Environmental Defense Institute

https://environmental-defense-institute.org

Snake River Plain Aquifer at Risk [1]

January 2019 Revision No. 33

I. Summary

The preponderance of data currently available to the Environmental Defense Institute at the time of this writing clearly indicate that there is a major public health and safety hazard looming related to the migration of U.S. Department of Energy (DOE) Idaho National Laboratory (INL) [2] waste discharges. This pollution is currently contaminating the Snake River Plain Aquifer. U.S. Geological Survey (USGS) data shows the threat to all downstream users of this sole source aquifer, as well as communities unitizing the Snake River and Columbia River (a tributary to the Columbia River) due to huge aquifer contribution to the regional river drainage volume. This waste dumping represents an existential environmental threat to all Idahoans due to the contaminated air and migration into our sole source Snake River Aquifer designated by EPA in 1991.

DOE has consistently claimed in many environmental reports over the decades that INL contaminates move very slowly ("inches per year") into the aquifer and that there is "no record of any historical flooding" or of "INL contaminates reaching the public". However, USGS studies of flooding and other reports of the Idaho Nuclear Technology and Environmental Center (INTEC) alone document 41 lava tubes capable to moving contaminates rapidly ("6 miles per day") and thus potentially reaching the Snake River in 8 days. Admittedly, these deadly hazardous chemical and radioactive contaminates are diluted in the aquifer, but continue to show up at increasing levels in off-site sampling data and at aquifer discharge sites on the Snake River, as the documentation below clearly shows. Even at below regulatory limits set by the Environmental Protection Agency (EPA), few water users want radionuclides in their water no matter the level. EPA's regulatory limits themselves are challenged in court for not being adequately protective of human health.

This report challenges the assumption, by state and federal government agency public proclamations that it will take INL contaminates 100 to 200 years to reach the Snake River, offers little solace when those contaminates (i.e. plutonium) have a deadly half-live of 24,000 years and technetium-99, with half-life 213,000 years, is a long lived carcinogenic radionuclide created by nuclear fission from nuclear reactors or nuclear weapons testing. Nuclear fuel debris buried underground at INL's Radioactive Waste Management Complex (RWMC) and waste from nuclear fuel reprocessing at INL's Idaho Nuclear Technology Center (INTEC) have released Tc- 99 into the ground. Technetium-99 contamination from INTEC operations of Tc-99 has been detected in the aquifer since 1998. [3] The public justifiably demands additional independent groundwater studies that include the cumulative contaminate hazard of toxic chemicals and radionuclides in our water supply.

Immediate action is needed by federal and state regulators, in addition to public pressure, to ensure that **all** tank waste, buried radioactive and hazardous chemical wastes are exhumed (into safe interim storage), and that continued dumping of INL liquid process waste into unlined percolation ponds is terminated because it facilitates the flushing of pollution into the aquifer. The current Administration cutbacks on "cleanup" funding at DOE sites and policy decisions

---

[1] This report is a publication of the Environmental Defense Institute, written by Chuck Broscious, David McCoy, First released in April 2003. Since then EDI has found significant information about major contamination issues added to this report.

[2] The current name Idaho National Laboratory (INL) and previous name INEEL are herein used interchangeably.

[3] Tami Thatcher, An Alarming Change in the Status of Technetium-99 in the Vadose Zone and Aquifer at INL. http://www.environmental-defense-institute.org/publications/alarmingtc2.pdf

designed to permanently leave huge quantities of deadly waste in current vulnerable underground disposal units portends a tragic legacy for future generations' water quality. [4]

Time is of the essence, since every day that goes by, more of this deadly pollution migrates beyond any means of mitigation. The hazard of INL contaminates extends to most of Idaho via the Snake River. Arguably, since the Snake River is a primary tributary to the Columbia River, the INL contaminate impact zone extends to northern Oregon, southern Washington states, and Pacific coastal areas where the Columbia discharges into the ocean west of Portland Oregon.

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. [5] 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. [6]

II. Snake River Plain Aquifer

In 1991 the Environmental Protection Agency (EPA) ruled that the Snake River Plain Aquifer is a "sole source aquifer." Under the Safe Drinking Water Act, EPA can determine that an area has an aquifer that is the sole or principal drinking water source for the area and if contamination would create a significant hazard to public health. [7] The Snake River Aquifer is the sole water source for nearly one fourth of Idahoans (>300,000 residents), second only in size/volume to the Ogallala Aquifer in northern Texas and southern Oklahoma.[8] The Snake River Aquifer flows to the south and southwest (starting near Island Park Reservoir on the east and Bliss on the west) and covers an area of 9,611 square miles. Water storage in the aquifer is estimated at two billion acre-feet, and a drainage area of 35,000 square miles. [9]

On a total per capita water usage basis, Idaho ranks first in the nation with 22,000 gallons/person/day - with second place going to Wyoming at 13,052 gal/person/day. [10] So much water is being drawn from the aquifer that the water table has dropped three feet in the late 1980's. Municipal water for >41 communities also adds to the drain on this aquifer. About one-

---

[4] 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

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

[6] See EDI comments to DOE on high-level waste reclassification at: http://www.environmental-defense-institute.org/publications/EDIComHLW6.pdf

[7] 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 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]."

[8] Hormel, Christopher, Declaration in NRDC vs. Abraham, DOE, 1/17/03, Case No. 01-CV-413 (BLW).

[9] Idaho High-Level Waste and Facilities Disposition, Final Environmental Impact Statement, September 2002, DOE/EIS-0287, page 4-47. Herein after called DOE/EIS-0287.

[10] University of Idaho; Snake River Plain Aquifer , Idaho Water Resources Research Institute, publication #877and #887, herein after called UIWR

fourth of the US potato harvest and 75% of the world's commercial trout are raised utilizing this aquifer. [11] Near continuous years of drought have exacerbated these conditions requiring even greater demands on the aquifer. Drought conditions continue with June 1992 Snake River average flow of 3.7 billion gallons per day. The previous low was in 1977 at 5.2 billion gallons per day. USGS studies show Snake River Plain Aquifer drawdown in excess of recharge is 410,000 acre feet/yr. [12] Recharge from the 1996-1997 winter show pack run off halted this trend but it is unclear whether previous loses were completely made up.

The Snake River Aquifer via Thousand Spring discharges (ranging from Bliss, Idaho on the west to American Falls Reservoir near Pocatello, Idaho on the east) provides in the summer months the entire flow (due to upstream irrigation) of the Snake River. See attached USGS maps. Thus the aquifer supplies (in the summer months) all the communities downstream that rely on the river as their primary water source. The US Geological Survey has identified 19 major springs, in an area called Thousand Springs, that 8 million acre feet of water is discharged to the Snake River starting with Devils Washbowl (near Kimberly, about 10 miles east of Twin Falls) on the east and ending with Birch Creek (about 3 miles west of Hagerman) on the west. [13]

There are also significant aquifer discharges to the Snake River further east in the vicinity of American Falls Reservoir west of Pocatello. DOE estimates that the aquifer discharges 7.1 million acre feet (8,754 trillion cubic meters) of groundwater into the Snake River every year. [14]

The hazard of INL contaminates extends to most of Idaho via the Snake River that flows from southern Idaho to the northern panhandle and at Lewiston the river flows west to meet the Columbia River at Richland, WA. [15] Arguably, since the Snake River is a tributary to the Columbia River, the INL contaminate impact zone extends to eastern and northern Oregon and southern Washington states. A State of Oregon report found that after the DOE Hanford nuclear reactors in Washington State were shut down and ended direct coolant discharges to the Columbia River, the highest radioactive pollutant contributor to the Columbia was the Snake River. [16]

III. Pollution Threats to the Snake River Plain Aquifer

The INL sits above the northeast half of the aquifer. "It's not surprising that much of Idaho's concern relating to the INL centers around the Eastern Snake River Plain Aquifer. If activities at the lab were to result in irreparable harm to the aquifer, it could be a devastating blow to Idaho's economy and way of life." [17]

Contaminate migration or "transmissivity" within the aquifer can vary widely depending on a number of the following factors:

---

[11] Hormel, 2003

[12] Times-News, Associated Press, 7/4/92 and 7/19/92

[13] Tritium in Flow from Selected Springs that Discharge to the Snake River, Twin Falls-Hagerman Area, Idaho, US Geological Survey, Open Report 02-185, DOE/ID-22180, page 6. Also State of Idaho Oversight Monitor, 5/05; "About 86% of the water going out of the aquifer (called discharge), about 7.1 million acre feet eventually flows into the Snake River. Groundwater pumping accounts for 14% or 1.1 million acre feet of the aquifer's discharge." "An acre-foot is the amount of water which would cover one acre of land with one foot of water."

[14] Remedial Investigation Final Report with Addenda for the Test Area North Groundwater Operable Unit 1-07B at INEEL, J. Kaminsky, EG&G Idaho, January 1994, EGG-ER-10643.

[15] Tami Thatcher, *INL Contamination and the Snake River Plain Aquifer – The Essentials* http://www.environmental-defense-institute.org/publications/

[16] Environmental Radiological Surveillance Report on Oregon Surface Waters, 1961- 1983, Oregon Department of Human Services, Radiation Control Section.

[17] State of Idaho Oversight Monitor, March 2006.

1. Disposal method (i.e. direct injection to the aquifer, discharge to unlined percolation ponds, or subsurface solid hazardous/radioactive waste landfills).
2. Waste chemistry (i.e. high levels of acids/solvents in the waste discharge facilitate transmissivity).
3. Volume of discharge (i.e. large volumes [used extensively to dilute waste] produce hydraulic pressure to move waste vertically, laterally and horizontally).
4. Chemical characteristics of individual contaminates (i.e. tritium acts just like water and volatile organic compounds move freely, or plutonium [insoluble] particles that bond with soil/rock particles as "colloids" and move more slowly).
5. Sampling location (i.e. directly under a disposal site, or at a distant location not as affected by disposal dilution volume or flooding recharge flushing). [18]
6. Flooding of disposal site (i.e. proximity to the Big Lost River flood plain) that periodically add to flushing of contaminates deeper into the aquifer and transit southwest to the Snake River. See Section IX below for flooding discussion.
7. Chemical characteristics (i.e. ph. values) of underlying soils and rock that can significantly affect transmissivity.
8. Rates of contaminate transmissivity (also called conductivity or "Kd values") vary widely within the available agency literature and DOE's public statements making public review doubly difficult. [19]

When NRC evaluated DOE Idaho high-level waste tank closure program, they were very critical of DOE's refusal to use appropriate Kd values, consequently rates of contaminate transmissivity are higher than we are told. The limited water samples we have access to confirms this fact.

> "Although uncertainty in transport parameters was not considered in the screening analysis [at INL], 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 [highly radioactive radionuclides] 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 [at INL]. 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." [20] [Pg40]

A joint report by DOE's Los Alamos National Laboratory and Lawrence Livermore National Laboratory on rapid plutonium contaminates groundwater transmissivity/conductivity at the Nevada Test Site (NTS) with similar soil notes:

> "The implication of our results is that Pu from the Benham [NTS nuclear bomb test] event has migrated a significant distance in the subsurface. The migration of Pu and other radionuclides (137 Cs, 60 Co, as well as the europium isotopes) in the subsurface is associated with naturally occurring particulate and colloidal material and not as dissolved species. We regard the observation of Pu in groundwater at this

---

[18] DOE requested that groundwater monitoring at INL be reduced from annual to every other year and both EPA and IDEQ concurred with the request. "Don't monitor what you do not want to know."

[19] *Tritium at 800 pCi/L in the Snake River Plain Aquifer in the Magic Valley at Kimama: Why This Matters* Environmental Defense Institute Special Report By Tami Thatcher December 31, 2016 (updated January 2017) Brief Summary: The truth about the migration of waste water contaminants in the Snake River Plain Aquifer from historical operations at what is now called the Idaho National Laboratory has long been hidden. This report will show why the contamination is not primarily from nuclear weapons fallout, globally or from the Nevada Test Site. By examination of the radionuclide and chemical constituents deep in the aquifer at the Kimama well, it can be shown that the contamination is in fact primarily from INL waste water practices. Weapons testing did shower Idaho and the rest of the country with elevated levels of tritium and other fallout . However, there are various contaminants in the aquifer from INL operations that would not result from weapons testing. http://www.environmental-defense-institute.org/publications/kimamareport.pdf

[20] NRC 2006, Pg. 40.

location as extremely significant. To our knowledge this is the first time Pu has been shown to be transported by groundwater and in addition such a long distance." [21]

The State of Idaho now finally, but quietly in Federal Court briefs, acknowledges that: "Over the years approximately twenty (20) thousand gallons of high-level radioactive waste have leaked into soil and groundwater at INL. [22] DOE's own earlier internal reports note:

"Radioactive, inorganic, and organic wastes releases from active and inactive waste sites have resulted in contamination of the Snake River Aquifer. Some of the injection wells, such as at Test Reactor Area, Power Burst Facility, Test Area North, and ICPP, disposed of the wastes directly into the Snake River Aquifer. Significant spills and leaks have frequently occurred over INEEL's history. Most spills have been the result of line and tank failures, leaking valves, and equipment and tank overfilling. [Spill and/or leak] volumes range up to 64,014 gal.. It should be noted that rather large quantities of chemicals were routinely disposed of [directly into the aquifer] via the ICPP [now called INTEC] disposal well." [23]

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. [24]

Table 1: 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. [25]

Table 2, Inventory of Radioactive Waste by Type at the Idaho National Laboratory [26]

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.

---

21 Thompson, J .L., Kersting, A.B., and Finnegan, D.L.; Plutonium in Groundwater at the Nevada Test Site; Observations at ER-20-5. Chemical Technology Division Los Alamos National Laboratory, and Isotope Science Division, Lawrence Livermore National Laboratory. See DOE FOIA response to Dr. Peter Rickards 12/10/97.

22 Joint Amicus Brief of Idaho, Washington, Oregon and South Carolina, NRDC vs. Abraham (DOE), US Federal Court District of Idaho, Case No. CV-01-413-S-BLW, March 24, 2003, page 4.

23 Environment, Safety, and Health Needs of the US Department of Energy, September 1988, pages 3-166, 3-115, and 3-116. DOE/EH/OEV-22-P.

24 DOE/NE-ID-11227, Table 5-7, page 5-12

25 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.

26 NAS 2006, TABLE II-3 Pg 28

These waste discharges are the most deadly material in the world. Direct contact for only a few minutes of this high-level waste would result in death from the radiation exposure. To offer a perspective, EPA knows this material is so deadly that its emission regulations are in units of pico curies or one trillionth of one curie. Over 10 million gallons containing more than 50 million curies of high-level waste have already been "processed" in unpermitted unregulated INL waste operations. Due to DOE's non-compliant previous waste processing plants, and those in operation today, much of the radioactive pollution is simply exhausted out the stack unimpeded by state and federal EPA regulators.

Because of flooding of the INL RWMC dump, another eleven billion gallons previously injected directly into the aquifer (via waste injection wells), along with an additional current discharge of ~2 million gallons **every day** to unlined percolation ponds, these liquid radioactive waste disposal sites pose a significant hazard due to contaminates being flushed through the soil column to the aquifer.

US Geological Survey (USGS) reports show the hydro-geologic vulnerability of the INL buried waste sites. Flooding incidents have already occurred in 1952,1962, 1969, and 1982, and these sites are within the Big Lost River 100-year flood plain. This is where DOE plans to permanently leave buried waste and dispose of high-level and transuranic non-liquid waste currently in tank sediments.[27] See Section IX for more details on flooding.

The Natural Resources Defense Council (NRDC), together with two northwest Native American Tribes and environmental groups, filed a lawsuit challenging this DOE high-level waste disposal policy. [28] The thrust of this lawsuit is based on DOE's arbitrary reclassification of formerly high-level waste to a lower category that would allow the DOE to leave about 115,000 gallons of mixed hazardous and high-level radioactive waste tank heels (sediments) as a permanent disposal in violation of the Nuclear Waste Policy Act. US Federal District Court ruled on July 3, 2003 in favor of NRDC. [29] DOE filed an appeal to the US Ninth Circuit Court of Appeals where pleadings were heard and a ruling in 2004 that remanded the case back to District Court stating the pleadings were not yet "ripe" for ruling. [30] [31]

The INL radioactive solid waste dump called the Radioactive Waste Management Complex (RWMC) is located in a regional depression about 40 feet **lower** than the Big Lost River that flows immediately north of the dump. [32] Buried or otherwise dumped radioactive high-level and transuranic waste is currently contaminating the Snake River Plain Aquifer. The State of Idaho reported plutonium in the aquifer under the INL dump at 66 pCi/L or 4.4 times above the drinking water standard of 15 pCi/L. [33] Depending on the species of plutonium, its toxic half-life can be as long as 24,000 years.[34]

---

27 For more information on high-level waste tank closure see EDI website Publications on the INTEC Closure of issue of WM-182 & 183. Also Comments on Closure of INTEC WM-184 through 186.

28 NRDC vs. Spencer Abraham (DOE), U.S. District Court for State of Idaho, Case No. CV-01-413-S-BLW.

29 See www.id.uscourts.gov/ and search for 01-413.

30 See: www.ca9.uscourts.gov/ for updates search for Cir. No. 03-35711

31 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.

32 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 August 2018 http://www.environmental-defense-institute.org/publications/RWMCCERCLA4.pdf

33 INEEL Oversight Program, Environmental Surveillance Program, Quarterly Data Report, October – December, 2000, page 25, State of Idaho. Hereinafter called INEEL OP December 2000. Well M1S located at the Radioactive Waste Management Complex, Subsurface Disposal Area detected plutonium 241 at 66 pCi/L (dated 7/99), and plutonium-239/240 at 24 pCi/L (dated 10/00). It is very important to note that these two separate samples were taken nearly a year apart which adds significant credibility to this not being a sampling anomaly.

34 The toxic half-life of Plutonium-238 is 87.74 years, Pu-239 is 24,110 years, Pu-240 is 6,537 years, Pu-241 is 14.4 years, and americium-241 is 432.2 years. The full term toxic life of radionuclides is generally considered to be ten times the half-life. Crucial to this is the fact that radionuclides decay to other radionuclides called the "decay chain" or "daughter" that are

US Geologic Survey (USGS) conducted a study of the INL RWMC burial ground plutonium propensity to migrate and found that plutonium: "is soluble in the water from the perched aquifer, and in time could be leached from the waste. Once dissolved, it could persist in solution and ultimately reach the Snake River Plain aquifer. Nevertheless, to conclude that the plutonium in the waste would not leach into the ground water over a period of time is **not** warranted. In addition, americium, although relatively insoluble and not subject to oxidation-state changes, could ultimately be leached from the waste to a small but **radiologically significant extent**." [35] [emphasis added]

More recent USGS reports show plutonium-239/239/240, americium-241, and cesium-137 in aquifer wells some twenty miles southwest of the INL boundary.[36] Although these off-site plutonium concentrations (0.013 pCi/L) are well below the EPA safe drinking water standard, independent scientists argue the standard is not protective of human health. [See Table Below]

Arjun Makhijani, Ph.D., a nationally recognized independent analyst of DOE's operations, discusses risks to the Snake River Aquifer from INL waste in a recently released book, *Poison in the Vadose Zone* where he states:

> "It should be noted, however, the Safe Drinking Water standard of 15 picocuries per liter for alpha emitting transuranics like plutonium-238, plutonium-239, or americium-241 allows doses on the order of a hundred times higher than the 4 mllirem annual limit specified for most beta emitters. A concentration of plutonium of only about 0.08 picocuries per liter in drinking water is required to produce a dose of 4 millirem per year to the bone surface (the crucial organ for plutonium)." "The Safe Drinking Water standard specifies dose limits, concentrations limits, and calculation procedures for doses that are not consistent and are more stringent in some cases (such as nickel-63, cesium-137, and tritium) and less stringent in others, notably transuranic radionuclides and strontium-90. Since the latter are among those presenting the most serious threats in Idaho, a more conservative approach that would limit groundwater contamination from transuranics is warranted. None of these limits take into account the potentially more serious problems arising from fetal [unborn baby] exposure." [37]

Table 3: 1995 INTEC (ICPP) Perched Water Well Sample Data [38]

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)

substantially longer than the original nuclear parent isotope. In essence, these radioisotopes are a permanent contaminate in Idaho in perpetuity.

35 Speciation of Plutonium and Americium in Ground Waters from the Radioactive Waste Management Complex, Idaho National Engineering Laboratory, Idaho, U.S. Geological Survey, Water Resources Investigations Report 93-4035,1993, pg. 1, 4, & 9.

36 Radiochemical and Chemical Constituents in Water from Selected Wells South of the INEEL, Idaho, May 2001, US Geological Survey, Report 01-138, DOE/ID-22175. The wells sampled were Grazing Well #2, Grazing Service CC #3, Haughland Well, Crossroads Well, and Fingers Butte Well, page 16. Plutonium concentrations ranged from 0.01 to 0.013 pCi/L in Grazing Service well CCC # 3.

37 Poison in the Vadose Zone, An examination of the threats to the Snake River Plain Aquifer from the INEEL, Institute for Energy and Environmental Research, Arjun Makhijani, Ph.D., Michele Boyd, October 2001, page 54. Herein after called IEER.

38 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."

Radionuclides dumped in INTEC Waste Injection Well
Total Injected = **22,200** Curies; Total remaining in Well = **3,920** Curies
(decayed to 1995 values) [39] DOE/ID-10660, pg. 5-71

Table 4: 2002 INTEC Perched Ground Water Sample Data [40]

Contaminate	Concentration	Regulatory Std. (MCL) [41]
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.

Table 5: 2006 Tank Farm Soil Downhole Gamma Log Data [42]

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]

While DOE likes to continue assuming that it just doesn't know where that plutonium in the monitoring wells could possibly come from, DOE's own internal studies show how plutonium and other "actinides" like americium can bond (called colloids that due to inherent particle electrical charges) with other material in the soil column and migrate with the water flows. [43] "It is well-known that colloids [radioactive particles attached to soil particles] have the potential to influence contaminant transport, but there is a lack of comprehensive understanding of the mechanisms.

Current modeling approaches underestimate, or even ignore, colloid-facilitated transport mechanisms, yet colloids are frequently offered as the explanation for why some contaminants move faster than we expect. Colloidal transport of actinide species may be responsible for sporadic and otherwise unexplainable detections of plutonium and americium in groundwater samples collected at the INL. There is also evidence that plutonium at the Nevada Test Site is traveling much faster than expected as a colloidal oxide." This is a reference to DOE's water sampling program at the Nevada nuclear weapons test site that shows significant plutonium

[39] DOE/ID-10660, pg. 5-71
[40] DOE/EIS-0287, Idaho HLW & FD EIS, page 4-52, 4-53 and 4-57.
[41] 40 CFR 140 and 141
[42] 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.
[43] Actinides are a class of elements that include radium, uranium and all transuranic elements with atomic weight heavier than uranium. The most common transuranics are plutonium and americium.

migration from bomb detonation locations to distant ground water monitoring wells. Idaho has recently discontinued monitoring for plutonium and americium at off-site wells for no reported reason. Recent Associated Press articles document falsification of reporting data on Yucca Mt groundwater data by USGS showing even more issues than the above.

2012 USGS Groundwater Monitoring at INL [44]

Well Number/ Location	Constituent	Concentration Pico Curies/Liter	EPA's Maximum Concentration Level pico curies/liter [45]
Site 19 Advanced Test Reactor	Tritium	250,000 [46]	20,000
USGS 14 South INL Boundary	Gross Alpha	4,000	15
USGS 97 Naval Reactor Fac.	Gross Beta	10	8*
USGS 103 South INL Boundary	Gross Beta	10	8*
USGS 107 Power Burst Facility	Gross Beta	11	8*
USGS 109 RWMC	Gross Beta	7	8*
USGS 110 Atomic City	Gross Beta	10	8*

A National Academy of Sciences committee report noted that "travel time estimates [of the buried waste to the Snake River Aquifer] have decreased from tens of thousands to a few tens of years." [47] USGS 2012 report shows contaminate travel time at 64.8 feet per day. [48]

"Higher than expected level of a radioactive contaminate [including technetium-99] has been found in the Snake River Plain Aquifer under the [INEEL/INTEC] liquid waste storage tanks from transfer lines used when tanks were being filled from 1956 through 1986." Idaho state officials claim; "The source of the technetium-99 was soils contaminated by leaks in transfer lines. The state has allowed that the process to be used on two of the INEEL tanks it determined

[44] US Geological Survey (USGS), Water-Quality Characteristics and Trends for Selected Sites at and Near the Idaho National Laboratory, Idaho, 1949-2009, Scientific Investigations Report 2012-5169, DOE/ID-22219. "Strontium-90 is a fission product of nuclear weapons tests, and is present in wastewater discharges at several facilities at INL (Davis, 2010). Strontium-90 has a half-life of 29.1 years. Water samples have been routinely been collected and analyzed for strontium-90 from 25 of the wells used in this study." "Plutonium- In 1974 USGS began monitoring plutonium-238 and Pu-239, Pu-240 (undivided) in water from selected wells around TAN, INTEC, and RWMC because of waste disposal practices." "Gross alpha and Beta particle radioactivity is a measure of the total radioactivity emitted as alpha and beta particles during the radioactive decay process. The radioactivity usually is reported as if it occurred as one radionuclide. Gross alpha and beta measurements are used to screen for radioactivity in the aquifer as a possible indicator of groundwater contamination."

[45] Environmental Protection Agency (EPA) National Primary Drinking Water Standards, 40 CFR ss 141.66. Gross Alpha (plutonium and americium are the primary alpha contributors) Maximum Concentration Level (MCL) is 15 pico curies/liter; Gross Beta (Strontium-90 is the primary beta contributor) is 8 pico curies/liter. http: water.epa.gov/drink/contaminates/index

[46] Record of Decision, Test Reactor Area Perched Water Systems, Operable Unit 2-12, Idaho National Engineering Laboratory, December 1992, pg. 15.

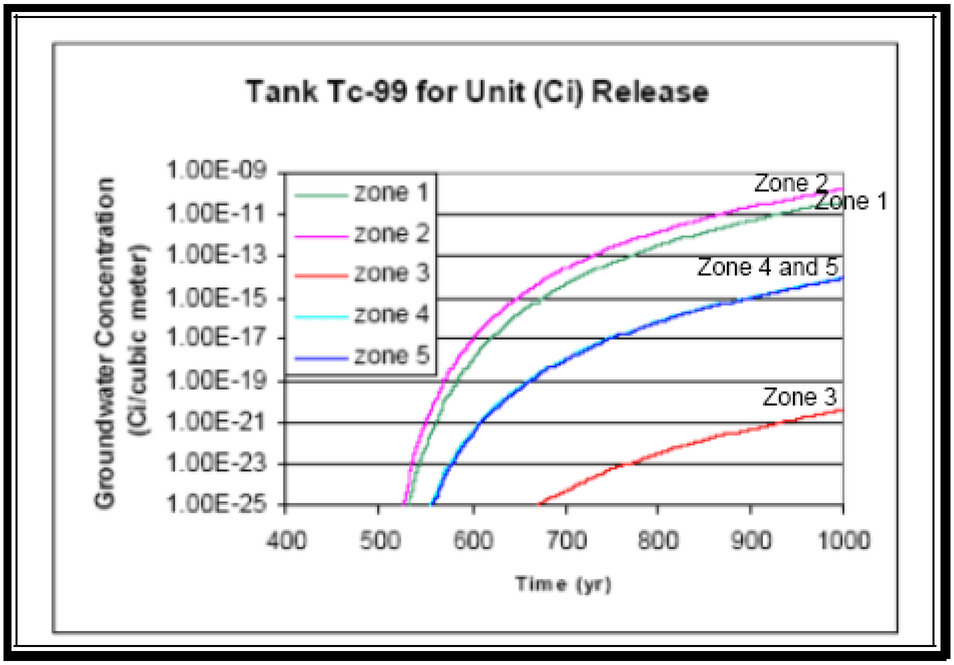
[47] Hormel, 2003, citing National Academy of Sciences report "Research Needs in Subsurface Science."

[48] US Geological Survey, A Comparison of USGS Three-Dimensional Model Estimates of Groundwater Source Areas and Velocities to Independently Derived Estimates, Idaho National Laboratory, Scientific Investigations Report 2012-5152, DOE/ID-22218.

did not include radioactive material, but environmentalists want that approval rescinded so the tanks can be completely emptied ." [49] "Sample results [for technetium-99] for the new well collected by the State INEEL Oversight Program, INEEL contractor and the USGS ranged from 2000 to 2840 pico curies per liter (pCi/L), well above the drinking water standard of 900 pCi/l. Tc-99 was also detected in August 2003 at wells between INTEC and Central Facilities Area (CFA)." [50] Technetium-99 has a half-life of 212,000 years which means (like I-129) it is effectively a permanent contaminant in the environment and eventually will end up in domestic water systems. [51] In NRC's report on INL's INTEC tank closure it states:

"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." [52] [Pg. 89]

---

[49] High Level of Radioactive Contaminant Found in Idaho Aquifer, *Santa Fe New Mexican*, Associated Press, September 26, 2003

[50] New Monitoring Well Finds Unexpected Contamination Near INEEL Tank Farm, INEEL Oversight Program, September 26, 2003.

[51] Tami Thatcher, *An Alarming Change in the Status of Technetium-99 in the Vadose Zone and Aquifer at INL.*

[52] NRC 2006, Figure 21a, pg. 95 and pg. 89.

The State of Idaho acknowledges that toxic chemicals and heavy metals such as chromium (a known carcinogen) in the aquifer "exceeded the drinking water [EPA standard maximum contaminate level] MCL of 100 ug/l" by 161% (161 ug/l). [53] Toxic heavy metals like hexavalent chromium have no half-life and therefore will always present a health hazard to the public via contaminated water. It must also be noted that chromium contamination is what elevated INL onto EPA's Superfund National Priority List in the first place primarily from INL Test Reactor Area ground water samples that found (the most toxic of the chromium species) hexavalent chromium at 178 ug/L (MCL is 50 ug/L) plus other chromium at 4,480 ug/l (MCL for total chromium at 100 ug/L). [54] USGS groundwater sampling south of INL along the Snake River detects chromium at 4.10 mg/liter (ug/L). [55] Though below the MCL, this contaminate is increasing steadily over the years in the groundwater south of INL and is definitive evidence of contaminate migration into the public's water system. [56]

Federal drinking water maximum contaminate level (MCL) standards recognize that radioactive pollutants are cumulative. For instance, in a given water sample, individual contaminates may be below the individual MCL, however collectively the sum of the individual contaminates can exceed the standard. [57] The collective contamination is estimated by adding the sum of the ratios of the actual level of each radionuclide to the MCL for that radionuclide. If the sum of the ratios for all radionuclides is less than one, (or less than 100%) the sample complies with the standard.

Although the federal standards provide for cumulative radionuclide contaminates (i.e. maximum cumulative dose of 4 mrem/yr.), they do not accommodate the cumulative hazard posed by **both** radioactive and toxic chemical contamination, which is the case with the Snake River Aquifer. IEER's *Poison in the Vados Zones* report took a scientifically defensible approach to conservatively evaluate the cumulative ground water hazard.

"While each single pollutant as well as the sum of the radionuclide pollution percentages are currently less than allowable drinking water limits [at some INEEL sample wells], the commutative burden is greater than the allowable drinking water limits in the [INEEL] RWMC well [by 146%], if TCE and carbon tetrachloride are added. This is a standard procedure for radionuclides. However, it is not mandated for hazardous chemicals, even though it provides a reasonable estimate of the quality of the water. It is not the most conservative way to estimate the impact of the pollutants in the water, since simple addition ignores synergistic effects between various hazardous chemicals and between hazardous chemicals and radionuclides." [58]

USGS samples taken in 1991 at INTEC found radioactive Iodine-129 near INTEC 3.82 times above the drinking water standard of one pCi/L. [59] A 1993 USGS report found Iodine-129 from INL INTEC's 3.4 square mile ground water plume, in two wells eight miles south of the

---

[53] INEEL Oversight Program, Quarterly Report, April - June 2002, State of Idaho, page 17 and 29. EPA regulatory Maximum Concentration Levels (MCL) are usually expressed in milligrams per liter. MCL for total chromium is 0.1 mg/L. The above units are in micro grams per liter or 161 ug/L. The State in their April-June 2003 Quarterly Report shows chromium at 117 ug/l in USGS well 065, page 22.

[54] Record of Decision, Test Reactor Area Perched Water System, Operable Unit 2-12, INEEL, December 1992, DOE, IDEQ, and EPA, page 13.

[55] DOE/ID-22190, page 17.

[56] Tami Thatcher, *The Hidden Truth About INL Drinking Water A Long Legacy of Aquifer Contamination at INL.*

[57] 40 CFR 141.15 and 141.16. "If two or more radionuclides are present, the sum of their annual dose equivalent to the total body or to any organ shall not exceed 4 millirem/yr" cited by IEER.

[58] IEER (2001) page 63 and 66.

[59] Iodine-129 in the Snake River Plain Aquifer at and Near the INEEL, 1990-91, Report 94-4257, US Geological Survey, April 1994.

INL boundary near Big Southern Butte. [60] Earlier USGS studies show aquifer Iodine-129 concentrations at 41 pCi/L. [61] Iodine-129, a byproduct of the fission of uranium is of concern because of its 15.7 million-year half-life, and its known ability (like iodine-131) to lodge in the thyroid causing cancer. Because of this it is considered by EPA to be a permanent environmental pollutant and the drinking water standard for I-129 is set by EPA at **one** (1) pCi/l. A 2003 USGS report even found Iodine-129 in significant concentrations (30 pCi/L) in the Big Wood River near Belleview south of Hailey, Idaho. [62]

Radioactive tritium is a wide-spread contaminate on and off the INL site. Tritium is a radioactive form of hydrogen that can be in the form of a gas or when it combines with oxygen as a liquid (tritiated water) by replacing one or both atoms on non-radioactive hydrogen in water (H2O). Tritiated water is an extremely pernicious contaminate because it easily mimics normal water and thus is easily absorbed in the body tissue and blood.

> "Due to its chemical properties, tritiated water can replace ordinary water in human cells (water constitutes approximately 70% of the soft tissue in the human body). In addition, tritiated water in the body can become organically-bound tritium by being incorporated into bio-molecules, such as amino acids, proteins, and DNA. The current tritium safe drinking water standard does not protect children and developing fetuses to the same standards as adults. Current radiation protection standards assume that exposure to beta radiation (such as that from tritium) causes the same biological damage as whole body exposure to gamma and x-rays. But cancer risk from tritium per unit of radiation energy can be far higher. A 2002 study concluded that the dose conversion factors for tritium may be 2 to 5 times larger for adults than used in current U.S. regulatory guidance, depending on the form of tritium (with considerable uncertainties around these best estimates), and 4 to 10 times larger for fetuses when pregnant women ingest tritium, also with considerable uncertainties." [63]

Tritium contamination from INL dumping reported by DOE in 1992 at 3,940,000 pCi/L [64] has migrated the 50 miles via the aquifer to the Snake River. USGS 1994-99 spring discharges to the Snake River sampling data show significant tritium concentrations of 65 pCi/L in the Twin Falls and Hagerman areas. The highest tritium concentrations were found in the eastern aquifer discharges to the Snake River at Devils Washbowl near Kimberly, Idaho. [65] State Oversight monitoring also found reportable levels of tritium in Minidoka (200 pCi/L), Shoshone (42 pCi/L) and Bill Jones Hatchery (90 pCi/L) and cesium-137 Mud Lake Water Systems (83 pCi/l). [66]

---

60 Environmental Science Foundation, July 1997. Well number 11 located 4 miles south of INEEL and 3.5 miles west of Big Southern Butte contained concentrations of I-129 of 1 x 10^{-5}. Well number 14 located 8 miles south of INEEL and 6 miles southeast of Big South Butte has I-129 concentrations of 3 x 10^{-5}. Also phone conversa tion with INEEL Oversight Program 2/18/93

61 Iodine-129 in the Snake River Plain Aquifer at the Idaho National Engineering Laboratory, Idaho, U.S. Geological Survey Water Resources Investigations Report 88-4146, September 1988, page 1, DOE/ID-22076. Also see Reevaluation of Background Iodine-129 Concentrations in Water From the Snake River Plain Aquifer, Idaho, 2003, USGS Report 03-4106, page 4 and 8 that shows I-129 at Big Wood River (Bellview) that documents continued migration of I-129 off the INEEL site.

62 Reevaluation of Background Iodine-129 Concentrations in Water from the Snake River Plain Aquifer, Idaho, 2003, USGS Report 03-4106, May 2003, page 8. An "aCi/l" is equal to 10X10-6 pCi/l or 10x10-18 curie.

63 Science for Democratic Action, Vol.12, No.2, March 2004, citing "Calculations by IEER from Harrison et al., 'Uncertainties In Dose Coefficients for Intakes of Tritiated Water and Organically-Bound Forms of Tritium by Members of the Public' Radiation Protection Dosimetry, 98:299-311 (2002)."

64 INEEL Test Reactor Area, Perched Water Systems, Record of Decision, December 1992, Waste Area Group OU-2-12, pages 14 through 16, DOE Idaho Operations Office.

65 Tritium in Flow from Selected Springs that Discharge to the Snake River – Hagerman Area, Idaho, 1994-99, US Geological Survey, Report 02-185, May 2002, DOE/ID-22180, page 7. The drinking water standard for tritium is 20,000 pCi/L which independent experts believe is not protective of human health.

66 Environmental Surveillance Program Quarterly Data Report, October - December, 2002, INEEL Oversight Program, page 21 and 22.

USGS reports also show groundwater flow, or "conductivity" in the Snake River Plain Aquifer can reach 32,000 feet per day, or 6.06 miles per day. [67] Contaminates discharged at INL have the potential to move rapidly through the aquifer to public water sources southwest of the INL boundary and take only 8 days to reach to the Snake River 50 miles south of INL. This rapid flow is attributed to the basalt lava flows underlying INL that have gaps called "lava tubes" that can "conduct" large amounts of water. [68] A 2003 USGS report analyzed the forty-one lava flows JUST under INTEC (formerly called ICPP) alone. "The 41 lava flows range in thickness from 9 to more than 197 feet, and are composed of one to typically two or more flow units." [69] Lava tubes can exist under the whole INL site which substantiates the earlier analysis of the presence of these lava flows. These lava flows and "fluvial silts, sands, and gravels along the course of the Big Lost River, a zone that can be up to 4 miles wide in places, makes the uppermost flows sampled near the new percolation ponds with a thickness of almost 80 feet in core hole ICPP-215," are significant factors of the "transmissivity" routes of INL contaminates horizontally to the aquifer westward-flow that eventually end up in the Snake River at Thousand Springs and other Snake River Aquifer outlets to the river. [70] Recent IDEQ report show sampling data at Alpheus Springs on the Snake River containing 4.2 pCi/L of gross beta. [71]

A 2001 USGS report analyzed the relative "age" of different water strata within the Snake River Aquifer under INL using sophisticated analytic tools that measure dissolved elements to determine how recently the water was on the surface. The study found that 20-50% of the aquifer water is between 14 and 21 years "old" (length of time since it was last on the surface before becoming subsurface aquifer recharge). The study also found chlorofluorocarbon gases generated from INL chemical waste discharges about 20 kilometers south of the INL boundary. [72] This USGS "age" study of the aquifer indicates a relatively rapid "turnover" of groundwater in the aquifer. The ramification being that radioactive and chemical contaminates in the aquifer are also likely moving as rapidly with the water through the aquifer. These findings are consistent with previously discussed sampling of aquifer spring discharges into the Snake River containing radioactive tritium that has a half-life of about 12.3 years. These USGS research findings moreover contrast dramatically with DOE's public claims that contaminates discharged at INL will take hundreds or thousands of years to reach the Snake River via the aquifer.

INL - over its operating history - has received significant quantities of spent reactor fuel from dozens of foreign and domestic (commercial and military) sources and recent minimal (non-

---

[67] Geologic Controls of Hydraulic Conductivity in the Snake River Plain Aquifer at and Near the Idaho National Engineering Laboratory, US Geological Survey, Report 99-4033, February 1999, DOE/ID-22155, page 1 and 16. USGS Report 03-4106 puts contaminate "transmissivity" in the aquifer at 70,000 square meters per day.

[68] Aley, Thomas, INEL[sic] Ground Water Study sponsored by DOE contractor EG&G, a six man group led by Wigus Creath, written by Thomas Aley, 1980, was canceled after its preliminary results showed that contamination "could move from INEL to the Magic Valley within months." Also see Reevaluation of Background Iodine-129 Concentrations in Water From the Snake River Plain Aquifer, Idaho, 2003, USGS Report 03-4106 p 3.

[69] Paleomagnetism of Basaltic Lava Flows in Core holes ICPP-213, ICPP-214, ICPP-215, and USGS 128 Near the Vadose Zone Research Park, INTEC, INEEL, Open Report 03-483, US Geological Survey, October 2003. DOE/ID-22189. page 3 and 9.

[70] DOE/ID-22189. Ibid. page 9.

[71] Department of Environmental Quality, Division of INL Quality and Radiation Control, Environmental Surveillance Program Quarterly Data Report, January-March 2004, page 20.

[72] Estimated Age and Source of the Young Fraction of Ground Water at the Idaho National Engineering and Environmental Laboratory, US Geological Survey, Water Resources Investigations Report 01-4265, DOE/ID-22177, page 1.

compliant) cleanup costs run between as 21 and 44.3 billion dollars. [73] Basically, this far exceeds the cumulative costs of all public works (including dams) in the history of the State of Idaho. And who will pay? Not the DOE contractors who, thanks to DOE, mostly have loopholes so they pay **no** taxes. The American taxpayer is left with the bill. Even regulatory violation penalties on INL operators are passed on by DOE contractors as expenses for doing business at INL and are thus paid by the taxpayer!

Most of INL irradiated reactor fuel (not all was easily "re-processable" and therefore dumped in the burial ground) inventory was "reprocessed" using an aqueous (PUREX) process which dissolves the fuel rods in nitric acid/solvent for aluminum clad fuel (or hydrofluoric acid for stainless/zirconium steel clad fuel) solution that then makes it possible to extract highly enriched uranium and other nuclear isotopes for various United States military programs. The mixed hazardous and high-level radioactive liquid waste and transuranic waste left over from this extraction process was then interned primarily but not exclusively (some waste was injected via wells into the aquifer) in underground storage tanks. "Each cubic meter of uranium-235 extracted during the nuclear fuel reprocessing operations generated 17 million cubic meters of liquid hazardous and radioactive waste, referred to as 'mixed low-level waste' as well as 5,000 cubic meters of liquid high-level waste. In addition, the largest volume of contaminated soil at INL (approximately 146,000 cubic yards) is found around and below the high-level waste tanks. According to DOE, 'the contaminated soils at the Tank Farm comprises about 95%' of the contaminant inventory ..." [74] This does not take into account the high-level waste tank heels DOE intends to leave in place as a permanent disposal site!

These (non-RCRA compliant) fifty-year-old single wall tanks were never intended to be the permanent repository for this waste because of the known toxicity of the waste, the limited service life of the tanks/vaults themselves, and the fact that at the time (and arguably currently) it was illegal under federal statute.

The concrete vaults that encase the eleven high-level 300,000-gallon tanks at the Idaho Nuclear Technology and Environmental Center (INTEC), formerly the Idaho Chemical Processing Plant (ICPP), are known to leak. A 1994 State of Idaho investigation showed that over a twenty-three month period (11/92 - 9/94) about 123,500 gallons of contaminated water was pumped from the tank vault sumps. The investigation concluded that the source of the water was precipitation, irrigation, and leaking high-level tank waste system lines.[75] DOE notes in an internal 1999 report that some 2,000 gallons/yr. of waste are pumped from the INTEC high-level tank farm sumps which could be tank leaks, service lines, or from other unknown sources. [76] Additional, and recent INL reports puts the various INTEC tanks and other high-level waste processing plant "sumps" annual accumulation at 36,633 gallons. [77] Moreover, given the known porosity (inability to contain liquid waste) of the tank vaults and other sumps, it is a reasonable assumption that a significant volume in addition to 36,633 gal/yr. pumped from the sumps are responsible for the massive groundwater contamination under the tanks. Regardless of the source of waste in the tank sumps (within the HLW tank vaults), this is high-level waste (containing 500,000 Ci) [78] that must be managed appropriately according to federal stature and regulatory

---

[73] C. Stephen Allred, Director of Idaho Department of Environmental Quality, affidavit to US Federal Court in (USA v. Kempthorne, 91-0035) 2/8/02.

[74] Hormel, 2003

[75] Investigative Evaluate Report, State of Idaho INEEL Oversight Program 1994 Progress Report, page 10.

[76] Trip, J.L. et al "INEEL Radioactive Liquid Waste Reduction Program" Lockheed Martin Idaho Technologies Co. March 4, 1999, page 7.

[77] Ibid. Footnote # 47, Page 9. www.wmsym.org/wm99/pqsta/44/43-6.pdf.

[78] National Academy of Sciences, NAS 2006, TABLE II-3 Pg. 28.

law. Any reasonable analysis would determine that the documented massive soil and ground water contamination beneath the Tank Farm originated therein.

DOE's reliance on these failed high-level tank concrete containment vaults for **permanent** disposal of high-level waste sediments under a new DOE Order 435.1 is misguided and puts the general public and future generations at significant risk. The tank sediments contain the bulk of the long-lived transuranics and will eventually migrate to the underlying aquifer. [79]

As previously noted, the Natural Resources Defense Council, together with numerous Native American Tribes and environmental groups, successfully challenged this DOE Order in US Federal District Court in 2003. [80] DOE appealed to the District Court ruling against the agency in the Ninth Circuit Court of Appeals. Because the INL sits directly atop the Snake River Plain Aquifer, designated by US Environmental Protection Agency (EPA) as a regional sole source aquifer, protection of this aquifer is a main component of the 1995 Settlement Agreement between the State of Idaho and DOE. [81]

Past and current high-level and transuranic waste mismanagement practices have resulted in massive contamination of the groundwater under the INL operations. This recognized groundwater contaminate pathway represents a significant hazard to the general public solely with current contaminate levels. Migration of buried waste contaminates into underlying soil and perched ground-water zones is extensively studied by US Geologic Survey and their report notes: "These zones are an integral part of the pathway for contaminates to move to the Snake River Plain Aquifer. Water moves rapidly through surficial [sic] sediments ..." [82] As previously cited, Plutonium-239-240 have been detected under INL at 66 pCi/L, or 4.4 times the drinking water standard . [83] This plutonium contamination represents a clear present and future danger to aquifer and or Snake River, Columbia River communities that rely on this crucial water resource.

Table 6. Summary of best estimates and upper bounds of Rocky Flats Plant waste buried at the RWMC Subsurface Disposal Area. [84]

Radionuclide	Best estimate (kg)	Upper bound (kg)
Plutonium	1,102	1,455
Amercium-241	44	58
Enriched uranium	386	603

[79] See EDI Comments on DOE plan to reclassify high-level waste: http://www.environmental-defense-institute.org/publications/EDIComHLW6.pdf

[80] Natural Resources Defense Council et al. vs. Spencer Abraham, Department of Energy, US District Court for the District of Idaho, Civil No 91-0035. Co-plaintiffs, as of this writing, include Confederated Tribes and Bands of the Yakima Nation, Shoshone-Bannock Tribes, and Snake River Alliance.

[81] Public Service Co. v. Batt, No. CV91-0035 S- EJL, US Federal Court for the State of Idaho, 1995 Settlement Agreement, page 8.

[82] A Transient Numerical Simulation of Perched Ground-Water Flow at the Test Reactor Area, Idaho National Engineering and Environmental Laboratory, Idaho, 1952-94, US Geologic Survey, Report 99-4277, DOE/ID-22162.

[83] Idaho INEEL Oversight Program Report, December 2000, page 25.

[84] A Comprehensive Inventory of Radiological and Nonradiological Contaminants in Waste Buried in the Subsurface Disposal Area of the INEL RWMC During the Years 1952-1983 Volume 1, INEL-95/031 0 (Formerly EGG-WM-1 0903) Rev. 1 August 1995, Appendix C, Table C-1.

IV. DOE Current Actions Pose an Imminent Threat

The INL - over its fifty-year operating history - has generated on-site, or received via off-site shipments, significant quantities of high-level radioactive nuclear fuel waste (i.e. Nuclear Navy and Hanford reactor fuel), and transuranic waste (i.e. DOE's Colorado Rocky Flats Site) from fabrication of plutonium nuclear bomb components.[85] Due to ongoing mismanagement, this waste continues to present a major hazard to the public due to migration into the ecosystem. [86]

INL uses many sites (in addition to the RWMC burial ground dump) for permanent disposal of transuranic waste including injection wells into the aquifer and unlined percolation ponds. [87] The largest and most significant INL disposal sites are the Radioactive Waste Management Complex (RWMC) dump, and the Materials Fuels Complex, Radioactive Scrap and Waste Facility, located on the INL site. [88] Internal DOE documents, gained by the Environmental Defense Institute (EDI) through Freedom of Information Act requests and other state and federal agency records, show more than ninety (90) metric tons of high-level irradiated reactor fuel was dumped at the RWMC. EDI's Amicus brief shows the itemized listing of this irradiated reactor fuel interned at the dump. [89] Generally, over the many decades of INL operation, the only reactor fuel put into "storage" was fuel the DOE intended to reprocess. The rest, apparently was simply dumped in the burial ground. Reactor fuel considered difficult or "un-reprocessable" were simply dumped in the RWMC burial ground along with the reactor cores.

Table 7. Spent Reactor Fuel 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

85 See EDI website publication reports on INEEL buried waste that documents about 3,000 kg of Rocky Flats plutonium was dumped at INL.

86 Tami Thatcher, *Irradiated Target Separations Continue at the ATR Complex* , EDI Newsletter September 2017.

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

88 Kathleen Trever, Declaration, US Federal Court for the District of Idaho, 2/18/02, in USA vs. Kempthorne.

89 The 90 metric ton (MT) numbers, 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 this 90 MT listing are even more numerous shipments called "unirradiated fuel", "fuel rods", "control rods", and other reactor fuel not identified specifically as "irradiated". The curie content of these non-included waste in this summary are shipments identified as "fuel rods" (>7,000 curies each) suggests that they are also irradiated reactor fuel. The 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 DOE's Spent Nuclear Fuel Environmental Impact Statement. Equally significant are nuclear reactor fuel related waste shipments to the RWMC burial grounds. This waste includes reactor fuel parts cut off the fuel elements prior to storage and fuel storage "canal trash" that represents over **9,866,112 curies.** The INL burial grounds are a shallow disposal area that would not meet EPA Subtitle D municipal garbage landfill regulations.

Equally significant are spent nuclear fuel related waste shipments to the RWMC burial grounds. This waste includes spent nuclear fuel parts cut off the fuel elements prior to storage and fuel storage "canal trash" that represents over **9,866,112 curies.** [90] The burial grounds are a shallow disposal area that would not meet municipal garbage landfill regulations.

DOE's Rocky Flats Plant in Colorado shipped substantial quantities of plutonium waste to INL. EDI's investigations into these Rocky Flats shipments show that considerably more plutonium was shipped to INL and dumped than is disclosed by Idaho or DOE. EDI's documentation contends and further shows that the concentrations of plutonium and highly enriched uranium waste dumped in the INL dump poses a significant criticality hazard. [91]

Prior to 1973, all waste shipped to INL for burial was simply dumped from the truck into an open pit or trench. Normally only one pit or trench was open at any given time, no sorting or assessment of what was in the barrels or boxes was made. Nuclear waste shippers like the Rocky Flats Plant in Colorado knew there would be no assessment of what was listed on the shipping manifest so there was no incentive to do thorough characterization prior to shipment. Although DOE is not publicly acknowledging the fact, its internal reports show the buried waste contains 11,000,000 curies [92] of radioactivity including 1,455 kilograms of plutonium from Rocky Flats alone. [93] According to DOE, the **total** buried plutonium (2,160 kg) from both Rocky Flats and **other** sources contains 700,400 curies of radioactivity. [94]

The above DOE totals are now known to be grossly understated due to 1996 revelations about Rocky Flats plutonium waste shipments to INL as noted above. The radioactivity in the INL buried waste cited above is still significantly understated because it relies on original Rocky Flats shipping manifest records that are completely unreliable. There were no checks at the INL dump to confirm the accuracy of the manifests because these were shipments between DOE facilities.

These discrepancies were revealed only in the last few years when DOE was forced to disclose (stipulated in international nuclear non-proliferation treaty agreements) where all its nuclear bomb material is located and give precise inventories. Rocky Flats Plant (largest plutonium waste shipper to INL) conducted a physical inventory of plutonium, compared it to the book inventory, and determined that 1,191.8 kg of plutonium was unaccounted for and 953 kg of that total was shipped as waste to INL, and not previously acknowledged in shipping manifests. The final total of 1,416 (kg) was dumped at the RWMC. [95] [96]

---

[90] DOE's Radioactive Waste Management Information System Database (P61SH090, and P61SH070, Run Date 10/24/89, obtained by EDI via a FOIA request.

[91] Criticality occurs when sufficient quantities of fissionable material spontaneously (or under controlled conditions in a nuclear reactor) produce a self-sustained nuclear reaction. An uncontrolled criticality event in buried waste represents an extreme hazard due to radioactive releases to the environment. Three spontaneous and apparent criticality fires occurred at the RWMC in September 1996 and June 1970. (PR-W-79-038 page 30. For a more complete discussion see EDI's INEEL News December 2000 issue.

[92] A Comprehensive Inventory of Radiological and Non-radiological Contaminates in the Waste Buried in the Subsurface Disposal Area of the INEL RWMC During the Years 1952-1983, Volume 1, Idaho National Engineering Laboratory, EG&G Idaho, Inc., June 1994, page 6-25, herein after referred to as EGG-WM-10903.

[93] DOE/ID Contractor Report, EGG-WM-10903, page 2-76 and C-5 Table C-1.

[94] DOE/ID Contractor Report, EGG-WM-10903, page xxix, Table S-2.

[95] The United States Plutonium Balance, 1944 – 2009 An update of Plutonium: The First 50 Years, DOE/DP-0137, February 1996, June 2012. Table 4 Plutonium in Waste Estimates 1,416 (Kg) dumped at Idaho Site .

[96] Openness Press Conference Fact Sheets, February 6, 1996, U.S. Department of Energy, page 65. In 1996, then DOE Secretary O'Leary revealed that 1,191.8 kg of Plutonium could not be accounted for at Rocky Flats. An August 1994 internal Rocky Flats report called "A Discussion of Inventory Difference, Its Origin and Effect," by N. J. Roberts says 200 to 300 kg of the unaccounted Plutonium (Pu) may be in holdup (in piping, duct-work, equipment and the like). Roberts thought Pu contained in waste sent to INL may have been understated by 600 to

So how much plutonium is dumped in Idaho? If the unreported Rocky Flats plutonium shortfall shipped to INL (953 kg) is added to what DOE previously thought was in the INL dump (2,160 kg) from Rocky Flats and other sources, it adds up to 3,113 kg in the dump from all sources. This is an enormous amount of plutonium (enough for about 1,000 bombs) given that it takes only about three to four kg of plutonium to make a nuclear bomb.[97] As previously discussed, this plutonium is migrating from the dump site into the aquifer and, therefore, continues to pose a public health threat.

A July, 2000 article in the Twin Falls, Idaho *Times News* discussed how much trouble INL is having shipping stored waste to the DOE's New Mexico transuranic waste dump (WIPP), due mainly to serious underestimates of the total plutonium in each drum. [98] Forty-seven barrels of plutonium-contaminated waste couldn't be shipped because they contained too much plutonium.

V. INL High-level Waste Tank Aquifer Hazard

At INL, the primary facility for reprocessing irradiated nuclear reactor fuel is the INTEC formerly known as the Idaho Chemical Processing Plant (ICPP), although some reprocessing is ongoing at the Materials Fuels Complex (MFC) formerly called Argonne National Laboratory-West that now is merged with INL. The INTEC underground high-level Tank Farm, consisting of eleven 300,000-gallon tanks with a current volume of about 1.4 million gallons, [99] is only part of a large complex of an <u>additional</u> 127 high-level waste tanks that are part of the INTEC high-level waste operations. EDI has listed these 127 tanks, their location and what process they are attached too, however the waste volume of their sediment contents is uncertain. [100] Some of these tanks are a significant criticality hazard due to the high concentration of fissile (uranium and plutonium) material content of the tanks. [101]

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. [102] DOE's own reports show radioactive groundwater contamination under INTEC greater than 60,000 times, and at Test Reactor Area 176,000 times, the EPA-regulated maximum radionuclide concentration level for drinking water. [103]

The hazard 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. [104] Flooding of these tanks and the related high-level waste processing buildings will flush pollutants into the aquifer and endanger the general public, since these radionuclides are toxic for tens of thousands of years.

---

800 kg. On Feb 21, 1996, then Rocky Flats DOE manager Mark Silverman said that up to 80% of the total unaccounted for Rocky Flats Pu -- that is, up to 953 kg-- went to INL.

97 Plutonium-239 is a nuclear weapons grade isotope, however other species of plutonium are also fissionable.

98 Data Raises Concerns About Accidental Nuclear Reaction, Twin Falls Times News, 11/11/00 Quoting Wayne Pierre of EPA. Also see, Subsurface Treatability Study Report, July 2000, INEEL/EXT-2000-0040-3.

99 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. Incinerators/evaporators have lately reduced the tank volume to about 900,000 gal..

100 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).

101 HLW/EIS, page 5-206.

102 IEER, October 2001, page 54, citing Environmental Science Foundation, July 1997.

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

104 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

Recent 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. [105] This data (not disclosed by DOE or IDEQ) clearly indicates either serious leaks or an equally serious surface/groundwater contributor to INTEC contaminate dispersion into the underlying Snake River Aquifer.

VI. High-level Waste Tank Closure Continues

The process of closure of these high-level waste tanks at INL has begun. At issue here is not the need to close the tanks, but what federal statutes and the Settlement Agreement stipulations on buried high-level and transuranic waste will be appropriately implemented and enforced to assure proper closure in order to protect the public and environment. The Idaho Department of Environmental Quality (IDEQ) issued a high-level waste tank Closure Plan for five INTEC tanks. [106] More recently IDEQ issued a closure plan for an additional three HLW tanks along the same misguided criteria. [107]

The IDEQ Tank Closure Plan violates environmental regulation that states in pertinent part, “A detailed description of the steps needed to remove or decontaminate **all hazardous waste residues** and contaminated containment system components, equipment, structures, and soils during partial and final closure including, but not limited to, procedures for cleaning equipment and removing contaminated soils, methods for sampling and testing surrounding soils, and criteria for determining the extent of decontamination necessary to satisfy the closure performance standard.” (Emphasis added) [108]

Closure and post-closure care regulation also states: “At closure of a tank system, the owner or operator must **remove or decontaminate all waste residues**, contaminated containment system components (liners, etc.), contaminated soils, and structures and equipment contaminated with waste, and manage them as hazardous waste.” [Emphasis added] [109] “As such, these liquids contain radioactive fission products in sufficient concentrations to warrant permanent isolation in a geologic repository.” [110]

DOE’s attempt to delist the high-level tank wastes defies its own internal contractor documents that show the history of these tanks. DOE estimates that about 20,000 gallons of tank sediment heels are in each of the eleven Tank Farm units which would leave a total of 220,000 gallons permanently interned. [111]

This review primarily focuses on the 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.

---

105 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

106 See Idaho Department of Environmental Quality, RCRA/HWMA Permit Docket No. 10HW-0204.

107 Idaho Department of Environmental Quality, RCRA/HWMA Permit Docket No. 10HW-314, dated November 14, 2003. Also see IDEQ closure permit for INTEC tanks WM-184,185, and 186, 2/25/04 .

108 40 CFR 265.112(b)(4)

109 40 CFR Sec. 265.197(a) Subpart J--Tank Systems

110 IHLW/EIS, page F-3.

111 IHLW/EIS, page 1-17

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.

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

The bottom line is Idahoans and all communities downstream from INL can ill afford to compromise the region's most valuable water resource for this and future generations. The state has already demonstrated its lack of enforcement "due-diligence" by approving a tank closure plan that will permanently leave thousands of gallons of high-level and transuranic waste in place over the aquifer. This is as much an issue of "homeland security" as fighting terrorists and the Bush Administration must commit the requisite resources to cleaning up the INL nuclear legacy of the cold war. It's unconscionable that the State of Idaho is actively blocking crucial information offered by EDI, and needed by the federal court and the general public to make informed decisions about the disposition of the INL massive waste problem. One can only assume that both the state and DOE want to keep both the court and the public in the dark about the extent of the INL problems.

Below is a table showing what limited information is available EDI only as a result of several Public Information Requests to the State of Idaho, and not generally available to the public.

Table 8. Residual "Heels" Inventory in Grouted/Closed INTEC Tank Farm Facility

Grouted Tanks	**sludge volumes** (PNNL) [112] **gal./m 3 (cm)**	**Residual Inventory** WSRC **Giga/Becquerel (GBq)*** [113]	**Residual Inventory DOE Curies** [114]	**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

112 PNNL-13651 UC-721, Pg. 3.1

113 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.

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

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.

State of Idaho INL Oversight Program Director, Kathleen Trever's reported statements to the media that "Idaho's agreement with the agency [IDEQ] says that if the department [DOE] can get the high-level waste out of the tanks by washing them and pumping the waste out, it can leave about an **inch of slightly radioactive liquid in the tanks**, fill the tanks with clean grout and leave them in place, Trever said." [115] [emphasis added] As discussed below, there is no credible basis for this claim. Moreover DOE intends (according to DOE INEEL HLW/EIS NEPA documentation) to mix high-activity (cesium and strontium) waste in the grout slated for the tanks (not "clean grout") which is yet another apparent misrepresentation by Idaho to the public.

The final INEEL HLW/EIS [116] puts the INTEC HLW (high-level waste) tank heels at between 5,000 and 20,000 gallons per tank, and makes no commitment to exhume the tank heels, only liquids extractable using existing jet pumps located 9.5 inches above the tank floor. [DOE/EIS-0287 page 2-14] and [DOE/ID-10802, 12/20/00, pg. A-19]

Given that all of the above eleven tanks are fifty feet in diameter, 9.5 inches of waste amounts to 11,620.3 gallons. [117] At the DOE's upper limit of 20,000 gallons of heels in each of the eleven INTEC HLW tanks (a more reasonably conservative estimate), the total volume for all eleven tanks could be 220,000 gallons. This conservative estimate of tank heel volume is especially pertinent given the presence of coolant coils in eight of the eleven Tank Farm HLW tanks that are about two feet above the bottom of the tanks. [118] See EDI Tank Closure Comments, Attachment A. [119]

"Construction Photo of HLW Tank Interior." Extraction of the ~ 29,400 gallons of tank heels in each tank or a total for the eight tanks with cooling coils of about 235,000 gallons without dedicated equipment capable of dislodging and exhuming the heels bound up in the cooling coils becomes extremely problematic. Again, DOE has made no commitment for any dedicated heel extraction equipment only implementing existing jet pumps for the liquid contents above the 9.5 inch level.

For general discussion purposes the eight INTEC HLW tank heel totals (with cooling coils) at ~ 235,000 gallons (29,400 times eight) and three tanks at 60,000 gallons each (20,000 times three) could leave potentially amount to about 295,000 gallons of high-level tank heels permanently in place under DOE's tank closure plans. [120]

There are about 145 additional (not including the eleven Tank Farm units listed above) INTEC HLLW tanks (part of the INTEC Liquid Waste Management System ILWMS) with

[115] Salt Lake Tribune October 19,2003, Associated Press story "Idaho wants support in reclassifying liquid waste."

[116] Idaho High-level Waste and Facilities Disposition, Final Environmental Impact Statement, September 2002, DOE/EIS-0287, referred hereafter as DOE/EIS-0278.

[117] It is a credible assumption to put the minimum amount of waste in each of the tank bottoms at 11,620 gallons since only the existing jet pumps are used. Therefore, the above table listing only 5,000 gallons of tank heels must be considerably understated by about 6,620 (11,620 - 5,000) gallons per tank or an additional 33,100 gallons for those five tanks listed at only 5,000 gallons.

[118] Idaho Hazardous Waste Management Act/Resource Conservation Recovery Act Closure Plan for Idaho Nuclear Technology and Engineering Center Tanks WM-182 and WM-183, DOE/ID-10802, Nov. 2001, page 2.

[119] Chuck Broscious, Supplementary Public Comments for the Record on U.S. Department of Energy Interpretation of High-Level Radioactive Waste Submitted by Environmental Defense Institute. http://www.environmental-defense-institute.org/publications/EDIComHLW6.pdf

[120] Assumptions in this "general purpose discussion" are; 1.) tank diameter is 50 feet; 2.) cooling coils are about two feet above the bottom of the tank based on the cited photo depiction of the tank interior; 3.) there are eight tanks with cooling coils as stated in DOE/ID-10802 page 2; 4.) the remaining three HLW tanks do not contain coolant coils and the existing jet pumps are 9.5 inches above the bottom of the tank as previously cited in DOE/ID-10802.

volume capacity of more than **440,000 gallons** of waste that may also be left and grouted in place in DOE closure plans. [121] To date, DOE has not disclosed any comprehensive assessment of these 145 additional tanks, or their liquid waste and heel volumes. There is however some limited information on the activity content of some operations.

Table 9: INTEC Tanks in Use Radioactive Solids/Heels Transuranic Contents

INTEC SBW Tanks in-use	Cs-137 Curies [122]	Solids Quantity (kg) [123]	Sand-Pads cushion under tanks Ci	Total Curies [124]	Total nCi/g [125]	No. Times Over Reg. Limit [126]
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 [127]	101,400	190,000	3,850	5,719 7,700	?	?
Table 5	21,820	3,815	3,850	24,800		
Total All	**123,220**	**193,815**	**7,700**	**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]

For instance the New Waste Calcine Facility (NWCF) will retain 8,610 curies and the Process Equipment Waste Evaporator (PEWE) will retain 7,768 curies (decayed to 2016) after closure. [DOE/EIS-0287D (1999) pages C.9-9] Again, as discussed below, these figures are considered to be significantly understated.

Idaho Department Environmental Quality (IDEQ) approved closure plan for WM-182 & 183 in July 2003. Preliminary closure plan was approved (11/14/03) by IDEQ (Docket # 10HW-0314) for INTEC HLW tanks WM-184, 185, 186 that will be finalized 12/03. The same basic regulatory issues and alleged violations apply to both closure plans as discussed below.

The completed closure of the Waste Calcine Facility at INTEC demonstrates how DOE is proceeding to close other operations (in addition to the Docket Number 10HW-0314, HLW tanks) by grouting them in place. It must be noted that these (as well as the HLW tanks) are **not** a Resource Conservation Recovery Act (RCRA) compliant "clean closure" but a negotiated "performance-based" deal with the State of Idaho that would not otherwise meet regulatory

---

[121] Chuck Broscious, INTEC Liquid Waste Management System, Rev, 13, 11/17/03, Tank List Report, Environmental Defense Institute .

[122] Ibid. Robert Alvarez

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

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

[125] 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.

[126] 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.

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

requirements under RCRA or the Nuclear Waste Policy Act (NWPA). Also see alleged non-compliant closure of INTEC SFE-20 tank closures containing HLW.

Since INL started operations over five decades ago, "reprocessing of reactor fuel generated approximately 10 million gallons of highly radioactive liquid waste, with more than 50 million curies of radioactivity." [128] This represents a volume to activity relational rate of 1 to 5 (liquid to curie). [129] If applied as a crude ball park to current activity level of the eleven INTEC HLW Tanks listed above would yield an activity curie content of about **forty or fifty million curies,** or many orders of magnitude more than what DOE and the State of Idaho are acknowledging to the general public. If the radioactivity contained in the other 145 ancillary tanks in the INTEC Liquid Waste Management System, discussed above, is not appropriately included in the tank closure plan risk assessment for the whole INTEC site. This represents an enormous amount of radioactivity DOE and the state intend to leave permanently in a flood zone and above the Snake River Aquifer. To put these radioactivity levels into perspective with respect to their deadly nature, EPA's drinking water standards for these radionuclides are in units of pico curies per liter or one trillionth of one curie.

Tank heels contain significantly higher radioactivity content than the liquid portion especially with respect to heavy long-lived transuranic elements like plutonium, uranium, and neptunium that tend to settle out into the tank heels. DOE claims that the tanks undergoing closure do not contain high-level waste, yet up until 1997 they received first cycle raffinate which means the dominate tank heels will contain HLW. See Attachment B. Moreover, the extensive ongoing use at INL of high-level liquid waste (HLLW) evaporators that burn off excess liquid containing volatile hazardous (i.e. mercury) and radioactive (i.e. tritium and C-14) portions of the waste to the atmosphere, means the current residual tank waste will have an even **higher** concentration of the non-volatile radioactive and hazardous waste constituents (i.e. cadmium, chromium, and lead). [130]

Internal INL reports (see previous EDI submittals to EPA/IOG on internal INL reports on tank closure) confirm that grout when dumped into the tank does not mix with the residual tank waste, nor does it flow underneath the tank heels as DOE claims in its publications. Additionally, grout dumped into the tank vault between the tank and concrete vault does not flow underneath the tank as DOE claims. Therefore, the waste Risk Calculation "fate-transport" model assumptions used by DOE to show impact of waste migration on Snake River Aquifer are not credible because (among other reasons) they do not include residual waste. [131] Moreover, this inability to fully mix grout with the residual tank heel waste and test the resulting mixture for homogeneity and resistance to waste leachate, is a violation of RCRA clean closure standards. [132] As previously discussed, long-half-life decay "daughter" products of radionuclides in the tank heels has not been included in the risk assessment. DOE cannot claim a credible risk assessment without including the entire "decay chain" for each radionuclide contaminate.

"There is insufficient understanding of the long-term risks to groundwater and surface water from simply grouting high-level waste in tanks. Given past experience with grouting of wastes, these contaminates may leach out into the groundwater much faster than anticipated and add to the existing contamination in the groundwater, and eventually to the surface water. Moreover, grouting the tank waste in place would put the residual wastes in a form that would be very difficult to retrieve were they to leak. Grouting would also make remediation of the vadose zone

[128] Affidavit of Kathleen Trever, State of Idaho Coordinator-Manager for INEEL Oversight, 3/24/03

[129] DOE's own tank closure plan (not readily available to the general public) also notes activity level as high as 40 curies per gallon. DOE/ID-10802, 11/01, page 5.

[130] INL/EXT-01-0066 Rev 2, 8/02, page 44

[131] DOE/ID-10802, 12/20/00, pg. B-2

[132] 40 CFR 264.111 and 265.111

even more difficult. DOE admits that: **'[T]ank closure is, for all practical purposes, irreversible. DOE would have great difficulty undoing a closure [with grout] if it were later discovered that an estimate [of residual radionuclide inventory] had been improperly developed, or that the performance had been improperly evaluated**.' " [133]

DOE/ID's INTEC HLW tank closure plan includes "landfill" rationale. [DOE/ID-10841, December 2000] This, in view of the recent Federal Court ruling in NRDC vs. DOE, is patently illegal. INTEC and the subject HLW tanks (the bottoms of which are some 40 feet below the flood level) are within the Big Lost River flood plain and therefore do not meet RCRA, NRC or NWPA criteria as a permanent disposal site for high-level waste.

Additionally, we request, in view of the court ruling, a review of the IDEQ INL INTEC tank closure permits related to INTEC tanks WM-182 and 183 closure (Docket # 10HW-0204) and INTEC SFE-20 tank closure permit (Docket # 10HW-0203), and IDEQ Closure Permit for the INTEC Waste Calcine Facility [Docket # 10HW0305] and related tanks containing high-level waste as defined by the 7/3/03 U.S. District Court Decision that states in pertinent part: "... the solids sink to the bottom, forming a sludge, leaving the liquids on top. This physical separation is analogous to the NWPA's definition for separation: The liquid and solids are treated differently by the Act. While NWPA allows DOE to treat the solids to remove fission products, thereby permitting reclassification of the waste, NWPA does not offer the option of reclassification for liquid waste produced directly in reprocessing." [page 10] Judge Winmill's decision therefore applies to all INL tanks containing high-level waste. The wastes that are from reprocessing are not to be left in **any** of the tanks at INL and merely grouted.

We note that the NRDC vs. DOE decision should be applied to the tanks (as previously noted) associated with the Waste Calcine Facility ("WCF"), the New Waste Calciner Facility ("NWCF"), including but not limited to the Calciner itself and the tanks for the High Level Liquid Waste Evaporator, Process Equipment Waste Evaporator (PEWE), Liquid Effluent Treatment Disposal (LET&D), and other INTEC Liquid Waste Management System tanks. The contents of these tanks should be slated for RCRA clean closure and removal from the state of Idaho and not allowed to enter into the "loosely-goosy" risk based CERCLA process.

VII. Percolation Pond Dumping Hazard

The legal question under the Clean Water Act of the connection between surface hazardous waste discharges and resultant liability of contamination of public water systems has been answered in US Federal Court. [134] The polluter is liable! Despite this court ruling EPA and State of Idaho regulators fail to indict INL for major discharge violations. The Test Reactor Area extensive use of unlined percolation ponds to dump radioactive and chemical liquid wastes is cited here only as an example of the INL site-wide use of this misguided practice. This deadly pollution will eventually migrate to the Snake River Aquifer. The Congressional Office of Technology Assessments states:

---

[133] *Science for Democratic Action*, March 2004, citing USDOE "Technology to Mitigate Effects of Technetium under Tank Closure Conditions," SR00-2051, November 2001.

[134] United States District Court in Idaho Rural Council v. J. Bosma, No. CV-99-0581-S-BLW, June 4, 2001 states, "Clean Water Act (CWA) extended Federal jurisdiction over groundwater that is hydro-logically connected to surface waters that are themselves waters of United States." Federal Water Pollution Control Act ss 502(7), as amended, 33 USCA ss 1362(7). The ruling further notes in other court rulings that, "Congress intended to regulate 'discharges of pollutants that could affect surface waters of the United States. The rationale supporting this conclusion is simple and persuasive: 'since the goal of the CWA is to protect the quality of the surface waters, whether directly or through groundwater, is subject to regulation by the NPDES permit" Washington Wilderness Coalition, 870 F. Supp. at 990. "Whether pollution is introduced by a visible, above ground conduit or enters the surface water through the aquifer matters little to the fish, waterfowl, and the recreational uses which are affected by the degradation of our Nations Rivers and streams."

"Contaminates may also form or absorb onto colloidal particles, which allows them to move with, or faster than the average groundwater flow. Flow can result from an apparently unrelated force, such as the flow of water and contaminates due to a thermal or electrical gradient instead of the expected hydraulic gradient. Chemical reactions and biotransformation may occur, possibly changing the toxicity or mobility of contaminates. Some contaminates dissolve and move with the water; some are in the gas phase; others are non-aqueous phase liquids; some are more dense than water and may move in a direction different from groundwater; others may be less dense than water and float on top of it." [135]

USGS additionally reports; "If large inputs of water are applied to the ponds or large amounts of water from the nearby Big Lost River infiltrate the subsurface, mounding of perched water can contribute to lateral flow-a potential mechanism for contaminant transport away from the new percolation ponds." [136]

Table 10. Liquid Waste Volumes Disposed at Test Reactor Area [137]

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

[TRA Record of Decision(a) @ 5]

Table 11. Test Reactor Area Perched Ground Water Sample Data

Nuclide	Concentration pCi/L	EPA Standard pCi/L	Times over Standard
Cobalt-60	12,200,000	100.00	122,000.0
Zinc-65	105,000	300.00	350.0
Cesium-134	62,400	8.13*	7,675.0
Cesium-137	21,000,000	119.0*	176,470.0
Europium-152	108,000	60.00	1,800.0
Europium-154	130,000	200.00	650.0
Europium-155	20,400	600.00	34.0
Americium-241	16,700	6.34	2,634.0

135 OTA(a); Complex Cleanup, The Environmental Legacy of Nuclear Weapons Production, US Congress Office of Technology Assessment, Feb.1991, p. 38

136 Spatial Variability of Sedimentary Inter-bed Properties Near the Idaho Nuclear Technology and Engineering Center at INEEL, USGS Report 03-4142, June 2003, DOE/ID-22187.

137 TRA ROD(a); Record of Decision, Test Reactor Area Perched Water System, Operable Unit 2-12, Idaho National Engineering Laboratory, December 1992, US Department of Energy. Also Administrative Record, TRA Summary Tables of Chemical and Radiological Analysis, Appendix G-484 and 485, Analytica-ID-12782-1 [D-615 to D-632] [EPA-570/9-76-003] *[FR-7/18/91].

Chromium-51	2,540,000	6,000.00	423.0
Nuclide	**Concentration pCi/L**	**EPA Standard pCi/L**	**Times over Standard**
Iron-59	2,600	200.00	13.0
Zirconium-95	11,500	200.00	57.0
Niobium-95	12,000	300.00	40.0
Ruthenium-103	3,970	200.00	19.8
Rhodium-106	4,980	30.00	166.0
Silver-108	14,400	90.00	160.0
Antimony-124	150	60.00	2.5
Cerium-141	6,140	300.00	20.4
Ytterbium-175	3,500	300.00	11.6
Hafnium-181	136,000	200.00	680.0
Tantalum-182	3,180	100.00	31.8
Lead-203	1,680	1,000.00	1.6
Plutonium-239	12	15.00	0
Uranium-234	520	13.9*	37.0
Strontium-90	18,000	8.00	2,250.0
Tritium	3,940,000	20,000.00	197.0

The above tables and other tables in this report citing EPA Maximum Contaminate Levels (MCL) utilize both the current standards (40 CFR 141.66) that specify a 15 pCi/L gross alpha and a cumulative dose: "If two or more radionuclides are present the sum of their annual dose equivalent to the total dose or to any organ shall not exceed 4 millirem/yr." The 4 millirem/year (mrem/yr) dose limit and the EPA 1976 published determination, and listing, for individual radionuclide MCL's that are based on the 4 mrem/yr limit are used in this report. EPA attempted unsuccessfully in the late 1970's and again in 1991 to propose changes to these standards.

General public outrage that the standards are not protective of public health resulted in EPA falling back on the original 4 mrem/yr standard. Thus currently EPA regulations do not show individual radionuclide MCL's but the earlier EPA individual 4 mrem/yr radionuclide doses are apparently not in contention. [138] [139]

VIII. Injection Wells Contribution to Aquifer Contaminate Migration

INL Radioactive and Chemical Waste Injection Wells

A clear exemplar of DOE/INL's complete disregard for environmental degradation and actualizing the "out-of-sight-out-of-mind" is seen in their extensive use of injection wells to dispose of hazardous/radioactive process waste. This practice was only partially curtailed (see Table 11 below for operational injection wells) after the passage of the Federal Facilities Act and

[138] National Primary Drinking Water Standards, Current EPA Maximum Concentration Levels for Radionuclides in Drinking Water, Tables IV-2A and IV-2B, EPA-570/9-76-003

[139] Tami Thatcher, Irradiated Target Separations Continue at the ATR Complex, EDI Newsletter September 2017

the Clean Water Act when former Governor Andrus forced DOE to close the INTEC injection well in 1982.

Table 11. INL Waste Injection Wells [140]

Injection Well	History	Contamination	Status
Test Area North (TSF-05)	Drilled 1953 305 feet	Radioactive and Volatile Organic	Now used for groundwater remediation
Test Area North Initial Engine Test (IET-06)	Drilled 1953, 329 feet Nuclear Engine coolant and fuel	Radionuclides and chemicals	Converted to a monitoring well 1982
Test Area North WRRTF well (WRRTF-05)	Drilled 1957 313 feet	50 mCi Cobalt-60 212 liter (56 gal) Turbine oil	Abandoned 1984
Test Reactor Area (TRA-05)	Drilled 1964	Chromium and radionuclides	Converted to monitoring well 1982
Test Reactor Area (USGS-53)	Drilled 1960	Chromium and radionuclides	Converted to monitoring well 1964
ICPP (CPP-23)	Drilled 1952 580 feet	21,302 Curies of rad. and chemicals	Pressure grouted closed 1989
ICPP (USGS-50)	Used Sept.1970 to present	Chemicals and radionuclides	**Currently used for emergency disposal & as a monitoring well**
Axillary Reactor Area Power Burst Facility (PBF-15)	Used 1972 to 1978 for reactor coolant discharge and corrosive waste	Sulfuric acid Sodium Hydroxide Chromium	Capped in 1979
Axillary Reactor Area Power Burst Facility (PBF-05)	Used 1973 to 1984 discharge rad. waste and reactor coolant	Radionuclides	Capped in 1984

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

The Test Area North (TAN) at INL is yet another area was significant radioactive and chemical waste was dumped via injection wells directly into the Snake River Plain Aquifer.

\

Table 12. Maximum Contaminant in Test Area North TSF-05 injection well sludge [141]

Substance	Concentration	EPA Standard
1,1 dichloroethylene	24 ug/gm	7 ug/L
methylene chloride	290 ug/l	?
trans-1,2-dichloroethylene	410 ug/gm	5 ug/gm
trichloroethylene	30,000 ug/gm	5 ug/gm
tetrachloroethylene	2,800 ug/gm	5 ug/gm

140 ICPP RI/FS, and USGS Report 00-4222, DOE/ID-22168

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

2-butanone(methyl ethyl ketone)	180 ug/gm	?
barium	326 ug/gm	1,000 ug/gm
lead	180 ug/gm	50 ug/gm
chromium	91 ug/gm	50 ug/gm
mercury	101 ug/gm	2 ug/gm
Gross Beta	4,900,000 pCi/l	8 pCi/l
Gross Alpha	6,000 pCi/l	15 pCi/l
cobalt-60	812 pCi/gm	
cesium-137	2,340 pCi/gm	
emporium-154	6.62 pCi/gm	
americium-241	23.6 pCi/l	6.34 pCi/l
tritium	1,000,000 pCi/l	20,000 pCi/l
plutonium-241	123.6 pCi/l	62.6 pCi/l
plutonium-239	12.2 pCi/gm	

[TAN Sludge] [TAN ROD @18][EGG-ER-10643][INEEL-95/0056@5-25] [OU 1-07B TAN groundwater RI/FS work plan, Appendix B and G]

The above TAN aquifer sampling data is derived from DOE 1992, Idaho National Engineering Laboratory documents. [142] This information on TAN is cited here only as an example to the extensive problem throughout INL from the use of direct injection of wastes into the aquifer.

IX. Flooding Facilitates Contaminate Migration from On-Site Waste

The Department of Energy (DOE) Idaho National Laboratory (INL) issued a Record of Decision in October 1999 to, among other things; construct an on-site mixed hazardous and radioactive waste dump.[143] This decision was made within the Superfund (CERCLA) process with the concurrence of the State of Idaho and the U.S. Environmental Protection Agency (EPA). Initially, this was welcome news since the Environmental Defense Institute has for years criticized DOE's illegal waste "disposal" practices in dumps that would not even meet municipal garbage landfill regulations let alone radioactive and hazardous chemical waste. After detailed analysis of the Record of Decision, it is clear that DOE plans to repeat the mistakes of the past by siting the new dump (called the INEEL CERCLA Disposal Facility) (ICDF) not only in a flood zone, but over top of Idaho's sole source Snake River Aquifer which sustains more than 200,000 families. In short, the issue is not the construction of the new dump, but the issue is **where** it is to be built on the INEEL site. EDI's position is that there are credible alternative sites on the INEEL that are not over the aquifer or in a flood zone.

---

142 TAN ROD; Record of Decision, Technical Support Facility Injection Well (TSF-05) and Surrounding Groundwater Contamination (TSF-23), Operable Unit 1-07A, Waste Area Group 1, Idaho National Engineering Laboratory, September 1992 ; TAN Sludge; Summary of RCRA Facility Investigations Activities at Test Area North, Table 1, Tan Sludge Sample TSF-050, Collection Date 071090 to 071090 page B-5; TAN-5171; Test Area North Leach Pond Sediments, Operable Unit TSF-07, D. B. Harelson, 9/1/92, Number 5171; TAN ROD; Record of Decision, Technical Support Facility Injection Well (TSF-05) and Surrounding Groundwater Contamination (TST-23), Operable Unit 1-07A, Waste Area Group 1, September

143 Final Record of Decision, Idaho Nuclear Technology and Engineering Center, Operable Unite 3-13, Idaho National Engineering and Environmental Laboratory, October 1999

Additionally, DOE is violating other environmental laws by claiming that the CERCLA process waves the requirements of the National Environmental Policy Act (NEPA) among other laws. Attorneys conversant in the regulations say CERCLA only waive the permitting and NEPA requirements in the direct removal and remediation of a contaminated site. CERCLA does **not** in this case waive the RCRA permitting or NEPA requirements on a major $85 million ICDF dump project. Specifically, the equivalent requirements under NEPA would require DOE to evaluate, in an Environmental Impact Statement, the credible alternative siting locations for the ICDF. This was never done. Yes, DOE evaluated alternatives for on-site verse off-site disposal.......but not alternative on-site locations. Once again, the legal requirements are obfuscated not only by DOE but by the State of Idaho and the Environmental Protection Agency. Since this appears to be a "done deal" between DOE and the regulators, it appears the public's only recourse is litigation. Once again the public's rights have been trampled.

A review of the available US Geological Survey (USGS) reports related to INEEL flooding scenarios and flood control infrastructures, it is clear that DOE and the regulators ignored this information. Moreover, DOE ignored USGS recommendation that additional analyses are conducted prior to any final siting decisions are made for new waste internment and disposition of existing buried waste. Specifically, USGS recommended a two dimensional model to expand the 1998 USGS one dimension model to include the upper 95% confidence flow estimates of 11,600 cubic feet per second for the Big Lost River 100-year flood, and include modeling for the upper range limit of the 500-year estimated flow rate in the Big Lost River flood plain on the INEEL.

DOE is constructing the ICDF as a step toward meeting regulatory requirements in the Resource Conservation Recovery Act (RCRA) Subtitle-C hazardous waste disposal criteria. After 25 years of thumbing its nose at RCRA, DOE finally is making a gesture toward compliance after five decades of mismanagement of its waste streams that cause massive environmental contamination. Estimated cleanup costs of this INEEL debacle are in the range of $19 billion that will come out of our pockets as taxpayers. DOES' decision to finally comply with RCRA is marred by the wrongheaded choice of **location**, when other on-site locations would not pose the same risks to the aquifer that is already severely contaminated from INEEL waste.

DOE is constructing the ICDF immediately south of the Idaho Chemical Processing Plant (ICPP) also now called INTEC mainly for economic reasons. It is close to the ICPP where much of the waste will be generated and it is near/over existing waste water percolation ponds which are on the Superfund cleanup list, and it is over extensive soil contamination caused from INTEC/ICPP stack releases. In other words, "kill three wasted birds with one stone." Only a few hundred feet (on the north side of the Big Lost River) of INTEC is DOE new waste dump.

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 [144] 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. [145] 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.

---

[144] DOE apparently did not like the "Disposal Facility" name so now it is the "Disposition Project" due to the "optics."

[145] Idaho National Laboratory Site Treatment Plan, January 2018, INL-STP Revision 37. Hereinafter INL-STP

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. [146] 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. [147]

The US Geological Survey released a 1998 report that modeled the **median** 100-year flow rates in the Big Lost River (that flows by the ICPP) downstream of the INEEL 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.[148] 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. The USGS flood map shows the northern half of the ICPP under water. There are only five-foot differences between the ICDF (south end of ICPP) 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 INEEL site. The ICPP as a whole is about as flat as a table top with only a couple feet change in elevation north to south.[149] The crucial point here is that even the slightest variation in a Big Lost River flood would put the ICDF underwater assuming the dump was on the surface. Proportionally less variation in floods would inundate the dump the deeper the ICDF is buried below the surrounding terrain.

An earlier USGS study in 1996 also estimated the flow range for the Big Lost River at the INEEL; "The upper and lower 95-percent confidence limits for the estimated 100-year peak flow were 11,600 and 3,150 cubic feet per second (cf/s), respectively." [150]

Since 1950, INEEL has experienced significant flooding events (localized and site-wide) in1962, 1965, 1969, 1982, and 1984. In an effort to mitigate the flooding problem, DOE built a diversion dam on the Big Lost River that is designed to shunt flood waters to the south and away from INEEL facilities. USGS's 1998 report that modeled the mean (midrange) 100-year flow rate of 7,260 cf/s upstream of the INEEL diversion dam. USGS estimated that the Big Lost median flow rate downstream of the diversion dam at 6,220 cf/s with a thousand cf/s going down the diversion channel for a total median flow rate of 7,260 cf/s upstream of the INEEL diversion

[146] See EDI Snake River Plain Aquifer Report available at, www.environmental-defense-institute.org

[147] 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.

[148] 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

[149] Topographic Map of Block 21, National Reactor Testing Station (now called INEEL) 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.

[150] Estimated 100-Year Peak Flows and Flow volumes in the Big Lost River and Birch Creek at the Idaho National Engineering Laboratory, Idaho, U.S. Geological Survey, Water-resources Investigations Report 96-4163, L.C. Kjelstrom and C. Berenbrock, 1996, page 9.

dam. [151] "This peak flow was routed downstream [of the Big Lost River] as if the INEEL diversion dam did not exist. On the basis of a structural analysis of the INEEL diversion dam (U.S. Army Corps of Engineers) assumed the dam incapable of retaining high flows. The Corps indicated that the diversion dam could fail if flows were to exceed 6,000 cubic feet per second."[152] This USGS study acknowledged that the northern half of the ICPP would be flooded with four feet of moving water, even at this midrange (mean) flow rate. If ICDF excavation goes two feet **below** present surfaces, it will be below the elevation of the mean 100 year flood zone. Plans are to excavate ICDF pits most of the entire 50 feet to bedrock. See flood map below.

Since the radioactive waste will be extremely hazardous for tens of thousands of years and flooding will flush contaminates down into the aquifer, a conservative risk assessment would model the upper 95-percent confidence limits for the estimated 100-year peak flow of 11,600 [cubic feet/sec] cf/s. USGS has proposed this additional research to DOE, but the Department is not willing to provide the funding. A USGS hydrologist notes, "The flow of 11,600 cfs represents the upper 95 percent confidence limit flow for the estimated 100-year peak flow (Kjelstrom and Berenbrock, 1996, pg.6). Future modeling needs are to model the area with this flow. We've expressed this to the INEEL and also have expressed that the WSPRO model used has limitations and that an application of more stringent models (two dimensional) is needed to refine and better delineate the extent of possible flooding of the Big Lost River." [153]

USGS estimates the mean 500-year Big Lost River flood rates are 34% greater flow rate than the mean 100 year flood.[154] This 500-year flood would inundate the INTEC/ICPP, ATRC, RWDF, ICDF and surrounding area. These potential hazards are being ignored when making hazardous mixed radioactive waste internment decisions in these vulnerable areas despite the long-term consequences and the potential for additional aquifer contamination.

Cascading events also are not considered. This is known as a worst case scenario where one event triggers another event. For instance a 500-Year flood plus failure of Mackay Dam (built in 1917) resulting in estimated flows of 9,700 + 54,000 cubic feet per second respectively would be an example of a cascading event. Failure of Mackey Dam is non-speculative in view of the 1976 failure of the Teton Dam of similar construction and the fact that Mackey Dam lies within 11 miles of a major earthquake fault line that produced the 1983 Borah Peak 7.3 magnitude quake. An internal 1986 DOE report that analyzed the impact of Mackey Dam failure scenarios notes that, "Mackay Dam was not built to conform to seismic or hydrologic design criteria," and "the dam has experienced significant under seepage since its construction." [155] This EG&G study acknowledged that the ICPP, Navel Reactors Facility, and the Test Area North (LOFT) facilities would be flooded with at least four feet of water moving at three feet per second.

USGS did not consider cascading events but noted previous studies showing that failure of Mackay Dam alone would result in 6 feet of water at the INL Radioactive Waste Management Complex (RWMC) waste burial grounds. Other studies recognized by USGS note that, "Rathburn (1989, 1991) estimated that the depth of water at the RWMC, resulting from a paleo-flood [early] of 2 to 4 million cf/s in the Big Lost River in Box Canyon and overflow areas, was

---

[151] 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

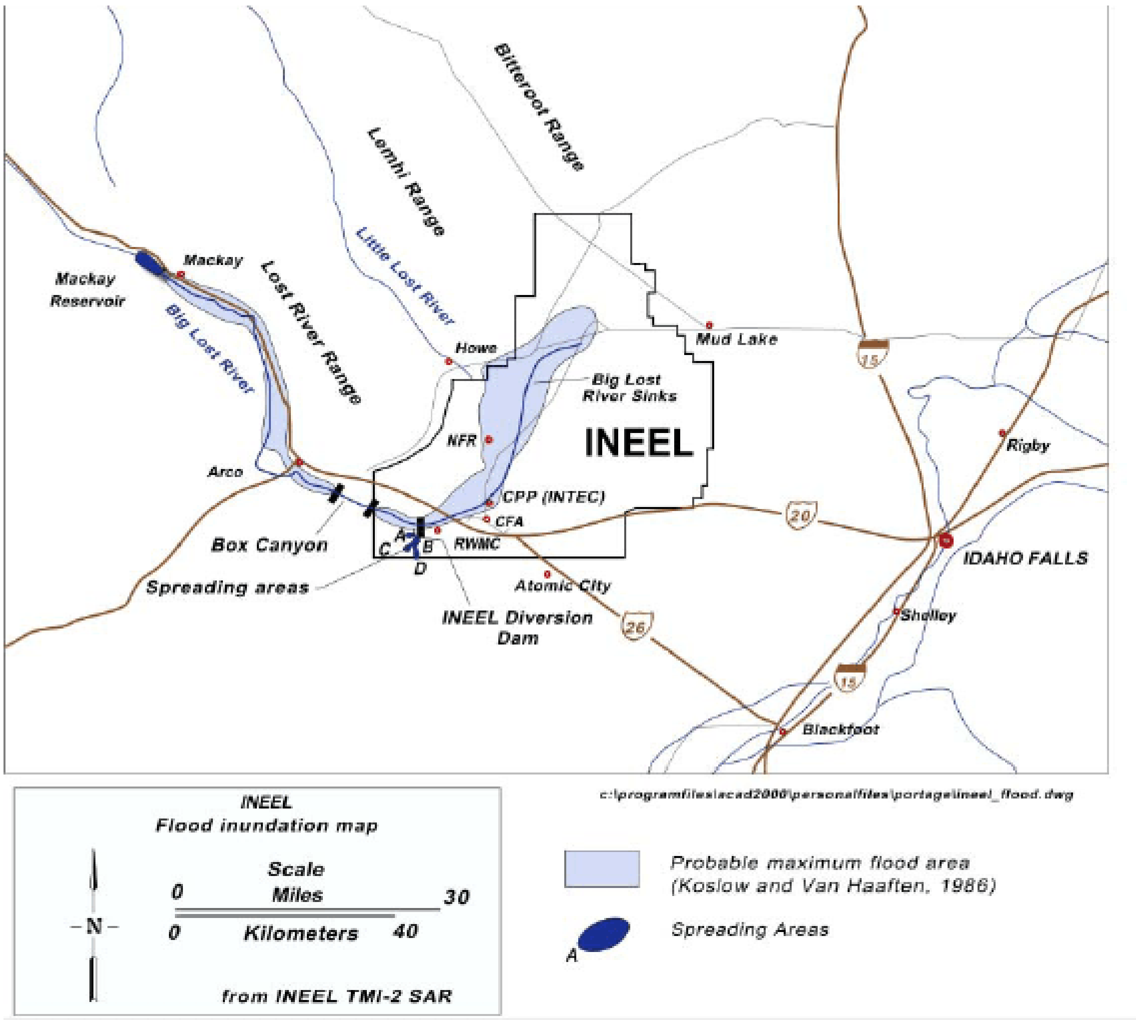
[152] USGS 98-4065, page 8

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

[154] Estimated 100 Year Peak Flows and Flow Volumes in the Big Lost River and Birch Creek at the Idaho National Engineering Laboratory, U.S. Geological Survey, Water Resources Investigations Report 96-4163, page 11 shows flow rates for 5-year, 10-year, 100-year, and 500-year floods

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

50-60 feet." "If Mackey Dam failed, Niccum estimated that peak flow at the [INTEC] ICPP would be at 30,000 cfs." [156] Comparing these flow rates with the USGS estimate 100-year mean flow of 6,220 cfs that would flood the north end of the INTEC/ICPP with four feet of water, and a Mackey Dam failure becomes a real disaster potential with respect to the existing underground waste tanks and underground spent reactor fuel storage at the INTEC/ICPP.



Location of INEEL Diversion Dam and Mackay Dam [157] [NRC 2006 Figure 19 pg. 87]

The 2006 Nuclear Regulatory Commission INL report states:

"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,

[156] USGS 98-4065, page 6

[157] NRC 2006 Figure 19 pg. 87

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]

"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]

"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." [158]

DOE is relying extensively on the Big Lost River Diversion Dam (located at the western INEEL boundary) to shunt major flood waters away from INEEL facilities. The last comprehensive analysis of this diversion dike system (below the diversion dam) was conducted by USGS in 1986 in a report titled *Capacity of the Diversion Channel below the Flood Control Dam on the Big Lost River at the INEL*. In this study USGS estimated a mean flow rate of 9,300 cf/s, 7,200 of which went into the diversion channel and "2,100 cf/s will pass through two low swells west of the main channel for a combined maximum diversion capacity of 9,300 cf/s." "A sustained flow at or above 9,300 cf/s could damage or destroy the dike banks by erosion. Overflow will first top the containment dike at cross section 1, located near the downstream control structure on the diversion dam." [159] This USGS study did not analyze the construction of the diversion dikes but they would likely fail as did the upstream diversion dam, built at the same time, that the Army Corps of Engineers found structurally deficient. "On the basis of a structural analysis of the INEEL diversion dam (U.S. Army Corps of Engineers, written comments, 1997), the dam was assumed incapable of retaining high flows. The Corps indicated that the diversion dam could fail if flows were to exceed 6,000 cf/s. Possible failure mechanisms are: (1) erosion of the upstream face of the dam that results from high-flow velocities and loss of slope protections (rip-rap), (2) overtopping of the diversion dam by flows exceeding the capacity of the diversion channel and culverts, (3) piping and breaching of the diversion dam because of seepage around the culverts, and (4) instability of the dam and its foundation because of seepage."[160]

Failure of the diversion dam and/or the diversion channel dikes would also directly impact the Radioactive Waste Management Complex (RWMC) waste burial grounds. A 1976 USGS report notes, "The burial ground is within 2 miles (3.2 km) of the Big Lost River and the surface is approximately 40 feet (12 m) **lower than the present river channel**. Sediments in the burial ground contain grains and pebbles of limestone and quartzite, suggesting that in recent geologic past, flood waters of the Big Lost River flowed through the burial ground basin. Two eroded notches or 'wind-gaps' in the basalt ridge bordering the west of the burial ground also suggest past Big Lost River floods." "A large diversion system on the Big Lost River was constructed by the AEC to control flood waters by diverting water into ponding Areas A, B, C, and D. The nearest of these, Area B is less than a mile [south] from and about 30 feet (9m) **higher** in elevation than the burial ground." [161]

USGS *Arco Hills SE* and *Big Southern Butte* quadrangle topographic maps clearly show the RWMC flooding vulnerability as do other USGS reports that note, "If [diversion] dike 2 [at ponding Area B] fails, large flows will drain directly toward the solid radioactive waste burial

---

[158] NRC, 2006, pg. 86 & 87.

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

[160] USGS 98-4065, page 9

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

grounds." [162] These vulnerabilities must be taken into consideration when DOE attempts to leave the buried transuranic waste at the RWMC and not exhume and relocate it to a safe permanent repository.

Building dams around the INL CERCLA Disposal Facility (ICDF) as was done at the RWMC is not an acceptable flood protection answer because lateral water migration will go under the dams and local precipitation will be held in exacerbating the leachate conditions. The liner of the ICDF will not be capable of maintaining integrity with the increased hydraulic pressure during a flood because liners are only capable of blocking what minimal surface water may leak past the cap and infiltrate the waste. There are good legitimate reasons why dumps (even municipal garbage dumps) are not allowed by statute in flood zones or above sole source aquifers.

Dams by definition are only functional if there is regular maintenance which cannot be assumed once DOE ends institutional control of INL in a hundred years. This bogus claim to maintain institutional control over waste that will be toxic forever defies any rational analysis. Thus, the Congressional has acknowledged that only deep geologic repositories must be used for this waste.

At the RWMC where Pad A containing TRU waste INL is dumping the waste on top of the ground and mounding the cover over it will result in the cap eroding over the long-term which again is unacceptable. [163] Regulator's contention that there is a degree of efficiency in co-locating the ICDF with the INTEC/ICPP percolation ponds that they must be remediated along with the "windblown" soil contamination area around the percolation ponds not only defies' common sense but is also illegal.

DOE failed to designate another location for the ICDF that is not near a flood plain and not over the aquifer. DOE's own study has identified at least two such sites (on the INL) where the Lemi Range meets the Snake River Plain. [164] DOE has not seriously considered these alternative sites as would normally be required under the National Environmental Policy Act (NEPA), stating that the sites were eliminated from consideration due to increased seismic activity. There is no documented evidence of this alternative site analysis. No empirical risk assessment was conducted to compare the relative risk of a location over a sole source aquifer and in a flood plain (INTEC/ICPP) as opposed to a site with a slightly higher seismic risk not over the aquifer or in a flood zone (Lemi Range terminus). Other credible options include purchasing land contiguous to the northern end of the INL site near the terminus of the Bitterroot Range that also would be off the aquifer and not in a flood zone and have more soil cover over the bedrock.

Another misguided project outlined in DOE's October 1999 Record of Decision is the construction of new ICPP process waste percolation ponds midway between INTEC/ICPP and Central Facilities Area to the south.

Nuclear Regulatory Commission restrictions prohibiting citing radioactive waste disposal dumps on 100 year flood plains must be observed. [NRC 10 CFR ss 61.50] The reason for these restrictions is based on the flood water will leach contaminates out of the waste and flush the pollution more rapidly into the aquifer. Since these wastes will remain toxic for tens of thousands of years, they must be disposed of responsibly in a safe permanent repository. These issues must be kept in mind also with respect to the INTEC/ICPP high-level waste tanks that are some forty feet underground as well as the underground spent reactor fuel storage and calcine

---

[162] Probability of Exceeding Capacity of Flood-Control System at the National Reactor Testing Station, Idaho, U.S. Geological Survey Water Resources Division, P. Carrigan, JR., 1972, page 4

[163] 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. http://www.environmental-defense-institute.org/publications/RWMCCERCLA4.pdf

[164] Moriarty, T. P., Feasibility of Locating Dry Storage of Spent Nuclear Fuel on Idaho National Engineering Laboratory Land at a Site That Does Not Overlie the Snake River Aquifer, November 1995

storage bins at the INTEC/ICPP. Water acts as a moderator and if the underground spent fuel vaults are flooded, it could cause a criticality. All of these underground high-level waste sites are extremely vulnerable. Former ICPP workers recall stacking sandbags six feet high around the plant during a Spring flood about ten years ago. The added external hydrologic pressure on the high-level waste tank concrete vaults could collapse the vaults and the tanks inside, and thus release the contents. These risks must be considered when DOE decides to leave the high-level waste tank sediments permanently in place as a cost cutting measure.

The ICDF, siting, engineering design, and waste acceptance criteria (WAC) must be developed with public involvement through a free and open discussion. The legal requirements of the process are spelled out in the National Environmental Policy Act that requires Environmental Impact Statements and public hearings. Only un-containerized wastes that can be compacted during placement should be allowed so as to minimize subsidence caused by container decomposition. Biodegradable, VOC, collapsible, soluble, TRU, or Greater than Class C Low-level, and Alpha-low-level waste must also be excluded from the ICDF dump and sent off-site. Prior to completing the ICDF Title II Design, workshops should be convened for stakeholders to comment on the proposal in addition to the NEPA requirements. Waste Acceptance Criteria maximum contaminate concentration levels must be determined from waste sampling prior to being mixed with any stabilizing materials. In other words, ”dilution is not the solution to pollution”.

USGS reports identified factors favoring downward waste migration. “In order for waste isotopes to be carried downward by water, four basic requirements are needed: 1.) availability of water, 2.) contact of the water with the waste, 3.) solubility or suspend ability of the waste in water, 4.) permeability in the geologic media to allow water flow downward.” [165] This USGS report describes in detail how all four conditions are met at INEEL including the solubility factor where they note “Hagan and Miner (1970) leached five different categories of solid waste from Rocky Flats [the main source of plutonium in the RWMC] with ground water from the INEL and Rocky Flats and measured the plutonium concentrations and pH of the leachate. They found the highest Pu-239 concentration in leachates from the acidic-graphite wastes, 62,000 to 80,000 ug/l plutonium or (3.8×10^9 to 4.9×10^9 pCi/L) [3,800,000,000 to 4,900,000,000 pCi/l].” [Ibid]

The most reliable indicators of contaminate migration are onsite sampling data. Cesium-137, plutonium-238,-239,-240 were all found at the 240 foot interbeds under the RWMC. [IDO-22056@74] Forty-one % of the samples from the 240 foot interbeds contained radionuclides. [Ibid.@87] Other literature confirmation of plutonium at 240 feet includes: "Radionuclides (including Pu-238.-239.-240, Am-241, Cs-137, Sr-90) have been detected in soils and in sedimentary interbeds to a depth of 240 feet beneath the RWMC, (Hodge et al, 1989)." "Positive values for Pu-238,-239,-240 were detected in samples obtained from the 240 foot interbed in bore hole DO2."[DOE/ID-10183@134-145][DOE/ID/12082(88) @14-16] Radionuclides are also confirmed in the aquifer under the RWMC. [EG&G-WTD-9438@25] USGS water sampling data at the 600 foot levels, expressed in pico curies per liter (pCi/l) show:

Table 13. Groundwater Sampling Data at 600 Feet under RWMC

Nuclide	Concentration pCi/L	Drinking Water Std. pCi/L
Tritium	10,000.00	20,000.00
Cobalt-57	48.00	1,000.00
Cobalt-60	100.00	100.00

[165] USGS 76-471 page 68-69

Cesium-137	400.00	119.00
Plutonium-238	9.00	7.02
Plutonium-239-240	0.14	62.10
Americium-241	15.00	6.34
Strontium-90	10.00	8.00

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

For more information on the contaminate migration from INEEL buried waste at the RWMC see EDI *Citizens Guide to INEEL* page 130 available on request.

X. Off-Site Snake River Aquifer Water Sampling

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

"In the past, wastewater containing chemical and radio chemical wastes generated at the INEL was discharged mostly to ponds and wells. Since 1983, most aqueous wastes have been discharged to infiltration ponds. Many of the constituents in the wastewater enter the aquifer indirectly following percolation through the unsaturated zone." [166]

The following tables show U. S. Geologic Survey (USGS) 1989-2001 water sample data from 33 of the 55 monitoring wells in the Snake River Aquifer south of INL between Rupert on the east and Bliss/Hagerman on the west. These monitoring wells are in the Magic Valley group of wells checked by USGS in multi-year sampling campaigns. The sample data show gross beta and alpha radioactivity over the period and is used as a screening method to determine if additional testing is needed.

The comparative water sample data is a means of identifying trends in the migration of radioactive contaminates. The USGS emphasizes that the Magic Valley monitoring wells remain below the Environmental Protection Agency maximum concentration level (MCL) standard for drinking water. Generally, this is correct except for Well MV-45 located between Bliss and Hagerman, Idaho about 65 miles southwest of INL that registered 18.70 $\pm$ 2.4 for gross alpha.[167] The drinking water MCL standard for alpha is 15 pCi/l. If increasing trends are confirmed, then additional isotope specific tests may be needed to identify the source of the contamination. As discussed previously, independent experts believe that this "Safe Drinking Water standard of 15 picocuries per liter for alpha emitting transuranics like plutonium-238, plutonium-239, or americium-241 allows doses on the order of a hundred times higher than the 4 millirem annual limit specified for most beta emitters. A concentration of plutonium of only about 0.08

[166] USGS/ DOE/ID-22130,p.3]

[167] Evaluation of Radionuclide, Inorganic Constituent, and Organic Compound Data from Selected Wells and Springs from the Southern Boundary of the Idaho National Engineering Laboratory to the Hagerman Area, Idaho 1989 through 1992, U.S. Geological Survey Water Resources Investigations Report 97-4007, January 1997, R. Bartholomay, L. Williams, DOE/ID-22133, page 23.

picocuries per liter in drinking water is required to produce a dose of 4 millirem per year to the bone surface (the crucial organ for plutonium)." [168]

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

Table 14. Snake River Aquifer Water Sample Data

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

Well #	1989	1990-92	1994-95	1996-98	1999-01	2002-04
MV-01	7.8 ±1.21	7.3 ±1.65		6.86 ±1.76	10.7±2.4	9.67± 2.5
MV-02	10.65 ±1.65	7.57 ±2.01	7.64 ±1.58	11.1±4.3	8.09 ±2.68	4.8 ± 1.0
MV-03	4.88 ±0.77	4.33 ±1.28	4.58 ±2.91	5.84 ±1.36	6.5±1.7	3.6 ± 1.0
MV-04	6.54 ±1.2	7.38 ±1.67		5.83 ±3.11	7.43± 2.6	
MV-05	7.36 ± 1.29	6.69 ± 1.51	12.0 ± 5.38	6.99 ± 1.89	9.28±2.55	8.9 ± 1.2
MV-06	6.12 ± 1.02	8.01 ± 1.63	7.93 ± 4.86	6.12 ± 1.61	8.52±2.18	3.8 ± 1.0
MV-07	4.62 ± 0.77	4.00 ± 1.26	6.49 ± 4.24	7.1 ± 4.2	3.2±2.16	1.8 ± 0.8
MV-09	10.6 ±2.0	8.96 ±2.31		10.2±4.2	17.34±5.3	
MV-10	10.60± 1.7	9.67± 2.23	9.93± 1.96		8.31 ±3.43	
MV-11	11.50 ± 1.90	13.40 ± 2.85	8.20 ± 3.5	8.2 ± 3.5	9.67 ±5.18	10.5± 3.07
MV-12	7.26 ±1.25	7.34 ±1.78		7.22 ±1.89	3.72 ±4.68	
MV-13	9.31± 1.5	7.50 ± 1.54	10.1± 5.9	8.24 ± 1.72	9.0±2.17	9.0 ±1.2
MV-14	5.36 ±1.17	3.56 ±1.12		5.78 ±1.89	5.79 ±2.6	3.4 ±1.0
MV-15	8.25 ± 1.39	10.60± 2.22	8.12 ± 2.07	8.12±2.07	4.65 ±4.85	10.68±2.47
MV-16	4.39 ± 0.73	3.99 ± 1.26	4.66 ± 1.15	7.6 ± 4.1	5.06 ±2.46	2.6 ±0.9
MV-17	4.64± 0.79	4.15± 1.24	7.01 ± 4.14	5.10 ± 2.84	5.91±1.23	1.8 ± 0.8
MV-18	7.73 ±1.38	7.51 ±1.86		6.24±2.6	8.5 ±4.93	8.9±2.95
MV-19	6.8 ±1.07	4.7 ±1.4	6.5 ±1.44	3.2±3.9	4.61 ±2.42	1.9 ±0.9
MV-20	6.17 ± 1.01	4.51 ± 1.14	5.48 ± 1.27	7.4 ± 4.1	5.36 ±2.05	1.7 ±0.6
MV-21	4.98 ±0.8	4.6 ±1.29		4.43±1.13	5.01 ±1.39	4.37±1.35
MV-23	9.37± 1.53	8.41± 1.89	4.39 ± 1.04	8.83±3.45	7.69 ±2.65	8.62±2.86
MV-24			11.0 ±2.39			
MV-24-A				8.38±3.62	11.4 ±3.65	12.29±3.96

[168] IEER, 2001

MV-25	22.21 ±2.85	9.13 ±2.08	10.5 ±2.2	11.5± 4.4	8.66±2.97	10.67±2.92
MV-26	5.99 ± 0.92	5.40 ± 1.26	9.02 ± 4.63	4.44 ± 1.47	7.81 ±2.63	4.54±1.85
MV-27	6.81 ± 1.04	6.73 ± 1.51	9.57 ± 5.18	6.06 ± 1.54	7.61±2.51	3.5 ± 1.1
MV-29	5.43 ±0.9	3.96 ±1.2	4.68 ±1.36	4.11±1.12	1.13 ±4.3	3.81±1.32
MV-30	7.16 ±1.22	6.25 ±1.62		6.59±3.19	7.93 ±4.93	7.80±2.66
MV-31	6.80 ± 1.22	7.32± 1.55	13.1 ± 4.37	9.53 ± 1.64	8.02 ±3.39	3.0 ±1.0
MV-32	8.38 ± 1.38	8.15 ± 1.91	9.45 ± 1.9	7.5 ± 4.2	8.28±2.63	4.7 ± 1.0
MV-35						10.1 ±1.1
MV-33	4.82 ± 0.78	3.27 ± 1.06	4.39 ± 1.04	4.39 ±1.04	5.74 ±1.79	
MV-36	5.44 ± 0.91	4.80 ± 1.18	7.03± 4.22	4.2 ± 1.05	4.98±1.59	1.5 ± 0.8
MV-37	6.83 ±1.07	4.75 ±1.45		3.75±1.21	2.93 ±4.36	5.44±1.82
MV-38	3.65 ± 0.69	3.87 ± 1.21	4.71 ± 3.85	3.93 ± 1.06	5.27±1.26	4.9 ±1.0
MV-39	8.56 ±1.52	7.81 ±1.88		5.26 ±3.08	7.34 ±2.73	3.6 ±0.8
MV-40	5.93 ±0.9	4.11 ±1.19	4.13 ±1.18	5.4±4.0	4.67 ±4.44	4.06±1.18
MV-41	6.39 ± 1.04	7.33 ± 1.89	7.24 ± 1.81	7.0 ± 4.2	6.89±2.41	8.35±3.20
MV-42	6.00 ± 0.94	0.71 ± 0.58	8.65 ± 4.36	6.03 ± 1.18	6.97±1.49	0.9 ±1.1
MV-43	10.1 ±1.71	9.17 ±2.13		6.68 ±3.32	8.91±5.06	7.0 ±1.3
MV-45	4.69 ± 0.78	4.45 ± 1.30	6.10 ± 4.19	4.0 ± 3.9		
MV-46	4.49 ±0.73	4.17 ±1.25	4.21 ±1.24	4.08 ± 1.03	3.49 ±1.67	
MV-47	4.82 ± 0.76	4.07 ± 1.06		3.6 ± 3.9	5.06 ±1.8	2.4 ±0.9
MV-49	3.62 ± 0.7	2.52 ± 0.87	3.15 ± 0.95	4.2 ± 3.9	4.79 ±2.43	1.1 ±0.9
MV-50	7.51 ± 1.25	8.75 ± 1.77	9.43± 1.87	4.95 ±3.1	8.96 ±3.39	
MV-51	8.06 ± 1.53	7.22 ± 1.83		11.2 ± 4.4	3.96±4.7	1.8 ±1.0
MV-52	9.56 ± 1.44	8.93± 1.88	8.44 ± 1.68	8.4 ± 4.2	8.81 ±3.42	
MV-53	9.43 ± 1.58	9.94 ± 2.06	9.57 ± 5.4	10.7 ± 2.23		5.2 ±1.2
MV-54	8.82 ± 1.52	9.19 ± 2.12	9.40 ± 2.05	8.4 ± 4.3	10.3 ±4.88	5.4 ±0.8
MV-55	4.80 ± 0.92	3.55 ± 1.10	8.46 ± 4.25	6.04 ± 1.37	2.78±2.34	2.9 ± 0.9
MV-56	4.89 ± 0.86	4.73 ± 1.32	5.21 ± 1.24	3.8 ± 3.9	0.48±4.33	2.2 ±1.0
MV-57	4.11 ± 0.67	2.81 ± 0.85	3.48 ± 1.06	3.25 ± 1.03	2.47±1.02	
MV-59	5.35 ± 0.83	4.37 ± 1.24	6.13 ± 2.37	8.44 ±2.75	2.78±4.53	4.71±1.18
MV-60					**11.0±2.98**	

Table 15. Gross Alpha (as dissolved thorium-230) (pCi/L)

Well #	1989	1990-92	1994-96	1997-1998	1999-2001	2002-04
MV-01						**5.77±3.69**
MV-03	2.62 ±0.65	2.0 ±0.76	0.218 ±1.2	4.48 ± 2.89	1.61±2.07	4.0 ±2.1
MV-05	4.65 ± 0.85	2.22 ±0.8	3.56 ± 2.96	5.26 ± 3.39	4.9±2.3	2.8 ±2.6
MV-06	1.88 ± 0.5	1.67 ± 0.65	4.22 ± 3.11	6.23 ± 3.36	2.8±2.39	2.3 ± 2.2
MV-07	2.46 ± 0.62	1.51 ±0.63	3.36 ± 2.71	2.17 ± 2.48	1.1±1.4	1.1 ± 1.4
MV-10	2.87 ± 0.65	3.35 ± 0.97	3.22 ± 2.14	2.3 ± 2.7	0.62 ±0.85	
MV-11	3.05 ± 0.65	3.91 ± 1.04	5.79 ± 3.79		1.88 ±2.59	5.91±5.81
MV-12	2.7 ±0.66	2.28 ±0.79	2.56 ±1.98		6.08 ±3.62	
MV-13	5.12 ± 0.97	2.15 ± 0.72	4.20 ± 3.09	4.55 ± 3.07	3.7±1.8	3.9 ±3.0
MV-15	2.30 ± 0.54	2.58 ± 0.82	4.84 ± 2.86		3.39 ±3.24	4.22±3.91
MV-16	2.32 ± 0.66	1.95 ± 0.73	1.42 ± 0.95	1.1 ± 2.1	1.33 ±1.47	0.1 ±1.6
MV-17	1.07 ± 0.59	1.31 ± 0.06	0.103 ± 1.82	5.1 ±2.84	0.69±1.56	0.3 ± 1.4
MV-20	1.08 ± 0.52	1.92 ± 0.074	3.02 ± 1.62	5.5 ± 3.0	1.19 ±0.78	0.7 ±1.1
MV-23	1.85 ± 0.48	2.39 ± 0.79	3.54 ± 2.77		-.21 ±2.43	2.56±3.65
MV-26	2.32 ± 0.62	1.59 ± 0.65	2.22 ± 2.36	0.96 ±2.35	0.81 ±1.26	2.12±2.10
MV-27	4.09 ± 0.8	2.62 ± 0.82	2.56 ± 2.73	4.83 ±3.12	5.12±3.37	
MV-30						**7.27±3.93**
MV-31	3.04 ± 0.72	2.31 ± 0.77	10.9 ± 4.65	9.22 ±3.8	1.42 ±1.73	1.7 ±2.1
MV-32	6.00 ± 1.04	3.75 ± 1.05	2.85 ± 2.06	3.9 ± 3.1	3.34±3.13	1.6 ± 2.2
MV-33	0.68 ± 0.46	2.29 ± 0.81	1.19 ± 1.3		0.72 ±0.52	0.8 ±1.3
MV-36	5.12 ± 1.0	2.10 ± 0.70	4.54 ± 3.08	2.64 ±2.34	2.3±1.7	2.8 ±2.1
MV-37	4.75 ±0.99	4.15 ±1.06	1.94 ±1.61		4.05 ±3.37	3.23±2.99
MV-38	1.86 ± 0.51	1.19 ± 0.58	1.62 ± 2.26	4.58 ±2.73	2.05±1.85	3.4 ±2.0
MV-39						4.5 ±1.5
MV-41	4.76 ± 0.98	5.24 ± 1.15	7.21 ± 3.16	4.3 ± 3.2	3.13 ±3.2	3.22±6.59
MV-42	2.08 ± 0.55	3.18 ± 0.93	3.21 ± 2.72	2.76 ±2.46	2.24±2.8	3.3 ±2.4
MV-43	5.01 ±0.92	4.58 ±1.13	4.49 ±3.01		4.64 ±3.25	5.5 ±2.5
MV-46	1.82 ±0.53	1.10 ±0.54	0.73 ±0.79	4.4 ± 2.62	1.23 ±0.66	

MV-45	**18.70 + 2.4**	1.27 + 0.54	3.96 + 2.85	2.1 + 2.2		
MV-47	1.66 + 0.51	2.02 + 0.73	0.8 +1.9		0.3 +0.54	0.1 +1.5
MV-49	0.00 + 0.7	1.56 + 0.63	3.04 + 1.49	2.8 + 2.4	1.36 +1.51	2.0 +1.5
MV-50	7.74 + 1.33	3.09 + 0.87	2.12 + 2.09		1.95 +1.35	
MV-51	2.92 + 0.67	3.15 + 0.93	3.2 +3.0	3.2 + 3.0	5.15 +3.45	1.8 +1.8
MV-52	3.80 + 0.73	4.00 + 1.02	4.15 + 2.2	2.8 + 2.8	2.16 +1.92	
MV-53	3.25 + 0.69	2.89 + 0.87	1.55 + 1.27	8.95 + 4.2	5.2+3.86	0.9 +2.8
MV-54	3.87 + 0.75	2.38 + 0.84	4.51 + 2.6	4.4 + 3.5	2.18 +2.97	1.9 +1.7
MV-55	2.38 + 0.65	1.57 + 0.63	0.80 + 1.44	3.33 + 2.79	1.4+1.5	1.4 + 1.5
MV-56	1.97 + 0.59	1.48 + 0.66	1.11 + 1.01	2.1 + 2.3	2.05 +2.83	2.3 +2.3
MV-57	0.03 +0.29	1.34 + 0.058	1.71 + 0.93	-.12 +1.78	2.2+1.13	1.1 + 1.4
MV-58	2.08 +0.54	1.02 +0.5	0.58 +1.03	-.12 + 1.83	1.1+1.2	1.1 + 1.2
MV-59	0.31 + 0.26	1.76 + .67	2.19 + 2.0		2.56+2.91	.95+1.88
MV-60					4.16+3.78	
MV-61	11.2 +1.6	2.97 +0.95	3.68 +2.43			1.97+2.32

Sources for above tables are drawn from USGS: DOE/ID-22124, DOE/ID-22130, DOE/ID-22133, DOE/ID-22141; DOE-IDO-22161; DOE/ID-22152; DOE/ID-22169; DOE-ID-22176; DOE/ID-22185;DOE/ID-22190. Also Idaho Department of Environmental Quality INL Oversight Environmental Surveillance Program Quarterly Reports. Bold faced entered are USGS designation of "concentrations that equal or exceed the reporting level of 3s."

The above table units abbreviation - pCi/L - stands for pico curies per liter or one trillionth of one curie per liter. The maximum contaminate levels (MCL) for selected radioactivity and selected radionuclides in drinking water is established by the Environmental Protection Agency. For comparison, the MCL for the beta emitter strontium-90 is 8 pCi/L, for beta/gamma emitter cesium-137 the MCL is 119 pCi/L based on an average concentration assumed to produce a total body or organ dose of 4 millirem per year. The MCL for gross alpha particulate radioactivity is 15 pCi/L. See previous discussion on the adequacy of this limit.

As with all water sampling techniques, there is a range of uncertainty from instrument and sampling procedure variation. So the sample concentration is stated as the mean or middle of the uncertainty range which in turn is stated as plus or minus(+). A slight increase or decrease in different samples from the same well may be a result of this analytic uncertainty or variation. A major component of uncertainty is the standard deviation which varies with each sample. USGS uses a factor of two times the sample's standard deviation to identify the uncertainty range which is noted as a plus or minus number after the mean concentration number. Bold faced table entries are USGS designation of "concentrations that equal or exceed the reporting level of 3s" "A concentration that equals 3s represents a measurement at the minimum detectable concentration. For samples containing a true concentration of 3s or greater, there is a 95% or more probability that the radioactive constituent will be determined as being present in the sample." [169]

[169] DOE/ID-22190, page 5.

The USGS uncertainty range appears to vary widely between sampling periods. For instance the average uncertainty in 1989 and 1990-92 sample campaigns was about 21 percent whereas the average uncertainty in 1994-95 was nearly 60 percent. More detailed testing of a broad range of isotopes may be needed to identify the sources of this well contamination. The State INL Oversight Program, Idaho State University, and the Environmental Research Foundation are also doing testing, however their instruments are according to USGS, a thousand times less sensitive than the USGS's National Water Quality Laboratory. The usefulness of the above tables is to demonstrate trends in contaminate levels in the Snake River Aquifer south of the INL and factor this information into waste management decisions.

XI. Aquifer Discharge to the Snake River Water Sample Data

Below is water sample data collected by the State of Idaho along the Snake River between Bliss and Minidoka, Idaho where the aquifer discharges into the river. [170] As noted above USGS acknowledges Idaho's sampling is a thousand times less sensitive than the USGS's National Water Quality Laboratory. Also as previously this data is presented only to show the presence of INL waste in the public water system. See Attached Locator Map.

Table 16. Gross Beta Sample Data

Sample Date	Alpheus Spring	Bill Jones Hatchery	Clear Spring	Minidoka Water Supply	Shoshone Water Supply
5/98	5.3 ± 1.0	1.6 ± 0.8	2.3 ± 0.8	2.3 ± 0.8	2.3 ± 0.8
11/99	4.0 ± 0.9	2.5 ± 1.0	2.6 ± 0.8	1.9 ± 0.7	0.6 ± 0.7
9/00	3.1 ± 1.0	2.0 ± 0.8	4.8 ± 0.8	2.3 ± 0.8	1.6 ± 0.8
11/01	4.1 ±1.1	3.3 ± 0.9	2.8 ± 1.0	1.3 ± 0.7	7.4 ± 1.3
2/02	3.6 ± 0.8	2.0 ± 0.9	2.8 ± 0.9	2.3 ± 0.9	2.0 ± 1.0
11/02	3.7 ± 1.0	2.4 ± 0.9	2.8 ± 1.0	2.1 ± 0.9	1.8 ± 0.9
2/03	5.2 ± 1.1	1.7 ± 0.9	1.3 ± 0.9	1.6 ± 0.6	1.5 ± 0.9
8/03	3.8 ± 1.1	1.9 ± 0.9	2.9 ± 0.7	3.9 ± 1.0	2.1 ± 0.9
5/03	3.8 ± 1.0	1.7 ± 0.9	1.8 ± 0.9	1.5 ± 0.7	2.1 ± 1.0
2/04	4.2 ± 1.2	1.0 ± 1.0	2.7 ± 0.8	1.8 ± 1.0	3.0 ± 0.7

Table 17. Gross Alpha

Sample Date	**Alpheus Spring**	**Bill Jones Hatchery**	**Clear Spring**	**Minidoka Water Supply**	**Shoshone Water Supply**
5/98	10.8 ± 2.4	7.0 ± 1.8	0.9 ± 1.5	1.7 ± 1.3	5.4 ± 1.7
12/99	1.1 ± 3.0	0.6 ± 3.2	1.2 ± 1.7	1.4 ± 1.6	0.5 ± 1.7
8/00	3.2 ± 2.4	1.2 ± 1.7	5.1 ± 2.0	0.7 ± 2.1	1.1 ± 1.5
11\01	1.7 ± 2.7	1.7 ± 1.8	4.2 ± 2.4	0.5 ± 0.8	11.4 ± 2.5
2/02	1.0 ± 1.0	1.3 ± 1.3	2.5 ± 1.6	3.2 ± 1.6	4.8 ± 1.9
11/02	3.3 ± 2.2	2.1 ± 1.5	1.9 ± 2.0	0.7 ± 1.8	4.2 ± 1.9

[170] State of Idaho Department of Environmental Quality Division of INL Oversight and Radiation Control Program Environmental Surveillance Program Quarterly Reports between 1998 and 2004

2/03	2.6 + 2.0	1.3 + 1.6	2.4 + 1.9	0.3 + 1.1	1.2 + 1.4
8/03	0.5 + 2.4	2.2 + 1.6	1.7 + 1.5	1.7 + 1.9	2.0 + 2.0
2/04	1.8 + 3.1	0.2 + 1.8	0.2 + 1.5	1.8 + 2.0	1.8 + 1.3

USGS reports in 1998 that "Magic Valley" gross beta rose from previous levels of 22.21 pCi/l to 43 pCi/l in 1995. Tritium levels were at 134 + 25.6 and strontium-90 levels of 76 + 3 pCi/L.[171]

Table 17. USGS Snake River In-Flow Spring Samples for Tritium (pCi/L)

Name of Spring See Attached Locator Map	1989 [172]	1994 [173]	2001 [174]
Banbury	130 +70	14.7 +1.0	4.2 + 1.0
Bickel	50 +150	15.6 +1.0	6.7 + 1.0
Billingsley Creek	140 +160	18.1 +1.5	8.6 + 1.0
Birch Creek	30 +150	47.7 +3.2	18.9 + 1.6
Blind Canyon	30 +70	12.9 +0.8	8.0 + 1.0
Blue Heart	110 +160	15.8 +1.0	5.8 + 1.0
Blue Lakes	130 +160	65.3 +4.5	37.4 + 2.6
Box Canyon	70 +70	14.1 +1.0	7.0 + 1.0
Biggs Creek	80 +70	18.5 +1.2	7.7 + 1.0
Clear Lakes	110 +70	16.2 +1.1	7.0 + 1.0
Crystal	160 +160	64.3 +3.8	30.7 + 1.6
Devils Corral (upper)	70 +160	71.7 +4.5	29.8 + 1.6
Devils Washbowl	150 +160	78.4 +5.1	35.5 + 1.9
Riley Creek	80 +160	17.2 +1.2	6.4 + 1.0
Sand	50 +70	16.2 +1.3	5.4 + 1.0
Thousand	130 +160	17.9 +1.2	6.1 + 1.0
Unnamed springs between Blind Canyon and Banbury	160 +160	17.2 +1.2	5.8 + 1.0
Shoshone Falls Power Plant	30 +70	65.0 +4.5	44.5 + 3.2

171 Effects of activities at the Idaho National Engineering Laboratory on the water quality of the Snake River Plain aquifer in the Magic Valley study, R. Bartholomay, USGS Fact Sheet FS-052-98, p4, August 17, 1998.

172 Tritium Concentrations in Flow from Selected Springs That Discharge to the Snake River, Twin Falls - Hagerman Area Idaho, USGS Report 89-4156, DOE/ID-22084, September 1989.

173 Tritium, Stable Isotopes and Nitrogen in Flow from Selected Springs that Discharge to the Snake River, Twin Falls - Hagerman Area Idaho, 1990-93, USGS Report 94-4247, DOE/ID-22119, December 1994.

174 Radiochemical and Chemical Constituents in Water from Selective Wells and Springs from the Southern Boundary for the INL to the Hagerman Area, Idaho, 2001, USGS, Report 03-168, DOE/ID-22185. Page 19. Also see attached locator map for sample locations.

Warm Creek	80 ±160	66.8 ±4.5	37.4 ± 2.6

XII. Clean Water Act Violations

David McCoy did a legal analysis that, among other issues, identified major Clean Water Act violations at INL.[175] McCoy notes that the INTEC (located at INL) lies within the 100 year floodplain of the Big Lost River. The INTEC facilities service wastewater system and the Percolation Ponds are also located within the 100 year floodplain of the Big Lost River.

DOE Order 5400.1 requires DOE to comply with the mandatory requirements of Executive Order 11988 for Floodplain Management and Executive Order 11990 for Protection of Wetlands. (See 10 CFR 1022 et seq.).

DOE Order 5400.1 requires DOE to comply with the requirements of the Clean Water Act, 33 U.S.C. § 1251 et seq. DOE violates DOE Order 5400.1 and the Clean Water Act by its failure to obtain a National Pollution Discharge Elimination System (NPDES) permit for the INTEC facilities.

The INTEC facilities are considered point sources under the CWA. 33 U.S.C. § 1362(14). Section 301 of the CWA, 33 U.S.C. § 1311(a) prohibits the discharge of any pollutant from a point source into the waters of the United States unless such discharge is permitted in a National Pollution Discharge Elimination System (NPDES) permit. As shown below, DOE has discharged pollutants including hazardous wastes and radionuclides to the waters of the United states without a NPDES permit, in violation of § 301(a) of the CWA, 33 U.S.C. §1311(a).

The INTEC facilities apparently do not, as of this writing, have a NPDES permit.

The unlined Percolation Ponds at INTEC, which receive the point source wastes from the HLLWE and the other INTEC facilities, are surface impoundments located in the floodplain above the Snake River Plain Aquifer which is hydro-logically connected to and part of the Snake River. The Snake River and its aquifer are waters of the United States. Waters of the United States include waters that are tributary to navigable waters. Congress intended to regulate the discharge of any pollutants that could affect surface waters of the United States, whether it reaches the surface water directly or through groundwater.

The INTEC Percolation Ponds discharge water into the waters of the United States, but DOE has failed to obtain a NPDES permit for the ponds. Also see US District Court for Idaho settlement agreement in Idaho Rural Council v. Bosma, No. CV-99-0581-S-BLW. where Judge Winmill ruled in favor of the citizen suit alleging noncompliance with NPDES permit. The court record acknowledges that if toxic waste ends up in surface waters, then it is covered under the Clean Water Act.

The USGS scientific studies show INL discharged waste eventually flows to the Snake River Plain Aquifer that then discharges to the Snake River, and federal court rulings document that the Clean Water Act regulations apply to INL toxic waste discharges. Court rulings state:

> "Congress intended to regulate 'discharges of pollutants that could affect surface waters for the United States,' the rationale supporting this conclusion is simple and persuasive: 'since the goal of the CWA is to protect the quality of surface waters, any pollutant which enters such waters, whether directly or through groundwater, is subject to regulation by NPDES permit. Stated even more simply, whether pollution is introduced by a visible, above-ground conduit or enters the surface water through the aquifer matters little

[175] David B. McCoy is an attorney and EDI Board Member who has written extensively about INL's violations of environmental law.

to the fish, waterfowl, and recreational users which are affected by the degradation of our nation's rivers and streams." [176]

XIII. Agency for Toxic Substances and Disease Registry INL Report

A comprehensive Agency for Toxic Substances and Disease Control (ATSDR), a division of the U.S. Environmental Protection Agency and funded by the Centers for Disease Control and Prevention, offered the following Public Health Assessment report on INL analysis.

"Groundwater samples have been further analyzed to identify the specific radionuclides responsible for the elevated alpha and beta radioactivity. Table A-2 in Appendix A presents the maximum concentration of specific radionuclides detected at INEEL. Of the radionuclides exceeding ATSDR's CVs or EPA's MCLs, tritium and strontium-90 were detected most frequently and/or in the highest concentrations. The following discussion describes the occurrence of tritium and strontium-90 in the groundwater in greater detail.

"Elevated tritium levels up to 75,000 pCi/L, or 2,793 Bq/L, were detected beneath the INTEC and TRA facilities. Tritium was injected with wastewater into a disposal well at INTEC and discharged, with the wastewater, to the infiltration ponds at INTEC and the TRA. Routine use of the disposal well ended in February 1984. Since that time most of the radioactive wastewater was discharged to the infiltration ponds (DOE 1999). Today, INEEL disposes of much less tritium in the infiltration ponds.

"A large plume extends from the INTEC and TRA areas southwestward, in the general direction of groundwater flow. The plume has also spread under the CFA. Tritium is the plume's primary contaminant. The plume has decreased from 51 square miles (mi^2) in 1985 to about 40 mi^2 in 1991. Although the tritium concentrations have remained nearly unchanged since 1991, the higher concentration lines appear to have "receded" to the source areas at INTEC and the TRA (DOE 1999). Dilution and radioactive decay (tritium has a relatively short half-life of 12.5 years) have greatly reduced the contaminant concentrations at the edge of the plume, giving the impression that the plume has receded (INEEL 2000). Today, the plume is monitored, but it is not actively remediated. As long as no further contamination enters the groundwater, it is expected that natural attenuation, dispersion, and decay will reduce the tritium in the groundwater to safe levels within 100 years. Researchers are looking at ways to reduce contamination entering the groundwater, such as by reducing the amount of water that can seep into the ground at disposal areas. The plume will continue to be monitored to determine the need for future cleanup (INEEL 2000)

"The USGS monitors wells (USGS wells 103, 105, and 108) along INEEL's southern boundary and down-gradient of the tritium plume. Tritium in these wells has been detected in only trace amounts, well below EPA's MCL of 20,000 pCi/L, or 740 Bq/L (USGS 1997). Tritium concentrations in groundwater are expected to decrease further, because the INTEC disposal well is no longer used and less tritium is being disposed of at INEEL.

"A strontium-90 plume has formed in the SRPA beneath the INTEC facility, extending southwest with the general direction of groundwater flow. Concentrations have reached 516,000 pCi/L, or 19.092 Bq/L (ATSDR 2000). Strontium-90 entered the groundwater as a consequence of past waste disposal practices. Between 1952 and 1995, about 24 Ci of strontium-90 were contained in wastewater injected directly into the SRPA through the INTEC disposal well and discharged to infiltration ponds (USGS 1997). In addition, 33 Ci of strontium-90 contained in wastewater were discharged into a pit at INTEC.

[176] Washington Wilderness Coalition, 870 F.Supp. at 990; cited in US Federal Court District of Idaho in Idaho Rural Council v. Bosma, No CV-99-0581-S-BLW. Also see State of New York v. PVS Chemicals, No 97-CV-596-A.

"Scattered detections of strontium-90 have also been reported at the TRA, but at lower concentrations (up to 1.9 pCi/L [0.07 Bq/L] in SRPA groundwater samples and up to 179 pCi/L [6.6 Bq/L] in the perched aquifer) than at the INTEC facility. Strontium-90 in the TRA does not appear to be moving in a plume. Strontium-90 in the groundwater beneath the TRA is believed to be related to radioactive waste percolating down to the groundwater from the infiltration and evaporation ponds.

"Until 1992, strontium-90 concentrations in groundwater were decreasing as a result of radioactive decay processes and dilution with water recharging from the Big Lost River. More recently, however, strontium-90 concentrations in most wells have remained relatively constant, between 2.6 ± 0.7 and 76 ± 3 pCi/L (compared to EPA's MCL of 8 pCi/L [0.3 Bq/L]). It is possible that the recharge entering the groundwater from the Big Lost River has decreased and that, therefore, the groundwater and associated contaminants are less diluted (USGS 1997).

"Gross alpha and beta radioactivity levels have been routinely monitored in on-site production wells and distribution systems. The detected levels of gross alpha and beta are generally consistent with background concentrations and are below their EPA MCLs (15 pCi/L, or 0.6 Bq/L, for gross alpha and 5 pCi/L, or 0.2 Bq/L, for gross beta).

"Over the years, monitoring has frequently detected tritium in certain on-site wells and distribution systems. While most of the detections have been at levels below EPA's MCL of 20,000 pCi/L (740 Bq/L), tritium levels in the CFA #1 well during the mid- to late-1980s reached levels up to 38,900 pCi/L, or 1,493 Bq/L, above EPA's MCL (ESRF 1988, 1989, 1990, 1991). Because the CFA lacks a source of tritium, it is believed that the tritium may have come from contaminated groundwater at the INTEC facility.

"The CFA distribution system was not sampled before 1990; therefore, ATSDR does not know what levels of tritium might have been delivered to the taps. It should be noted, however, that water from well CFA #1 would have been mixed with water drawn from well CFA #2 during that time period, and that tritium levels in the CFA #2 well were safely below EPA's MCL. Since 1989, the tritium levels in the CFA #1 well have fallen below EPA's MCL (ESRF 1998). The tritium levels in both CFA wells and the CFA distribution system currently meet water quality criteria.

"Production wells near the strontium plume originating at INTEC have also been regularly monitored for strontium-90. Strontium-90 has been detected at levels up to 1.1 pCi/L (0.04 Bq/L), below EPA's MCL of 8 pCi/L (0.3 Bq/L). Strontium-90 was not detected at all during most recent monitoring events.

"Historical groundwater sampling has identified very low levels of three radionuclides beyond site boundaries: tritium, iodine-129, and chlorine-36. In 1985, tritium detection was reported for several monitoring wells located just south of the site boundary. The levels were below EPA's MCL of 20,000 pCi/L (740 Bq/L). By 1988, the leading edge of the tritium plume had receded to within site boundaries. In 1992, iodine-129 was reported in two wells about 4 and 8 miles from the southern site boundary. The detected levels were well below 1 pCi/L (0.04 Bq/L), EPA's MCL for iodine-129.

"The U.S. Geological Survey (USGS) has identified chlorine-36 as being significantly above background in 1984 at well USGS 14. USGS 14 is located approximately seven miles south of the southern INEEL boundary and southeast of Big Southern Butte. The elevated chlorine-36 values at the well have been correlated to discharges at INTEC by evaluation of chlorine isotope data in other wells. These isotopes have not been detected in more recent samples.

"The USGS and the Idaho Department of Water Resources, in cooperation with DOE, have sampled select off-site private wells and water sources. These wells are between the southern boundary of INEEL and the Hagerman area, and they tap into the SRPA. They include domestic wells, irrigation wells, springs, dairy wells, and stock wells. The wells have been analyzed for selected radionuclides. Monitoring indicates that no radionuclides have exceeded the established MCLs for radionuclides in drinking water.

"During monitoring in 1998, ESRF collected 28 samples from the off-site drinking water locations and analyzed the samples for gross alpha and beta radioactivity particles and tritium. No samples contained detectable concentrations of gross alpha or tritium. Gross beta activity above the minimum detectable concentration was present in many of the drinking water samples at levels between 3.0 ± 2.0 pCi/L and 8.0 ± 3.0 pCi/L, but at levels below EPA's MCL (50 pCi/L) for drinking water. Concentrations in this range are normal. They are attributed to the decay of naturally occurring potassium-40, thorium, and uranium, which dissolve with water as it trickles down through the soil (ESRF 1999).

"As noted in the on-site groundwater discussion, groundwater moves south-southwest from INEEL toward Minidoka, located 73 miles away. It could take between 50 and 220 years for the water in the groundwater plume to reach the town, at which point the contamination is expected to be greatly diluted. " [177]

XIV. Conclusion

This report is not, and cannot claim to offer all the relevant information related to the INL impact on the Snake River Plain Aquifer. Nonetheless, the Environmental Defense Institute is compelled to offer this "snapshot" in the interest of expanding the information base upon which the residents of the northwest can make informed decisions on the disposition of INL's radioactive and chemical wastes. Much is at stake, and DOE's gross past waste mismanagement may well continue into the future if fundamental changes are not implemented.

A 2005 USGS report on INL contaminate transport unusually notes the fundamental deficiencies in the USGS reporting.[178] This undermines public confidence of USGS reports as being understated and politically biased in favor of DOE that funds USGS studies.

DOE is currently side-stepping (otherwise applicable) regulatory requirements by claiming it can maintain "institutional control" over INL waste sites for a 100 years to prevent public access. This is little consolation, even if it were true, because the INL waste that DOE intends to leave in place, will continue to be a public hazard for ever, or for "perpetuity."

"According to the a 2000 study on long-term stewardship by the National Research Council: 'The Committee on Remediation of Buried and Tank Wastes finds that much regarding DOE's intended reliance on long-term stewardship is at this point problematic... [O]ther things being equal, contaminate reduction is preferable to containment isolation and imposition of stewardship measures whose risk of high failure is high...[T]he Committee believes that the working assumption of DOE planners must be that many contamination isolation barriers and stewardship measures at sites where wastes are left in place will eventually fail, and that much of our current knowledge of the long-term behavior of wastes in environmental media may eventually be proven wrong. Planning and implementation at these sites must proceed in ways that are cognizant of this potential fallibility and uncertainty.' " [179]

Fundamentally, given the long half-life of radioactive contaminates, and the fact that toxic chemicals have NO half-life, it makes no difference when various water samples were collected

---

177 Agency for Toxic Substances and Disease Registry, Public Health Assessment, Idaho National Engineering and Environmental Laboratory U.S. Department of Energy, Idaho Falls, ID, Butte, Clark, Jefferson, and Bin [sic] counties, Idaho. http://www.atsdr.cdc.gov/HAC/PHA/idahoengineering/ine_p1.html

178 Review of the Transport of Selected Radionuclides in the Interim Risk Assessment for the Radioactive Waste Management Complex, Waste Area Group 7 Operable Unit 7-13-14, INL, Report 2005-5026, DOE/ID-22192

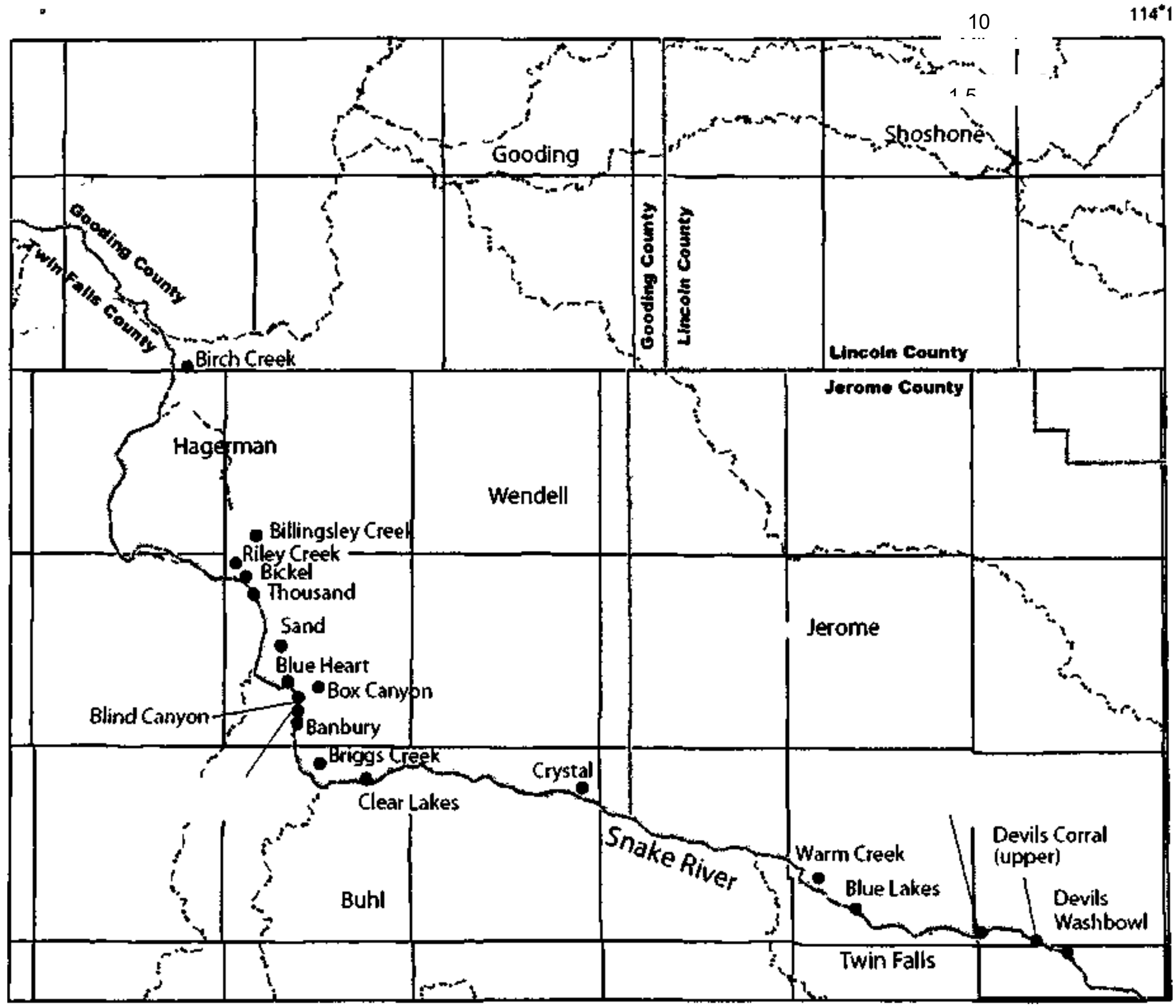
179 *Science for Democratic Action*, March 2004, citing National Research Council, Board on Radioactive Waste Management, Commission on Geosciences, Environment, and Resources. Long-Term Institutional Management of USDOE Legacy Waste Sites, Washington, DC, National Academy Press, 2000, pages 3-5

because this pollution will eventually reach somebody's water tap since it is already in the water system. The limited data currently available to the Environmental Defense Institute at the time of this writing, clearly indicate that there is a major public health and safety hazard looming related to the migration of the INL waste discharges and plans to permanently leave huge quantities of waste, in effect, create a "nuclear sacrifice zone." This pollution is currently, and will continue for millennia, contaminating the Snake River Aquifer Plain Aquifer that poses a long-term threat to all downstream (including Oregon and Washington) users of this regional water source. Immediate action is needed by federal and state regulators, in addition to public pressure, to ensure that tank waste, buried radioactive and hazardous chemical wastes are exhumed, and that continued dumping of INL process waste into unlined percolation ponds is terminated. Time is of the essence, since every day that goes by, more of this deadly pollution migrates beyond any means of mitigation.

XV. Attachments:

The below USGS maps show Magic Valley locations of off-site INL Snake River Plain Aquifer Sample Wells between the southern boundary of INL and the Snake River. Also below are USGS locator maps of Snake River Plain Aquifer springs that discharge into the Snake River reference in this report.

Location of Springs at Which Water Samples Were Collected for Tritium Analyses, Twin Falls-Hagerman Area, Idaho.



USGS Report 03-168, DOE/ID-22185, page 5. Also see DOE/ID-22133 for below USGS maps

Location Map of USGS Sample Wells in the Magic Valley Area South of INL USGS

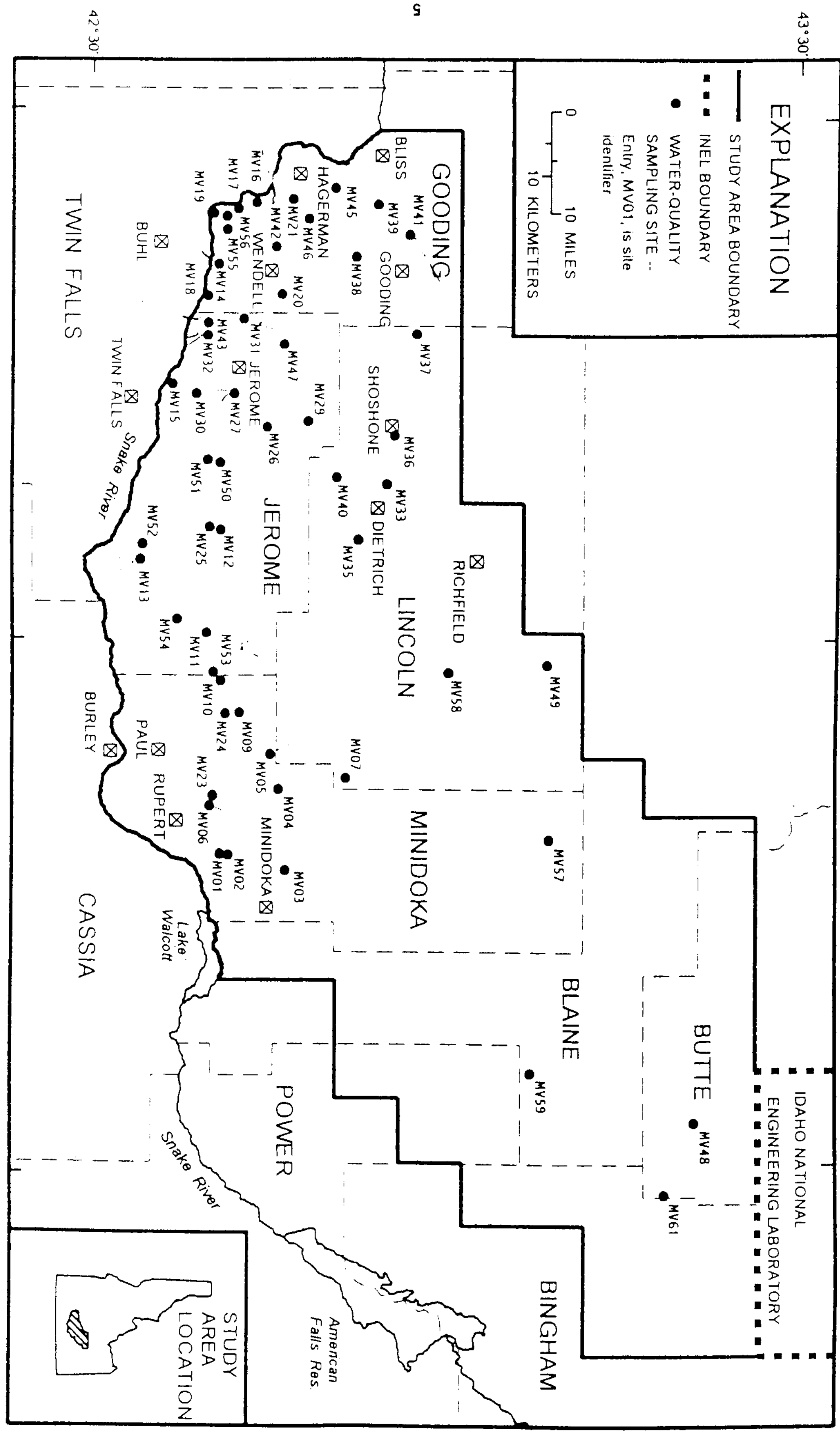


Figure 2.--Location of selected water-quality sampling sites on the eastern Snake River Plain

DOE/ID-22133
USGS

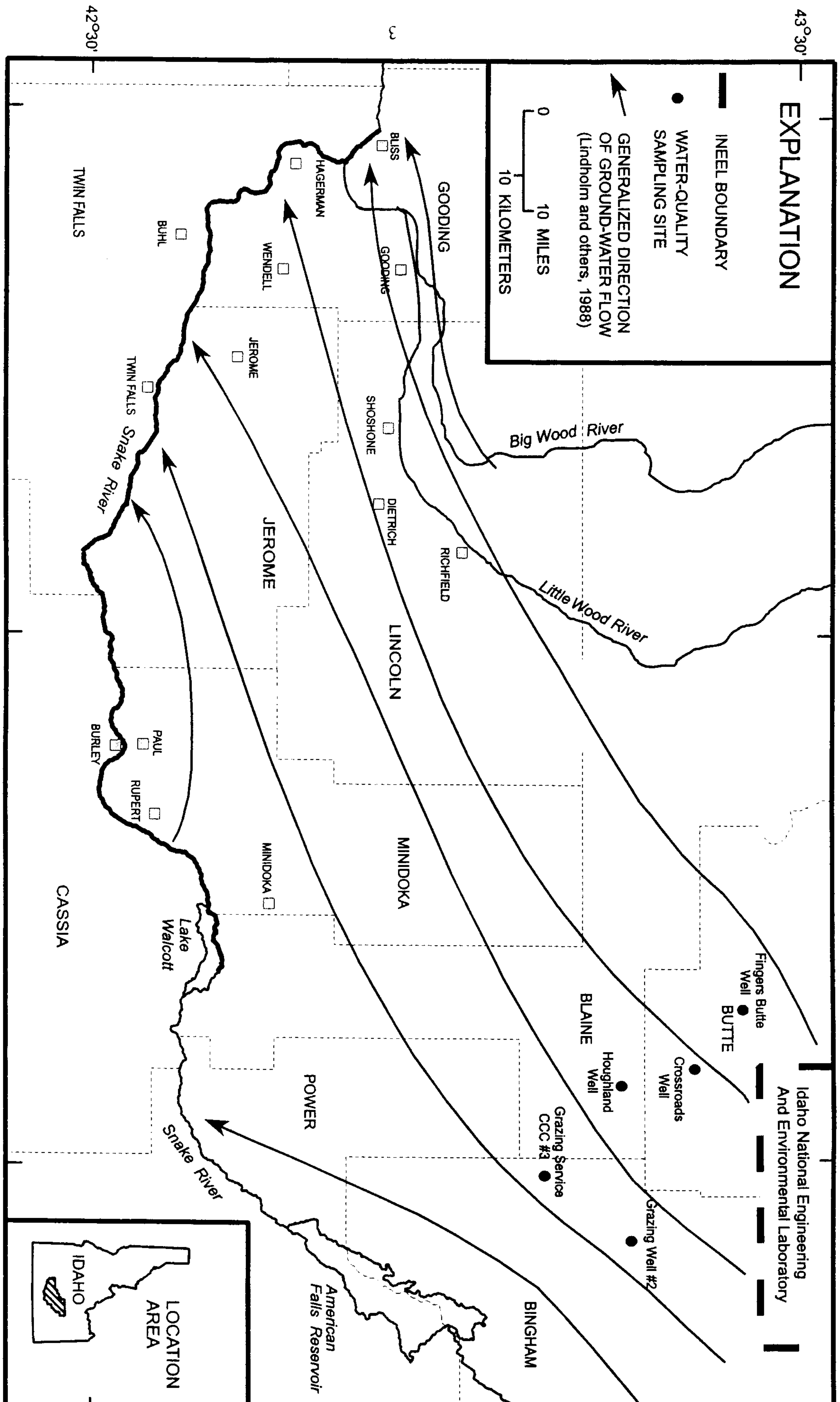


Figure 2. Location of selected wells
USGS