idaho, Case No. CV 91-0423-E-EJL, Idaho Department of Health &Welfare vs. US Department of Energy.

[293] US District Court for the District of Idaho, Case No. CV 91-0436-E-EJL, Shoshone-Bannock Tribes vs. US Department of Energy.

plant in Colorado. Idaho won their suit but the Tribes lost. Idaho's suit was appealed to the 9th US Circuit Court of Appeals by Public Service of Colorado.

> "The 9th US Circuit Court of Appeals ordered the lifting of US District Judge Edward Lodge's injunction against storage of that waste at the federal facility in Idaho. The state has been fighting the shipments since 1989. Meanwhile, Idaho Gov. Cecil Andrus said the state has several possible responses to the ruling, such as tightening up ambiguous state environmental regulations through the Legislature or even going to the US Supreme Court. USDOE has said in federal court papers that it would not resume shipments to Idaho until it completes an environmental impact statement of the transportation route at the request of the Shoshone-Bannock Tribes. Attorney General Larry Echo Hawk said his office could petition for a rehearing of the case, or ask for a review by the US Supreme Court. 'They're speaking for a lot of people when they say Idaho shouldn't be a nuclear waste dump.'"[294]

Governor Andrus and his successor Philip Batt subsequently were able, together with then DOE Secretary James Watkins, to go back to federal court and hammer out an agreement that both the government and Idaho could agree on that became the 1995 Settlement Agreement and Consent Order enforceable by US Federal District Court that states in pertinent part:

1995 Settlement Agreement

"C. Spent Fuel and High-Level Waste Shipments Leaving Idaho

1. DOE shall remove all spent fuel, including naval spent fuel and Three Mile Island spent fuel from Idaho by January 1, 2035. Spent fuel being maintained for purposes of testing shall be excepted from removal, subject to the limitations of Section F.1 of this Agreement.

2. Until all of the aluminum-clad spent fuel then stored at INEL has been shipped to the Savannah River Site, the cumulative number of shipments of spent fuel from the Savannah River Site to INEL under Section D as of the end of any calendar year shall not exceed the cumulative number of shipments of aluminum-clad spent fuel from INEL to the Savannah River Site for the same period.

3. DOE shall treat all high-level waste currently at INEL so that it is ready to be moved out of Idaho for disposal by a target date of 2035. [pg2 and 3] [295]

D. Shipments of Spent Fuel to INEL; The federal parties may transport shipments of spent fuel to INEL only in accordance with the following terms and conditions.

1. Shipments of naval spent fuel to INEL shall take place as follows:

a. The Navy may make only those shipments of naval spent fuel to INEL that are necessary to meet national security requirements to defuel or refuel nuclear powered submarines, surface warships, or naval prototype or training reactors, or to ensure examination of naval spent fuel from these sources. The Secretary of Defense, upon notice to the Governor of the State of Idaho, shall certify the total number of such shipments of naval spent fuel required to be made through the year 2035.

b. The Navy shall not ship more than twenty four (24) shipments to INEL from the date of this Agreement through the end of 1995, no more than thirty six (36) shipments in 1996, and no more than twenty (20) shipments per year in calendar years 1997 through 2000. From calendar year 2001 through 2035, the Navy may ship a running average of no more than twenty (20) shipments per year to INEL. The total number of shipments of naval spent fuel to INEL through 2035 shall not exceed 575. Shipments of naval spent fuel to INEL through 2035 shall not exceed 55 metric tons of spent fuel.

c. Prior to January 1 of each calendar year through the year 2035, the Navy shall provide to Idaho an estimate of the number of shipments and the number of metric tons of naval spent fuel to be shipped during the following calendar year.

d. By January 31 of each calendar year, the Navy shall provide to Idaho the actual number of shipments and actual number of metric tons of naval spent fuel shipped during the preceding calendar year.

e. The naval spent fuel stored at INEL on the date of the opening of a permanent repository of interim storage facility shall be among the early shipments of spent fuel to the first permanent repository or interim storage facility.

f. The sole remedy for the Navy's failure to meet any of the deadlines or requirements set forth in this section shall be suspension of naval spent fuel shipments to INEL as set forth in Section K.1."

2. Shipments of DOE spent fuel to INEL shall take place as follows:

a. If DOE and the U.S. Department of State adopt a policy to accept spent fuel from foreign research reactors into the United States, DOE may send to INEL a maximum of 61 shipments of spent fuel from foreign research reactors during the period [pg3]

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[294] Bob Egelko of the Associated Press, Feds reject Idaho ban on nuclear waste, Andrus retrenches, considers taking case as far as US Supreme Court, Lewiston Tribune March 24, 1992

[295] 1995 Settlement Agreement, The State of Idaho, through the Attorney General, and Governor Philip E. Batt in his official capacity; the Department of Energy, through the General Counsel and Assistant Secretary for Environmental Management; and the Department of the Navy, through the General Counsel and Director, Naval Nuclear Propulsion Program, hereby agree on this 16th day of October, 1995, to the following terms and conditions to fully resolve all issues in the actions Public Service Co. of Colorado v. Batt, No. CV 91-0035-S-EJL (D. Id.) and United States v. Batt, No.CV-91-0065-S-EJL (D. Id.), Pgs. 2&3.

beginning on the date such a policy is adopted and ending on December 31, 2000. The Secretary of Energy, upon notice to the Governor of the State of Idaho, must certify that these shipments are necessary to meet national security and nonproliferation requirements. Upon such certification, DOE may ship not more than 10 such shipments from the date such policy is adopted through December 31, 1996, not more than 20 such shipments from the date the policy is adopted through December 31, 1997, and not more than 40 such shipments from the date the policy is adopted through December 31, 1998.

b. Until such time as a permanent repository or interim storage facility for storage or disposal of spent fuel, located outside of Idaho, is operating and accepting shipments of spent fuel from INEL, DOE shall be limited to shipments of spent fuel to INEL as set forth in Sections D.2.a., c., d., e., and (f). After a permanent repository of interim storage facility is operating and accepting shipments of spent fuel from INEL, the State of Idaho and DOE may negotiate and reach agreement concerning the timing and number of shipments of DOE spent fuel that may be sent to INEL, in addition to those otherwise permitted under this Section D.2., for preparation for storage or disposal outside the State of Idaho.

c. After December 31, 2000, DOE may transport shipments of spent fuel to INEL constituting a total of no more than 55 metric tons of DOE spent fuel (equivalent to approximately 497 truck shipments) and subject to the limitations set forth in Sections D.2.e., f., g., and h. below, except that the limitations of Section D.2.a. above will not apply.

d. No shipments of spent fuel shall be made to INEL from Fort St. Vrain, unless a permanent repository or interim storage facility for spent fuel located outside of Idaho has opened and is accepting spent fuel from INEL, in which case such shipments may be made for the purpose of treating spent fuel to make it suitable for disposal or storage in such a repository or facility. Shipments of spent fuel from Fort St. Vrain shall remain at INEL only for a period of time sufficient to allow treatment for disposal or storage in such a repository or facility. The total number of Fort St. Vrain shipments shall not exceed 244, constituting no more than sixteen (16) metric tons of spent fuel, and shall be in addition to those allowed under Section D.2.c. above.

e. Except as set forth in Section D.2.d. above, DOE will make no shipments of spent fuel from commercial nuclear power plants to INEL.

f. After December 31, 2000, and until an interim storage facility or permanent repository is opened and accepting spent fuel from INEL, DOE shall not ship to INEL more than 20 truck shipments of spent fuel in any calendar year, except that:

(i) In one calendar year only, DOE may make not more than 83 truck shipments of spent fuel to INEL from the West Valley Demonstration Project;

(ii) DOE may not make more than 13 truck shipments in any of the nine calendar years succeeding the shipment of the West Valley Demonstration Project spent fuel to INEL; and [pg4]

(iii) Shipments DOE is entitled to make to INEL in any calendar year, but has not made, may be shipped in any subsequent calendar year, notwithstanding the limitations in this Section D.2.f. on the number of shipments per year.

For purposes of this section and Section D.2.c., in determining the number of truck shipments, one rail shipment shall be deemed equivalent to 10 truck shipments, except that in the case of shipments from West Valley Demonstration Project, seven rail shipments shall be deemed to be equal to 83 truck shipments. DOE may elect to make rail shipments in lieu of truck shipments, in accordance with this conversion formula and subject to other limitations of this section.

g. Prior to January 1 of each calendar year through the year 2035, DOE shall provide to Idaho an estimate of the number of shipments and the number of metric tons of DOE spent fuel to be shipped during the following calendar year.

h. No later than January 31st of each calendar year, DOE shall provide to Idaho the actual number of shipments and actual number of metric tons of DOE spent fuel shipped during the preceding year.

i. The sole remedy for DOE's failure to meet any of the deadlines or requirements set forth in this section shall be the suspension of DOE spent fuel shipments to INEL as set forth in Section K.1."

3. Operation of High-Level Waste Evaporator. DOE shall commence operation of the high-level waste evaporator by October 31, 1996, and operate the evaporator in such a manner as to reduce the tank farm liquid waste volume by no fewer than 330,000 gallons by December 31, 1997. Efforts will continue to reduce the remaining volume of the tank farm liquid waste by operation of the high-level waste evaporator.

4. **Calcination of Remaining Non-Sodium Bearing Liquid Wastes**. DOE shall complete the process of calcining all remaining non-sodium bearing liquid high-level wastes currently located at INEL by June 30, 1998.

5. **Calcination of Sodium-Bearing Wastes**. DOE shall commence calcination of sodium bearing liquid high-level wastes by June 1, 2001. DOE shall complete calcination of sodium-bearing liquid high-level wastes by December 31, 2012.

6. **Treatment of Calcined Wastes**. DOE shall accelerate efforts to evaluate alternatives for the treatment of calcined waste so as to put it into a form suitable for transport to a permanent repository or interim storage facility outside Idaho. To support this effort, DOE shall solicit proposals for feasibility studies by July 1, 1997. By December 31, 1999, DOE shall commence negotiating a plan and schedule with the State of Idaho for calcined waste treatment. The plan and schedule shall provide for completion of the treatment of all calcined waste located at INEL by a date established by the Record of Decision for the Environmental Impact Statement that analyzes the alternatives for treatment of such waste. Such Record of Decision shall be issued not later than December 31, 2009. It is presently contemplated by DOE that the plan and schedule shall provide for the completion of the treatment of all calcined waste located at INEL by a target date of December 31, 2035. The State expressly reserves its right to seek appropriate relief from the Court in the event that the date established in the Record of Decision for the Environmental Impact Statement that analyzes the alternatives for treatment of such waste is significantly later than DOE's target date. In support of the effort to treat such waste, DOE shall submit to the State of Idaho its application for a RCRA (or statutory equivalent) Part B permit by

December 1, 2012."

"Section G. INEL Environmental Restoration Program

"1. INEL Environmental Restoration Program to Continue. DOE shall continue to implement the INEL environmental restoration program in coordination with Idaho and EPA. Such implementation shall be consistent with the schedules contained in the Federal Facilities Agreement and Consent Order (FFA/CO) entered into with the State of Idaho, EPA and DOE, and it shall include schedule requirements developed pursuant to the completed and future records of Decision under the FFA/CO. The sole remedies for failure to implement the environmental restoration activities specified in FFA/CO shall be those specified in the FFA/CO." [296] [emphasis in original] [Pg.8]

After hearing that DOE planned to ship new SNF nuclear waste to INL in violation of 1995 Settlement Agreement former Governor Andrus, who initiated the Settlement Agreement, stated in a "dear friend letter" published in Idaho Falls that states in part:

"As you know, I have happily spent many years of my life serving Idaho and her citizens. As your 4-term governor elect, one of my proudest achievements was opposing efforts by the federal Department of Energy to use Idaho as a dumpsite for nuclear waste – laying the groundwork for my successor and friend, Governor Phil Batt, to negotiate the historic 1995 Batt Agreement.

"This Agreement clearly states that *no new commercial nuclear waste will be brought to Idaho.* So when DOE made known its plans to shirk *clear* legal commitments made to you, Idaho's citizens, and ship commercial nuke waste to the Idaho National Laboratory – which is perched just above the Snake River Plain aquifer – Governor Batt and I knew we needed to act." [emphasis in original] [297]

DOE has been trying to amend every part of the original 1995 Idaho Settlement Agreement; not only to increase spent nuclear fuel shipments to INL, import more commercial nuclear waste, miss stipulated crucial milestones for treating liquid highly radioactive liquid waste, reduce by (90%) the amount of buried HLW/TRU retrieved and all the low-level alpha waste [298] retrieval from the INL Radioactive Waste Management Complex Subsurface Disposal Area (RWMC/SDA); but also attempt to extended completion milestones and the above stated time limit of 6 months to ship new waste back out of Idaho. Idaho Attorney General Lawrence Wasden is resisting this extension, concerned (for good reason) that DOE will - as Andrus forecast – "continue making Idaho a defacto nuclear waste dump." [299]

Even DOE's own Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage and Disposal of Radioactive and Hazardous Waste (WMPEIS) Transuranic Waste Alternatives Table in PEIS and the Preferred Decentralized Alternative is consistent with the 1995 Settlement Agreement were the PEIS states:

"All TRUW [transuranic waste at INL] would be shipped to WIPP for disposal. An important change from the No Action Alternative is that retrievably stored TRUW would be treated under this alternative, whereas it would not be treated under the No Action Alternative." 300

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[296] 1995 Settlement Agreement; The State of Idaho, through the Attorney General, and Governor Philip E. Batt in his official capacity; the Department of Energy, through the General Counsel and Assistant Secretary for Environmental Management; and the Department of the Navy, through the General Counsel and Director, Naval Nuclear Propulsion Program, hereby agree on this 16th day of October, 1995, to the following terms and conditions to fully resolve all issues in the actions Public Service Co. of Colorado v. Batt, No. CV 91-0035-S-EJL (D. Id.) and United States v. Batt, No. CV-91-0065-S-EJL (D. Id.) Pg. 2 &5&8: Hereinafter 1995 Settlement Agreement. http://deq.idaho.gov/media/550338-1995_Settlement_Agreement.pdf

[297] Cecil D. Andrus, Governor of Idaho 1971-1977 and 1987-1995 and U.S. Secretary of the Interior under President Jimmy Carter from 1977 to 1981, Dear Friend letter October 13, 2015 published in Post Register.

[298] Alpha Low-Level Waste: Waste with >10 nCi/g TRU that is classified by the NWPA as TRU was changed by DOE to alpha low-level waste in violation NWPA. Alpha low-level waste is a transuranic waste but has a transuranic concentration lower than the DOE/NRC currently established limit for transuranic waste. Alpha low-level waste requires additional controls and special handling (relative to low-level waste). This waste stream cannot be accepted for onsite disposal under the current waste acceptance criteria; therefore, it is special-case waste. DOE/EIS-0203-F. https://digitalcommons.usu.edu/govdocs/368

[299] It is relevant to discuss some of the spent nuclear fuel issues, and the State of Idaho's suspension of allowing research quantities of SNF to be shipped to INL (stipulated in the 1995 Settlement Agreement (Section B.2) as the remedy for violation of the court order, which ID Attorney General Laurence Wasden would not sign a waiver for (as of this writing).

[300] DOE/EIS-0200-F, The Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage and Disposal of Radioactive and Hazardous Waste, U.S. Department of Energy, Office of Environmental Management (WM PEIS), Summary, Section 8.3.2, DOE/EIS-0200-F.
Also Transuranic Waste Alternatives Table in PEIS shows all alternatives S = storage after treatment for one year, prior to transportation for disposal, for all alternatives except No Action or store current inventory under review. Page 8-20

The new AGREEMENT TO IMPLEMENT U.S. DISTRICT COURT ORDER DATED MAY 25, 2006 [301] commonly called the "2008 Agreement to Implement" filed on July 1, 2008, between the State of Idaho and the Department of Energy (DOE) is a legally binding agreement in U.S. Federal District Court. This new "Agreement to Implement" signed by current Governor Otter significantly undermines DOE/INL buried radioactive waste removal obligations specified in the original 1995 Settlement Agreement by allowing DOE to leave most of the buried radioactive waste in place. Governor Otter is capitulating to DOE by vacating crucial parts of the original 1995 Settlement Agreement with DOE that stipulated that: "DOE shall ship all transuranic waste now located at INEL, currently estimated at 65,000 cubic meters in volume."

Governor Otters "Agreement to Implement" states in relevant part:

> "The Parties hereto enter this Agreement in full and final settlement of the current dispute between the Parties in the matter entitled *Public Service Company of Colorado v. Batt*, CV-91-0035-S-EJL and CV 91-0054-S-EJL2, regarding the interpretation of Paragraph B.1 of the October 17, 1995 Settlement Agreement and Consent Order which is attached hereto as Appendix A." [Pg. 1] [emphasis added]
>
> "In executing this Agreement, the Parties agree to the following:
>
> A. On October 17, 1995, the Parties to this Agreement entered into the 1995 Settlement Agreement, which was subsequently entered as a Consent Order in the matter entitled *Public Service Company of Colorado v. Batt*, CV-91- 0035-S-EJL and CV 91-0054-S-EJL.
>
> B. On April 18, 2002, Idaho sought to re-open the above-entitled matter seeking a declaratory ruling that Paragraph B.1 of the 1995 Settlement Agreement applied to "Transuranic Waste" located in the SDA at the INL.
>
> C. A trial was conducted before the Court in the above-captioned matter on February 6-10, 2006.
>
> D. On May 25, 2006 the Court entered a Memorandum Decision and Judgment establishing the responsibilities of DOE under the 1995 Settlement Agreement with respect to Transuranic Waste buried in the Subsurface Disposal Area.
>
> E. On July 24, 2006 the United States Department of Energy appealed the decision to the Ninth Circuit Court of Appeals. On March 17, 2008, the Ninth Circuit Court of Appeals affirmed the decision of the District Court."
>
> F. Since the filing of the Motion to Re-open in 2002 and the date of this Agreement, DOE, Idaho and the United States Environmental Protection Agency (EPA) have continued to evaluate environmental hazards posed by the Subsurface Disposal Area and Transuranic and other wastes disposed of there. In furtherance of that evaluation, DOE conducted comprehensive reviews of shipping and disposal records, which information was compiled in the WILD Database, and generated maps showing the locations of waste forms in the SDA. In reaching this agreement, DOE and Idaho base their knowledge of waste locations on the WILD database and maps generated by DOE on or before February 28, 2007. Copies of these maps have been lodged with Idaho and shall be kept throughout the duration of this Agreement. Idaho's participation in this Agreement is based upon the representation by DOE that the information contained in the WILD Database and accompanying maps represents a substantially accurate estimate of the extent of Targeted Waste in the SDA." [Pg.3]
>
> **"IV. AGREEMENT TO RETRIEVE TARGETED WASTE**
>
> "Based upon the facts and conclusions set forth above in Sections II.F-L the Parties agree that in determining compliance with Paragraph B.1 of the 1995 Settlement Agreement and the Court's May 25, 2006 Memorandum Order, with respect to Transuranic Waste located in the Subsurface Disposal Area, removal of the following waste streams (Targeted Waste) in accordance with Section V satisfies removal of Transuranic Waste from the Subsurface Disposal Area:
>
> A. 741 Sludge
> B. 742 Sludge
> C. 743 Sludge
> D. Graphite Waste
> E. Filters/pre-filters

VOLUME I. April 1995. This EIS is cited in the 1995 Idaho Settlement Agreement and relies on its definitions of radioactive waste. Available at various websites including *All U.S. Government Documents (Utah Regional Depository).* Paper 368. https://digitalcommons.usu.edu/govdocs/368

[301] Agreement to Implement, U.S. District Court Order, Dated May 25, 2006. Herein after Agreement to Implement. http://deq.idaho.gov/media/550373-implementation_agreement_2008.pdf

F. Uranium Oxide (DOE and Idaho recognize that Uranium Oxide is not a Transuranic Waste within the definition of the 1995 Settlement Agreement. Notwithstanding that, the Parties agree that removal of Uranium Oxide co-located with other Targeted Wastes is environmentally beneficial and thus have included it as a Targeted Waste.)

G. Other waste streams mutually agreed by the Parties, as the result of operational experience or process knowledge, to routinely be recognizable as Transuranic Waste." [302]

This above "Agreement to Implement" states it's an "interpretation" of original 1995 Settlement Agreement actually is a "bait-and-switch" very similar to how DOE got around dealing with 900,000 of INL/INTEC previously classified high-level liquid waste by unilaterally reclassifying it as mixed hazardous transuranic (MTRU) sodium-bearing/MLL TRU waste [303] and redefining transuranic waste from >10 nCi/g to >100 nCi/g. These policy actions are only to save money for legacy waste cleanup. Another example is NRC/EPA's changing the maximum contaminate level (MCL) for tritium from 10,000 to 20,000 pCi/L. DOE has the full weight of the federal Department of Justice behind it, so its ability to take these types of unilateral policy actions to cover-up environmental reactor releases is easier - especially in ill-informed small economically limited states like Idaho.

This new 2008 Agreement to Implement only requires DOE to "exhume not less than 6,238 cm" (<10% of 65,000 cm) stipulated in the 1995 Settlement Agreement from the RWMC/SDA in a grossly limited "Accelerated Retrieval Project." [304]

Former Governors' Andrus and Batt were the first to exercise the requisite political leadership and take a stand in opposition to DOE/INL abuse of our state. It's a possibility DOE sold current Governor Otter who signed the 2008 "Agreement to Implement" that radically changes major components to the earlier 1995 Settlement Agreement by convincing him INL wanted to get started with SDA cleanup and that it would not be the final CERCLA action. [305] We need to know the answer to this question. According to DOE's report on the question of "final" RWMC cleanup it states: "OU 7-13/14, the comprehensive remedial investigation and feasibility study for the RWMC/SDA, is the final operable unit planned under CERCLA and implemented under the Federal Facility Agreement and Consent Order for Waste Area Group 7." [306] [emphasis added]

DOE has consistently missed cleanup milestones which were the primary driver for Governors' Andrus and Batt to initiate Federal Court Consent Order to force compliance. We will list these missed milestones later. SDA Active Low-level Waste Disposal Facility (Pits 17 to 20) will continue to receive waste through 2020 despite the fact that it does not qualify under EPA regulations as a city dump. The legal frame work is:

"Ultimately, the entire SDA (including the [Active Low-level Waste disposal Facility]ALLWDF) will be closed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 USC § 9601 et seq.), in accordance with the Record of Decision (ROD) for the RWMC Operable Unit (OU) 7-13/14 (DOE-ID 2008b). Until final closure occurs, DOE is responsible for self-regulation of the ALLWDF, in accordance with the

[302] AGREEMENT TO IMPLEMENT U.S. DISTRICT COURT ORDER DATED MAY 25, 2006

[303] DOE unilaterally reclassified 900,000 gal. sodium-bearing liquid waste in INL/INTEC underground tanks from high-level as identified in Idaho High-Level Waste & Facility Disposition Final Environmental Impact Statement, 2002, (DOE/EIS-0287) to mixed low-level waste. EDI joined NRDC in a suit challenging this action. See: Civ. No. 01-0413-S-BLW.

[304] Idaho INL Oversight Program states: "Requires shipment of all retrieved transuranic waste and at least 7,485 cubic meters of targeted waste out of Idaho." *2008 Agreement to Implement U.S. District Court Order dated May 25, 2006 Oversight Program* website. http://www.deq.idaho.gov/media/

[305] ICP-EXT-05-00784 "OU 7-13/14, the comprehensive remedial investigation and feasibility study for the RWMC, is the final operable unit planned under CERCLA and implemented under the Federal Facility Agreement and Consent Order for Waste Area Group 7, Pg. iii. [emphasis added]

[306] ICP-EXT-05-00784, pg. iii

> Atomic Energy Act (42 USC § 2011 et seq.) and management requirements within DOE O 435.1 Chg. 1, for ongoing waste disposal operations through final closure, including interim closure procedures." [307] [emphasis added]

The 1995 Settlement Agreement in the above removal and treatment definition is: "Treat" shall be defined, as applied to a waste or **spent fuel**, as any method, technique, or process designed to change the physical or chemical character of the waste or fuel to render it less hazardous; safer to transport, store, dispose of; or reduce in volume." Also in Section C "Spent Fuel and High-Level Waste Shipments Leaving Idaho" also states: "1. DOE shall remove all spent fuel, including naval spent fuel and Three Mile Island spent fuel from Idaho by January 1, 2035." This is an issue for SDA remediation **because irradiated spent fuel is found there along with most of the 52 reactors that were built/operated over INL's history**.

The 1993 INL EIS Restoration Program Assessment Table 4.7-5 shows **high-level irradiated reactor fuel (SNF) in SDA in Trenches (25, 27, 28, 30, 31, 33, 35, 40, 41, 42, 43, 46, 52, and 54**) and enriched uranium dumped in Trench No. 49. [308] See Attachment A to this report for details.

This SNF dates back to pre-1977 nuclear waste dumping practices that allowed DOE to bury every type of waste in the RWMC/SDA including irradiated reactor fuel and the whole reactors. INL built/tested 52 reactors that eventually ended up in the SDA. DOE has denied that high-level (irradiated reactor fuel) waste was dumped in the SDA despite EDI's repeated efforts to raise the issue and it is of no particular focus for the "targeted waste." Governor Otters' 2008 Agreement to Implement reinforces DOE requirement to protect national by stating:

> "[T]the Parties used historic disposal records generated by DOE to identify areas within the SDA where retrieval is, based upon current knowledge and technological capabilities, appropriate in light of countervailing considerations of worker safety and national security."

In fact Idaho Governor Otter reinforced this secrecy in the "Agreement to Implement" 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." [309] DOE/INL have always denied that high-level (irradiated reactor fuel) waste and the remains of the 52 reactors built/tested at INL, were dumped in the SDA and it is of no focus for the "targeted waste retrieval" cleanup program.

Selected Rocky Flats TRU Waste Dumped at the Subsurface Disposal Area, 1954-1972 [310]

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

[ER-BWP-82 @A-4]

[307] RPT-1267, Annual Performance Assessment and Composite Analysis Review for the Active Low-Level Waste Disposal Facility at the RWMC FY 2013, RPT-1267.

[308] Draft Idaho National Engineering Laboratory EIS Environmental Restoration Program Assessment 3/14/93, Pg. 4.7-9

[309] Idaho and Department of Energy Agreement to Implement, pg. 8, 2006.

[310] ER-BWP-82, Engineering Design File, Pit 9 Project, Revised Plutonium, Americium-241, and Uranium-235 Inventory estimates for Pit 9 Based on the 1993 Historical Data Task, Pg. A-4, EG&G Idaho Inc. ER-BWP-82.

The below reactor picture is one of many leftover from the Aircraft Nuclear Propulsion Program operated at the INL Test Area North. The project tried to develop a nuclear-powered airplane engine one is on display at INL/EBR-I and the rest dumped in SDA that are part of the 52 nuclear reactors built and operated at INL over its history. [311]

Discussed below, "Dissolution of key contaminants are associated with metal debris buried at the SDA are contaminants that were produced in situ in metal reactor components by transmutation or activation." This represents what the hazard of dumping reactor fuel parts in the SDS pits/trenches prior to 1977 and later in soil vaults that DOE refuses to remove in its cleanup process. [312] See Section XII below. The issue of SDA waste contaminates migration into soil and aquifer is even described in the following DOE report:

> "Of particular interest are disposals of activated metals, especially irradiated beryllium blocks and reactor components made of stainless steel and Inconel (high nickel content) alloy. Irradiated beryllium blocks used as neutron reflectors at the [Test Reactor Area] TRA contain a significant percentage of the total buried inventory of C-14 and tritium estimated to occur in the SDA (DOE-ID 2002a). Activation products in irradiated stainless steel and Inconel include long-lived (C-14, Ni-59, Nb-94, and Tc-99) and short-lived (Co-60 and Ni-63). Some of the stainless steel was in the form of highly irradiated end pieces from Experimental Breeder Reactor-II fuel elements; these items were buried in scrap cask inserts that were open on top and perforated on the bottom, placing these

[311] Citizens Guide to INL offers a history of the site's Aircraft Nuclear Propulsion Program and a listing of the many reactors built, operated and emissions released. http://www.environmental-defense-institute.org/publications/GUIDE.963.pdf

[312] Chuck Broscious Citizens Guide to INL (Section I-F) for the history of federal government designation of RWMC dump site. http://www.environmental-defense-institute.org/publications/GUIDE.963.pdf

disposed items in direct contact with the soil after burial (Salomon 2001)." [313]

"Dissolution:

"A number of key contaminants are associated with metal debris buried at the SDA. Tc-99, C-14, Nb-94, Ni-59 are contaminants that were produced in situ in metal reactor components by transmutation or activation. These activated elements are produced inside the metallic parts and are not surficial contamination. Activated elements are released to the environment by corrosion of the metal in which they were produced. To determine the release of the long-lived activated elements to the environment from the irradiated metals, it is necessary to determine the corrosion rates of the metals.

"Corrosion of metal debris underground is a complex process. Soil oxygen, soil moisture, infiltrating precipitation, chemical species in the pore water, and soil bacteria contribute to faster rates of corrosion than observed in air alone.

"During spring thaw, the shallow RWMC soils may be in near saturated conditions, which can have high concentration of corrosive chemicals such as MgCl (Nagata and Banaee 1996). In certain areas, residual moisture levels can remain high which can lead to development of bacterial colonies on the surface of the metals, which in turn can create localized areas of corrosion. [emphasis added]

"Both soil clumps and microbial colonies on the metal surface can provide a mechanical barrier to soil gasses interacting with the steel. These localized areas are referred to as oxygen concentration cells where the metal beneath the barrier is exposed to less oxygen, becomes anodic with respect to the rest of the metal, and corrodes preferentially (Nagata and Banaee 1996)." [314]

"Americium-241 was determined in [Baseline Risk Assessment] BRAs to be a [contaminant of concern] COC associated with liquid and solid waste disposals to the subsurface at TRA, RWMC, and NRF (Table 4-1). The combined activity disposed from these facilities since 1952 is estimated to be about 1.83 u 105 Ci, with almost all of the activity attributed to wastes buried at the RWMC. The radioactive decay half-life for americium-241 is 432.2 years. Plutonium isotopes associated with solid wastes disposed to pits and trenches at the RWMC are available for release through surface washoff as locally derived infiltrating water comes into contact with those wastes. The kd was used in numerical analyses to evaluate release from the contaminated soil source term to the vadose zone. Protactinium-231 was identified as a COC at the RWMC. The half-life of protactinium-231 is 32,760 years." [INEEL/EXT-03-01169, pg. 4-3]

"Also, all tests on metal corrosion were performed on unirradiated metals. The difference between un-irradiated and irradiated metal, especially beryllium may have a significant effect on the corrosion rates (Adler-Flitton, Nagata, and Norby 2001). The characteristics of beryllium metal are greatly affected by irradiation, which causes the blocks swell and crack, increasing the effective surface area. Also, although corrosion is usually measured by differences in weight of specimens, the susceptibility of beryllium to corrode via pitting of the surface may be an important mechanism that increases potential releases of activation products versus what one might expect in estimating potential releases and the degree of corrosion based on weight loss alone. All estimates of corrosion rates have been consistently caveated with the need to gather empirical data to substantiate "reasonable guesses" of corrosion rates.

"Complexing agents – The presence of complexing agents in waste at the INEEL has not been evaluated. The formation of aqueous complexes in soil solutions can keep contaminants in solution and inhibit solution-solid reactions that retard the migration of contaminants. Decontamination solutions containing complexing agents such as citrate, oxalate, and EDTA (present in RFP waste as Verbenas) were used and disposed of in the SDA. Inorganic anions such as fluoride, carbonate, and phosphate can form aqueous complexes with contaminants. Exact amounts of complexing agents disposed at the SDA are not known, and anions are not always measured because they are not considered contaminants. Thus, the potential impact of complexing agents on release rates from buried waste at the SDA is not known." [315] [INEEL/EXT-03-01169, pg. 3-53]

Groundwater monitoring is the only way groundwater contaminate migration can be tracked. It's unconscionable that these regulatory agencies – likely fearing public knowledge of the extent of this hazard – via Freedom of Information Act/Public Records Requests – would find out. "Don't monitor

[313] INEEL/EXT-03-01169, INEEL Subregional Conceptual Model Report Volume 3: Summary of Existing Knowledge of Natural and Anthropogenic Influences on the Release of Contaminants to the Subsurface Environment from Waste Source Terms at the INEEL September 2003, pg. 3-35, INEEL/EXT-03-01169.

[314] INEEL/EXT-03-01169, Section 3.2.4.1

[315] INEEL/EXT-03-01169, Pg. 3-53

what your trying to hide" from the public that relies on this sole source aquifer. Earlier DOE report show both water and air contaminate migration as shown below:

> "The most frequently detected analytes, in order of detection frequency, are VOCs [volatile organic compounds], plutonium isotopes, Am-241, and uranium isotopes.
>
> "Of the contaminants of potential concern, Pu-239/240 and Am-241 are the most frequently detected in surface soil samples (i.e., within the top 15 cm [6 in.]) inside and outside the SDA, at detection rates of about 22 and 21%, respectively. The high number of Pu-239/240 detections compared to Pu-238 suggests the plutonium is either from weapons-manufacturing waste in the SDA or from fallout. [xii]
>
> "A few constituents are consistently detected in the vadose zone (see Figure E-3), exhibit concentration trends, and show evidence of migration. Vadose zone constituents that have been identified as contaminants of potential concern, in order of their detection frequency from highest to lowest are VOCs, uranium isotopes, nitrate, Tc-99, and C-14. The following subsections summarize these constituents.
>
> "E-1.1.4.3.1 Volatile Organic Compounds**—**Carbon tetrachloride, tetrachloroethylene, and trichloroethylene are consistently detected in perched water and lysimeter samples. Each has been detected above MCLs in perched water samples and in shallow, intermediate, and deep lysimeter samples.
>
> "Methylene chloride is detected less frequently and at lower concentrations. Methylene chloride has been detected above the MCL in shallow lysimeter and perched water samples, but has not been detected in any intermediate or deep lysimeter [sic] samples. [emphasis added]
>
> "Uranium Isotopes**—**Uranium concentrations in all but one location in the vadose zone and aquifer are consistent with naturally occurring uranium. The one exception, TW1:DL04 in Pit 5 near Pad A, exhibits concentrations and isotopic ratios that clearly indicate uranium at this location is anthropogenic and slightly enriched with U-235." [316] [section E-1.1.4.3.2]
>
> "The graph of the migration of the buried waste at RWMC that will remain at RWMC buried in soil is shown below in Figure 1. The contamination migration is not realistically modeled by the DOE nor is it conservatively modeled. Flooding and fast paths of contaminant migration are ignored. [317] The ingestion doses will undoubtedly exceed the 30 to 100 mrem/yr radiation doses shown, intermittently at least. The CERCLA cleanup ignored doses after 10,000 years. Check out how, even after 100,000 years, the long lived radioactive waste, including americium-241, various plutonium and uranium isotopes, iodine-129, neptunium-237 and technetium-99, remains an ingestion hazard, even with the modeling assumptions biased toward retention in the burial grounds."
>
> "Americium-241, uranium-235, uranium-238, and plutonium-239 are top contributors to ingestion dose after 10,000 years. Beware, however, that contamination migration by the DOE appears to be modeled with a bias toward delaying the release timing to be after 10,000 years. The EPA ignores post-10,000 contamination in its INL CERLCA cleanup." [318]

Idahoans' and downstream Snake River populations (like Boise) can be legitimately outraged by this new Agreement the State of Idaho and EPA's complicity to allow DOE to leave most of this mixed hazardous radioactive waste in place where it will continue to pose a significant hazard to the public and future generations. [319] [320]

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[316] DOE-ID-11241, Remedial Investigation and Baseline Risk Assessment for Operable Unit 7 13/14, May 2006, DOE-ID-11241, Section ***E-1.1.4.1 Waste Zone Data.***

[317] Johnson, TM et al., *Geology*, "Groundwater "fast paths" in the Snake River Plain aquifer: Radiogenic isotope ratios as natural groundwater tracers," v. 28; no. 10; p. 871-874, October 2000.

[318] Tami Thatcher, Idaho Too Miss Important Idaho Settlement Agreement Milestones Environmental Defense Institute, News on Environmental Health and Safety Issues June 2018, Volume 29, Number 6. http://environmental-defense-institute.org/publications/News.18.June.pdf

[319] Thatcher, Tami, Tritium at 800 pCi/L in the Snake River Plain Aquifer in the Magic Valley at Kimama: Why This Matters. http://environmental-defense-institute.org/publications/kimamareport.pdf

[320] See references at the end of the report for additional information sources of contaminate migration.

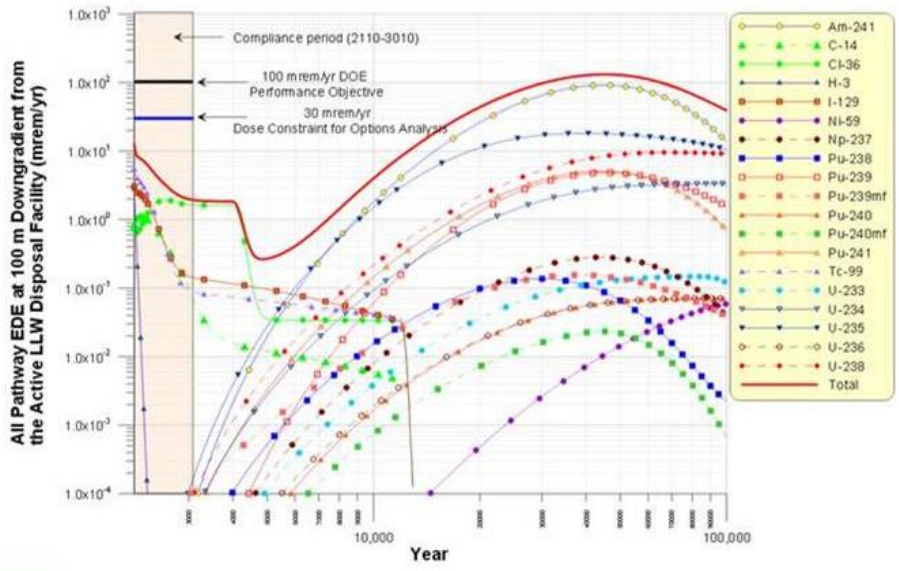

Figure 4-2. All-pathways effective dose equivalent 100 m downgradient from the Radioactive Waste Management Complex boundary from year 2110 to year 100,000 with cover infiltration rate equal to 1 cm/year.

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

Generator	Mass in grams
INL Site Generators	
Argonne National Laboratory-West	2,177,150
Idaho Chemical Processing Plant	9,246,306
Naval Reactor Facility	27,707,700
Special Power Excursion Reactor Test	14,517
Test Area North	16,433193
Test Reactor Area	273,866
Other Generators	
General Dynamics, General Atomics Div. San Diego, CA	22,861,440
General Electric, Vallecitos Atomic Lab. Pleasenton, CA	11,568,800
Total Mass in Grams	90,282,972
Total Mass in Metric Tons	90.282

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

Equally significant are spent nuclear fuel related waste shipments to the RWMC burial grounds. This waste includes NRF 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.

Water in the SDA was studied in considerable detail because this is a significant indicator of future contaminate migration into the underlying vadose zone and aquifer below the RWMC. Water probes were inserted into various parts of the SDA waste and found the following:

2.5.2 Success in Meeting the Purpose Water probes:

"Radionuclides that would exceed 25% of the drinking water standards are neptunium-237, plutonium-239, plutonium-240, technetium-99, uranium-234, and uranium-238. These radionuclides all have half-lives, with the minimum half-life being 6,537 years for plutonium-240." [321] [emphasis added]

V. Difficulty in Detecting HLW, TRU, Plutonium and Other Alpha HLW Emitting Radionuclides in SDA Waste

Herein lies one of the major fundamental flaws in DOE claims to be able to appropriately identify TRU waste in the "Accelerated Retrieval Program (ARP). DOE claims that trained operators using remote video and some detection monitors to legitimately determine what is TRU (alpha emitting isotopes) and what is not. Their monitors simply cannot get close enough to the waste in the trench without extracting it completely in a "glove box" type arrangement to do legitimate determinations as their own reports states:

"To achieve adequate detection sensitivity, the distance of the alpha detector from the dig face cannot be more than a few inches. The closer the detector to the soil the better the alpha detection. However, the distance will be limited by the scanner's ability to position the detector next to the irregular surface of the face. Considering this restriction on distance, instrument sensitivity must be as high as possible or detection of alpha particles might not be made.

"Real-time radiography is required to determine the contents of intact barrels or boxes. The degree of uncertainty in the nuclear assay system's measurement ability to define whether waste is low level or TRU waste depends on some knowledge of the mixture of waste in the waste container being assayed. Specific items to be measured/detected are metals, liquids, pressurized bottles or cylinders, explosives, packing material, container integrity, etc... . [Pg. 18]

"Waste characterization requires exhaustive spectrum analysis of waste packages. Best results are obtained when measuring homogeneous waste. Detecting plutonium requires, as a minimum, a high-energy neutron radiography facility capable of scanning the waste under precisely controlled conditions and configuration. It appears that more studies of the technique and instrumentation to characterize waste need to be done to allow finalization of the assay system location in the waste stream and functional design.
[pg. 30]

"Real-time radiography is required to determine the contents of intact barrels or boxes. The degree of uncertainty in the nuclear assay system's measurement ability to define whether waste is low level or TRU waste depends on some knowledge of the mixture of waste in the waste container being assayed. Specific items to be measured/detected are metals, liquids, pressurized bottles or cylinders, explosives, packing material, container integrity, etc.

"Detecting Plutonium for Determining Criticality: The method of an in situ measure of the plutonium by volume in the dig face before excavation remains to be defined. It appears that the method must be developed for this unique configuration. Assurance is needed that the plutonium present in the waste cannot be configured during retrieval in a mass that could cause criticality. [322] [Pg.31] [emphasis added]

[321] ICP-EXT-05-00784, Pg. 47 and 57.

[322] DOE/NE-ID-11201, Five-Year Review of CERCLA Response Actions at the Idaho National Laboratory, Revision 3, February 2007, Pgs. 18, 30 and 31. Also see EGG-WM-8296, Executive Summary of the EG&G

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. [323] [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] Also see "Nuclear Criticality Safety Issues Pertaining to the INL SDA." [324] [325] [326]

Another exemplar of the above nuclear criticality issues and how pyrophoric/hazardous the buried waste is DOE's found in Phase I RWMC Targeted Waste Report [pg.49] that shows sparks during retrieval operations.

> "Drum Fire. On November 21, 2005, during exhumation of 3.1.2.1 waste in ARP I, an apparent deflagration occurred during retrieval of a drum from Grid I-2 (Figure 38). The equipment operator sprayed water on the smoldering material and smothered it with soil in accordance with procedures (ICP 2006). The facility was placed on standby status and an investigation ensued to confirm the nature of the drum fire and to augment procedures to address future occurrences." [327]

J. A. McHugh, et.al. writes in a revealing 2000 report titled *Nuclear Criticality Safety Issues at the SDA about crucial steps that DOE/ Bechtel must take to prevent criticality events*.

> "No conclusive evidence has been presented (to date) that places the future risk of nuclear criticality in the SDA at an insignificant level. The DOE and Bechtel must complete a comprehensive nuclear criticality safety assessment to support current and future actions in the SDA and Pit 9."
>
> "Since characterization data are extremely limited or nonexistent, best estimate information must be gleaned from Rocky Flats Plant (RFP) historical waste records (which do not appear to be a reliable source) or the RFP assessments of quantities shipped off-site for disposal. If one developed a best estimate (with uncertainties) relative: to the amount, distribution, and nature of the Pu waste, it might be possible to encompass all likely future histories with bounding scenarios. If a best estimate of the defining parameters cannot be developed with historical information, then it will be necessary to physically characterize the Pu distribution in the SDA. [pg1]
>
> **"GENERAL ISSUES**
>
> "Nuclear criticality safety in waste disposal sites differs somewhat from other nuclear safety problems in that exact quantities and locations of the fissile material are not well known. The disposal of Pu, U, Am and Np wastes from the Rocky Flats Plant (RFP) was not controlled by adequate administrative and engineered safeguards. Generally, waste disposal involves small quantities of discarded fissile material, and nuclear material control and accountability requirements provide adequate safeguards to avoid significant accumulations. However, the controls placed on waste from the RFP are not consistent with current standards. Disposal of single items that contain significant quantities of fissile material has occurred. This presents current issues and future concerns which include:
>
> "1. There is potential for interaction among waste units and surrounding neutron-reflecting materials. Evaluation of waste disposal records and practices, coupled with preliminary Stage I Results, suggest fissile material "hot spots" exist within Pit 9 and the SDA. If the distribution of Pu and other fissile nuclides were uniform and in a stable geometry, throughout the: waste volume, sub-criticality would be assured. However, the presence of localized "hot spots" is a significant concern.
>
> "2. The evaluation of RFP waste disposal practices, packaging, and assaying suggests that Pu "hot spots" are

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Idaho Buried Waste Program Retrieval Project, October 1988, for difficulty in remotely classifying waste for retrieval.

[323] PR-W-79-038; A History of the Radioactive Waste Management Complex, at INEL, September 1979, EG&G Idaho, Pg. 30

[324] 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.

[325] PR-W-79-038, Pg. 44

[326] Broscious, Chuck, Citizens Guide to INL, offers a history of nuclear mismanagement of waste disposal. http://environmental-defense-institute.org/publications/GUIDE.963.pdf

[327] DOE/ID-11396, Phase I Interim Remedial Action Report for Operable Unit 7-13/14 Targeted Waste Retrievals, Pg. 48-49.

highly likely. Significant quantities of Pu and other fissile materials exist in Pit 9 and the SDA. Single 55-gallon drum loadings of> 1 kg (with a potential for 2.9 kg) is possibilities within the Pit 9 waste volume. An estimate of a total of 27 to 40 kg of Pu 239 in Pit 9 has been stated as a reasonable expectation. Also, an estimate of 1000 kg Pu 239 for the SDA has been stated as a reasonable expectation. In neither location is the distribution of drums well characterized.

"3. A drum loading of about 3 kg (a rough upper bound estimate for a graphite mold waste drum), distributed uniformly over the 55-gallon drum volume, would have a Pu concentration of about 15 g/liter. This Pu mass, if homogeneously distributed in water throughout the drum volume, could be critical even if unreflected. The minimum critical mass of about 500 g Pu in water is approached with a spherical volume only 10-20% of that of the 55-gallon drum with water reflection. Heterogeneous distribution of plutonium in water would raise the minimum critical mass. A 55 gallon drum containing greater than or equal to 1 kg of Pu waste can be a significant criticality safety issue depending on the waste form, matrix stability, packaging geometry, and container integrity. The behavior of each such drum requires careful attention with respect to long-term concentration and redistribution mechanisms.

"4. Graphite, and possibly beryllium, are not present in the quantities and purity to reduce the Pu minimum critical mass. However, they may contribute to reflection (better reflectors than water and other hydrogenous materials).

5. "Other fissile nuclides (i.e. U 235) and fissile transuranic nuclides (i.e. Am 241, Np 237) are present in Pit 9, in addition to the isotopes of Pu. The distribution within waste volumes and mixture characteristics are not known for this RFP waste. These data are important for a complete nuclear criticality safety assessment.

"6. Subsurface processes, which, for example, could result in substantial geometry changes, as well as inherent changes in neutron moderation, are not understood for this RFP waste disposal area. Therefore, the long-term geometric stability of the fissile material configuration in the waste cannot be guaranteed. Subsidence events, water infiltration, waste decomposition, displacement, aggregation and separation processes will occur. Each can directly affect the nuclear criticality potential. [Pg. 2]

"7.The accountability and NDA [standard] methods used in the 1960[1]s time frame to determine or estimate the fissile content of waste are not accurate by today's standards. Considerable uncertainty exists in the stated amounts of Pu and other fissile material in the RFP waste containers. The result is that the current Pit 9 (and the SDA) inventory information (i.e. the fissile nuclides and their quantities, distribution, mixture types, concentrations, etc.) makes it difficult to assess nuclear criticality safety.

"8. The fissile material forms are significantly more dense than typical waste constituents. This physical property presents opportunities for accumulation or separation by physical and chemical processes within the waste volume, especially when one considers time frames of 100's to 1000s of years.

"**SPECIFIC ISSUES**

"Appendix A of the PSA [Probability Safety Analysis] presents probability distributions for Pu and Am-241 in waste drums stored at the INEEL. These distributions are intended to be used in some way to support the PSA. These distributions are pertinent to RFP waste generated in a time frame very recent, as compared to the wastes in the SDA pits and trenches. It appears that significant differences in waste packaging and attention to recovering Pu waste materials occurred between the early era (i.e., 1950s to 1960s) and the later era (1970s on). Therefore, using these data for Pu and Am distributions within the SDA and Pit 9 will not yield appropriate radiological and criticality risks.

"A review of historical Rocky Flats Plant information on Pu losses to burial (DEK-04-94 Letter) indicates that a number of Pu significant waste forms were sent to the INEEL SDA. For example, the first and second stage prefilters from Building 771 contain significant amounts of Pu; the destructive analysis results for these filter types averaged 300 grams per filter. To estimate quantities that likely went to burial, a value of 200 grams per filter was used.

"Considering the measured average was 300 grams, one could expect some filters to contain amounts significantly greater than 300 grams. Release of material from the filter media and the long-term chemical stability of the filter media are important issues that must be addressed in nuclear criticality analyses. Also, a detailed understanding of how this waste type was packaged and prepared for disposal in the 1950s, 1960s, and 1970s is necessary. Heavily loaded prefilters pose significant risks relative to criticality because of matrix structure, mechanically trapped Pu particles, and the fact that reasonable mechanisms exist to accumulate Pu quantities of concern. [Pg. 3]

"CRITICALITY SCENARIOS

"A criticality evaluation must not be restricted to the short-term, but must focus on the long-term probability

of assembling sufficient fissile material in a location of the waste disposal area to present an unacceptable risk to future site workers or occupants. One must consider both short and long-term processes that involve the fate, transport and/or concentration of Pu. Also, the natural occurrences that take place within this type of landfill must be evaluated long-term. A few examples are:

Current Time Frame (l0's of years)

"1. Subsidence of high concentration waste into void spaces after corrosion failure of barrels, or disintegration of other container types. Concentration reaches critical.

"2. Inadvertent flooding in-situ increases reactivity of waste to critical in one, or an adjacent group of drums/containers with a high concentration of fissile material.

"3. Inadvertent flooding after failure of drums and subsidence of high-level fissile waste increases reactivity to critical.

"Extended Time Frame (100 years)

"1.Decay and disintegration of organic components of waste. Biologic degradation of all organic solvents. Corrosion disintegration of all drums/containers. All soluble components of waste transported away from pit. Fissile material (heavy metal oxides) remains insoluble. Resulting compaction of fissile material. Water present to provide increase in reactivity.

"2. Change in climate and increase of vegetation at pit. Generation of humic acids mobilize fissionable elements. Fissionable elements transported to location where conditions permit re-precipitation at a critical concentration. Scenario with and without disintegration, decay and elimination of all organic materials.

"Long Term (100s to 1000 years)

"Assumed loss of institutional control. No earlier remediation of pit. All hazard markers lost. Climate has changed to wetter summers and longer growing seasons. Ground water flow increased. Water table rises.

1. Further fissile waste added to pit to bring total to critical amount.

Decay and disintegration of organic components of waste. Biologic degradation of all organic solvents. Corrosion disintegration of all drums. Disintegration of other container types. Organic materials are degraded, solubilized and lost. All soluble components of waste transported away from pit. Fissile materials remain insoluble. Resulting compaction of fissile material. Water present to provide increase in reactivity.

All containers disintegrated. Waste exposed to surroundings. Change in climate or vegetation at pit. All organic waste is degraded and lost. Generation of chelating humic [sic] acids together with any surviving chelating agents mobilize fissionable elements. Fissionable elements transported to a location were conditions permit re-precipitation to a critical configuration.

All waste exposed to surroundings. Pit used to dump acid. Non-fissile components solubilized and transported away by ground water. Residual fissile material concentrated to a critical configuration.

All waste exposed to surroundings. Pit used to dump acid. All contents solubilized and transported away by ground water. Fissionable elements transported to location where conditions permit re-precipitation to a critical configuration.

"Alternative: Climate remains constant. INEEL in high desert dry condition. Loss of institutional control. No earlier remediation of pit. All hazard markers lost. Same scenarios as above case, except for scenario 3. Scenario 3 can be replaced by the assumption of agriculture at the INEEL site with other assumptions remaining. Irrigation provides water source to drive transport.

"These are some of the scenarios that can be postulated for the SDA situation. Some are more credible than others. However, all depend heavily upon the nature, amount and distribution of fissile material currently present in the disposal areas, and this needs to be the initial focus of a comprehensive nuclear criticality safety assessment.

"CONCLUSION

"No conclusive evidence has been presented (to date) that places the future risk of nuclear criticality in the SDA at an insignificant level. The DOE and Bechtel must complete a comprehensive nuclear criticality safety assessment to support current and future actions in the SDA and Pit 9. If an assessment addressing the current data with all of its uncertainty is unable to demonstrate that credible scenarios will lead to subcritical configurations, then actions must be defined to assemble or otherwise gather the data required to complete a valid assessment." [328] [329] [330] [331] [emphasis added]

[328] J. A. McHugh , *Nuclear Criticality Safety Issues Pertaining to the INL SDA*, , J. A. McHugh, R. A. Knief, and M.A. Robkin, May 3, 2000.

What is Required for Appropriate Remediation of SDA?

Technically, once any material that is EPA RCRA listed mixed hazardous/radioactive waste is accessed/ handled during a remediation action, it reenters the regulatory phase and cannot be returned to its original dump unless the dump qualifies as a licensed Subtitle C mixed hazardous/radioactive waste landfill. This is another fundamental flaw in DOE's "Targeted Waste Retrieval" program that must be recognized and corrected. By only extracting, what are called "hot spots" in a pit/trench that probes into the waste have identified and only limiting the retrieval to these spots and leaving the rest of the mixed hazardous radioactive waste in place is illegal under the following Land Disposal Restrictions.

EPA Requirements for Management of Hazardous Contaminated Media states:

> "To accomplish the objective, the proposal would establish modified Land Disposal Restrictions (LDR) treatment requirements, and modified permitting procedures for higher-risk, contaminated media that remain subject to hazardous waste regulations; and give EPA and authorized States the authority to remove certain lower-risk, contaminated media from regulation as ''hazardous wastes'' under most of Subtitle C of RCRA. [332]

40 CFR 265.114 Disposal or decontamination of equipment, structures and soils states:

> "During the partial and final closure periods, all contaminated equipment, structures and soil must be properly disposed of, or decontaminated unless specified otherwise in §§ 265.197, 265.228, 265.258, 265.280, or 265.310. By removing all hazardous wastes or hazardous constituents during partial and final closure, the owner or operator may become a generator of hazardous waste and must handle that hazardous waste in accordance with all applicable requirements of part 262 of this chapter."

40 CFR 268.50 Prohibitions on storage of restricted wastes states:

> "(a) Except as provided in this section, the storage of hazardous wastes restricted from land disposal under subpart C of this part of RCRA section 3004 is prohibited, unless the following conditions are met: (1) A generator stores such wastes in tanks, containers, or containment buildings on-site solely for the purpose of the accumulation of such quantities of hazardous waste as necessary to facilitate proper recovery, treatment, or disposal and the generator complies with the requirements in §§ 262.16 and 262.17 and parts 264 and 265 of this chapter."
>
> "(b) An owner/operator of a treatment, storage or disposal facility may store such wastes for up to one year unless the Agency can demonstrate that such storage was not solely for the purpose of accumulation of such quantities of hazardous waste as are necessary to facilitate proper recovery, treatment, or disposal.
>
> "(c) An owner/operator of a treatment, storage or disposal facility may store such wastes beyond one year; however, the owner/operator bears the burden of proving that such storage was solely for the purpose of accumulation of such quantities of hazardous waste as are necessary to facilitate proper recovery, treatment, or disposal."
>
> "(e) The prohibition in paragraph (a) of this section does not apply to hazardous wastes that meet the treatment standards specified under §§ 268.41, 268.42, and 268.43 or the treatment standards specified under the variance in § 268.44, or, where treatment standards have not been specified, is in compliance with the applicable prohibitions specified in § 268.32 or RCRA section 3004."

Nuclear Regulatory Commission Regulations on Low-level Mixed Radioactive Waste (LLMRW) also apply to INL's INTEC HLW Tanks, Calcine Bins and RWMC/SDA dump.

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[329] Thatcher, Tami, Environmental Defense Institute Special Report, "Public Comment for Class 2 RCRA Permit Modification for Materials and Fuels Complex," 2017. www.environmental-defenseinstitute.org/publications/EDIRCRAcomments2017.pdf

[330] Thatcher, Tami, Several Barrels of Waste Over pressurize Within Hours After Being Repackaged at the Idaho Cleanup Project ARP V, May 2018 EDI Newsletter. http://environmental-defense-institute.org/publications/News.18.May.pdf

[331] Fluor Idaho Continues Analysis of Drum Breach at INL, Exchange Monitor, July 05, 2018 https://www.exchangemonitor.com/fluor-idaho-continues-analysis-drum-breach-inl/?printmode=1

[332] 40 CFR Parts 260, 261, 262, 264, 268, 269 and 271 [FRL–5460–4] RIN 2050–AE22 Requirements for Management of Hazardous Contaminated Media (HWIR-Media) Federal Register / Vol. 61, No. 83 / Monday, April 29, 1996 / Proposed Rules.

40 CFR § 266.255 When is your LLMW no longer eligible for the storage and treatment conditional exemption? [66 FR 27262, May 16, 2001, as amended at 81 FR 85827, Nov. 28, 2016]

(a) When your LLMW has met the requirements of your NRC or NRC Agreement State license for decay-in-storage and can be disposed of as non-radioactive waste, then the conditional exemption for storage no longer applies. On that date your waste is subject to hazardous waste regulation under the relevant sections of 40 CFR parts 260 through 271, and the time period for accumulation of a hazardous waste as specified in 40 CFR 262.16 or 262.17 begins.

(b) When your conditionally exempt LLMW, which has been generated and stored under a single NRC or NRC Agreement State license number, is removed from storage, it is no longer eligible for the storage and treatment exemption. However, your waste may be eligible for the transportation and disposal conditional exemption at § 266.305.

§ 266.305 What does the transportation and disposal conditional exemption do?

This conditional exemption exempts your waste from the regulatory definition of hazardous waste in 40 CFR 261.3 if your waste meets the eligibility criteria under § 266.310, and you meet the conditions in § 266.315.

§ 266.315 What are the conditions you must meet for your waste to qualify for and maintain the transportation and disposal conditional exemption?

You must meet the following conditions for your eligible waste to qualify for and maintain the exemption:

(a) The eligible waste must meet or be treated to meet LDR treatment standards as described in § 266.320.

(b) If you are not already subject to NRC, or NRC Agreement State equivalent manifest and transportation regulations for the shipment of your waste, you must manifest and transport your waste according to NRC regulations as described in § 266.325.

(c) The exempted waste must be in containers when it is disposed of in the LLRWDF as described in § 266.340.

(d) The exempted waste must be disposed of at a designated LLRWDF as described in § 266.335.

§ 266.335 Where must your exempted waste be disposed of?

Your exempted waste must be disposed of in a LLRWDF [Low-level Mixed Radioactive Waste] that is regulated and licensed by NRC under 10 CFR part 61 or by an NRC Agreement State under equivalent State regulations, including State NARM licensing regulations for eligible NARM.

Congress' RCRA landmark hazardous waste legislation allowed EPA to issue Land Disposal Restrictions (LDR) program that sets standards on hazardous waste dumps with the following purpose:

"The purpose of this document is to provide you with a usable summary of the requirements of the Land Disposal Restrictions (LDR) program. The LDR program under 40 *CFR* Part 268 has grown and changed since its introduction in 1986. The Environmental Protection Agency (EPA) made significant efforts over the years to address public and industry suggestions for improvement by streamlining the program and providing compliance assistance." [333]

"For example, the stringent treatment requirements established by RCRA land disposal restrictions (LDRs) have encouraged many generators to reduce the amount of hazardous waste they generate. On the other hand, when these requirements are applied in the context of site cleanup, they often provide a strong incentive to leave hazardous waste and contaminated media in place, or to select alternate remedies that will minimize the applicability of RCRA regulations. This can result in remedies that are less protective of human health and the environment. (See 54 FR 41566, October10, 1989; 58 FR 8658, (February 16, 1993); and the information in the docket to today's proposed rule)).

"In the administration of remedial programs such as Superfund and these corrective action program, EPA and the States are already faced with an unacceptable situation that must be remedied while operating within the technical and practical realities of the site.

"For example, contaminated media are often physically quite different from as generated wastes. Contaminated soils often contain complex mixtures of multiple contaminants, and are highly variable in their composition, handling, and treatability characteristics. For this reason, treatment of contaminated soils can be particularly

[333] Land Disposal Restrictions: *Summary of Requirements* Revised August 2001, Offices of Solid Waste and Emergency Response & Enforcement and Compliance Assurance, Pg. 1-1, ECDIC-2002-013; PA530-R-01-007. www.epa.gov/osw

complex, involving one or a series of custom-designed treatment systems. As-generated wastes however, are usually more consistent in composition, since they are derived from specific known manufacturing processes. [334] [emphasis added]

The importance of the above EPA and NRC regulatory information is to emphasize the existing Land Disposal Restrictions and how DOE with current state and EPA regulatory agencies are violating them by leaving most of the hazardous waste in the SDA. Also it's important to show the extent of RCRA listed hazardous contaminants that are co-mingled in all the waste and soil media. The small quantity (<10%) of targeted waste that DOE is simply leaving the remaining RCRA waste in place and thus violates the statutory cleanup requirements defined as:

"**Statutory Preference for Treatment**—The National Oil and Hazardous Substances Pollution Contingency Plan expresses a preference for remedies that use permanent solutions and alternative treatment technologies to the maximum extent possible to reduce toxicity, mobility, and volume. The Selected Remedy employs treatment, which is statutorily preferred to the extent practical, as a principal element of the remedy, as follows: (1) in situ grouting to reduce mobility of technetium-99 and iodine-129, (2) flameless catalytic oxidation and destruction of solvent vapors collected from the vadose zone, and (3) treatment of targeted waste, if needed, to satisfy disposal requirements."

"SDA contains high organic content waste that contains solvents (e.g., carbon tetrachloride, tetrachloroethylene, and trihreat waste. Carbon tetrachloride has been detected at levels slightly above its maximum contaminant level (MCL) in the aquifer. Principal threat waste is largely contained within targeted waste and will be addressed through removal of targeted thin 5.69 acres and through treatment of vapors by the vapor vacuum extraction system. [Pg. iii]

"Monitoring and modeling indicate that carbon-14 and technetium-99 could threaten groundwater thresholds) beneath the SDA over the next 100 years. Carbon tetrachloride from solvents already exceeds its MCL, and several other contaminants of concern could exceed MCLs over the next few hundred years. Other secondary contaminants of concern (e.g., uranium-238) could exceed MCLs several thousands of years in the future. To inhibit migration of contaminants from buried waste a surface barrier will be constructed to reduce infiltrating moisture that would move through the SDA and downward toward the Snake River." [335]

"The storage of any form of hazardous waste is prohibited unless the waste has available treatment to meet land disposal restriction (LDR) requirements in accordance with 40 CFR 268 of the Resource Conservation and Recovery Act (RCRA). In 1992, Congress passed the Federal Facility Compliance Act (FFCA), which allows for the storage of radioactive and hazardous mixed waste (mixed waste) until available treatment can be developed that meets the LDR requirements. Transuranic-contaminated mixed (TRU) waste is covered under the [Federal Facility Compliance Act] FFCA through the Site Treatment Plan (STP) since the implementation of the plan in November, 1995." [emphasis added]

"The State of Idaho, Department of Environmental Quality (State or DEQ) asked DOE to submit enforceable schedules under the STP for transportation of mixed TRU from INEEL to WIPP. Because such waste is no longer considered to be prohibited waste under RCRA, the Department of Energy's position is that they should no longer be subject to the enforceable requirements under the STP. The Department of Energy Idaho Operations Office (DOE-ID) proposed to the State that all TRU waste that was designated for disposal at WIPP be removed from the STP or that any schedules for shipments to WIPP be provided under the processes of the STP for information only.

"The State concurred that wastes properly designated for disposal at WIPP were not subject to the LDR requirements but did not concur that all mixed TRU waste currently located at the INEEL had been properly "designated" within the meaning of the Amendment Act. The State also disagreed that these wastes are exempt from the enforceable section of the STP and requested DOE-ID to comply with the appropriate sections of the STP." [336]

"The Federal Facilities Compliance Act (FFCA) required all DOE facilities managing mixed waste to develop Site Treatment Plans (STP) to address mixed waste that are subject to Land Disposal Restrictions (LDR) standards promulgated pursuant to RCRA Section 3004 (m). In 1996 the Waste Isolation Pilot Plant (WIPP) Land Withdrawal Amendment Act states that 'transuranic mixed waste designated by the Secretary [of Energy] for

[334] Ibid, ECDIC-2002-013; PA530-R-01-007.

[335] DOE/ID-11359, Record of Decision for Radioactive Waste Management Complex Operable Unit 7-13/14, Revision 0 September 2008, DOE/ID-11359.

[336] TRU MANAGEMENT IN THE SITE TREATMENT PLAN AT THE INEEL, WM'02 Conference, February 24-28, 2002, Tucson, AZ, Monte Davis, Bechtel BWXT Idaho, LLC, Report Abstract.

disposal at WIPP…. is exempt from treatment standards promulgated pursuant to section 3004 (m) of [RCRA]'. Therefore, DOE position is that Transuranic mixed waste destined for WIPP is not subject to, or requires inclusion in, the provisions of the STP." [337]

"While DEQ concurred that waste properly designated for disposal at WIPP are not subject to the LDR restrictions of RCRA, DEQ did not concur that all mixed TRU waste currently located at the INEEL was properly designated within the meaning of the WIPP Withdrawal Act. DEQ also did no agree that such wastes are exempt from the STP of the enforceable schedules found in the STP. Instead DEQ believed that the STP must be complied with until such time as the wastes have been shipped to WIPP.

"DEQ interpret the amendments to the WIPP Withdrawal Act to require that a waste acceptance determination be made prior to being removed from the STP. Wastes destined for disposal at WIPP must be designated as such by the STP and information related to interim storage and transport to WIPP is provided. For wastes that have not yet been identified in the STP as going to WIPP, these wastes must stay in the relevant portion of the STP, even if they may eventually be so designated. Finally, DEQ requested that before removal from the enforceable STP schedules, all wastes listed in the STP as TRU waste must be shown to meet the Waste Acceptance Criteria (WAC) at WIPP. This would satisfy DEQ that these wastes would indeed be accepted at WIPP.

"Several written correspondences were submitted back and forth between DEQ and DOE. Based on the position of DEQ, DOE responded with a position paper detailing portions of the WIPP withdrawal Act where DEQ and DOE agreed and disagreed. At this time there are two positions, out of three, on the table being discussed. These positions are: 1) That all TRU waste stored at the INEEL be removed from the INEEL STP since the waste is "designated" for disposal at WIPP, 2) That all TRU waste streams remain in the INEEL STP, but in a new section of the STP which has no enforceable milestones, and 3) That only the TRU waste streams that meet the WIPP WAC will exit the INEEL STP. Positions 1 & 2 above are both acceptable to DOE, but position 3 is not because of the potential for enforceable milestones being applied to TRU waste before it is evaluated against the WIPP WAC or treated to meet the WIPP WAC.

"Since the negotiations has [sic] stalled in the technical level, the Idaho Attorney General's Office and the DOE- ID Office of Chief Counsel got involved in the specific of the laws. Both offices have outlined their positions and provided legal background to support these positions. Again, no movement has occurred and discussions have stopped short of filing legal suits in court and been returned to the technical groups for the next round of discussion, which are schedule for the end of January, 2002." [338]

"A change in the law did not sufficiently explain all potential regulatory interpretations to adequately address all issues that have arisen. DEQ and DOE find themselves in such a legal ambiguity with a uncertain resolution with in any linear timeframe. The potential for this issue to be taken to court is doubtful. Unless a solution is reached in January, 2002 it is very likely that public involvement may occur." [339] [emphasis added]

DOE has NO Plans to Remove Soil Vault Highly Radioactive Metal Waste Produced from SNF Processing in the SDA [340]

The Agencies "Preferred Alternative" [pg. 25] will leave huge quantities of hazardous and long-lived radioactive metals from SNF processing waste in place to further contaminate Idaho's sole source aquifer. Even IDEQ has reservations. "[T]he State has not agreed to accept DOE's currently proposed retrieval area of 5.69 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 flooded the RWMC numerous times in the past. Water samples under the SDA show:

> "Radionuclides that exceed 25% of drinking water standards are neprtunium-237, plutonium-239, plutonium-240, technetium-99, uranium-234, and unarium-238. These radionuclides all have half-lives, with the minimum half-life being 6,537 years for plutonium-240." [341] [Pg.7-79] [DOE-EIS-0200-F,]

In 1977, the use of soil vaults (the use of the word "vault" is a misnomer because they're just holes in the ground with 2 metal waste cans is dropped) for the disposal of high-radiation-level waste since

[337] TRU MANAGEMENT IN THE SITE TREATMENT PLAN AT THE INEEL, Introduction.
[338] TRU MANAGEMENT IN THE SITE TREATMENT PLAN AT THE INEEL, Pg. 3.
[339] TRU MANAGEMENT IN THE SITE TREATMENT PLAN AT THE INEEL, Pg. Conclusion.
[340] DOE/NE-ID-11201, Five-Year Review of CERCLA Response Actions at the Idaho National Laboratory, Revision 3, February 2007.
[341] Ibid. DOE-EIS-0200-F, Pg.7-79.

dumping began in the SDA. Soil vaults eventually replaced trenches for the disposal of such waste. The vaults are drilled in rows, as shown in Figure 1-2. As of this writing, final preparations are underway to dispose of future high radiation level LLW in concrete lined vaults placed in SDA pits 17-20. [342]

The 21 rows of post-1977 soil vaults (~1,200 holes each with at least 2 waste cans each) largely contain INL Naval Reactor Facility spent nuclear fuel parts that individual shipments typically contain over 10,000 curies of remote handled waste. It is no wonder that DOE is averse to exhuming this deadly/extremely radioactive waste. [343] [344] However, these soil vault containers can be exhumed and put into the existing NRC permitted above ground shielded interim storage at INL/INTEC or the newly constructed Remote-Handled Disposal Facility near INL/ATRC. Additionally, as documented below, DOE fails to acknowledge that about 90.28 metric tons of spent nuclear fuel was dumped in the SDA. [345]

> "Soil Vault Row [SVR] disposal practices also were modified to minimize personnel exposures to radiation emanating from waste. Beginning in 1977, areas not suited for pits were reserved for SVRs, typically used for disposing of remote-handled waste. Drilled in rows, soil vaults consisted of unlined, cylindrical, vertical holes with diameters ranging from 0.4 to 2 m (1.3 to 6.5 ft.) and averaging about 3.6 m (12 ft.) deep.
>
> "Vaults in any given row are at least 0.6 m (2 ft.) apart. A layer of soil at least 0.6 m (2 ft.) thick was placed in bottoms of holes when basalt was penetrated during drilling. Soil vaults were designed for disposing of high-radiation waste that was defined as material producing a beta-gamma exposure rate greater than 500 mR/hour at a distance of 0.9 m (3 ft.). Soil vault disposals were conducted concurrently with trench disposals from 1977 to 1981. Trenches also received high-radiation waste until trench disposal was discontinued in 1981.[3-8]
>
> "The final report (McKinley and McKinney 1978a) states that about 6.1% of the drums (1,236 drums) had external alpha contamination to 120,000 cpm and these drums all came from Pit 11. Drums from Pit 12 had no external contamination except for some fixed contamination. Approximately 2.4% of the drums (486 drums) were breached and about one third of these drums (162 drums) leaked free liquids. The leaking free liquid was usually uncontaminated though contamination levels up to 40,000 cpm were found in some of the liquids. No further analysis was reported in the document. [346] [3-17] [emphasis added]
>
> "Treatment to reduce gas generation is considered in this PEIS. For TRU, gas could be generated by the corrosion of metal containers t themselves, and by microbial decomposition of the waste. DOE is evaluating in the WIPP SEIS-II (DOE, 1996e) an alternative for disposal of TRUW after treatment to reduce gas generation." [347] [8-3]

The Plan will leave over >1,200 "soil vaults" (DOE documents show >20 rows) [348] permanently in place with only grouting to "reduce mobility of Tc-99 and I-129 waste migration." [349] 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**

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[342] Ibid. INEL-95/0310, Pg. 1-7.

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

[344] The INL Site EM CAB will meet Thursday, June 22, 2017 in Idaho Falls agenda. "During active RWMC operations about 241,000 cubic meters of waste were disposed in 21 pits, 58 trenches and 21 soil vault rows (totaling approximately 35 acres)."

[345] Radioactive Waste Management Information System; Solid Master Database, P61SH090, printouts, 1954 to1989, Books 1 through 5, a.k.a. RWMIS. These printouts show each shipment to RWMC along with origin, content and estimated curie amount. EDI gained access to all 5 volumes via FOIA and found after reviewing it were able to manually total some of waste (i.e., amount of SNF.)

[346] INEEL-EXT-02-01125, Ancillary Basis for Risk Analysis of the Subsurface Disposal Area September 2002, Pg. 3-17.

[347] Ibid. DOE-EIS-0200-F, Pg.8-3.

[348] ERP-Wag7-05 Rev 2, Radioactive Waste Management Complex, Subsurface Disposal Area, EG&G Diagram, Description/ Material/ Specification, No. 416511, Revised 3/19/92. Large plot plan (32"x20") of all Pits, Trenches Soil Vaults location, Pads and Liquid Acid Pit with individual number and Transuranic Storage Area Cells and Pads. Note F states: "Unrecorded waste hot spots uncovered during excavation of what is now Pit 20 and SVR-11, SVR 12 and SVR-16." Additional reference sees EDF No. ERP-Wag7-05 Rev 2.

[349] DOE/ID-11513, Five-Year Review of CERCLA Response Actions at the Idaho National Laboratory Site— Fiscal Years 2010– 2014, December 2015, DOE/ID-11513 Revision 0, pg. 10-29.

into the vadose zone and aquifer." [pg. 26]

From the beginning of RWMC in the 1950s the extremely radioactive waste (from processing SNF) of this type (INTEC/NRF) reactor fuel (not containing uranium) parts cut off the top and bottom of the assembly were dumped in the pits and trenches until 1977 when the use of holes bored in the ground for "soil vaults" was implemented. Again it must be emphasized that the highly radioactive waste now in the soil vaults was previous to 1977 was distributed in all the pits/trenches and therefore must be removed.

> "Soil Vaults Disposal practices also were modified to minimize personnel exposures to radiation emanating from waste. Beginning in 1977, areas not suited for pits were reserved for SVRs, typically used for disposing of remote-handled waste. Drilled in rows, soil vaults consisted of unlined, cylindrical, vertical holes with diameters ranging from 0.4 to 2 m (1.3 to 6.5 ft.) and averaging about 3.6 m (12 ft.) deep.
>
> "Vaults in any given row are at least 0.6 m (2 ft.) apart. A layer of soil at least 0.6 m (2 ft.) thick was placed in bottoms of holes when basalt was penetrated during drilling. Soil vaults were designed for disposing of high-radiation waste that was defined as material producing a beta-gamma exposure rate greater than 500 mR/hour at a distance of 0.9 m (3 ft.). Soil vault disposals were conducted concurrently with trench disposals from 1977 to 1981. Trenches also received high-radiation waste until trench disposal was discontinued in 1981. [Pg.3-8]
>
> "Waste disposed of in the SDA must meet the requirements of waste acceptance criteria (DOE-ID 2001). However, exceptions can be obtained from DOE by completing an analysis that shows that overall limits on LLW inventories will not be exceeded. Exceptions have been made roughly once every three years. These exceptions have been related to a given disposal exceeding concentration limits or for unanticipated waste containing short-lived radionuclides such as H-3 or Cs-137. Waste disposal operations in the SDA are currently anticipated to extend until 2020 (McCarthy et al. 2000). [Pg.3-9]
>
> "3.1.3.1.3 Soil Vault Rows—Disposal in soil vaults was discontinued in 1993. Soil vaults are unlined holes bored 5.2 to 7.6 m (17 to 25 ft.) deep that received remote-handled, containerized waste transferred from a bottom-discharge shipping cask. [Pg. 3-10] [350] [emphasis added]

Soil Vault Rows (1–13) No further action. This operable unit is addressed under OU 7-13/14. 7-02 also Acid Pit No CERCLA further action.

> "12.2.6.1 OU 7-01—Soil Vaults. Based on screening-level assessment of Soil Vault Rows 1 through 13, the Agencies concluded that waste in soil vaults would be evaluated in the comprehensive remedial investigation/feasibility study to assess potential transport of contaminants to the surface in concentrations that could exceed threshold values. Because the OU 7-13/14 RI/BRA and Feasibility all waste within the SDA, including that buried in soil vaults, no further action is under OU 7-01." [Pg. 54] [351] [emphasis added]

Waste Type. Radionuclides disposed of in the soil vaults include those shown in Table 4.7-1. Many of these radionuclides may have decayed since emplacement. The form of the waste also varied. Identified waste forms are listed in Table 4.7-2 below

Radionuclides Disposed in Soil Vaults OU 7-01[pg. 4.7-4] [352]

46Sc	60Co	95Zr	119Sn	144Ce	240Pu	58Fe
51Cr	90Sr	106Rh	125Sb	144Pr	228^{Th}	Note the number of TRU nuclides
54Mi	90Y	106Ru	134Cs	182Ta	235U	in above table.
58Co	95NB	19Cd	137Cs	239Pu	236U	

[350] INEEL-EXT-02-01125, Ancillary Basis for Risk Analysis of the Subsurface Disposal Area September 2002

[351] ICP-EXT-05-00784, Pg. 54 and 80

[352] Draft Idaho National Engineering Laboratory EIS Environmental Restoration Program Assessment May 14, 1993, Section 4.7.1.2

Note many of the listed wastes identified above should be listed as HLW or TRU waste. Due to public pressure DOE agreed recently to stop using holes (soil vaults) in the SDA soil for the highly radioactive waste mostly from Navy's INL Naval Reactors Facility Expanded Core Facility that cuts off the non-fuel parts of the used reactor fuel assembly.

Table 10-5 below shows the waste types, concentration, compared to EPA's maximum contaminate level (MCL) in surface storage Pad A that will remain in place to continue add contaminates to the aquifer.

Table 10-5. Summary of analytes detected at reportable levels in Zone 1 (Pad A) during Fiscal Years 2010–2014. [353]

Analyte	Number of	Number of	Number of Reportable Detections	Maximum	MCL	Units	Detections Greater Than MCL[c]
Cl-36	13	49	1	16 ±5	700[d]	pCi/L	0
C-14	12	86	1	37 ±9	2,000[d]	pCi/L	0
Nitrate (as nitrogen)	9	21	8	**119[e]**	10	mg/L	8
Selenium	2	2	1	**70.3[e]**	50	µg/L	1
Tc-99	13	111	5	**15,700 ±904[e]**	900[d]	pCi/L	4
Tritium	3	9	9	**964,000 ±95,300[e]**	20,000[d]	pCi/L	9
U-233/234	7	17	11	90 ±8	NA[f]	pCi/L	NA[f]
U-235/236	7	17	3	5.5 ±1	NA[f]	pCi/L	NA[f]
U-238	7	17	10	24 ±2	NA[f]	pCi/L	NA[f]
Uranium (total)	13	49	24	**67.1[e] J[g]**	30	µg/L	11

a. Includes field duplicates.
b. Radionuclide concentrations include an uncertainty of ±1σ.
c. MCLs are from "National Primary Drinking Water Regulations" (40 CFR 141). Though soil moisture and perched water are not sources of drinking water, MCLs are used as convenient and familiar values for comparison.
d. The given value is derived from the MCL for gross beta of 4 mrem/year based on the concentration of a single isotope yielding a dose of 4 mrem/year to the total body or to any critical organ. 40 CFR 141 establishes an MCL of 4 mrem/year for beta particle and photon radioactivity, provides derived values for Sr-90 and tritium, and indicates how other derived values should be calculated.
e. **Bold** font indicates a sample concentration that exceeds the MCL.
f. The uranium MCL applies to total uranium and not to individual uranium isotopes.
g. The "J" data qualifier flag indicates limitations associated with the result. The reported concentration is an estimate.

MCL maximum contaminant level
NA not applicable

[353] DOE/ID-11513, Five-Year Review of CERCLA Response Actions at the Idaho National Laboratory Site-Fiscal Years 2010–2014 December 2015 DOE/ID-11513 Revision 0.

"ARP I Underburden: ARPU0801VA List Constituent Result Analytical Method"
[i.e. CONTAMINATED SOIL UNDER WASTE]

2ARN1801GR	5/20/2008	NTW 250-ml	AA-3		

Constituent	Result		TRU	
Americium-241	1.06e+06	pCi/g	1.06e+03	nCi/g
Europium-152	7.75e+01	pCi/g		
Plutonium-239	3.38e+06	pCi/g	3.38e+03	nCi/g
			4.44e+03	**nCi/g**

"10.6.1.2 Vadose Zone Vapor Monitoring**.** Downward vapor-phase transport from buried waste through the vadose zone to the aquifer is the most likely transport process for the carbon tetrachloride and other VOCs observed in aquifer wells near RWMC (Holdren et al. 2006). OU 7-13/14 monitors VOC vapors in the vadose zone to track progress towards remediation goals defined for two zones in the subsurface (Figure 10-4). Within Region A and Region B, inside and outside the SDA, respectively, zones are referred to as A0, A1, A2, A3, B0, B1, B2, and B3 based on lithology as described above for vadose zone soil moisture and perched water monitoring (Figure 10-5)." [354] [emphasis added]

Table 10-6. Summary of analytes detected at reportable levels in Zone 2 during Fiscal Years 2010–2014. [pg. 10-16] [355] [356]

Analyte	Number of Sample Points	Number of Analyses[a]	Number of Reportable Detections	Maximum	MCL	Units	Detections Greater Than MCL[c]
C-14	11	76	2	59 ±13	2,000[d]	pCi/L	0
Chromium (unfiltered)	2	7	3	**930[e]**	100	ug/L	3
Nitrate (as nitrogen)	7	21	17	**88[e]**	10	mg/L	12
Tc-99	12	102	1	34 ±11J[f]	900[d]	pCi/L	0
U-233/234	4	13	12	85 ±10	NA[g]	pCi/L	NA[g]
U-235/236	4	13	2	1.3 ±0.4	NA[g]	pCi/L	NA[g]
U-238	4	13	11	27 ±4	NA[g]	pCi/L	NA[g]

DOE's CERCLA cleanup objectives also fail to consider flooding as previously discussed in Section IV in this report but must be reemphasized as the below Environmental Restoration Program Assessment states:

"Recent Track 2 investigations for OU 7-05 collected radionuclide data from the drainage and ponding areas where existing data is not available. Radionuclides that have previously been detected at the site are: ^{239}Pu, 238pu, 241Am, 137Cs, and 90Sr. The majority of soil samples taken during this investigation had activities below the detection limits of 0.1 pCi/g for gamma emitting radionuclides (e.g., 137Cs, 60Co) and 0.03 pCi/gm for alpha emitting nuclides (e.g., Pu, Am). Uranium and thorium isotopes were detected, but at

[354] Ibid., DOE/ID-11513, Section 10.6.1.2 Vadose Zone Vapor Monitoring
[355] Ibid. DOE/ID-11513, Pg. 10-16.
[356] Ibid. DOE/ID-11513, Pg. 10-17.

levels below those found in INEL background soils. [Pg. 4.7-15]

"Section 4.7-9 Table 4.7-5 shows irradiated reactor fuel in Trenches (25, 27, 28, 30, 31, 33, 35, 40, 41, 42, 43, 46, 52, 54) and enriched uranium dumped in Trench 49." [emphasis added] [357]

DOE's CERCLA cleanup objectives also fail to consider the serious health impact of inhalation of tiny amounts as Figure 4.1-2 below shows and as previously discussed in Section IV in this report but must be reemphasized as the below Basis for Risk Analysis states:

> Figure 4.1-2 emphasizes the severity of plutonium inhalation in comparison to other radiation exposures. Inhalation of one microgram (one-millionth of a gram) of plutonium results in a cumulative lifetime dose 6.7 million times greater than the cumulative lifetime dose that would be received from one microgram of depleted uranium from Rocky Flats Trench-1; this dose would also be four times the DOE annual dose limit. Therefore, the plutonium contaminated waste materials at OU 7-10 cannot be handled and packaged in the same manner used for uranium waste materials at the Rocky Flats Trench-1 operation. [4-4] [358] [359]

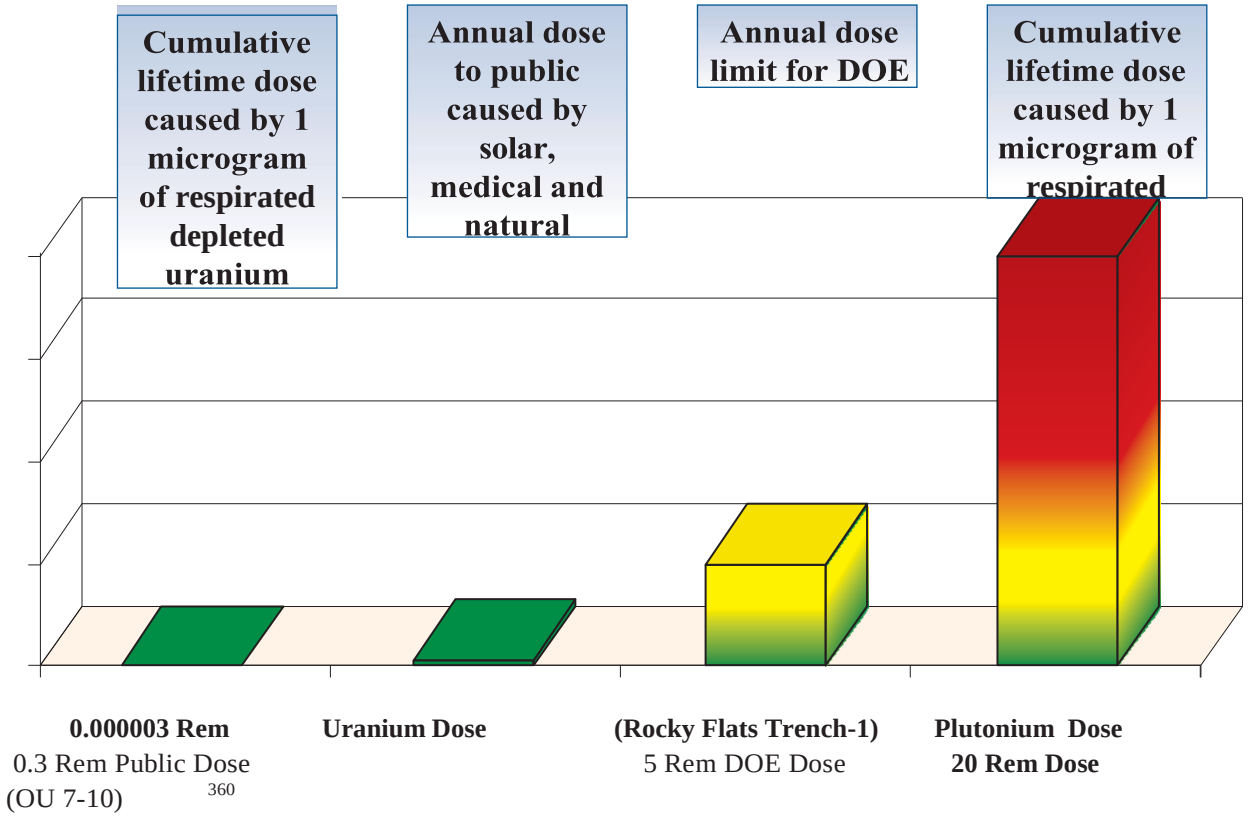

Figure 4.1-2 Above. "Radiological Exposure Hazards of Plutonium Versus Depleted Uranium. ***Radiation exposures caused by inhalation of plutonium are 6.7 million times greater than equivalent exposures of depleted uranium—internal exposure of only 1 microgram of plutonium exceeds the allowable exposure limits established by DOE."***

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[357] Draft Idaho National Engineering Laboratory EIS Environmental Restoration Program Assessment, 3/14/93, Sec. 4.7.2.2 Waste Type

[358] INEEL-EXT-02-01125, Ancillary Basis for Risk Analysis of the Subsurface Disposal Area September 2002, Pg. 4-4

[359] *Potential Un-reviewed Safety Question Affecting Department of Energy Complex Concerning Hydrogen Generation in TRU Waste Drums*. Also; *Radiation Workers at the Idaho National Laboratory and Around the DOE Complex Need to Understand Blood Count Changes That Can Indicate a Significant Radiation Exposure*. http://www.environmental-defense-institute.org/edipubs.html

[360] INEEL/EXT-01-01105, Waste Area Group 7 Analysis of OU 7-10 Stage II Modifications October 1, 2001

94

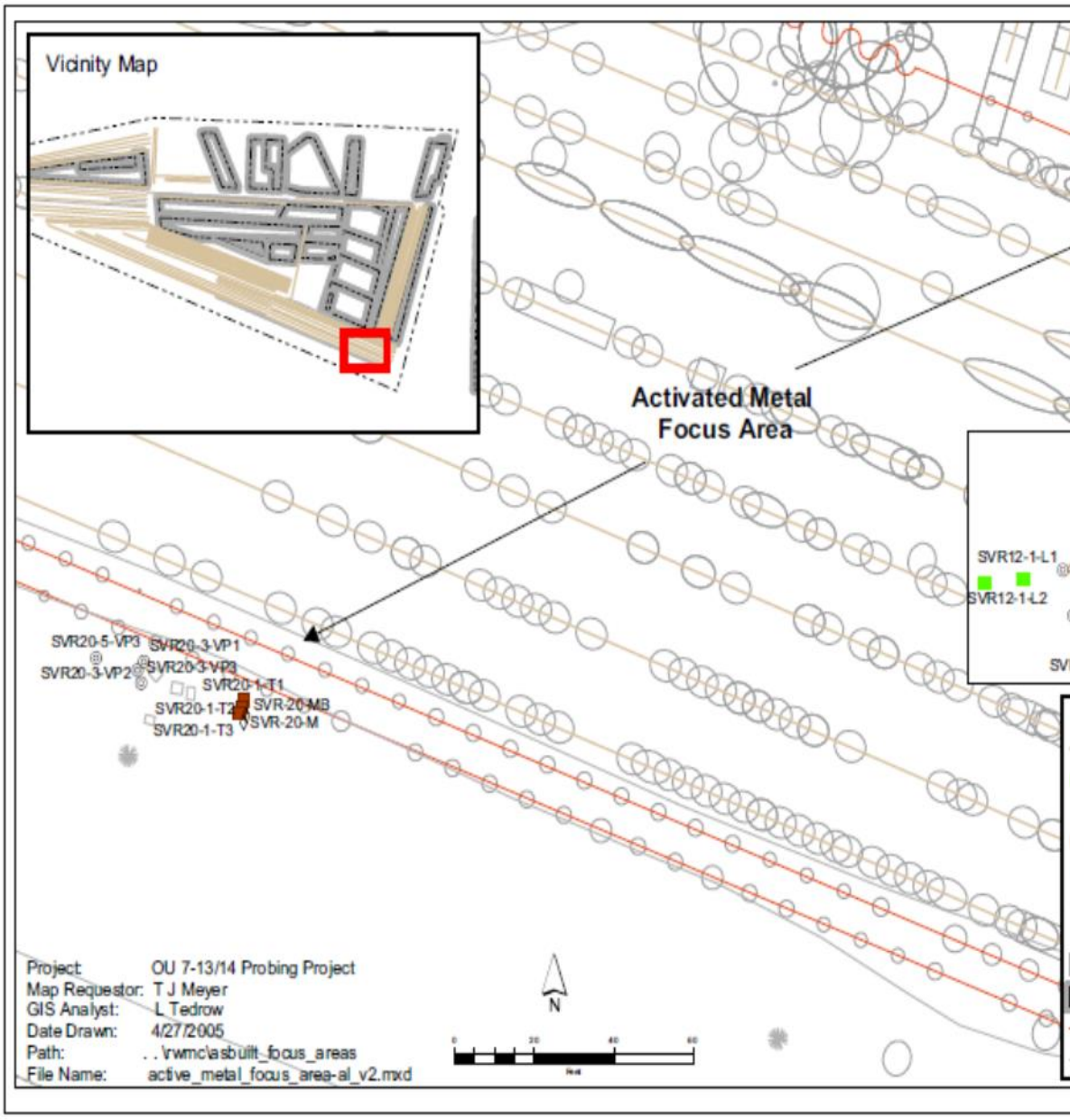

Figure B-7. Probes installed in the Activated Metals Focus Area in Soil Vault Rows 12 and 20.

Source Figure B-7: ICP-EXT-05-00784, Pg. 94

Figure B-7 above probes shows a closer look at soil vault probes that Agencies erroneously decided not to include in the SDA cleanup. As discussed in the EDI's Review attached Section XI No Plans to Remove Soil Vault waste and the issue of "activated metals" and the issue of fires resulting from the waste in Section VIII. See below for data on the findings of those probes that should have convinced Agencies to expand the waste retrieval areas.

95

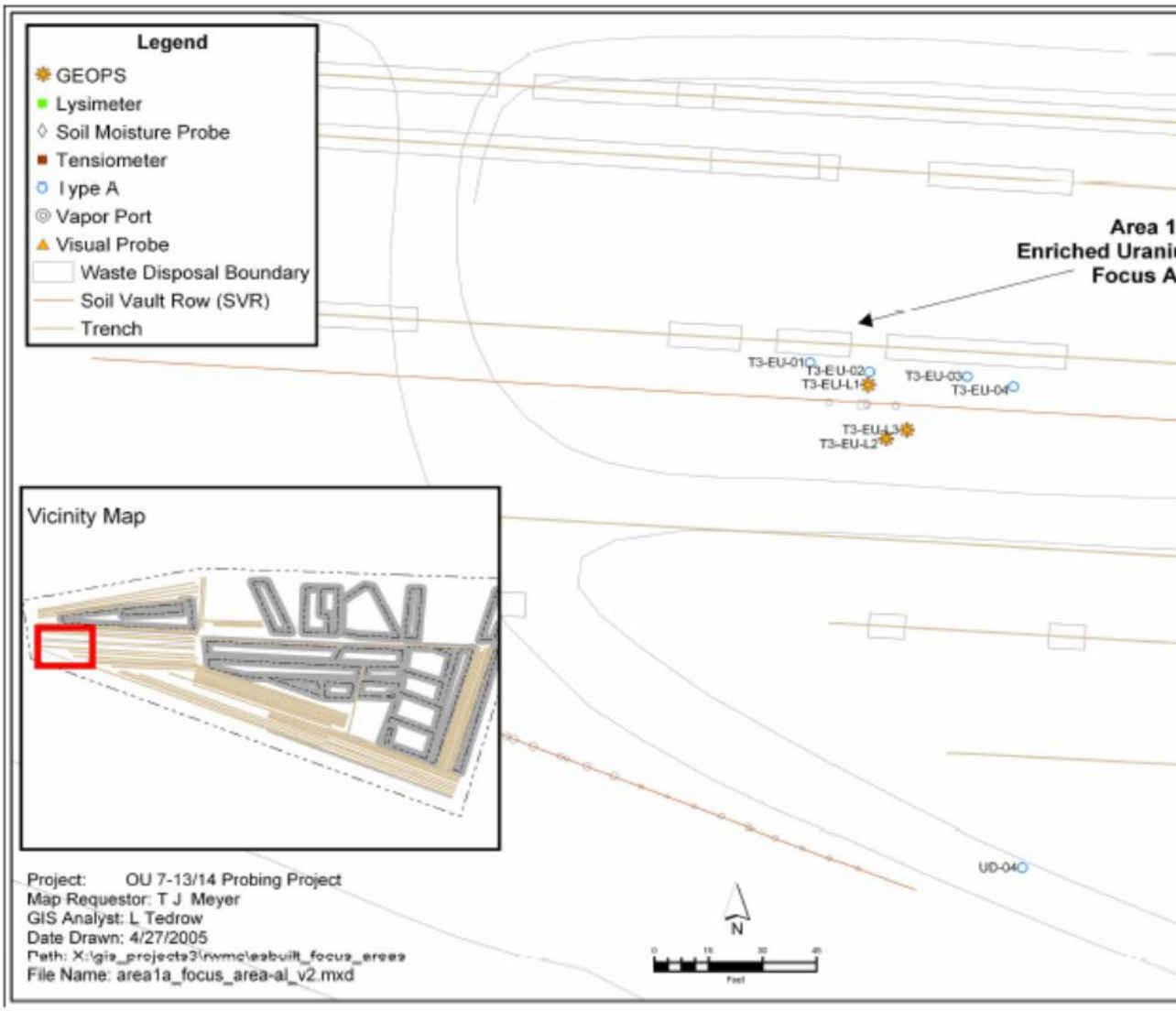

Figure B-8. Probes installed in the Enriched Uranium-Source Focus Area in the west end of Area 1A, Tren

Source Figure B-8: ICP-EXT-05-00784, Pg. 95

Figure B-8 probes show enriched uranium area that also apparently was not included in the retrieval area (no ARPS over these areas) and as discussed in the EDI's Review attached Section XI "No Plans to Remove Soil Vault Waste." Enriched uranium is a high-level and/or a TRU waste stipulated in the 1995 Settlement Agreement and DOE's WMPEIS for removal to WIPP but excluded in the "Accelerated Retrieval Program" ARPs. DOE/INL has never admitted dumping high-level waste in the SDA; yet even their own SDA waste probes show it, if a person looks far enough into their documents.

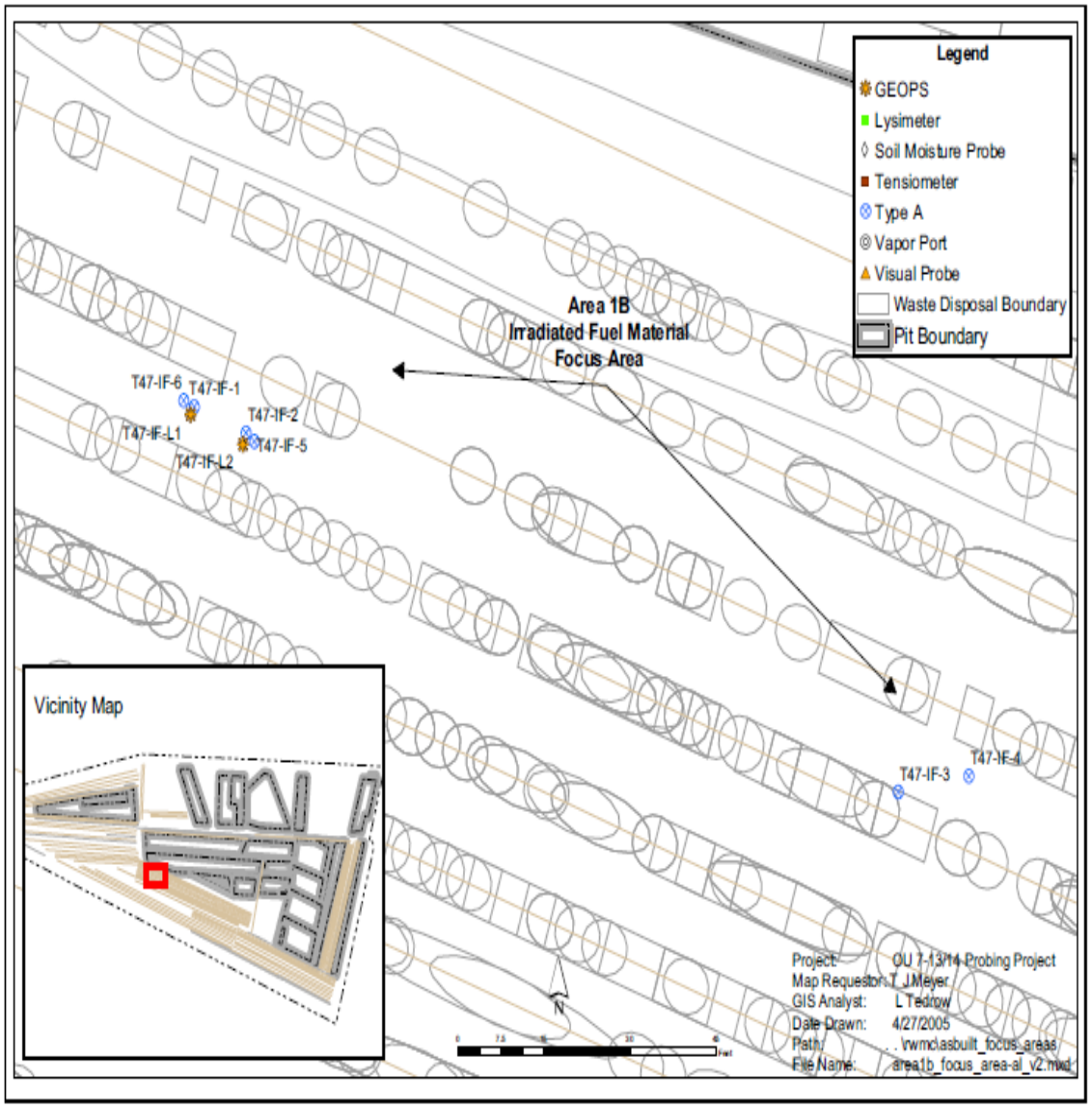

Figure B-9. Probes installed in the Irradiated Fuel Material Focus Area in the west end of Area 1B, Trench 47.

Source Figure B-9: ICP-EXT-05-00784

Figure B-9 above shows probes findings of irradiated fuel material area that also apparently was not included in the "targeted waste" Accelerated Retrieval Project (ARPs). Irradiated fuel is used spent reactor fuel that is classified as high-level radioactive waste that legally (according to NRC) must be disposed in a deep geologic repository because of its intrinsic biological hazard to human contact for thousands of years. As discussed in the EDI's Review attached Section VI "No Plans to Remove Soil Vault Waste" on page 57.

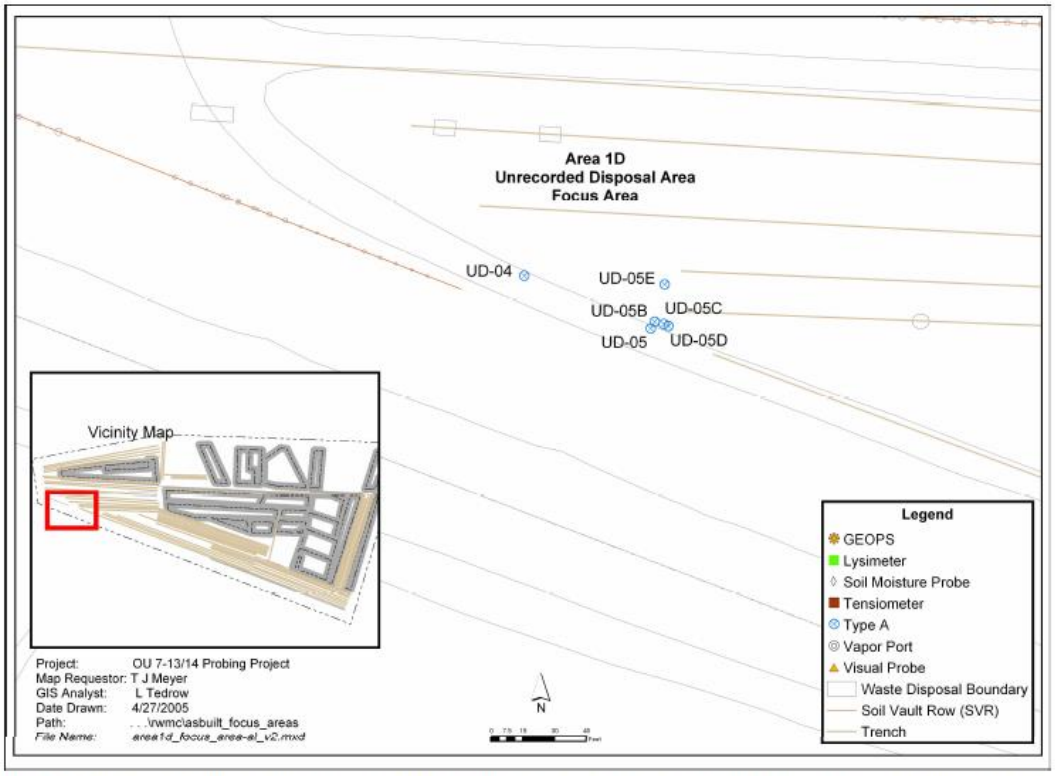

Figure B-10. Probes installed in the Unrecorded Disposal Focus Area in the west end of the Subsurface Disposal Area, Area 1D.

Source Figure B-10: ICP-EXT-05-00784, Pg. 97

Figure B-10 above shows probes findings of unrecorded (previously unknown) disposal area that also apparently was not included in the targeted waste ARPS. Agency dependency on historical records on what and where this extremely hazardous waste is buried is unjustified. These ICP-EXT-05-00784 excerpts are only a tiny examples of what is available in this report that show how wide spread this type of "unknown" waste is distributed in the SDA. INL RWMC/SDA practices between 1950 to 1970 was anything gets dumped into whatever pit/trench was open at the time with no limit on how radioactive it was. "Just dump it and cover it up." This included whole reactors from the 52 built/operated over the history of the site – originally called National Reactor Testing Station. Also many off-site reactors were dumped in the SDA. See EDI's Citizens Guide to INL for a historical account of the site's operations. http://environmental-defense-institute.org/inlguide.html#Citizens%20Guide%20to%20INL

Table A-1 below shows SDA probe data showing HLW (irradiated fuel, enriched uranium plutonium, americium, neptunium, depleted uranium etc.) locations that were not remediated during the CERCLA cleanup process.

Table A-1. (continued).

Probe Type	Probing Project Focus Area	Probe Name	Installation Date	Probe Depth (from surface) (ft)	Sensor/Port Depth (from surface) (ft)
Tensiometer	Moisture monitoring	MM1-3-T3	10/09/01	12.5	11.72
Tensiometer	Moisture monitoring	MM1-3-T1	10/10/01	5.9	5.14
Tensiometer	Americium/Nepunium	741-08-T2	10/11/01	11.4	10.55
Tensiometer	Americium/Nepunium	741-08-T3	10/11/01	20.7	19.91
Tensiometer	Activated metal	SVR12-1-T1	10/11/01	4.4	3.60
Tensiometer	Activated metal	SVR12-1-T2	10/11/01	9.2	8.43
Tensiometer	Activated metal	SVR12-1-T3	10/11/01	11.6	10.83
Tensiometer	Americium/Nepunium	741-08-T1	10/16/01	4.4	3.60
Visual probe	Pit 9	P9-09-V	10/23/01	6.7	NA
Visual probe	Pit 9	P9-20-V	10/25/01	12.6	NA
Visual probe	Pit 9	P9-09-VB	11/01/01	10.9	NA
Type A	Uranium/enriched uranium	P5-UEU-7	06/05/03	13.1	NA
Type A	Uranium/enriched uranium	P5-UEU-8	06/05/03	16.1	NA
Type A	Uranium/enriched uranium	P5-UEU-1	06/09/03	18.9	NA
Type A	Uranium/enriched uranium	P5-UEU-2	06/09/03	19.1	NA
Type A	Uranium/enriched uranium	P5-UEU-3	06/09/03	16.3	NA
Type A	Uranium/enriched uranium	P5-UEU-4	06/09/03	17.8	NA
Type A	Uranium/enriched uranium	P5-UEU-5	06/09/03	16.3	NA
Type A	Uranium/enriched uranium	P5-UEU-6	06/09/03	16.1	NA
Type A	Irradiated fuel material	T47-IF-1	06/10/03	11.6	NA
Type A	Irradiated fuel material	T47-IF-2	06/10/03	10.8	NA
Type A	Irradiated fuel material	T47-IF-3	06/10/03	11.6	NA
Type A	Irradiated fuel material	T47-IF-4	06/10/03	9.8	NA
Type A	Enriched uranium source	T3-EU-01	06/11/03	18.4	NA
Type A	Enriched uranium source	T3-EU-02	06/11/03	21.8	NA

Table A-1. (continued).

Probe Type	Probing Project Focus Area	Probe Name	Installation Date	Probe Depth (from surface) (ft)	Sensor/Port Depth (from surface) (ft)
Type A	Enriched uranium source	T3-EU-03	06/11/03	11.9	NA
Type A	Enriched uranium source	T3-EU-04	06/12/03	13.5	NA
Type A	Liquid waste disposal	HAL1	06/16/03	20	NA
Type A	Liquid waste disposal	HAL2	06/16/03	22.4	NA
Type A	Liquid waste disposal	HAL3	06/16/03	8.7	NA
Type A	Liquid waste disposal	HAL4	06/16/03	12.9	NA
Type A	Pit 6 high plutonium density	P6-PU-3	06/19/03	8.3	NA
Type A	Pit 6 high plutonium density	P6-PU-1	06/23/03	20.3	NA
Type A	Pit 6 high plutonium density	P6-PU-2	06/23/03	20.3	NA
Type A	Pit 10 high plutonium density	P10-PU-1	06/25/03	5.9	NA
Type A	Pit 10 high plutonium density	P10-PU-2	06/25/03	10.4	NA
Type A	Pit 10 high plutonium density	P10-PU-3	06/25/03	20.7	NA
Type A	Americium/Nepunium	741-10	06/30/03	20.2	NA
Type A	Americium/Nepunium	741-11	06/30/03	20.1	NA
Type A	Unrecorded disposal	UD-04	07/01/03	14.4	NA
Type A	Unrecorded disposal	UD-05	07/01/03	4.7	NA
Type A	Unrecorded disposal	UD-05B	07/02/03	5.2	NA
Type A	Unrecorded disposal	UD-05C	07/02/03	5.5	NA
Type A	Unrecorded disposal	UD-05D	07/02/03	5.6	NA
Type A	Unrecorded disposal	UD-05E	07/07/03	10.8	NA
Type A	Unrecorded disposal	UD-03	07/09/03	4.6	NA
Type A	Unrecorded disposal	UD-03B	07/09/03	14.9	NA
Type A	Unrecorded disposal	UD-01	07/10/03	10.7	NA
Type A	Americium/Nepunium	741-08-C	11/12/03	22.2	NA
Type A	Americium/Nepunium	741-08-D	11/12/03	19.3	NA
Soil-moisture probe	Depleted uranium	DU-10-ME	11/20/03	6.3	5.5
Soil-moisture probe	Depleted uranium	DU-14-M2	11/20/03	12	12

SECTION 5. Materials Fuel Complex at INL [361] [362] [363]

The Materials Fuels Complex (MFC) formerly Argonne National Laboratory-West at INL holds significant inventories or high-level waste (HLW) both in the form of spent nuclear fuel (SNF), special nuclear material (plutonium), high-level waste (HLW), and activated metals from SNF processing and electro-pyro-reprocessing.

In Environmental Defense Institute's (EDI) view, the DOE's Draft Environmental Assessment (EA) [364] on this MFC program fails to provide the public a credible analysis of potential environmental impacts for the use of DOE-owned high assay low-enriched uranium (HALEU) currently stored at Idaho National Laboratory (INL). [365] This literally thumbs DOE's collective nose at the National Environmental Policy Act that this EA is theoretically intended to serve. The proposed use of this HALEU would involve fabrication of advanced reactor fuel from used spent nuclear fuel (SNF) in support of nuclear energy.

DOE fails to document how much sodium-bearing SNF at INL is going to be reprocessed, how much high-level waste (HLW) as defined by the Nuclear Waste Policy Act (NWPA) will be produced and how this HLW will be disposed as required by the NWPA and other relevant statutes. As discussed earlier, DOE's authority to reclassify HLW produced from reprocessing SNF is not a settled legal question. Judge B.Lynn Winmill, Chief Judge U.S. District Court for Idaho, July 2, 2003 states:

> "While DOE has the authority to 'fill any gap left…by Congress,'…it does not have the authority 'to adopt a policy that directly conflicts with its governing statute.'…
> DOE's Order 435.1 directly conflicts with the NWPA's definition of HLW. NWPA's definition pays no heed to techical or economic constraints in waste treatment. Moreover, NWPA does not delegate to DOE the authority to estblish 'alternative requirements for solid waste.' Because Congress has spoken to that subject "that is the end of this matter,' leaving no room for 'alternative requirements'" [366] [Pg. 12]

The MFC inventories of HLW (spent nuclear fuel (SNF), special nuclear material (plutonium), HLW from sodium [367] cooled reactor fuel handling and waste from various specialized nuclear fuel experiments and SNF chemical reprocessing operations and pyro-processing/electro-processing. All of

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[361] Comprehensive Review of Materials Fuel Complex at the Idaho National Laboratory December 2015, Public Comments on US Department of Energy (DOE) Draft HWMA/RCRA Partial Permit, Argonne National Laboratory-West (ANL-W) Idaho National Laboratory (INL) and the following operations: Contaminated Equipment Storage Building (CESB) Hot Fuel Examination Facility (HFEF) Sodium Components Maintenance Shop (SCMS) Sodium Process Facility (SPF) Sodium Storage Building (SSB) Transient Reactor Test Facility (TREAT) EPA ID No. ID4890008952 Idaho Department of Environmental Quality Public Notice April 12, 2004 Docket # 10HW-0404, submitted by Environmental Defense Institute.

[362] Tami Thatcher, EDI, Public Comment for Class 2 Permit Modification Request (PMR) Including a Request for a Temporary Authorization for Proposed Modifications to the Hazardous Waste Management Act (HWMA)/Resource Conservation and Recovery act (RCRA) Permit for the Materials and Fuels Complex (MFC) at the Idaho National Laboratory (INL), Environmental Protection Agency (EPA) Identification Number ID4890008952 (referred to herein as the MFC Permit), September 28, 2017.

[363] Tami Thatcher, Public Comment Submittal on the U.S. Department of Energy Draft Environmental Assessment for Use of DOE-Owned High-Assay Low-Enriched Uranium Stored at Idaho National Laboratory Comment submittal by Tami Thatcher, November 30, 2018.

[364] Pursuant to 10 CFR 1021.321, the U.S. Department of Energy (DOE) has prepared the Draft Environmental Assessment for the Use of DOE-Owned High Assay Low-Enriched Uranium Stored at INL, 10/31/18, DOE-EA-2087. Hereinafter called DOE-EA-2087.

[365] Chuck Broscious, Comments for the Record on U.S. Department of Energy the Draft Environmental Assessment for Use of DOE-Owned High Assay Low-Enriched Uranium Stored at INL, 11/29/18.

[366] B.Lynn Winmill, Chief Judge U.S. District Court for Idaho, July 2, 2003, Memorandum Decision in NRDC v. DOE, Civ. No. 01-0413-S-BLM, pg. 12.

[367] Sodium is highly reactive when exposed to air or water.

these HLW waste materials [368] are covered by Nuclear Waste Policy Act, DOE's Order 435.1 and the P.L. Section 3116 rules. The Nuclear Waste Technical Review Board report on SNF notes the safety issues with MFC inventory of sodium-bearing SNF:

"Sodium-bonded SNF from the Experimental Breeder Reactor 2.

"Sodium-bonded driver fuel element from INL's Experimental Breeder Reactor 2. Corroded SNF elements from a sealed metallic canister, initially air-filled, that leaked while in a water storage basin. After leakage of water into the container, corrosion of the stainless steel cladding in some elements ruptured the cladding. The metallic fuel reacted with water to produce hydrogen gas and uranium corrosion products, and also released radionuclides into the water in the container. Moisture in dry storage containers penetrated small holes—pinhole-sized—in stainless steel cladding surrounding the spent nuclear fuel from a reactor that used sodium for heat transfer (cooling) and reacted vigorously with metallic sodium inside the cladding, creating hydrogen and sodium hydroxide, which split the cladding. Hydrogen evolved and accumulated in the storage canisters due to reaction of water with sodium." [369] [pg.21]

"Sodium SNF

"Not all DOE SNF that is currently stored will be disposed of without processing. As described in Section 5.2.2.4, DOE is using an electrometallurgical treatment at INL to process approximately 22 MTHM of sodium-bonded SNF [foot note 31] that is currently unsuitable for disposal. This process uses an electrorefiner with a molten salt electrolyte to dissolve the fuel. The process separates the cladding from the fuel, which results in the sodium and fission products accumulating in the molten salt. The cladding, along with some added metals, is then converted into a metallic HLW form in a furnace. Once the molten salt reaches its capacity to accumulate radionuclides, the salt and accumulated radionuclides in the salt will be converted into a ceramic **HLW form**. DOE believes these waste forms [370] are acceptable for repository disposal, but this has not yet been confirmed as part of a repository licensing process." [371] [pg. 26]

"**DOE-NE treats sodium-bonded driver SNF by dissolving it in a molten salt medium. This process creates two waste streams (metallic and salt) that are both considered HLW**. Because DOE-NE is not a "waste custodian" and, hence, is not subject to the waste acceptance system requirements that apply to all SNF and HLW that will be disposed in a repository, the fate of these waste streams is uncertain." [372] [pg. 106]

"Approximately 0.25 MTHM of the fuel used in the Fast Flux Test Facility is known as sodium-bonded SNF because it has a small amount of sodium inside the cladding . The remainder of the Fast Flux Test Facility SNF is non-sodium-bonded. In 2008, Hanford shipped the sodium-bonded SNF to INL for processing. Sodium is highly reactive when exposed to air or water. [373] [pg.67] [emphasis added]

"DOE plans to continue treatment of the driver SNF at the Fuel Conditioning Facility that is located at the Materials and Fuels Complex, and evaluate possible interim dry storage of this SNF (Lacroix 2014a, 2014b). In developing its plans, DOE is considering whether the driver fuel is suitable for treatment. For fuel that may not be suitable for treatment, "that will have to be further investigated" (Lacroix 2014b). Other considerations include shipping schedules, processing rates at the Fuel Conditioning Facility, funding, and receipt and storage capabilities indicates that non-EBR-II sodium-bonded SNF stored at the Radioactive Scrap and Waste Facility includes sodium debris bed material [foot note 139] from Sandia National Laboratories." [374]

"5.2.2.4 Treatment and Management of Sodium-bonded Spent Nuclear Fuel

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368 U.S. Nuclear Waste Technical Review Board, Management of U.S. Department of Energy Spent Nuclear Fuel, Report to the United States Congress and the Secretary of Energy, December 2017, Pg. 10. Hereinafter called NWTRB SNF Report. "High-level radioactive waste is the highly radioactive material that results from SNF reprocessing. Historically, reprocessing also separated the fissile material for reuse. All defense-related domestic HLW is owned and managed by DOE. Some of the liquid HLW from reprocessing has been converted to solid form, *e.g.*, by vitrification and calcination, but most HLW created from reprocessing is in tanks in the form of liquid, salt cake, or sludge. The solid waste forms created from the tank wastes is also HLW. Treatment to convert the HLW into a solid form is necessary to meet transportation and disposal requirements."

369 NWTRB SNF Report, Pg. 21.

370 NWTRB SNF Report, Pg. 181. Waste form: Radioactive waste materials and any encapsulating or stabilizing matrix.

371 NWTRB SNF Report, pg. 26.

372 NWTRB SNF Report, pg. 106

373 NWTRB SNF Report, pg. 67

374 NWTRB SNF Report, pg. 88. Foot note 139 states: "139 This material was formed in experiments that used crucibles containing high-enriched uranium dioxide (93% U-235) that were immersed in sodium."

"In 2000, DOE issued a final EIS and record of decision to manage and treat sodium-bonded SNF, which addressed the issue that 'sodium could complicate compliance with the eventual final repository waste acceptance criteria'. DOE currently manages about 55.7 MTHM of sodium-bonded SNF and considers and treats the SNF as hazardous waste. Approximately 34.2 MTHM of this inventory consists of blanket fuel from the Fermi-1 reactor; another 19.2 MTHM, approximately, is blanket fuel from the EBR-II reactor. The remaining roughly 2.3 MTHM is driver fuel from the EBR-II reactor (Box 2-2 describes driver and blanket fuel). In addition, DOE manages a small quantity of sodium-bonded material (approximately 50 kilograms) from experiments at the Hanford Site and Sandia National Laboratories. [375] [pg.94]][Emphasis added]

"DOE is in the process of retrieving the EBR-II fuel and transferring it in 227 shipments to the Materials and Fuels Complex. The remaining shipments of EBR-II SNF to the Materials and Fuels Complex are scheduled to be completed by fiscal year 2022. This will allow DOE to meet the December 31, 2023, deadline—established as part of the 1995 Settlement Agreement—for removing all SNF at INL from wet storage." [376]

SNF using electrometallurgical treatment or to use another treatment method and/or disposal technique." As of 2010, about 85% of the EBR-II fuel remained untreated, and DOE had not made any decision concerning the treatment of Fermi-1 blanket SNF. Since 1996, DOE has treated approximately 4.5 MTHM of sodium-bonded SNF—less than 10% of **the 55.7 MTHM awaiting treatment at INL**. [377] [pg. 95]
[emphasis added]

"***5.3.2.1.5 Continue Treating Sodium-bonded Spent Nuclear Fuel***

"DOE continues to treat sodium-bonded SNF in the Fuel Conditioning Facility at the Materials and Fuels Complex. In fiscal year 2013, **DOE treated approximately 170 kilograms (17 MT)** (DOE 2013e). DOE planned to treat **76 kilograms (76 MT) in fiscal year 2014** (DOE 2013e) and to continue treatments into the future." [378] [emphasis added]

"***Why does sodium-bonded SNF require special consideration and treatment?***
"Metallic sodium reacts with water to produce explosive hydrogen gas and corrosive sodium hydroxide that would likely not be acceptable for geologic disposal" (DOE 2000a). Elemental sodium is considered a hazardous waste and is regulated under the Resource Conservation and Recovery Act (RCRA) of 1976. Sodium-bonded SNF is not listed under RCRA as a hazardous waste, but it could be considered characteristically hazardous under RCRA because of its chemical reactivity.[379] [emphasis added]

"To overcome the waste acceptance obstacle, DOE opted for electrometallurgical treatment for EBR-II driver fuel and small quantities of other miscellaneous sodium-bonded SNF at INL. The treatment uses an electrorefiner with a molten salt electrolyte to dissolve the chopped fuel. This chemical treatment process separates the cladding from the fuel and results in the sodium and fission products accumulating in the molten salt, creating two waste streams that are considered HLW. First, the cladding, along with some added metals, is converted into a metallic HLW form in a furnace. Second, once the molten salt reaches its capacity to accumulate radionuclides, the salt and accumulated radionuclides in the salt will be converted into a ceramic HLW form. After the electrometallurgical treatment of the sodium-bonded SNF, the HLW metallic and ceramic forms created will be stored at the Radioactive Scrap and Waste Facility to await geologic disposal (Hill and Fillmore 2005). Alternatively, the salt waste could be stored and disposed of in a repository other than Yucca Mountain. [380] [emphasis added]

"In contrast to driver SNF, mechanical stripping is an option for blanket SNF cladding, which opens up other treatment alternatives 151 for this type of SNF. Also, 'because of the different physical characteristics of the Fermi-1 sodium-bonded blanket SNF,' decided to continue to store its inventory of this material while alternative treatments were evaluated. According to DOE's record of decision, 'while EBR–II SNF is undergoing electrometallurgical treatment and the Fermi-1 blanket SNF remains in storage, DOE has approximately four years in which to evaluate the operating experience of electrometallurgical treatment technology and further evaluate other alternatives for the Fermi-1 blanket SNF'. The record of decision goes on to state that "after these data are evaluated, DOE will decide whether to treat the Fermi-1 blanket."

"DOE did not include sodium-bonded SNF in the Yucca Mountain license application; This SNF does not meet the waste acceptance technical requirements. Unless the sodium-bonded SNF can be shown to not be regulated under the RCRA, sodium-bonded SNF disposal options need to include either physical removal or chemical

[375] NWTRB SNF Report, pg. 94.
[376] NWTRB SNF Report, pg. 95
[377] NWTRB SNF Report, pg. 95
[378] NWTRB SNF Report, pg. 99.
[379] NWTRB SNF Report, pg. 21
[380] NWTRB SNF Report, pg. 94

deactivation of the sodium. Classifying ceramic and metallic waste products from the electrochemical treatment of sodium-bonded SNF as HLW and disposing of these wastes in a geologic repository will require action to ensure that the waste products meet waste acceptance requirements. These waste forms may need their own DOE waste acceptance product specification, comparable to the specification for vitrified HLW forms." [381] [emphasis added]

"Most of the mass of SNF in the 200 Area Interim Storage Area is from the Fast Flux Test Facility (approximately 10 MTHM). The Fast Flux Test Facility reactor was cooled with liquid sodium. DOE removed any adhering sodium113 from the SNF cladding before storing the fuel. Approximately 0.25 MTHM of the fuel used in the Fast Flux Test Facility is known as sodium-bonded SNF because it has a small amount of sodium inside the cladding (Box 2-2). The remainder of the Fast Flux Test Facility SNF is non-sodium-bonded. In 2008, Hanford shipped the sodium-bonded SNF to Idaho National Laboratory (INL) for processing (Simpson 2010)." [382] [emphasis added]

DOE is apparently using the new Section 3116 HLW reclassifying policy as a way to reclassify the MFC electroprocessing waste product as non-HLW in violation of the NWPA. As the above Nuclear Waste Technical Review Board report notes, unless DOE commits to MFC waste product vitrification there will be problems with repository waste acceptance criteria.

MFC Permit Requested Waste Storage Capacity is Enormous

The requested capacity of the outdoor storage at MFC is enormous compared to other MFC facilities including the Radioactive Scrap and Waste Facility. The storage proposed at the INL's MFC of 666 m^3, 333 m^3 for each asphalt pad, is enormous relative to current MFC facilities storage facilities and relative to the entire INL storage when Rocky Flats transuranic waste is excluded.

The DOE's Environmental Assessment (EA) proposes fabricating approximately only **10 metrics tons** (10,000 g.) of HALEU nuclear reactor fuel, to support near-term research, development and demonstration needs of private-sector developers and government agencies, including advanced reactor developers. The preferred action identified in the EA calls for establishing the capability at INL to fabricate HALEU ceramic and metallic fuels from the HALEU produced through the electrometallurgical treatment system currently operating at INL, and by using other **small** quantities of HALEU stored at INL. Most of the HALEU to be used for "feed stock" fuel fabrication results from the processing and treatment of **10 MT** [383] used fuel from the now-decommissioned EBR-II reactor. DOE is deliberately not disclosing all of the sodium-bonded/sodium cooled SNF eventually it intends to reprocess – discussed more below.

The EA is also leaving out the INL radiological air emissions from other processes at MFC and for the entire INL. The cumulative effects of all INL radiological air emissions have not been presented. And the air emissions from this HALEU processing are going to be harmful and EA does provide a table of which radionuclides are calculated to contribute the most to the dose they've calculated. But the emissions are for long-lived radionuclides that will be in the environment forever. The americium-241 will decay to unstable radionuclides that will keep decaying.

DOE announces the 2,000 ^{0}C electrometallurgical treatment [384] of SNF High-Assay Low-Enriched Uranium. [385] DOE's HALU EA "Radiological Impacts of Atmospheric Releases" only uses one of the two MFC reprocessing facilities (2,500 kg of HULU feedstock) to estimate the annual emissions. "Alternative 1a, assumes two processing facilities at MFC that would process 2,500 kg annually for a total of 5,000 kg processes at MFC." [386] This is intentionally deceptive by only showing ½ of production

[381] NWTRB SNF Report, pg. 100

[382] NWTRB SNF Report, pg. 67

[383] Environmental Assessment for Use of DOE-Owned High-Assay Low-Enriched Uranium Stored at Idaho National Laboratory Draft October 2018 DOE/EA-2087, Pg. 3. Herein after DOE/EA-2087.

[384] DOE/EA-2087, Pg.13.

[385] DOE/EA-2087

[386] DOE/EA-2087, Pg.14.

emissions. Also the EA does not offer the total emissions for reprocessing all of the 10 MT SNF let alone the rest of the sodium SNF processing.

DOE's deception extends to the total amount of sodium-bonded fuel slated for reprocessing at MFC. "**Since 1996, DOE has treated approximately 4.5 MTHM of sodium-bonded SNF—less than 10% of the 55.7 MTHM awaiting treatment at INL."** [387]

DOE's EA "Waste Management" only reports 218 m^3 attributable to MFC but states: "During FY-2018, INL sent 934 m^3 low-level waste (LLW) to off-site facilities for disposal. INL would accumulate and store any waste generated per federal and state regulations, and if required treat and disposed at an off-site permitted/licensed facility." [388]

Regardless what DOE wants to classify the MFC SNF reprocessing waste as – it still is HLW as defined by the NWPA and must be disposed in a deep geologic repository. [389]

DOE is pushing this nuclear fuel program when there is no market for new reactors [390] and most importantly nowhere to put the SNF and high-level waste generated by the HALEU processing nor the SNF after use in current reactors. The Nuclear Waste Technical Review Board report on SNF as it relates to limited HLW disposal options notes:

> "The MFC activated metals [waste] will be RH LLW in that package contact dose is expected to routinely exceed 200 mR/hr. and like the NRF and ATR activated metals could reach 30,000 R/hr. The activated metal would be classified under 10 CFR 61 typically as Class B and C with **some exceeding Class C."** [391] [emphasis added]

The EA is leaving out the complete disposal accounting of MFC Sodium-bonded SNF and HLW Produced by HALEU Reprocessing.

As previous noted, **"**DOE continues to treat sodium-bonded SNF in the Fuel Conditioning Facility at the Materials and Fuels Complex. In fiscal year 2013, **DOE treated approximately 170 kilograms** [170 MT]. DOE planned to treat **76 kilograms in fiscal year 2014** (DOE 2013e) and to continue treatments into the future." [392] [393]

An example of the uncertainty of the quantity of sodium-bonded SNF at INL that will require reprocessing and will produce high-level waste (HLW) the Hanford Fast Flux Test Facility shipped to INL (shown below 10 MTHM) is included in the above table. As previously cited:

> "Most of the mass of SNF in the 200 Area Interim Storage Area is from the Fast Flux Test Facility (approximately 10 MTHM). The Fast Flux Test Facility reactor was cooled with liquid sodium. DOE removed any adhering sodium113 from the SNF cladding before storing the fuel. Approximately 0.25 MTHM of the fuel used in the Fast Flux Test Facility is known as sodium-bonded SNF because it has a small amount of sodium inside the cladding (Box 2-2). The remainder of the Fast Flux Test Facility SNF is non-sodium-bonded. In 2008, Hanford shipped the sodium-bonded SNF to Idaho National Laboratory (INL) for processing (Simpson 2010)." [394] [emphasis added]

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[387] NWTRB SNF Report, pg. 95

[388] DOE/EA-2087, Pg.12.

[389] NWTRB SNF Report, pg. 81. "The approximately 56 MTHM of sodium-bonded SNF in [Figure 5-3] Group 31 will be processed into two solid forms of high-level radioactive waste and will not be transported as SNF."

[390] Dan Pope, A Northwest distaste for nuclear power, Originally published Seattle Times, July 31, 2008, Updated July 31, 2008.

[391] INL/EXT-06-11601 Rev. 1, Pg. B-2

[392] NWTRB SNF Report, pg. 99. Metric ton = 1,000g = kilograms; This is different (includes total wt. (fuel + cladding) than a metric ton heavy metal (includes uranium/plutonium).

[393] DOE. 2013e. *Department of Energy FY 2014 Congressional Budget Request Energy Efficiency and Renewable Energy, Electricity Delivery and Energy Reliability, Nuclear Energy, Race to the Top for Energy Efficiency and Grid Modernization, Fossil Energy Research and Development, Naval Petroleum and Oil Shale Reserves, Strategic Petroleum Reserve, Northeast Home Heating Oil Reserve, Ultra-Deepwater Unconventional Natural Gas, Elk Hills Lands Fund, Advanced Tech. Vehicle Manufacturing Loan Program, Title 17 Innovative Tech. Loan Guarantee Program, Energy Information Administration*. DOE/CF-0086, Vol. 3. April.

[394] NWTRB SNF Report, pg. 67

Sodium-bonded fuel at INL Table

INL Storage Site	Used Fuel Type	Quantity in MTHM *
Materials and Fuels Complex (MFC)		
Radioactive Scrap and Waste	EBR-II driver fuel	2.30
Facility (RSWF)	EBR-II blanket fuel	19.20
	Han. FFTF driver	10.00
Hot Fuel Examination Facility	Han. FFTF driver	0.01
Idaho Nuclear Engineering and Technology Center (INTEC) (only the sodium bearing fuel)		
CPP-666 (wet)	EBR-II driver fuel	2.00
CPP-749 (dry)	Fermi-1	34.20
	Totals	~57.71 **
Sodium-bonded SNF treated at MFC		
In fiscal year 2013		17 MT
In fiscal year 2014 [395]		76 MT
Total Sodium-bonded SNF treated		93 MT ***

Source: Management of U.S. Department of Energy Spent Nuclear Fuel, December 2017, U.S, Pg. 94.
* MTHM = metric ton heavy metal (uranium); this understates the weight of the fuel that includes cladding and attached parts.
** DOE does not offer a clear inventory of sodium SNF in the EA or in other publicly available reports; so this total is an estimate based on what EDI has found to date. Also the above table does not include the 170 kilograms treated in 2013 and 76 kilograms treated in 2014.
*** Metric ton (MT) is the total weight of the fissile material + the cladding and attached parts.

Materials and Fuels Complex has treated roughly 4.5 MTHM of sodium-bonded SNF (driver fuel) since 1996. The two waste forms are Ceramic and Metal Waste HLW forms stored at the MFC's Radioactive Scrap Waste Facility (RSWF). The discrepancy between the 4.5 MTHM and the table above showing 93 MT treated at MFC cannot be solely attributed to cladding but more likely the difference between the sources (DOE and the more independent NWTRB) analysis and/or the dates of the reports. The public is intentionally thus left in the dark.

Activated metals produced during MFC SNF reprocessing

> **"**The Materials and Fuels Complex (MFC) will generate activated metals during waste segregation operations in the planned Remote Treatment Project (RTP) [now called the Remote-Handled Waste Disposal Facility]. LLW stored at MFC consists primarily of irradiated reactor subassembly hardware that has been drained of sodium and fuel removed. The hardware is typically stainless steel. LLW is stored in a number of configurations including pre-1978 waste cans, and in the post 1978, HFEF 5-Cask waste cans. Some of the LLW is co-mingled with other waste types and will have to be retrieved and sorted in RTP. The operations are expected to produce ~6 m3/y (as packaged estimate) of activated metal. The MFC activated metals will be RH LLW in that package contact dose is expected to routinely exceed 200 mR/hr. and like the NRF and ATR activated metals could **reach 30,000 R/hr.** The MFC activated metal would be classified under 10 CFR 61 typically as Class B and C with about 50% exceeding Class C. No specific activity information is included. The RTP is expected to operate FY 2012 through 2035." [396]

DOE's EA makes no declaration of this critical Greater-Than- Class C waste produced by MFC HALEA SNF reprocessing nor the ability of the INL Remote-Handled Waste Disposal Facility to safely

[395] NWTRB SNF Report, pg. 99.
[396] INL/EXT-06-11601 Rev. 1, Section B.2-4.

isolate this HLW from the environment in violation of the Nuclear Waste Policy Act (NWPA) that states in pertinent part:

> "In this case, Congress defined HLW in NWPA as 'highly radioactive material resulting from the reprocessing of spent nuclear fuel.' Congress then used the word 'including' to signal that what followed were examples designed to illustrate the definition just given. The two examples designated to illustrate the definition just given. The two examples are (1) 'liquid waste produced directly in reprocessing'; and (2) 'solid material derived from such liquid waste that contains fission products in sufficient concentrations.'" [Pg.10]
>
> "NWPA's definition of HLW considers the source of the waste and, in the case of solids derived from liquid waste, its hazard. It is undisputed that the waste stored at Hanford, INEEL, and Savannah River is highly radioactive and the result of reprocessing. No solids are yet been extracted from the liquid waste at those sites and treated to reduce fission products. Thus, the waste at issue in this case falls within NWPA's definition of HLW." [397] [Pg.11]
>
> "**Nuclear Waste Policy Act** The federal statute enacted in 1982 that establishes both the Federal Government's responsibility to provide a place for the permanent disposal of high-level radioactive waste and spent nuclear fuel, and the nuclear power generators' responsibility to bear the costs of permanently disposing of commercial spent nuclear fuel. Amendments to the Act in 1987 limited the Federal Government's site characterization activities to a possible geologic repository at Yucca Mountain, Nevada. The Act provides for extensive state, tribal, and public participation in the planning and development of permanent repositories." [Pg.180]
>
> "Finding: DOE's aging management programs are not fully implemented. Some DOE SNF storage facilities lack aging management programs to facilitate retrieving stored SNF and packaging it into multi-purpose canisters needed to transport it to either a centralized interim storage facility or a permanent repository." [398] [Pg.7&8]

EDI understands full well that all sodium-bonded and sodium cooled SNF must be treated in order to meet any HLW repository waste acceptance criteria (RCRA prohibition of sodium), but DOE is attempting to use the HALEU reprocessing to reclaim the usable uranium for nuclear fuel without dealing with the HLW produced in the process. **The critical issue is: DOE is not treating the waste produced by processing this class of SNF as a HLW and NOT directly making it "road-ready" for disposal in a NRC geologic HLW repository as required by the 1995 Settlement Agreement and the Nuclear Waste Policy Act. DOE is simply illegally dumping it in the Remote-handled Waste Disposal Facility at INL.**

The extensive deficiencies of this EA, EDI discusses above, demonstrate that a full MFC Environmental Impact Statement or preferably a Programmatic Environmental Impact Statement be prepared to fulfill the requirements of the National Environmental Policy Act for the reprocessing of sodium-bonded and sodium-cooled SNF.

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[397] B.Lynn Winmill, Chief Judge U.S. District Court for Idaho, July 2, 2003, Memorandum Decision in NRDC v. DOE, Civ. No. 01-0413-S-BLM, pg. 11.
Also see Settlement Agreement/Consent Order that states: "3. DOE shall treat all high-level waste currently at INEL so that it is ready to be moved out of Idaho for disposal by a target date of 2035." Pg.3

[398] U.S. Nuclear Waste Technical Review Board, Management of U.S. Department of Energy Spent Nuclear Fuel, Report to the United States Congress and the Secretary of Energy, December 2017, Page 7&8

SECTION 6. Remote-Handled Waste Disposition Project [399]

Summary

DOE/INL solution to properly manage "orphan waste" that has no permitted/regulatory compliant path forward for disposal especially the non-compliant remote-handled highly radioactive waste that EDI considers under the NWPA restrictions would be considered HLW.

Some of this waste interned in the Remote-Handled Waste Disposition Project formerly called Remote-Handled Low-Level Waste Disposal Facility [400] is Greater-Than-Class C waste (GTCC LLW) discussed more in SECTION 7 below and **"**transuranic waste having characteristics similar to GTCC LLW (referred to as GTCC-like waste) and which may not have an identified path to disposal in the scope of this EIS." DOE's 2018 Site Treatment Plan does not have any mention of GTCC waste. [401] So basically, DOE is not considering this significant waste class. Given DOE's history at INL we can legitimately expect this facility to be a permanent dump since it is "orphaned" without a disposal pathway.

DOE's short-cut Final Environmental Assessment (FEA) and attached Finding of No Significant Impact of the Remote-Handled Low-Level Waste Disposition Facility (RHWDP) are a violation of the National Environmental Policy Act (NEPA) that – if appropriately applied - would require a full Environmental Impact Statement (EIS) given the major potential environmental, health and safety impact of this project. Moreover, given DOE/INL gross mismanagement of existing nuclear waste disposal at the Idaho National Laboratory (INL) over six decades – resulting in extensive contamination of the underlying Snake River Aquifer, the public has no confidence that this new highly radioactive near-surface dump will not further impact their health and safety. [402] Thus, at the minimum, a full scale EIS should have been conducted. EDI and KYNF won a lawsuit against DOE forcing a full EIS on 2008 inadequate EA on an incinerator at INL AMWTP. [403]

DOE's management of HLW at INTEC and MFC from processing sodium cooled/bonded SNF according to the 2018 INL Site Treatment Plan:

> "The Remote-Handled (RH) Waste Disposition Project (RWDP) transfers RH waste from INL storage areas and prepares the waste for shipment and disposal. This project manages RH-TRU and RH-MLLW. Additionally, some of the RH waste is contaminated with contaminants that require treatment in CPP-659 or CPP-666 (sort, segregate, absorb, size, and react) before disposal. These contaminants include sodium (Na) and sodium potassium (NaK), which present significant handling and treatment challenges. CPP-666 and CPP-659 have several permitted treatment processes for Na and NaK. The CPP-666 Fluorinel Dissolution Process Area (FDPA) Sodium Distillation System (SDS) treats Na- and NaK-contaminated debris. Additionally, the CPP-666 FDPA cell and CPP-659 decon cell are permitted for water and air treatment of Na and NaK. CPP-659, CPP-666, and CPP-1617 are permitted waste storage areas, with the majority of the waste stored in CPP-1617." [404] [STP-3-5]

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[399] Review of U.S. Department of Energy Final Environmental Assessment Replacement Capacity for Disposal Remote Handled Low-Level Waste Generated at Idaho National Laboratory, December 2011, DOE/FEA-1793 [399] Submitted by Chuck Broscious on behalf of Environmental Defense Institute 3/30/17 [Rev12]
Also see EDI special report *Unwarranted Confidence in DOE's Low-Level Waste Facility Performance Assessment The INL Replacement Remote-Handled Low-Level Waste Facility Will Contaminate Our Aquifer for Thousands of Years. b*y Tami Thatcher , http://www.environmental-defense-institute.org/publications/rhllwFINALwithFigs4.pdf

[400] DOE apparently did not like the "Disposal Facility" name so now it is the "Disposition Project" due to the "optics."

[401] Idaho National Laboratory Site Treatment Plan, January 2018, INL-STP Revision 37. Hereinafter INL-STP

[402] See EDI Snake River Plain Aquifer Report available at, www.environmental-defense-institute.org

[403] In the United States District Court for the District of Idaho, Keep Yellowstone Nuclear Free, Environmental Defense Institute, et.al. (Plaintiffs,) v. United States Department of Energy, (Defendants), DECISION AND ORDER, Filed 04/28/2008. In this case, plaintiffs forced DOE to conduct a full EIS related to INL Advanced Mixed Waste Treatment that had originally planned on a plutonium/transuranic waste incinerator. DOE subsequently eliminated the incinerator.

[404] STP Section 3.2.5 Remote-Handled Waste Disposition Project (CPP-659, CPP-666, CPP-1617), Pg. 3-5. https://www.deq.idaho.gov/media/60179380/inl-annual-site-treatment-plan-report-1116.pdf

Given that DOE/INL constructed the RWDP to be in operation for **at least 50 years**, and given their resistance unless ordered by a federal court order [405] to remove waste once dumped at INL, the public is forced to assume this is a permanent disposal repository. The waste slated is some of the most radioactively toxic in the world and will remain so for millennia – long after DOE is gone - the long-lived radionuclides will still toxic and migrate into the aquifer. For instance, plutonium-242 and Tecnecium-99 will have only lost half their toxicity in 376,500 yrs. and 16,700 yrs. respectively. [406] [407]

Congress and DOE's unwillingness to open a deep geologically permanent repository for this waste that laws [408] normally disallow in shallow sub-surface disposal means Idaho is forced to accept it because EPA and the State of Idaho are in concurrence. The State of Nevada successfully blocked opening Yucca Mt. high-level waste repository because it was so poorly designed that even EPA would not permit it. DOE is experiencing the problem of waste stream constipation which as DOE intends will leave it in Idaho.

DOE presents these EAs to convince the state and the public that their design will survive whatever potential environmental or other intrusion will develop over 500 years the laws require. For pertinent perspective, Idaho has only been a state for ~127 years. [409] DOE as an agency, has only existed for about 37 years. For DOE's unelected officials to be making decisions that could affect residents of Idaho for 100s of thousands of years is shamefully unacceptable. It must not be the responsibility of Idahoans who depend on safe water to solve DOE's waste "path-forward" problems.

Not only do DOE RWDP related reports have significantly different R-H waste inventory but DOE further confuses the public by publishing two different versions of the Final EA.

> Final Environmental Assessment for the Replacement Capability for Disposal of Remote-Handled Low-Level Radioactive Waste Generated at the Department of Energy's Idaho Site, Final December 2011 DOE/EA-1793. Final Environmental Assessment for the Remote-handled Waste Disposition Project February 2009, DOE/EA-01386

Huge discrepancies exist between the above DOE EA reports as well as related DOE reports directly related to and "supporting" the decision-making for the Remote-Handled Waste Disposal Project (RWDP) concerning current waste inventories volumes and activity levels. This EDI Review discusses many of these discrepancies in these reports; fundamentally this raises serious questions about the reliability of DOE's final EA. Again, this constitutes prima facie evidence for the case for conducting a full Environmental Impact Statement. Below, EDI will make a case supporting the need for a full EIS.

Specific Deficiencies of this Environmental Assessment (FEA)

1. No consideration of alternate dump sites on INL that are NOT over the aquifer;
2. No detailed waste characterization (including curie content) of known waste streams slated for dump internment for the following INL operations;

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[405] In The United States District Court for the District of Idaho, Cecil Andrus, Governor (Plaintiff) v. United States of America (Defendant), CIVIL No. 91-0035-S-HLR (lead case), 91-0054-S-HLR, Memorandum Opinion, 6/29/93. Herein after Consent Order. See at; http://www.deq.idaho.gov/inl-oversight/oversight-agreements/1995-settlement-agreement/

[406] Explanation of Significant Differences Between Models Used to Assess Groundwater Impacts for the Disposal of Greater-Than-Class C Low-Level Radioactive Waste and Greater- Than-Class C-Like Waste Environmental Impact Statement (DOE/EIS-0375-D) and the Environmental Assessment for the INL Remote-Handled Low-Level Waste Disposal Project (INL/EXT-10-19168) August 2011. Herein after INL/EXT-10-19168.

[407] Boyd D. Christensen, Hazard Classification of the Remote Handled Low-Level Waste Disposal Facility EFCOG Safety Analysis Workshop 2012, Boyd D. Christensen, May 2012 INL/CON-12-25627

[408] 10 CFR §60.2 RAD Waste Definitions states in pertinent part: "(5) Waste that will not decay to levels which present an acceptable hazard to an intruder within 100 years is designated as Class C waste. This waste is disposed of at a greater depth than the other classes of waste so that subsequent surface activities by an intruder will not disturb the waste. Where site conditions prevent deeper disposal, intruder barriers such as concrete covers may be used. The effective life of these intruder barriers should be 500 years. A maximum concentration of radionuclides is specified for all wastes so that at the end of the 500 year period, remaining radioactivity will be at a level that does not pose an unacceptable hazard to an intruder or public health and safety. Waste with concentrations above these limits is generally unacceptable for near-surface disposal."

[409] Idaho won statehood in the USA in 1890.

a. Naval Reactor Facility (Naval Nuclear Propulsion Program) ;
b. Advanced Test Reactor;
c. Materials and Fuels Complex (MFC) (formally Argonne National Lab – West) to include the restart of the Transient Reactor Test Facility;
d. Idaho Nuclear Engineering and Technology Complex (INTEC) formerly called Idaho Chemical Processing Plant (ICCP);
e. Other specific INL operations to include RWMC non-compliant WIPP/ICDF waste;
f. Other Non-INL waste shipped to INL (past/future);

3. No cumulative radioactive/curie content of annual/final estimate waste to be dumped;
4. Inadequate flood plain documentation; the RHWD site is located in a flood zone, above the Snake River Plain Aquifer and right beside to the Big Lost River;
   a. Analysis for INL's RH-LLW facility downplays the flooding harm and then basically completely ignores the acceleration of contaminants from flooding;
   b. The analysis assumes constant precipitation levels and geologic stability. It purports to give average ingestion doses but the doses may be far higher than stated in the analysis;
5. Inadequate disclosure of Greater than Class-C Low-level waste slated for the dump. According to Nuclear Regulatory Commission regulations, GTCC waste is prohibited from shallow landfill dumps and must be interred in a deep geologic repository; [410]
6. No consideration of credible onsite interim "road-ready" storage currently operating;
7. No cumulative doses from all INL operations to the aquifer – the public has a right-to-know how much this new dump will add to existing INL contamination to the aquifer and general environment;
8. Inadequate consideration of "Consent Order" compliance that all high-level, transuranic and alpha-emitting waste is to be shipped out of state for permanent disposal. [411]

"Methodology-Hazardous Material Inventory

"RHLLW is considered to be any waste container with contact radiation dose rate (including neutron and beta radiation) > 200 mrem/hr. Waste streams generated at ATR may include waste containers with radiation exposures up to 30,000 R/hr at near contact, and NRF waste streams may be encountered with exposure up to 60,000 R/hr at near contact that will be accepted for storage at RH-LLW disposal facility.

"Preliminary evaluations of the waste streams proposed in this facility indicate that the waste streams involved do not contain significant quantities of fissionable material. A 15 gram limit in waste shipments would be compliant with transportation limits of 40 CFR 173.424(h) and <u>would be low enough that criticality would be a credible event even when considering multiple waste containers per vault and also considering potential interaction between adjacent vaults.</u>

"The waste streams destined for disposal at the proposed facility consist largely of activated reactor hardware, highly radioactive process materials, and resins form coolant purification systems. The reactor hardware waste streams are characterized as consisting of mostly activated metals with Co-60 being a principle component. The resin waste is comprised on contaminants removed from primary cooling systems and contains quantities of fission generated isotopes in addition to activation products. In no case will reactor fuel be considered for disposal at this facility." [412] [Pg.4] [emphasis added]

Siting Issues with Remote-Handled Low-Level Waste Disposal Facility

Consistent with all of DOE's decision-making, cost reigns. The siting choice of the RWDP is largely based where the digging is easy – in the loose alluvial soils along the Big Lost River as opposed to sites in the northeastern INL not above the aquifer but where soil depth is shallow. The original siting of the RWMC was based on the same failed logic.

[410] Title 10 Code of Federal Regulations (CFR) Subsections 72.3 and 61.55
[411] Consent Order. See Summary Section above for complete list of related ID v. DOE Orders.
[412] Boyd D. Christensen, Hazard Classification of the Remote Handled Low-Level Waste Disposal Facility EFCOG Safety Analysis Workshop 2012, Boyd D. Christensen, May 2012, page 4, INL/CON-12-25627

The FEA states: "The scope of the proposed action only addresses the need for **final disposal location** of remote-handled LLW waste generated by various operations at various facilities on the INL Site. The environmental impacts from operating facilities at the INL Site that will or may generate remote-handled LLW in the future are out of the scope of this FEA." [413] [Emphasis added] The public is justifiably angry that DOE and the Navy is building yet another permanent nuclear waste dump [414] in a flood zone and over the sole-source aquifer that due to over 6 decades of mismanagement is extensively contaminated.

Waste Stream	Maximum TRU content (nCi/g)	Maximum Co-60 content (Ci)	Maximum Fissile Material Content (g)
NRF activated metals	5.4	2500	0.06
	5.4	7000	0.15
NRF resins	7.4	159	0.17
	7.4	443	0.48
ATR activated metals	0	2000	0
ATR resins	5.0	44	1.2
MFC legacy waste (RSWF)	0.4	337	6.5
MFC future (HFEF)	26	<0.001	0.11

Table 1. Maximum concentration of selected inventories [415]

The Environmental Protection Agency (EPA) and the Idaho Department of Environmental Quality (IDEQ) are in collaboration (with the exception of former Governor Andrus' 1995 Settlement Agreement/Consent Order) with INL's six decade long mismanagement of INL waste disposal because they deliberately failed to exercise their regulatory/legal oversight. These regulatory agencies with jurisdiction must demand a full EIS of the INL new RWDP and make their comments available to the public. EPA, Nuclear Regulatory Commission, and the IDEQ bothered to even comment on the closely related Greater-than-Class-C (GTCC) Waste EIS despite DOE's disclosed intent to construct a new GTCC and Transuranic waste dump at INL now known as the Remote-Handled Waste Disposition Project (RWDP). [416] Where is their "due-diligence "as regulators?

The FEA states: "No other federal or state agencies were formally consulted during preparation of this Environmental Assessment." [417] DOE's Notice of Intent states: "**In addition, DOE proposes to include DOE LLW and transuranic waste having characteristics similar to GTCC LLW (herein referred to as GTCC-like waste) and which may not have an identified path to disposal in the scope of this EIS**." [Emphasis added] [418]

[413] FEA-1793, pg. A-9.

[414] INL currently has 2 permanent mixed hazardous/radioactive waste dumps in flood zones (ICDF, RWMC and the MFC Remote-handled Waste Storage underground dump. The new RHWD will be the third.

[415] INL/CON-12-25627, page 4

[416] "Greater-than-Class-C (GTCC) Waste is defined as radionuclide concentrations exceeding the limits for Class C LLRW as provided in 10 CFR 61.55 and requires isolation from the human environment for a longer period of time than do Class A, B, and C LLRW, which are disposed of in existing commercial disposal facilities. GTCC LLRW consists of activated metals from the decommissioning of nuclear reactors, disused or unwanted sealed sources, and Other Waste. GTCC "Like" waste consists of LLRW and potential non-defense generated TRU waste that has no identified path for disposal. The use of the term "GTCC-like" is not intended to and does not create a new DOE classification of radioactive waste." DOE GTCC EIS.

[417] FEA-1793 pg. 6-1

[418] Federal Register / Vol. 72, No. 140, DOE Notice of Intent, 7/23/07.

DOE fails to disclose if this new dump is permanent. "At the end of the operational life [50 years] of the disposal facility, an engineered cover would be placed over the disposal vaults." [419] This sounds permanent by any reading and consistent with past INL waste dumps. "Engineered covers" will not survive adequate institutional control willing to maintain them.

> "INL also provides infrastructure and research, development, and testing for other federal tenants and sponsors. Remote-handled LLW could be generated over the next 50 years from other INL support facilities and operations as part of ongoing activities (such as spent nuclear fuel management) or from potential new missions." [420]
>
> "The alternative of interim storage involved storage of remote-handled LLW at either the generator facilities or another acceptable, safe location until disposal capability is available. The generator facilities have very limited storage capacity available and there are no plans to expand interim storage capability. No other facilities exist or are planned onsite that could accommodate the remote-handled LLW for interim storage. Even if storage were available, implementation of an alternative for storage instead of disposal does not provide for permanent disposal of remote-handled LLW generated at the INL site beyond 2017." [421] [emphasis added]
>
> The FEA states: "The alternative of storage for decay considered storage of remote-handled LLW for sufficient time to enable its radioactive source term to decay to levels that would make it acceptable for disposal as contact-handled LLW. Storage for over 80 years would be required to provide time for the remote-handled LLW isotopes to decay to contact-handled LLW. Storage facilities do not exist to support this alternative. Even if storage were available, disposal capability for 80 to 130 years in the future is uncertain. In addition, an alternative for storage instead of disposal does not provide for permanent disposal of remote-handled LLW generated at the INL site beyond 2017." [422] [emphasis added]

The above FEA statements are grossly miss-leading because it fails to acknowledge existing onsite temporary "road-ready" storage of highly radioactive waste. The INL INTEC has for many years managed (Independent Spent Fuel Storage Instillation) – under NRC permit – heavily shielded dry casks filled with waste as interim-storage pending final geologic disposal facility availability.

SECTION 7. Greater-Than-Class C Low-Level Waste Issues [423]

Summary

Environmental Defense Institute's (EDI) comments on DOE's Draft Greater-than-Class-C GTCC waste EIS must be considered because Department of Energy (DOE) fails to include all relevant legacy waste under the department's control. Also see GTCC waste discussed in SECTION 6 RWDP above. Additionally, below referenced Bodman letter submitted previously does not include all of Idaho National Laboratory (INL) stranded waste issues resulting from the Nuclear Navy Propulsion Program (NNPP) Expanded Core Facility HLW SNF processing that has no disposal path forward. INL's Naval Reactors Facility part of the NNPP and generates the most GTCC waste at INL.

Given the documented evidence of long-lived radioactive and hazardous waste migration into the INL underlying Snake River Plain Aquifer, and DOE current near-surface dumping and proposed additional waste dumping in "soil vaults" at the INL Radioactive Waste Management Complex must stop. This waste must be returned to generator within six months of receipt as specified in Idaho/DOE Settlement Agreement where it can be put in generators robust above ground safe/monitored storage until a licensed disposal site is established outside of Idaho.

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[419] FEA-1793, pg. 2-5
[420] FEA-1793 pg. 2-2
[421] FEA-1793 pg. 2-4
[422] FEA-1793, page 2-5
[423] Comments On U.S Department of Energy Draft Environmental Impact Statement for the Disposal of Greater-Than-Class C (GTCC) Low-Level Radioactive Waste and GTCC-Like Waste (DOE/EIS-0375-D) February 2011, Submitted by Chuck Broscious, May 12, 2011.

The GTCC draft EIS fails to discuss alternatives for the current Navy highly radioactive SNF process waste and other Spent Nuclear Fuel dumped at INL because there is no current National Environmental Policy Act (NEPA) analysis for what to do with this waste because the 2001 INL High-Level Waste Management EIS assumes Yucca Mt. as a deep geologic disposal site. All 23 INL EIS/EA dubiously assume Yucca Mt. repository. The Navy considers its operations a national security that must be kept secret from any disclosure – consequently even their HLW waste management data is classified.

DOE generated a new waste category called "Greater-than-Class-C-Like Low-level waste" (GTCC-LLW). "Most of the DOE GTCC-like waste consists of transuranic waste [424] (a DOE waste category) that may have originated from non-defense activities and therefore may not be authorized for disposal at WIPP under the Waste Isolation Pilot Plant Land Withdrawal Act of 1992 and has no other currently identified path to disposal." [425]

"The NRC regulations at 10 CFR 61.5(a)(2)(iv) define GTCC LLW as that waste which would require disposal in a geologic repository as defined in 10 CFR Part 60 or 63… although NRC regulations state that GTCC LLW is generally not acceptable for near surface disposal." [426]

So DOE is apparently violating statutes/regulations and taking the least expensive route by leaving the RWMC SNF and INTEC SNF reprocessing tank solids in place and grouting the remaining tank and concrete vault and thus avoiding the expensive disposal path forward problem. The same applies to MFC SNF reprocessing high-level waste.

NRC regulations on Class C Low-level waste classification state:

> "Waste that is not generally acceptable for near-surface disposal is waste for which form and disposal methods must be different, and in general more stringent, than those specified for Class C waste. In the absence of specific requirements in this part, such waste must be disposed of in a geologic repository as defined in part 60 or 63 of this chapter unless proposals for disposal of such waste in a disposal site licensed pursuant to this part are approved by the Commission." [427]

NRC 10 CFR § 60.1 Purpose and scope states: "This part prescribes rules governing the licensing (including issuance of a construction authorization) of the U.S. Department of Energy to receive and possess source, special nuclear, and byproduct material at a geologic repository operations area sited, constructed, or operated in accordance with the Nuclear Waste Policy Act of 1982, as amended."

> "*Radioactive waste* or *waste* means HLW **and other radioactive materials** other than HLW that are received for emplacement in a geologic repository. [emphasis added]
>
> "HLW includes irradiated reactor fuel as well as reprocessing wastes. However, if DOE proposes to use the geologic repository operations area for storage of radioactive waste other than HLW, the storage of this radioactive waste is subject to the requirements of this part.
>
> "Conditions that permit the emplacement of waste at a minimum depth of 300 meters from the ground surface. (The ground surface shall be deemed to be the elevation of the lowest point on the surface above the disturbed zone.)
>
> "*Geologic setting*. The geologic repository shall be located so that pre-waste-emplacement groundwater travel time along the fastest path of likely radionuclide travel from the disturbed zone to the accessible environment shall be at least 1,000 years or such other travel time as may be approved or specified by the Commission.
>
> "The release rate of any radionuclide from the engineered barrier system following the containment period shall not exceed one part in 100,000 per year of the inventory of that radionuclide calculated to be present at 1,000 years following permanent closure, or such other fraction of the inventory as may be approved or specified by the Commission; provided, that this requirement does not apply to any radionuclide which is released at a rate less than

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[424] "Transuranic waste is radioactive waste containing more than 100 nanocuries of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years, except for (1) high-level waste; (2) waste that the Secretary of Energy has determined, with concurrence of the Administrator of EPA, does not need the degree of isolation required by the 40 CFR Part 191 disposal regulations; (3) waste that the NRC has approved for disposal in a case-by-case basis in accordance with 10 CFR Part 61."

[425] Federal Register/Vol. 72, No 140, 7/23/07/Notices.

[426] Ibid. pg. 40137.

[427] 10 CFR Part 61.55 (Waste Classification) Last updated: 4/12/2012.

0.1% of the calculated total release rate limit. The calculated total release rate limit shall be taken to be one part in 100,000 per year of the inventory of radioactive waste, originally emplaced in the underground facility that remains after 1,000 years of radioactive decay." [428]

The joint 5/14/08 letter to Department of Energy (DOE) Secretary Bodman by five organizations lead by Natural Resources Defense Council correctly challenged the Amendment to DOE's Waste Management Programmatic Environmental Impact Statement (PEIS) Record of Decision (ROD) and accompanying Supplement Analysis 3/7/08 and 2/08 respectively.

Specifically, this Bodman letter questions DOE's "proposed action of shipping up to 9,019 cubic meters of contact-handled (CH) and remote-handled (RH) [to radioactive for human contact] transuranic (TRU) waste to the Idaho National Laboratory (INL) and to the Waste Isolation Pilot Plant (WIPP)." DOE offers no evidence that this waste shipped to INL meets WIPP Waste Acceptance Criteria and therefore will become stranded at INL with no path forward for disposal. [429] This joint letter to Secretary Bodman continues; "Thus, if those waste streams are included in the proposed action, they would be 'stranded' at INL, in violation of the Idaho Settlement Agreement. That possibility for those waste streams is not analyzed in the ROD or [Supplement Analysis] SA." [430] [emphasis added]

Other Stranded Highly Radioactive Waste at INL

Below EDI offers another category of "stranded" or "orphaned" [431] waste resulting from Spent Nuclear Fuel (SNF) shipped to INL for processing that generates non-TRU RH waste that cannot be sent to WIPP or any other disposal site. [432] DOE designated INL as the central collection site for all SNF (foreign and domestic) with stainless steel/zirconium cladding. Ongoing processing at INL Idaho Nuclear Technology Center (INTEC) of this imported SNF for reprocessing/ storage/ disposal also generates significant amounts of remote handled highly radioactive waste that falls in the category of Greater-than-Class C (GTCC) low-level waste. [433]

DOE created a new category of waste called GTCC-"**Like**" waste that contains TRU waste [434] and/or mixed radioactive and hazardous waste regulated under the Resources Conservation Recovery Act (RCRA) that also fails to meet WIPP Acceptance Criteria (WIPP/WAC). DOE estimates the combined stored and near-term projected GTCC and GTCC-like waste volume at 5,600 cubic meters containing 140 million curies [435] of radioactivity. [436]

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[428] 10 CFR Part 60.1 and 60.2; (Disposal of High-level Radioactive Waste in Geologic Repository).

[429] In addition, DOE proposes to include DOE low-level waste (LLW) and transuranic (TRU) waste having characteristics "like" greater-than-Class-C (GTCC) LLW and which may not have an identified path to disposal (hereafter referred to as GTCC-**like** waste) in the scope of this EIS. DOE's GTCC-like waste is owned or generated by DOE. The use of the term ''GTCC-like'' does not have the intent or effect of creating a new classification of radioactive waste.

[430] See Attachment A Below for the full text of the joint Bodman letter. Also for more information contact Don Hancock at Southwest Research and Information Center; 505-262-2371; sricdon@earthlink.net

[431] Don Hancock, "What Will Happen to 'Orphan' Nuclear Waste," *Voices from the Earth*, Fall 2007, Vo.8, No. 3.

[432] See Federal Register Vol. 72, No. 140 7/23/07; "GTCC LLW is defined by the Nuclear Regulatory Commission (NRC) in 10 CFR 72.3 as ''low-level radioactive waste that exceeds the concentration limits of radionuclides established for Class C waste in [10 CFR 61.55].'' GTCC LLW is generated by NRC or Agreement State-licensed activities (hereafter referred to as NRC-licensed activities).

[433] DOE also designated its Savannah River Site as the collection site for all foreign/domestic aluminum-clad SNF due to existing reprocessing infrastructure for this category of SNF and INL existing infrastructure can reprocess SST/ZR clad fuels.

[434] Transuranic waste is radioactive waste containing more than 100 nanocuries of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years, except for: (1) High-level waste; (2) waste that the Secretary of Energy has determined, with the concurrence of the Administrator of EPA, does not need the degree of isolation required by the 40 CFR Part 191 disposal regulations; or (3) waste that the NRC has approved for disposal on a case-by-case basis in accordance with 10 CFR Part 61.

[435] A curie of radioactivity is a huge amount within the context of EPA regulations limiting public exposure in units of pico-curies or one trillionth of one curie.

[436] Federal Register, Vol.72, No.140/ Monday, 7/23/07, page 40137.

The US Navy Nuclear Propulsion Program continues to send spent nuclear fuel (SNF) from various sites to the Idaho National Laboratory/Naval Reactor Facility as part of its regular decommissioning or refueling program of its nuclear fleet. Possessing of this SNF for reprocessing/storage/disposal generates significant amounts of highly remote handled radioactive waste that falls in the category of GTCC low-level waste. According to Nuclear Regulatory Commission regulations, GTCC waste is prohibited from shallow landfill dumps and must be interred in a deep geologic repository. [437] Given that there is no final disposal site for this waste and DOE finally issued a Notice of Intent (7/18/07) to prepare an Environmental Impact Statement (EIS) for the disposal of GTCC waste. [438]

This is a violation of the State of Idaho's Settlement Agreement with DOE despite Susan Burk, then coordinator for Idaho Department of Environmental Quality (IDEQ) INL Oversight Program statement; **"**Paragraph E.2.a of the Idaho Settlement Agreement and similar terms of the Site Treatment Plan require that treatable waste shipped into the State of Idaho shall be treated within six months of its receipt and shall be shipped outside of Idaho within six months of any treatment. Incoming waste is subject to these terms whether it is shipped to WIPP, another storage or disposal facility, or is returned to the shipping facility." [439]

IDEQ refuses to admit that ongoing waste imports to Idaho/INL results in "orphan waste" that has no permitted/regulatory compliant path forward for disposal especially the non-compliant INL Radioactive Waste Management Complex/ Subsurface Disposal Area (RWMC/SDA).

> "Waste that has no path to disposal and characteristics similar to waste classified as GTCC under the NRC definitions is not addressed in the two EISs above. Under the Low-Level Radioactive Waste Policy Amendments Act of 1985, the federal government is responsible for the disposal of greater-than-Class-C low-level waste generated by licensees of the NRC and Agreement States. DOE was identified as the federal agency responsible for this effort. In February 1989, a report to Congress from DOE (1990) stated that it plans to accept and manage limited quantities of greater-than-Class-C LLW until a disposal facility is developed." [440]

SECTION 8. Naval Reactors Facility [441]

Summary

The Environmental Defense Institute (EDI) comments on the Department of Energy (DOE) Draft Environmental Impact Statement DOE/EIS-0453-D, submitted previously for the record, are available on EDI's website. [442] EDI's comments on the draft have more background contamination and radioactive waste information needed to fully understand all the environmental impacts. EDI's comments on NRF CERCLA review is also available. Tami Thatcher's DOE comments on DEIS that cover other crucial issues are available. The comments below focus on the final FEIS issues that were not covered and therefore make it deficient for the following reasons:

* The FEIS fails to comply with all National Environmental Policy Act (NEPA) requirements;
* The FEIS fails to fully evaluate keeping the existing Expanded Core Facility (ECF) spent (used) nuclear fuel (SNF) cooling pool in operation for "over 33 years" as an integral part of NRF operation;
* The FEIS incorrectly says NNPP will not generate high-level-waste, greater- than-class waste or

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437 Title 10 Code of Federal Regulations (CFR) Subsections 72.3 and 61.55

438 http://www.gtcceos.anl.gov

439 Susan Burke, Idaho Department of Environmental Quality Director, 6/4/08 email to Chuck Broscious

440 INL/EXT-06-11601 Rev. 1, Pg. C-5.

441 EDI comments on NNPP. http://www.environmental-defense-institute.org/publications/EDINNPPFEIS.pdf

442 http://www.environmental-defense-institute.org/publications/EDINRFcomments.pdf http://www.environmental-defense-institute.org/publications/NNPP-Report7A.pdfhttp://environmental-defense-institute.org/publications/CommentsECF.pdf

transuranic waste;

* The FEIS failed to adequately assess the ECF's seismic vulnerabilities.

"The Naval Nuclear Propulsion Program (NNPP), also known as the Naval Reactors Program, is a joint United States (U.S.) Navy and Department of Energy (DOE) organization with responsibility for all matters pertaining to naval nuclear propulsion from design through disposal (cradle-to-grave)." [FEIS pg. Vol. I Abstract] [443] The Naval Reactors Facility (NRF) located on DOE's INL is the waste end-of –the road for SNF from the NNPP's nuclear fleet. DOE's role is designated to manage the Navy's waste.

> "NRF produces activated metals during routine operations. Volume averages ~35 m3/yr (as packaged estimate) and is forecasted through at least FY 2035. The NRF activated metals are RH LLW in that package contact dose routinely exceed 200 mR/hr and have been documented at nearly 30,000 R/hr. Future projections are that on-contact dose rates will be <15,000 R/hr. Currently the waste is disposed in the RWMC concrete vaults in 55-ton scrap cask liners, see Table B-2-5. The 55-ton scrap cask is currently used to transport the waste with an on-site transport plan that provides requirements for safe waste shipments. Off-site transport of the NRF activated metals will require DOT Type B cask transport systems." [444] [emphasis added]

EDI finds this EIS a clever effort to slip in major expansion of the Navy's SNF waste management without acknowledging 50+ years of massive radioactive contamination at INL by claiming previous NRF environmental studies. [445] DOE/NAVY claim these CERCLA reports are beyond the scope of this EIS. The Navy's previous radioactive contamination at INL will remain for manila putting Idahoans at risk. This is an unconscionable and avoidable assault on Idaho's most valuable Snake River Aquifer that we depend on.

SECTION 9. Advanced Reactor Test Complex [446] [447]

The Advanced Reactor Test Complex (ATRC) main facility is the Advanced Test Reactor (ATR) used to test reactor fuels and materials used by the nuclear Navy researchers for commercial nuclear power, and also used for isotope production. ATRC previously had the Materials Test Reactor, Engineering Test Reactor and TRA Retention Basin.

The ATR would probably experience a severe core meltdown and/or spent fuel canal draining in the event of a plane crash into the ATR building. This has been documented in the ATR probabilistic risk assessment (PRA). The ATR core and spent fuel canal are also vulnerable to building structural failure due to seismic events, building fires or overhead crane malfunction events, as well as many other accident scenarios. [448] Significant high-level radiation hazards and spent nuclear fuel (SNF) waste issues are linked to this INL site as Tami Thatcher reports:

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[443] FEIS pg. Vol. I Abstract

[444] INL-EXT-06-11601 Excerpt 1, Section B.2.3.

[445] Remedial Investigation/Feasibility Study (RI/FS) studies required by CERCLA to characterize the nature and extent of contamination because of past releases of hazardous and radioactive substances to the environment, to assess risks to human health and the environment from potential exposure to contaminates, and to evaluate cleanup actions.

[446] David McCoy, J.D, Unacceptable Risk at the Idaho National Laboratory Advanced Test Reactor The Case for Closure Volume I By David McCoy, J.D. and Chuck Broscious Updated January 2013 Revision No. 6-05, Environmental Defense Institute. http://www.environmental-defense-institute.org/publications/News.17.August.pdf

[447] Chuck Broscious, Review of CERCLA Cleanup and Decommissioning and Decontamination at Engineering Test Reactor TRA Retention Basin Materials Test Reactor at Reactor Technology Center now Called Advanced Test Reactor Complex Waste Area Group 2 Idaho National Laboratory Submitted by Chuck Broscious May 2016 Revision G. http://www.environmental-defense-institute.org/publications/y2016ETRMTRcleanup.pdf

[448] Tami Thatcher, A Brief History of Radiation Exposures to Idaho National Laboratory Workers By Tami Thatcher, January 5, 2016 Update http://www.environmental-defense-institute.org/publications/TopTenINLR2.pdf

"In looking over EHA-50 and other relevant documents pertaining to severe accident source terms, some variations existed due to simplifications in EHA-50 because it considered only the radioisotopes that predominantly contribute to the short term accident plume passage dose rather than the entire 300 million curie inventory of radioisotopes. However, a significant error was found in EHA-50 in that it significantly under represents the radiological release and therefore the protective action distances for a canal or combined reactor/canal draining accident.

"The protective action distances for a severe reactor accident at the Advanced Test Reactor accident, excluding canal fuel, for 95 percent worst-case meteorology was 30,000 meters due to thyroid dose and 54,000 meters (or 33 miles) for TEDE. The lethality distance was also calculated as 1,800 meter (1.1 miles).[449] While 100 percent of the core was assumed to melt, many of the release fractions for a reactor accident are significantly less than 1.0.

"While the canal draining release source term and subsequent protection action distance of 65 miles is indication of the potential for a massive uncontained release of radionuclides that would cause tremendous environmental, economic, and human displacement issues, it still under represents the bounding accident. Why? The ATR canal accident, as EHA-50 points out, can contain more than the fuel elements for a single core loading. In fact, the most recent The protective action distances for a severe reactor accident at the Advanced Test Reactor accident, excluding canal fuel, for 95 percent worst-case meteorology was 30,000 meters due to thyroid dose and 54,000 meters (or 33 miles) for TEDE. The lethality distance was also calculated as 1,800 meter (1.1 miles).[450] While 100 percent of the core was assumed to melt, many of the release fractions for a reactor accident are significantly less than 1.0.

"The protective action distances for a severe accident at the Advanced Test Reactor involving canal draining are also given and include the description that "multiple core quantities of spent fuel may be in storage at any given time." The protective action distances from EHA-50 for a canal draining severe accident at the Advanced Test Reactor for 95 percent worst-case meteorology was 105,000 meters due to thyroid dose and 105,000 meters (or 65 miles) for TEDE. The lethality distance was also calculated as 19,400 meter (12 miles). The release fractions for the canal are assumed to be 1.0." [451]

Activated Metal wastes produced at ATRC

"ATR produces activated metals during reactor core change-out operations approximately every 8 years. These components require ~8-yr decay time. Volume averages ~3 m3/yr (as packaged estimate) and is forecasted through at least FY 2035. The activated metals are RH LLW in that package contact dose routinely exceed 200 mR/hr and have been documented at nearly 30,000 R/hr. The activated metal would be classified under 10 CFR 61 typically as Class B and C with some exceeding Class C. Previous disposals of ATR activated metals have been at the RWMC using the Waste Calciner Filter (WCF) cask, see Tables B-2-8 and B-2-9. The WCF is used in conjunction with a transport plan and is not NRC licensed. Off-site transport of the ATR activated metals will require DOT Type B cask transport systems." [452] [emphasis added]

INL announced in News Release Feb. 21, 2012 new ATR missions:

"National Nuclear Research Capabilities Expand at National Scientific User Facility: The Advanced Test Reactor National Scientific User Facility (ATR NSUF) has added several new nuclear research capabilities with the support of two new partners. The addition of Pacific Northwest National Laboratory (PNNL) and Purdue University –plus one additional facility at current partner Oak Ridge National Laboratory (ORNL) – significantly increases the sample analysis and post-irradiation examination opportunities offered to researchers.

These additional partners offer a wide range of facilities, from reactors to ion beams, and from synchrotron radiation to specialized post-irradiation examination instruments. Through ATR NSUF's peer-reviewed proposal process, researchers can gain access to any of the facilities – both at INL and its 10 partners – expanding opportunities for researchers performing cutting-edge nuclear energy science and engineering.

"The addition of these facilities to the NSUF is a strong indicator of the belief that the NSUF model – pairing the best research ideas with the best facilities across the country –is the direction of 21st century nuclear R&D," said ATRNSUF Scientific Director Dr. Todd Allen.

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[449] EHA-50, "Emergency Management Hazards Assessment for TRA-670, Advanced Test Reactor Building, Tables D-6, D-31 and D-32 for source term release designator ATRPDS-1. The source term for ATR in EHA-50 was simplified and limited to Kryton, Xenon, Cesium, Tellurium, and Iodine.

[450] EHA-50, "Emergency Management Hazards Assessment for TRA-670, Advanced Test Reactor Building, Tables D-6, D-31 and D-32 for source term release designator ATRPDS-1. The source term for ATR in EHA-50 was simplified and limited to Kryton, Xenon, Cesium, Tellurium, and Iodine.

[451] Tami Thatcher, Review of Recent ATR Occurrence Reports: Reason for Concern http://www.environmental-defense-institute.org/publications/ATRorsSept2015.pdf

[452] INL/EXT-06-11601 Rev. 1, Section B.2.3.

"With the partnership, PNNL is offering access to its Radiochemistry Processing Laboratory (RPL), Materials Science and Technology Laboratory (MSTL) and irradiation experiment design and fabrication capabilities. The RPL and MSTL facilities offer a wide range of specialized equipment for handling and testing fuels and materials. Capabilities include experiment hardware design, fabrication and assembly, testing facilities for both nonradioactive and radioactive structural materials, and the advanced characterization of unirradiated and irradiated fuels and materials using instruments including transmission electron microscopy (TEM), scanning electron microscopy (SEM) and optical microscopy.

"Purdue University is providing access to its IMPACT (Interaction of Materials with Particles and Components Testing) facility, which offers a wide range of spectroscopy techniques to study the surface of materials. The IMPACT facility houses a variety of examination instruments including low-energy scattering spectroscopy (LEISS), X-rayphotoelectron spectroscopy (XPS), auger electron spectroscopy (AES), extreme ultraviolet reflectometry (EUVR), extreme ultraviolet (EUV) photoelectron spectroscopy and mass spectrometry."

In INL-EXT-06-11601 Table B-2-4. Summary of remote-handled low-level waste Advanced Test Reactor resin (IWTS MP 2312A.R2). Generating Process Description (Janke 2000):

"Depleted ion exchange resins from multiple sources and locations. The TRA-670 and TRA-605 Warm Waste Treatment Facility (WWTF) resin beds are used to clean up radionuclides from various TRA-670 sources and The TRA-605 warm waste feed tank. The sources of the aqueous liquid waste passing through these resins include:

"Low Pressure Demineralized Water
ATR-670 Primary Coolant System Tanks/Drains water
ATR-670 WWTF
ATR-670 Hot Waste Tank/Drains
MTR Labs Drains (TRA-605 WWTF only)."

"Depleted resins may also be from ATR cation/anion primary coolant resin beds used to maintain water purity. Resins are composed of copolymers of styrene and divinylbenzene formulated for either cation or anion exchange processes. Resins from both WWTF and ATR were analyzed for RCRA metals in 1996 and 1997 and none were found above TCLP limits. The processes and resin types have not changed since those analyses. " [453]

"Expected dose rate: surface 10 to 5,000 mrem/hr/ 1-meter: 10-3,500 mrem/hr." [pg. B-17]

Table B-3-2. ATR Contact-Handled low-level waste – Typical Profile #2.

Waste Stream - Typical #2 – [Pg. B-44]

Transuranic		U233 & U235	
Isotope	Max range	Isotope	Max range
Am-241	1.00E+01 nCi/g	U-233	1.00E+01 nCi/g
Am-242	1.00E+01 nCi/g	U-235	1.00E+01 nCi/g
Am-242m	1.00E+01 nCi/g		
Am-243	1.00E+01 nCi/g		
Cm-242	1.00E+01 nCi/g		
Cm-243	1.00E+01 nCi/g		
Np-237	1.00E+01 nCi/g		
Pu-236	1.00E+01 nCi/g		
Pu-238	1.00E+01 nCi/g		
Pu-239	1.00E+01 nCi/g		
Pu-240	1.00E+01 nCi/g		
Pu-241	**1.50E+02 nCi/g**		
Pu-242	1.00E+01 nCi/g		

[453] INL/EXT-06-11601 Rev. 1, Section B.2.3, Pg. B-44

Table B-2-9. Remote-handled low-level waste Advanced Test Reactor core subassembly parts. [Pg. B-43] [454]

Transuranic U233 & U235

Isotope	Max range	Isotope	Max range
Am-241	8.70E+00 nCi/g	U-233	6.82E-10 nCi/g
Am-242	1.13E-07 nCi/g	U-235	4.00E-02 nCi/g
Am-242m	1.13E-07 nCi/g		
Am-243	6.44E-09 nCi/g		
Cm-242	9.10E-09 nCi/g		
Cm-243	2.92E-09 nCi/g		
Cm-244	5.10E+02 nCi/g		
Cm-245	5.31E-13 nCi/g		
Cm-246	8.34E-15 nCi/g		
Cm-248	1.70E-01 nCi/g		
Np-237	6.10E+00 nCi/g		
Np-239	6.44E-09 nCi/g		
Pu-236	1.82E-06 nCi/g		
Pu-238	4.17E+00 nCi/g		
Pu-239	7.70E+00 nCi/g		
Pu-240	4.93E-02 nCi/g		
Pu-241	4.93E+00 nCi/g		
Pu-242	1.10E-04 nCi/g		
Pu-244	1.93E-17 nCi/g		

Table B-3-2 above shows Pu-242 at 1.5E+02 nCi/g =150 nCi/g = TRU illegally dumped.

SECTION 10. Comment References

[The extensive references used for these Comments are available on request from EDI]

[454] INL/EXT-06-11601 Rev. 1, Pg. B-43