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Review of Idaho Nuclear Technology and Engineering Center INTEC Tank Farm Soil, Calciner and Groundwater CERCLA Cleanup Plan and Tank Farm Closure Plan at Department of Energy Idaho National Laboratory

Submitted by Chuck Broscious
Revision J
July 14, 2016

RE: **Public Comments on INTEC Tank Farm Soil and Groundwater Cleanup Plan, Operable Unit 3-14, Idaho National Laboratory, Idaho Department of Environmental Quality, August 22, 2007, Notice of Intent to Approve Plan for Closure of Hazardous Waste Units at INL, Docket # 10HW-0706 and 10HW-1604.**

Idaho Nuclear Technology
and
Engineering Center

Idaho National Laboratory
Idaho Falls, Idaho
Operable Unit 3-13
DOE/Idaho Photo

Introduction

Environmental Defense Institute (EDI) submits this review to Department of Energy (DOE), Idaho Department of Environmental Quality (IDEQ) and Environmental Protection Agency Region 10 as part of our ongoing comments on the agencies CERCLA cleanup plan at INL. EDI accessed new information related to the Idaho Nuclear Technology and Engineering Center (INTEC) waste tanks (Operable Unit 3-14) and Calcine Bins that was not included in previous comments. Since the INTEC plan is about to undergo its 5-Year CERCLA Review, this is the appropriate time to submit EDI's Review that includes:

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

Section II: INTEC tank closure plan covers the waste tank solids/heels and DOE's intent to grout these wastes in place as a permanent disposal operation in apparent violation of NRC disposal standards requiring deep geological disposal. [1]

Attachment A: EDI's compellation of the ~ 136 INTEC Liquid Waste Management System Tanks that apparently are not being evaluated in DOE's cleanup plans.

Attachment B: Institute for Energy and Environmental Research Report, "Why Grouting Does Not work" articulates the problems related to DOE's tank closure plans using grouting.

Additionally, this review is supplemental to EDI previous comments on the Liquid Waste Management System, the Integrated Waste Treatment Unit and Replacement Capacity for Disposal Remote-handled Low-level Waste. As stated above, EDI has accessed new information related to INTEC waste tanks that was not included in our previous comments.

DOE's Charles Anderson, Principal Deputy Assistant Secretary for Environmental Management statement; "DOE will proceed to complete grouting the Tank Farm Facility components that have been cleaned to remove highly radioactive radionuclides **to the maximum extent practical** and for which the State of Idaho has approved a closure plan." [2] [Emphasis added] This plan to leave the tank solids and grout the tanks remains in effect today along with Idaho's concurrence.

Documentation cited below show the history of significant INTEC Tank Farm leaks resulting in massive hazardous and radioactive contamination of the Tank Farm area. In EDI's view, the grouting of the tanks will not provide the stated objective of a safe permanent disposal site for the highly radioactive tank solids. Attachment B below, offers additional independent analysis on why "grouting" will not work to immobilize the tank waste solids in a durable medium that meets regulatory requirements for permanent nuclear waste disposal. The highly acidic tank contents will readily compromise the grout integrity and allow the contaminates to migrate into the aquifer below. EDI's objective is to offer independent analysis of the issues so that the public is better equipped to make informed decisions on DOE/INL operations.

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

[2] Department of Energy, Washington, DC, Dear Interested Party letter, 11/20/06, Charles E. Anderson, Principal Deputy Assistant Secretary for Environmental Management.

Section I:

A: INTEC Tank Farm Contamination Problems

Department of Energy's (DOE) mailings to the public describing Idaho National Laboratory (INL) Idaho Nuclear Technology and Engineering Center (INTEC) cleanup plans for Waste Area Group 3 [WAG-3] Operable Unit 3-14 [OU 3-14] are attractive from a public relations perspective, however, they lack crucial basic information the public needs in order to make an informed decision about the adequacy of the program's various cleanup alternatives. This persistent and deliberate trivialization of waste characterization leads the public to believe that there is no major problem - nothing to worry about.

DOE's deficiencies of full disclosure are rampant in DOE and Idaho Department of Environmental Quality (IDEQ) public mailing describing the cleanup plan for the INL high-level waste tank farm soils and groundwater located at the INTEC. DOE, Environmental Protection Agency and IDEQ, are involved in this misinformation because they approved of this action. For instance, the public mailing only states that "strontium-90 contamination exceeds the Idaho groundwater quality standard" but fails to say how much it exceeds that standard, or when DOE claims CPP-15 only "released kerosene and condensate" but failed to state that the estimated 120 gallon release contained contaminated soils.

Environmental Defense Institute (EDI) review of DOE's Administrative Record documentation shows the total source term release of mixed hazardous and radioactive contaminates from major leaks in the INTEC tank farm states: 32,700 curies from of leaks. [3] [4] This is an enormous amount of contamination that eventually will end up in the Idaho's sole source Snake River Aquifer under INL.

"A remedial investigation and baseline risk assessment was conducted for Operable Unit (OU) 3-14 tank farm soil and groundwater. OU 3-14 was created to address data gaps that prevented a final remedial action decision for the Idaho Nuclear Technology and Engineering Center (INTEC) tank farm soil and groundwater during the OU 3-13 comprehensive remedial investigation/ feasibility study (DOE/ID-10572). New source terms were developed based on extensive searches of historical records and using process knowledge. New and existing probeholes were gamma-logged, and new cores were collected through the alluvium and analyzed for contaminant concentrations.

"Site CPP-31 was caused by a 1972 leak of 18,600 gal of sodium-bearing waste during an unsuccessful transfer of waste between two underground storage tanks. This site accounts for an estimated 87.8% of the source of strontium-90 to groundwater from the tank farm and is the dominant risk driver. An estimated 15,900 Ci of strontium-90 were leaked at this site. The remaining 12% of the strontium-90 source term is from Sites CPP-79 (deep) (4.8%), CPP-7/33 (3.9%), and CPP-28 (3.7%). All other OU 3-14 sites account for less than 0.05%.

"Groundwater in the Snake River Plain Aquifer in the vicinity of the INTEC currently exceeds drinking water standards for technetium-99, strontium-90, iodine-129, and nitrate (measured as nitrogen) in one or more monitoring wells. The INTEC groundwater flow and contaminant transport model, which was originally developed for OU 3-13, was revised and updated based on new

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

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

information. A geochemical model was added to better simulate strontium-90 transport from Site CPP-31. The numerical model predicts that the aquifer will exceed drinking water standards for strontium-90 beyond the year 2095 but not for the other INTEC contaminants.

"Results of the recent investigations indicate that soil used as backfill throughout the tank farm is contaminated with cesium-137 and poses an unacceptable risk from external exposure to radiation. The revised baseline risk assessment concludes that the soil inside the tank farm boundary poses an unacceptable risk to current and future workers. The two OU 3-14 sites outside the tank farm boundary (CPP-15 and -58) each pose an unacceptable risk to current workers." [5]

"The aquifer area [below INTEC] with predicted peak concentrations greater than the MCL and 10^{-6} risk based concentration is relatively large. In the year 2095, the volume of the aquifer material containing I-129 at concentrations above the 1 pCi/L is $16.8x10^{+6}$ m^3 (16,800,000 cubic meters) with the peak I-129 concentrations predicted to be 4.67 pCi/L in 2095. This concentration is greater than both the 10-6 risk based concentration (0.261 pCi/L) and the MCL (1 pCi/L). The predicted maximum aquifer concentration is predicted to exceed the 10-6 risk level until well beyond the year 2095 and exceed the MCL until about the year 2167." [6]

In other words, this contamination - if not adequately cleaned up (isolated from the environment), will be a health hazard for everything for millennia.

Table 1: INTEC Tank Soil Sampling Summary Samples; just 3 of 5 Sampling Sites. [7]

Isotope	Sample Site CPP-31 Contaminate level (pCi/g)	Sample Site CPP-28 Contaminate level (pCi/g)	Sample Site CPP-79 Contaminate level (pCi/g)
Cesium-137	8,990,000	2,540,000	3,500,000
Strontium-90	20,700,000	379,000	219,000
Plutonium- 238	41,800	12,600	21,100
Pu-239/240	8,530	8,160	23,600
Pu-241	?	13,700	18,700
Am-241	8,970	2,000	2,330
Eu-154	9,620	3,770	2,860
Rad/Hour [8]	11.2	2.867	4.1

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

[5] Operable Unit 3-14 Tank Farm Soil and Groundwater Remedial Investigation/Baseline Risk Assessment, April 2006, Idaho Cleanup Project, Abstract, DOE/NE-ID-11227.

[6] DOE/ID-10619, pg. B 2-1.

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

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

Table 2: INTEC Tank Source Terms for all 3-14 release sites in curies (Ci). [9]

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

Table 3: 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

Additionally, the INTEC Percolation Ponds add 700 Mgal/yr. (700,000,000) to the ground water recharge that forces contaminates into the aquifer below. [10]

Table 3: * 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.

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

B: INTEC High-level Waste Tank Contribution to Soil Contamination 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 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 1999 volume of about 1.4 million gallons, is only part of a large complex of an additional 127 high-level waste tanks that are part of the INTEC high-level waste operations.[11] 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. See Attachment A below. Some of these tanks are a significant criticality hazard due to the high concentration of

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

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

[11] 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.

fissile isotopes (uranium and plutonium) solid material content of the tanks. [12]

If DOE's new attempt to obfuscate the legal requirements and allow **permanent** disposal in these already leaking waste tank units is not stopped, more pollution will migrate to the aquifer, further putting the general public at risk. DOE's own reports show radioactive groundwater contamination under INTEC greater than 60,000 times, and at nearby Reactor Technology Center (RTC) formerly called the Test Reactor Area 176,000 times, the EPA-regulated maximum radionuclide concentration level for drinking water. [13] Citing the RTC contamination is germane because of their close proximity and the fact that these contaminate sources must be considered collectively in making cleanup decisions that will impact the aquifer.

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. [14] 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.

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

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

"The contaminated soil beneath the Idaho Nuclear Technology and Engineering Center (INTEC) tank farm is currently undergoing a remedial investigation and baseline risk assessment (RI/BRA). Infiltrating water, resulting from precipitation, may move down through the contaminated soil to mobilize contaminants and eventually transport them to the aquifer. This infiltration study simulated the vadose zone water balance at several locations within the tank farm soil and provided estimates of the net infiltration rate through the tank farm soil.

"The main objective of this study was to quantify the net infiltration rate through the tank farm soil from observations of soil moisture. This was accomplished by simulating infiltration patterns with a one-dimensional vadose zone model and calibrating the model to transient observed soil moisture. The model calibration consisted of estimating soil hydraulic properties and infiltration from precipitation events by matching the simulated soil moisture to the observed soil moisture during winter 1993 and spring 1994. The model used a daily meteorological record as the upper model boundary condition and the precipitation amount was modified to account for snowpack accumulation, snowpack melting, and water redistribution over a

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[12] 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).

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

[14] 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.

[15] 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

synthetic membrane covering the tank farm soil. The results of the calibration were then used to simulate infiltration during the entire operational period of the INTEC (1954-2003). The final simulation results will be used as a surface recharge boundary condition in further subsurface pathway modeling efforts for the Waste Area Group 3, Operable Unit 3-14, RI/BRA and evaluation of proposed INTEC remedial actions.

"The average annual potential evaporation from open water is approximately 43 in. /yr. and exceeds the average precipitation by several times. The highest relative humidity occurs in the winter and the average B-4 midday value is approximately 55%. The lowest relative humidity occurs in the summer and the average midday value is approximately 18%. The prevailing wind direction at the INTEC is southwesterly with a diurnal shift to northeasterly. The average wind speed at 6 m ranges from 5.1 mph in December to 9.3 mph in March and April. Calm conditions exist approximately 11% of the time (DOE-ID 2003a)." [16]

"The simulation results confirm previous observations that spring infiltration events from melting snow and rain account for a large proportion of the recharge occurring beneath the INTEC. The overall recharge rate inside and outside the tank farm appear similar. The recharge rate is a large percentage of the annual precipitation and may be approximately 18 cm/year (85% of the average annual precipitation). The effect of the tank farm membrane is mostly a redistribution of infiltration, which focuses the infiltration at membrane breaches and the membrane perimeter. **The high infiltration rate predicted by the simulations is consistent with the need to pump the tank vault sumps. Approximately 0.5 cm/year recharge across the entire tank farm area (total area including tanks and surrounding area) is removed from the sumps even though the vaults have concrete roofs."** [emphasis added] [17]

DOE steadfastly claims the tanks do not leak, however no credible data is provided distinguishing surface infiltration into the tank vaults from leaks. Regardless, the presence of water in the tank vaults should disqualify leaving the tank sludge/heals in place as a RCRA hazardous waste landfill as planned.

A typical example of ~ 14 sample Tank Farm locations in Table B-B-1, A-65 summery of years 1954 through 2003 resulted in a total of 1,623.8 cm of recharge through the Tank Farm to the aquifer below. [18]

Table 4: 1995 INTEC (ICPP) Perched Water Well Sample Data [19]

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)

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[16] Operable Unit 3-14 Tank Farm Soil and Groundwater Remedial Investigation/Baseline Risk Assessment, April 2006, Idaho Cleanup Project, DOE/NE-ID-11227, Appendix B, Estimation of Net Infiltration at the Idaho Nuclear Technology and Engineering Center Tank Farm, Peter Martian, Idaho National Laboratory.

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

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

[19] 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."

Table 5: 2002 INTEC Perched Ground Water Sample Data [20]

Contaminate	Concentration	Regulatory Std. (MCL) [21]
Gross Alpha	1,100.00	15
Gross Beta	590,000.00	4 millirem/yr.
Tritium	40,400.00	20,000.00
Strontium-90	136,000.00	8.00
Plutonium-238	0.0501	7.02
Americium-241	0.0374	6.34
Iodine-129	0.650	1.00
Technetium-99	476.00	3,790.00
Uranium-233/234	15.30	13.80
Uranium-235/236 0	0.142	13.80

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

Radionuclides dumped in INTEC Waste Injection Well

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

Table 6: 2006 Tank Farm Soil Downhole Gamma Log Data [22]

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]

[20] DOE/EIS-0287, Idaho HLW & FD EIS, page 4-52, 4-53 and 4-57.

[21] 40 CFR 140 and 141

[22] 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.

INTEC Groundwater Monitoring Data (2009 and 2014) [23]

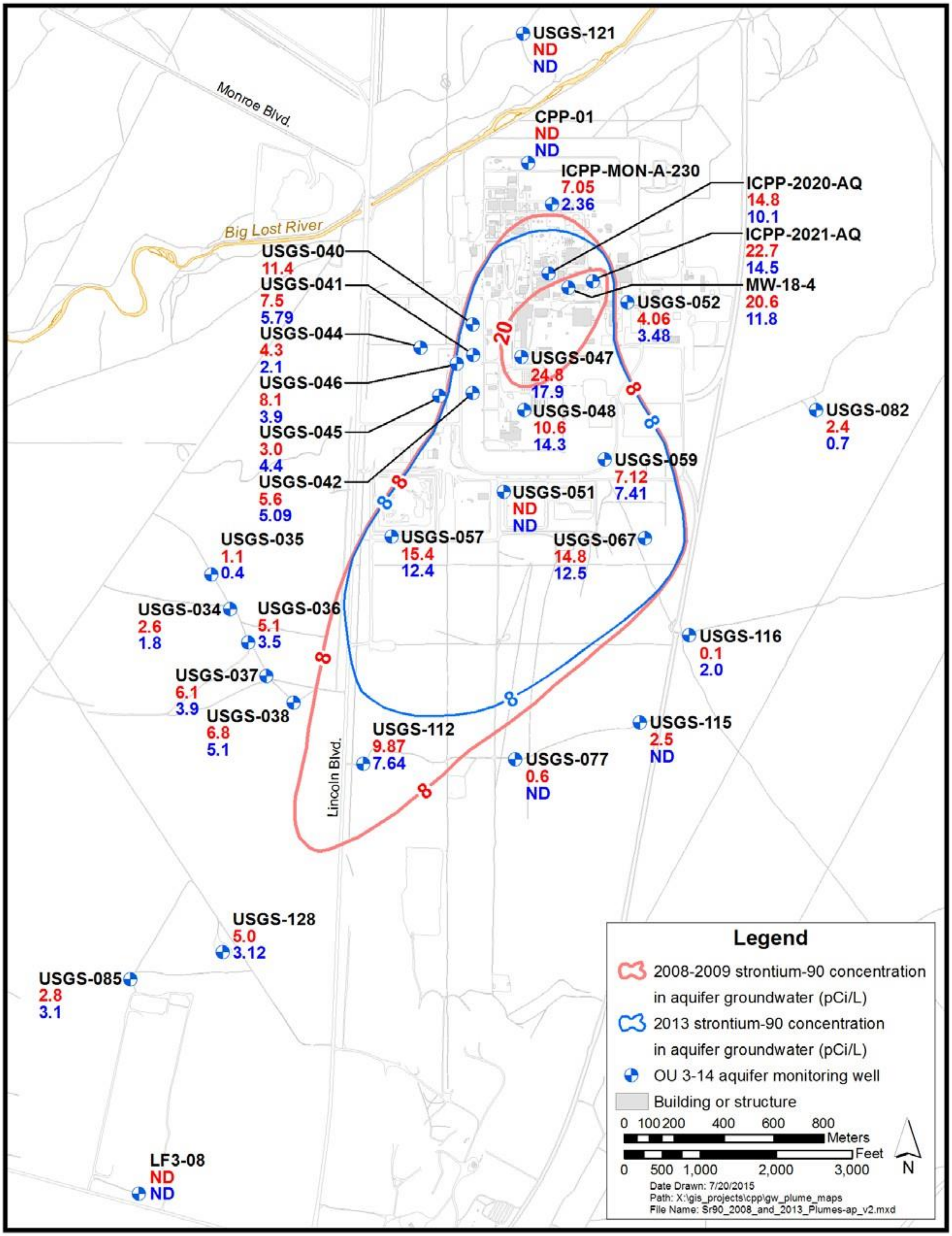
Table 6-6. Maximum concentrations in groundwater and perched water samples (2009 and 2014) at the Idaho Nuclear Technology and Engineering Center.

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

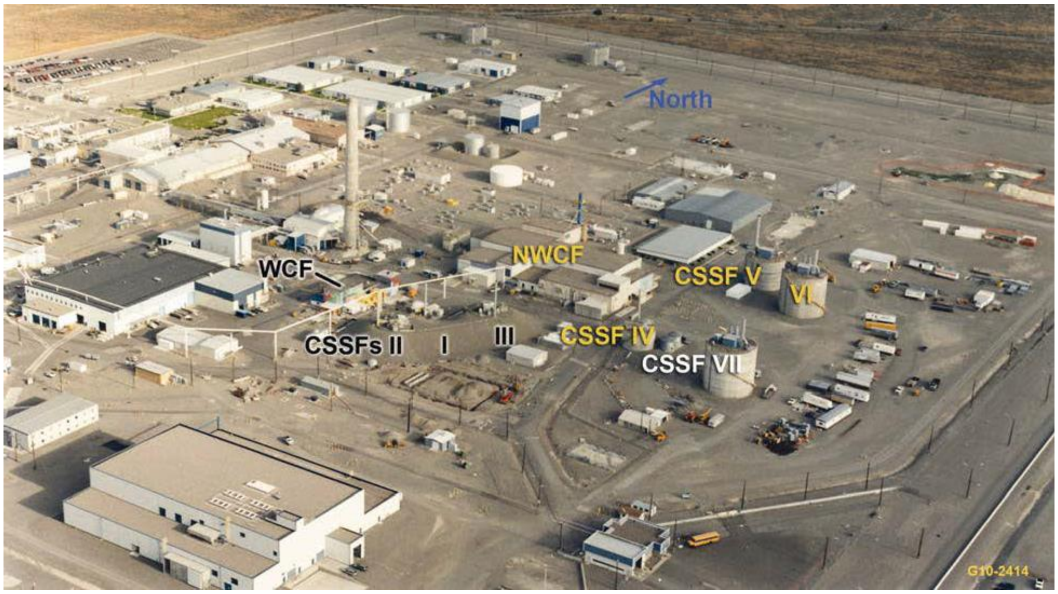
a. Because some wells are sampled only during odd years (DOE-ID 2012e), data from 2009 are included for completeness.
b. Includes field duplicates.
c. **Bolded** values exceed the MCL.
d. Derived MCL equivalent to a dose of 4 mrem/year from a single beta- or photon-emitting isotope.
e. Derived MCL assuming a single alpha-emitting isotope (see gross alpha).

J estimated value
UJ detection limit is an estimate
MCL maximum contaminant level
NA not applicable

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


USGS-121
ND
ND
Monroe Blvd.
CPP-01
ND
ND
ICPP-MON-A-230
7.05
2.36
ICPP-2020-AQ
14.8
10.1
ICPP-2021-AQ
22.7
14.5
MW-18-4
20.6
11.8
Big Lost River
USGS-040
11.4
USGS-041
7.5
5.79
USGS-044
4.3
2.1
USGS-046
8.1
3.9
USGS-045
3.0
4.4
USGS-042
5.6
5.09
USGS-052
4.06
3.48
20
USGS-047
24.8
17.9
USGS-048
10.6
14.3
USGS-082
2.4
0.7
USGS-059
7.12
7.41
USGS-051
ND
ND
USGS-035
1.1
0.4
USGS-057
15.4
12.4
USGS-067
14.8
12.5
USGS-034
2.6
1.8
USGS-036
5.1
3.5
USGS-116
0.1
2.0
USGS-037
6.1
3.9
USGS-038
6.8
5.1
USGS-112
9.87
7.64
USGS-115
2.5
ND
USGS-077
0.6
ND
Lincoln Blvd.
8
USGS-128
5.0
3.12
USGS-085
2.8
3.1
LF3-08
ND
ND
Legend
2008-2009 strontium-90 concentration in aquifer groundwater (pCi/L)
2013 strontium-90 concentration in aquifer groundwater (pCi/L)
OU 3-14 aquifer monitoring well
Building or structure
0 100 200 400 600 800
Meters
Feet
0 500 1,000 2,000 3,000
N
Date Drawn: 7/20/2015
Path: X:\gis_projects\cpp\gw_plume_maps
File Name: Sr90_2008_and_2013_Plumes-ap_v2.mxd

Calcine Bin Closure



Aerial Photograph Showing the Waste Calcining Facility (WCF), the New Waste Calcining Facility (NWCF), and the Calcined Solids Storage Facilities (CSSFs) at the Idaho National Laboratory. DOE picture.

"High-level radioactive waste at INEEL was generated in the process of extracting useful isotopes from spent nuclear fuel at INEEL. Most of this [highly-enriched] fuel was from the Naval Reactors Program. Most aqueous solutions from spent nuclear fuel processing and isotope extinction were concentrated by evaporation and separated into low-level and high-level radioactive waste streams in the Process Equipment Waste Evaporator. The liquid high-level radioactive waste was stored in subsurface tanks and them transformed by calcination into solid metallic oxides in a granular form.

"Liquid high level waste from reprocessing operations was originally stored in the Tank Farm. It was then converted to a solid form (calcine) by the Waste Calciner and stored in the bin sets. Apparently the original plan was to store the calcine on-site at the Chem Plant forever. Hence, the first two bin sets were not designed to allow retrieval of the calcine. Later, DOE changed its mind and decided that the high level waste should go to Yucca Mountain, NV whenever it opens. So the rest of the bin sets were designed to be retrievable. [24]

The calcine form of high level waste is not suitable for shipment to Yucca Mountain; it must be converted to another more stable form. There is no approved plan to do so, but DOE is leaning toward some form of insitu-grouting.

[24] *Final Programmatic Environmental Impact Statement for Accomplishing Expanded Civilian Nuclear Energy. Pg. 3-83*

"The Calcined Solids Storage Facilities contain seven bin sets, with each bin set containing multiple bins used for calcine storage. Each set of bins is arranged inside a concrete structure called a vault. The bins themselves are large vertical cylinders constructed of stainless steel. Bin set 1, the first constructed, is much smaller than the other six. In bin set 1, the bins vary in diameter from 3 feet to 12 feet, and in length from 20 feet to 24 feet. The bins in the rest of the bin sets are 12 feet to 13.5 feet in diameter and from 40 feet to almost 70 feet in length. **The bins (with the exception of those in bin set 1) are equipped with retrieval risers or pipes that connect to the surface. These risers would be used during calcine retrieval operations. New risers would be installed on the bins in bin set 1 during the calcine retrieval activities. The vaults for bin sets 2 through 7 are hollow cylinders, with inside diameters of 40 feet to 60 feet, and a wall thickness of 2 feet to 4 feet.**

"The vault for bin set 1 is a square design, with walls about 2.5 feet thick. The systems used for closure of the bin sets would include remotely operated drilling and cutting equipment, remotely operated carbon dioxide pellet blasting systems, remotely operated robots for cleaning the interior surfaces of the bins, and equipment for filling the lines and vaults with clean grout. The Class C grout would be pumped to the bin sets using the same systems as in the Tank Farm." [25]

Table 1. Summary of High-Level Waste Calcination and Storage at the Idaho National Laboratory (Staiger and Swenson, 2011)

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

U.S. Nuclear Waste Technical Review Board, "Calcined High-Level Radioactive Waste," Factsheet. http://www.nwtrb.gov/facts/Calcined_HLW.pdf

INL Calcine Bins at INTEC

Bin Number	Quantity in cubic meters	Curies per cubic meter	Total Curies
CSSF I	217	20,422.47	4,431,675.9
CSSF II	356	11,192.69	3,984,597.9
CSSF III	1,052	5,021.05	25,210,997.0
CSSF IV	488	12,075.76	5,892,972.2
CSSF V	552	13,302.45	7,342,957.6
CSSF VI	74	4,977.08	368,304.4
CSSF VII	0	0	0
Total			**44,231,505.0**

Treatment/Disposal of Calcine, Greg Duggan/Mike Patterson, National Academy of Sciences Review Meetings, Idaho Falls, Idaho, December 3 2003, pages 3 and 10.

[25] Idaho HLW & FD EIS DOE/EIS-0287 Pg C-6-126&127

Table C.7-3. Bin *set* total inventory of radionuclides *(decayed* to *2016)*. a

Constituent List	Column 2	Column 4	Column 6
	Constituent Total activity (Ci)	Constituent Total activity (Ci)	Constituent Total activity (Ci)
	33,283,934	33,336.4	221,830.1
Total All Bins & Constituents			**33,539,100.5**

Idaho High Level & FD EIS, DOE/EIS-0287, Appendix C.7-3, Table C.7-3, September 2002

The difference between complete list 2003 Nat. Academy of Science's Treatment/Disposal of Calcine Reports: 44,231,505.0 curies

The incomplete list in DOE Idaho HL & FD EIS, 2002, 33,539,100.5 curies

Huge Difference 10,692,409.5 curies

Given the magnitude of the calcine curie inventory and the impact on the environment if DEQ allows DOE to grout the calcine in place, the public must be told the truth.

Calcine Inventory – Curies/M³

Radionuclide	CSSF I	CSSF II	CSSF ID	CSSF IV	CSSF V	CSSF VI
	Curie /M^3	Curies/M3	Curies/M^3	Curies/M^3	Curies/M^3	Curies/M^3
60-Co	l.55E-02	2.29E-01	3.21E-01	6.63E-01	6.77E+OO	l.39E+OO
63-Ni	0.OOE+OO	7.62E-01	1.46E+OO	1.95E+OO	l.90E+OO	6.26E-01
90-Sr	4.80E+03	2.61E+03	2.36E+03	2.88E+03	3.21E+03	1.18E+03
90-y	4.80E+03	2.61E+03	2.36E+03	2.88E+03	3.21E+03	1.18E+03
99-Tc	1.93E+OO	9.21E-01	6.67E-01	8.34E-01	8.97E-Ol	3.06E-01
106-Ru	4.18E-08	1.90E-03	4.57E-05	7.42E-04	3.16E-02	1.48E-01
125-Sb	3.53E-02	6.00E-01	2.17E-01	8.42E-01	2.66E+OO	8.32E-01
126-Sb	7.06E-03	3.35E-03	2.49E-03	3.13E-03	3.31E-03	1.40E-03
126m-Sb	5.03E-02	2.41E-02	1.81E-02	2.28E-02	2.41E-02	1.00E-02
129-I	4.17E-04	1.99E-04	1.46E-04	1.80E-04	1.97E-04	l.29E-04
134-Cs	5.94E-03	l.17E-01	1.71E-01	l.40E+OO	l.05E+Ol	3.58E+OO
135-Cs	4.92E-02	3.23E-02	3.41E-02	4.39E-02	4.51E-02	l.85E-02
137-mBa	5.17E+03	2.90E+03	2.44E+03	3.07E+03	3.34E+03	l.27E+03
137-Cs	5.46E+03	3.07E+03	2.58E+03	3.24E+03	3.53E+03	1.34E+03
144-Ce	4.0lE-10	2.0SE-08	3.86E-06	l.15E-04	2.32E-02	1.75E-01

Treatment/Disposal of Calcine, Greg Duggan/Mike Patterson, National Academy of Sciences Review Meetings, Idaho Falls, Idaho, December 3 2003, pages 3 and 10. Bin Set CCF VII is empty.

C: DOE's Modeling is Flawed

DOE's computer modeling of contaminates fate and transport is fundamentally and deliberately flawed. DOE's own report states "The modeling results indicated that actions on Tank Farm Soil alone will not meet Snake River Plane Aquifer Remedial Action Objectives." [26] INTEC is in the Big Lost River flood plain and has been flooded numerous times in the recent past. Flood waters travel horizontally in the alluvial soils at

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

INTEC and will generate "recharge" to flush INTEC soil contamination into the perched zones and ultimately to the aquifer. DOE additionally fails to disclose how much of the INTEC high-level waste tank sediments will be left in the tanks, what specific contaminate concentrations are in the sediments, and how ineffective the "grouting" of these sediments permanently in place. DOE's own studies show that the grout cannot mix with the tank sediments and therefore cannot provide a waste disposal medium that meets regulatory compliance.

Again, DOE fails to offer groundwater contaminates levels and the corresponding Maximum Concentration Level limits in EPA's standards. [Appendix B "Estimation of Net Infiltration at INTEC Tank Farm"]This data is crucial for the public to fully understand the severity of the problem and draw their own conclusions on the appropriate cleanup.

The DOE's own internal INL documents indicates comments by INL officials that show grouting cannot be appropriately accomplished because (1) the tanks sit on a sand bed; (2) grouting under the tanks will be necessary, but the grouting of the non-RCRA compliant concrete tank vault containment structures will float the tanks and bend and distort the tank bottoms so that the grouting may bend or break the wastes grouted inside the tanks so that the waste will not be immobilized; and (3) there will not be any homogenous mixture formed within the tanks between the grout and the wastes; (4) the side panels and side walls and floors of the vaults are contaminated with radioactive and mixed (RCRA) wastes; (5)

Vessel Off-gas Systems (VOG) problems are avoided as "outside the scope of this study"; (6) nine out of eleven tanks do not meet seismic criteria. The DOE report shows that mixing of the grout and the tank sediments will not occur. The displacement grout will simply "roll over" the solids, leaving potential High-Level Waste, Transuranic, and/or Greater than Class C Low Level Waste at the tank bottoms which is not immobilized. Comments indicate that adequate hydraulic studies have not been performed.

One DOE official comment states "since the new grout in the vault will not travel under the tanks and nine of them sit on sand, will this be a problem when the regulators see it or should we say right now that the sand will be contained by the grout and the old floor and therefore any waste or leakage will be contained or something similar to this?" Another DOE commenter states, "The grout will roll over the solids." Another commenter states, "The grout will not encase the solids, they will sandwich them between the grout and the bottom of the tank. Underneath the tank is sand. Under the sand is the existing tank vault. The vault has been proven to leak from the infiltration of rainwater." The clear indication of these comments is that Idaho will not be protected by grouting from the High Level Waste contained in the tanks.

Numerous comments address problems which exist respecting how to "wash down" the tanks, i.e., removal of solids from the tanks by the use of a "mixing pump". No backup plan exists for solids removals from the tanks in case the mixing pump plan doesn't work. The mixing pump will not likely be sufficient to remove a significant fraction of the potential solids. There is no backup for solids removal from the tanks in case the mixing pump plan doesn't work. The mixing pump will not likely be sufficient to remove a significant fraction of the potential solids and the mixing pump design has not been established. One commenter states in part, "This clean/wash/rinse activity will have little or no effect on the chemical composition of the solids since they are insoluble even in 2-3 molar nitric acids. This activity may or may not physically move the solids inside the tank or remove them from the tank. This clean/wash/rinse activity may also have little effect on the liquid SBW [Sodium Bearing Waste] held interstitially by the solids depending on the turbulence involved."

"The lack of a mixing pump design comment is resolved by stating that "Establishing the actual agitation and mixing effectiveness is beyond the scope of this study." [27]

DOE commenter state that doubles containment should be required by IDEQ. The existing

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

concrete vaults do not qualify with the double containment required by Resource Conservation Recovery Act.

A reference in the document was deliberately deleted to avoid the problems about 30,000 gallon tanks which sit on a gravel bed. Any liquid that might accumulate on top of the grout is handled as "being beyond the scope of work for this study." None of the tanks initially passed a seismic analysis and analyses have not been performed. Corrosion rates may be well beyond design value for INTEC liquid waste storage tanks.

Comments in the document also disclose that the grout will not commingle/mix with the tank heels and therefore will not meet any of the EPA Land Disposal Regulations applicable to this waste even for deep geologic burial (i.e. Waste Isolation Pilot Project/Waste Acceptance Criteria).

The most egregious DOE action is trying to change the high-level tank waste classification to a lesser category it concocted called "incidental waste." The Natural Resources Defense Council together with tribal governments is currently litigating this arbitrary waste reclassification as a violation of Nuclear Waste Policy Act. This case has been the courts for a number of years and the outcome will affect how INL can proceed with closure of its high-level waste tanks.

Section II: INTEC Waste Tank Closure

The DOE has been in the process of closing the Idaho National Laboratory (INL) tank system for over a decade in response to a January 1990 Notice of Noncompliance and subsequent Consent Order (State of Idaho et al. 1992). This program covers the permanent disposal of grouted residual waste in the tank systems at the Idaho Nuclear Technology and Engineering Center (INTEC) Tank Farm Facility (TFF) that are being closed.

"The TFF consists of eleven 300,000-gal below-grade stainless steel tanks in unlined concrete vaults, four 30,000-gal below-grade stainless steel tanks, and associated ancillary equipment and piping. Historically, the TFF tanks were used to store various INTEC wastes, including those from spent nuclear fuel (SNF) reprocessing (first-, second-, and third-cycle reprocessing wastes), decontamination waste, laboratory waste, and contaminated liquids from other INTEC operations. In general, because of significantly higher radioactivity levels, first-cycle reprocessing wastes were segregated from the other types of liquid waste.

These other tank wastes, referred to as sodium-bearing waste (SBW) because of their high sodium levels, were made up of wastes other than first-cycle reprocessing wastes, were generally much lower in radioactivity, and had a significantly different chemical composition than first-cycle reprocessing wastes. [emphasis added] [28]

"The scope of this closure plan (3116 Basis Document) does not include any other facilities or systems at INTEC or the INL Site such as the evaporators, the New Waste Calcining Facility, the calcine storage bin sets, the 900,000 gal of stored sodium-bearing waste, contaminated soils, or the treated sodium-bearing waste for off-Site disposal." [29]

"Recent tank cleaning operations have resulted in the removal of the remaining SBW and tank heels from seven 300,000-gal tanks and four 30,000-gal tanks to the **maximum extent practical for the cleaned tanks.** Four 300,000-gal tanks remain to be cleaned, and these four tanks are anticipated to be cleaned as efficiently as the other 300,000-gal tanks that have been cleaned. Sampling and analysis of tank and ancillary equipment residuals indicate that the residual inventory at closure is less than that established in the 2003 PA (DOE-ID

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

[29] Ibid. pg. 6

2003b).” [30] [emphasis added]

EDI’s Tank Table 1 below summarizes the transuranic contents of 10 of the INTEC tanks slated for closure. Of particular concern is the radioactive and quantity content of the tank solids/heels that are significantly higher than previously publically known. EDI’s Table 1 below challenges DOE contention (highlighted) above that “These other tank wastes, referred to as sodium-bearing waste (SBW) because of their high sodium levels, were made up of wastes other than first-cycle reprocessing wastes, were generally much lower in radioactivity” especially with respect to the tank solids/heals remnants of the previous tank contents from “first/second/ third- cycle reprocessing waste.”

EDI concedes that there are less **fissile** materials (isotopes of U-235, Pu-239) in the SBW but there are more **fission** products, transuranic (TRU) [31], and RCRA hazardous corrosive/toxic wastes because the whole point of reprocessing is to extract fissile material (U-235, Pu-239) for reactor fuel, bomb material and Xe/Kr for US Air Force.

In Table 1 below, the half-life of the transuranic elements are; Pu-238 (88 yrs.); Pu-239 (24,000 yrs.); Pu-240 (6,500 yrs.); Pu-242 (370,000 yrs.); Am-241 (458 yrs.). Because these isotopes have such long half-lives, they represent a biological hazard requiring deep geological disposal to prevent intrusion – for all practical reasons – forever. Regulations further require disposal sites not be subject to groundwater contact that could facilitate contaminating migration; or earthquakes that could compromise waste containers and site integrity.

According to DOE, the original high-level waste (from reprocessing spent reactor fuel) tank **liquid** contents (not the solids) were calcined in the Waste Calciner and/or the New Waste Calcine Facility. This high-level calcine waste remains in INTEC underground storage bins with no final treatment and no path-forward for permanent geologic disposal. EDI continues to emphasize that the tank **solids** from the original INTEC reprocessing remain and should continue to be classified as high-level waste but are NOT by DOE or the ID Department of Environmental Quality.

[30] Ibid. pg. 6

[31] **Fissile** material includes isotopes (U-235, Pu-239). **Fission** products are the fragments that result from splitting the nucleus in a nuclear reactor. The fission products build up in the fuel and create the bulk of the radioactivity and are separated out in fuel reprocessing as waste.

Table 7: INTEC Tank Radioactive Transuranic Contents

INTEC former High-level now Sodium-Bearing Waste Tanks (Transuranic) Solids/Heels Only Pu-238, Pu-239, Pu-240 and Am-141 included below (not all TRU). [32]

Tank	Curies (Ci/kg) [33]	Solids Quantity (kg) [34]	Total Curies	Total nCi/g [35]	No. Times Over Reg. Limit [36]
WM-180	0.094768	10,000	947.68	94,768	947
WM-181	0.015943	10,452	166.64	15,943	159
WM-182	0.016240	10,452	171.41	16,240	162
WM-183	0.004322	19,743	85.32	4,322	43
WM-184	? [37]	10,452	?	?	?
WM-185	?	10,452	?	?	?
WM-186	?	10,452	?	?	?
WM-187	0.03395	160,000	5,432	543.2	5
WM-188	0.028698	10,000	286.98	28,698	286
WM-189	?	20,000	?	?	?
Totals		272,003			

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

The INTEC (ICPP) mission since 1952 has been reprocessing spent reactor (SNF) fuel to extract fissile material (primarily uranium) for military programs. Spills, leaks, and releases over the years resulted in significant contamination of the surface soils and underlying groundwater. INTEC releases 979,486,072 gal/year in system leaks to flush contaminates to aquifer. [DOE/ID-10660, pg. 5-4] Additionally, CPP- 02 released 3,698,408 gal. /yr. [DOE/ID-1066002, pg. 5-16] A Remedial Investigation/ Feasibility Study Final Work Plan [INL-95/0056, referenced below as A] for the ICPP was completed in August 1995. The three

[32] *Feed Composition For The Sodium-Bearing Waste Treatment Process*, INEEL/EXT-2000-01378, Rev. 3. Idaho National Engineering and Environmental Laboratory, Bechtel BWXT Idaho, September 2003. Transuranic elements not included in this table are Pu-236, Pu-241, Pu-242, Pu-244, Am-243 because they have shorter than the 20 year half-life (established in 10 CFR Part 61.5 regulations) or are not major curie contributors. Thus, these amounts are understated and not complete totals.

[33] Ibid. Table 26, pg. 57; Table 28, pg. 61; Table 29, pg. 63.

[34] Ibid. Table 24, pg. 53 and pg. 54

[35] 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 x 10^{-9}).
Ci/g and nCi/g are concentration unit ratios for quantifying radioactivity per unit quantity.

[36] Transuranic (TRU) waste is radioactive waste that is not classified as high-level radioactive waste and that contains more than **100 nano-curies** (3700 becquerels) 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.

[37] ? = represent data not included in the DOE/INL report cited. The high curie concentration in other tank sediments suggests that WM-184,185,186 and 189 may also have TRU concentrations.

party INTEC cleanup Record of Decision was released in 1999 [DOE/ID-10660, Section 5, referenced below as B] was issued. The following table shows surface soil sample excerpts from these studies.

Table 8: INTEC CERCLA Cleanup Sites and Contaminate Concentrations

INTEC CPP Cleanup Site	Contaminate	Concentration pCi/g
CPP-15 Solvent Burner [B]	Am-241 Cs-137 Eu-154 Sr-90 Pu-238 Pu-239-240 Pu-241 U-235	16,600 102,000,000 565,000 56,800,000 276,000 12,600 106,000 9,000
CPP-89 Soil Storage Area [A]	Cs-137 Sr-90	7,730 10,800
CPP-34 Soil Storage Area [A]	Cs-137 Sr-90	2,000 6,000
CPP-26 Tank Farm Soil Steam Flush [A]	Cs-137 Sr-90	11,000 4,900
CPP-28 Tank Farm Soil South WM-108 [A]	Co-60 Sr-90 Cs-134 Cs-137 Eu-154 Pu-239 Pu-240 Pu-241 Am-241	23,000 57,000,000 76,000 100,000,000 570,000 13,000 12,000 1,100,000 1,500,000
CPP-31 Tank Farm South WM-183 [B]	Co-60 Sr-90 Cs-137 Eu-154 U-235 Pu-239 Pu-240	120 140,000 900,000 1,500 6,400 1,100 1,000
CPP-35 Tank Farm Soil [B]	Cs-137 Sr-90 Gross Beta	8,643 3,240 12,100
CPP-36 Tank Farm Soil [B]	Am-241 Cs-137 Eu-154 Pu-238 Sr-90 Gross Alpha	763 408,500 4,740 8,180 51,300 27,500

Table 8: INTEC CERCLA Cleanup Sites and Contaminate (continued)

INTEC CPP Cleanup Site	Contaminate	Concentration pCi/g
CPP-79 Tank Farm Valve Box A-2 12 meters or 40 feet below surface [A page 5-4]	Sr-90 Cs-137 Am-241 Pu-238 Pu-239	5,410,000 33,700,00 16,600 276,000 89,900
CPP-91 Tank Farm Soil Boring [B pg.5-25]	Gross Alpha Gross Beta	190 20,900
CPP-01 Tank Farm Soil [B pg.5-26]	Gross Alpha Gross Beta	3,323 43,200
CPP-04/05 Soil around CPP-603 Settling tank [A]	Cs-134 Cs-137 Ce-144 Co-60 Eu-152 Eu-154 Eu-155	1,450 26,500 2,390 2,390 35,000 32,200 7,600
CPP-19 CPP-603 to CPP-404 SNF Storage Pool Line Leak [A]	Cs-137 Co-60 Eu-152 Eu-154 Eu-155 Sr-90 Gross Alpha Gross Beta	408,000 21,600 87,600 53,500 9,620 125,000 16,100 548,000

* The Radiological Release Criteria for Cesium-137 is 10 pCi/gram. [EG&G-WM-8804] INL-95/0056 pg. 2-115

Sources:

[A] A Remedial Investigation/ Feasibility Study Final Work Plan, October 1998, Volume 1, DOE/ID-1066002, pg. 5-16; also see INL-95/0056, August 1995.

[B] INTEC cleanup Record of Decision [DOE/ID-10660, Section 5] Three party (DOE/EPA/IDEQ) agreement was released in 1999.

The ICPP Remedial Investigation/Feasibility Study lists 100 chemical/radiological release sites. Of the 100 release sites, 13 are related to the tank farm. The estimate of radioactivity in decayed values in the surface soils within the ICPP compound is 50,000 curies plus 22,200 curies released to the aquifer. [38] Contaminates migrating from the ICPP are found in the following perched water sample data.

Total Tank Farm contaminated soil originally was (111,835 cm) or (146,275 cu. ft.) but later investigations designated as "additional soils" is (84,606 cu m) or (110,660 cu yds.) down to 40 ft. were added. [INTEC-RI/FS, 1998, pg.5-4]

The Environmental Defense Institute (EDI) and Keep Yellowstone Nuclear Free submitted detailed formal comments on this tank closure and waste treatment intended for the liquid portion (~900,000 gal.) in 2007. [39] Since then, EDI has accessed DOE reports related to the characterization of the individual tanks slated for closure that were not available in 2007.

[38] DOE's INL Environmental Management Site Specific Advisory Board [EMSSAB @ 5]

[39] "Comments on U.S.DOE Class 3 Modification Permit No. EPA ID ID-49800089521"; Environmental Defense Institute and Keep Yellowstone Nuclear Free, 2/28/07 [Rev.2], available on EDI website; http://environmental-defense-institute.org

Of particular concern is the radioactive and quantity content of the tank solids/heels that are significantly higher than previously known. In Table 1 below, the half-life of the transuranic elements (as noted above) are extremely long and therefore, this waste will threaten the underlying Snake River Sole- Source Aquifer for hundreds- of-thousands of years .

Moreover, DOE intends to leave the solids; presumably because DOE will not spend the money to install a rotating robotic high-pressure “slucer” to break up the tank solids and pumps capable of extracting the waste. (See Attachment A below for currently available means of extracting the tank solids.) This tank solids extraction technology was sponsored by DOE Office of Environmental Management, Office of Science and Technology **back in 2001**. [40] Instead, DOE wants to cut costs by pouring grout (concrete) over the top of the tank solids calling it “incidental low-level waste” and a permanent “clean enough.”

Additionally, the high Cesium-137 (half-life of 30 yr.) in INTEC tanks WM-180 (2,070 Ci), WM-181 (2,539 Ci) WM-182 (3,490 Ci), WM-183 (13,721 Ci), WM-187 (75,200 Ci), WM-188 (26,200 Ci) or a **total of 123,220 Curies adds to the hazard.** [41] This waste falls into the Greater-Than-Class C Nuclear Regulatory Commission regulations (10 CFR Part 72.3) as low-level waste that exceeds the concentration limits established for Class C waste in (10 CFR Part 61.55). This waste must be disposed in a deep geologic repository, not in near surface INTEC tanks as DOE is doing to save money.

As a point of reference, radioactive isotopes are so biologically dangerous, that EPA pubic drinking water ingestion standards (life-time) are expressed in pico-curies (pCi) or 1 trillionth of one curie (10^{-12}) /liter. “Health Concerns for Cesium-137: a) Exposure can be through ingestion, inhalation, or just being near it (since it emits gamma radiation); b.) In humans, is flushed from the body fairly quickly. Exposure Levels: EPA has established a maximum contaminant level of 4 millirem per year for beta particle and photon radioactivity from man-made radionuclide's in drinking water. Cesium-137 would be covered under this MCL. The average concentration of cesium-137 which is assumed to yield 4 mRem/year is 200picocuries per liter. If other radionuclide's which emit beta particles and photon radioactivity is present, the sum of the annual dose from all the radionuclides must not exceed 4 mRem/year.” [42]

DOE report states: “[Tank] WM-188 has since been filled with HLLWE [High-level Liquid Waste Evaporator] concentrate. A sample from WM-189, which was filled with much the same evaporator concentrate, showed significantly more solids than a similar sample from WM-180. However, other high solids waste, i.e., New Waste Calcine Facility (NWCF) flushes and off-gas scrub, were added to WM-189 and not to WM-188. Thus Tank WM-189 should have more solids than WM-180, and WM-188 likely has fewer solids than WM-189. For lack of additional data, the amount of solids WM-188 was assumed to be equal to

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[40] Dr. Darryl Siemer, retired INL scientist who released several reports on the INTEC waste tanks and treatment, states; “I’ve read the tank cleanout technology reports and I don’t see why they wouldn’t work just fine with the sorts of solids apt to be left in INL’s tanks after the liquid is pumped out.”

[41] Robert Alvarez with the Institute for Policy Studies reports; “It's been 26 years since the Chernobyl accident and there remains a large area of at least 1,000 square kilometers that remain uninhabitable from Cs-137. In the Marshall Islands, where the U.S. exploded 66 nuclear weapons in the open air, between 1946 and 1958, islands of several atolls; (Rongelap, Eniwetok and Bikini) where the native people gathered food still remain so contaminated with Cs-137; they are officially considered "forbidden territories." “The other important consideration about Cs-137 is chronic, long-term exposure to both external penetrating radiation (gamma rays) and beta particles as it decays. Internal exposure from ingestion of contaminated food is a serious concern because it concentrates Cs-137 as if it were potassium. Once Cs-137 enters the body, about 75% lodges in the muscle and has also been found in other organs. After initial internal exposure its biological half-life is 70 days. However, in a seriously contaminated area, the uptake of foods containing Cs-137, will result in continuous, long-term internal exposures, as is happening around Chernobyl and parts of Japan.”

[42] http://www.water.epa.gov/drink/contaminants/index.cfm

that in WM-180 and the amount in WM-189 twice the amount in WM-180. The estimated expected amount of settled solids in WM-189 and the maximum amount in WM-188, 10,000 kg, is approximately equivalent to 20,000 gallons of sludge with a solids content of 7 vol. % and a solids density of 2 g/cm3." [43] [emphasis added]

In Table 8 above, EDI summarized the radioactive curie content and quantity of the tank solids with a focus on transuranic components; but as noted above other radioisotopes like cesium-137 also represent additional disposal hazard. Leaving this waste is an apparent violation of 10 CFR Part 61.55 (requiring appropriate packaging and deep geologic disposal) but also the Settlement Agreement between DOE and the State of Idaho that states in pertinent part; "Transuranic Waste Shipments Leaving Idaho: DOE shall ship all transuranic waste now located at INEL, currently estimated at 65,000 cubic meters in volume to the Waste Isolation Pilot Plant (WIPP) or other such facility designated by DOE by a target date of December 31, 2013 and in no event later than December 31, 2018." [44]

DOE generated a new waste category called "Greater-than-Class-C-Like Low-level waste" (GTCC- LLW). "Most of the DOE GTCC-like waste consists of transuranic waste [45] (a DOE waste category) that may have originated from non-defense activities and therefore may not be authorized for disposal at WIPP under the Waste Isolation Pilot Plant Land Withdrawal Act of 1992 and has no other currently identified path to disposal." [46]

"The NRC regulations at 10 CFR 61.5(a)(2)(iv) define GTCC LLW as that waste which would require disposal in a geologic repository as defined in 10 CFR Part 60 or 63… although NRC regulations state that GTCC LLW is generally not acceptable for near surface disposal." [47]

So DOE is apparently violating regulations and taking the least expensive route by leaving the tank solids in place and grouting the remaining tank and concrete vault and thus avoiding the disposal path forward problem.

NRC regulations on Class C Low-level waste classification state: "Waste that is not generally acceptable for near-surface disposal is waste for which form and disposal methods must be different, and in general more stringent, than those specified for Class C waste. In the absence of specific requirements in this part, such waste must be disposed of in a geologic repository as defined in part 60 or 63 of this chapter unless proposals for disposal of such waste in a disposal site licensed pursuant to this part are approved by the Commission." [48]

NRC 10 CFR § 60.1 Purpose and scope states: "This part prescribes rules governing the licensing (including issuance of a construction authorization) of the U.S. Department of Energy to receive and possess source, special nuclear, and byproduct material at a geologic repository operations area sited, constructed, or operated in accordance with the Nuclear Waste Policy Act of 1982, as amended."

"*Radioactive waste* or *waste* means HLW **and other radioactive materials** other than HLW that are

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[43] *Feed Composition For The Sodium-Bearing Waste Treatment Process,* INEEL/EXT-2000-01378, Rev. 3. Idaho National Engineering and Environmental Laboratory, Bechtel BWXT Idaho, September 2003, page 54.

[44] Settlement Agreement, State of Idaho and Department of Energy, October 15, 1995, pg. 2.

[45] "Transuranic waste is radioactive waste containing more than 100 nanocuries of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years, except for (1) high-level waste; (2) waste that the Secretary of Energy has determined, with concurrence of the Administrator of EPA, does not need the degree of isolation required by the 40 CFR Part 191 disposal regulations; (3) waste that the NRC has approved for disposal in a case-by-case basis in accordance with 10 CFR Part 61."

[46] Federal Register/Vol. 72, No 140, 7/23/07 Notices.

[47] Ibid. pg. 40137.

[48] 10 CFR Part 61.55 (Waste Classification) Last updated: 4/12/2012.

received for emplacement in a geologic repository. [emphasis added]

"HLW includes irradiated reactor fuel as well as reprocessing wastes. However, if DOE proposes to use the geologic repository operations area for storage of radioactive waste other than HLW, the storage of this radioactive waste is subject to the requirements of this part.

"Conditions that permit the emplacement of waste at a minimum depth of 300 meters from the ground surface. (The ground surface shall be deemed to be the elevation of the lowest point on the surface above the disturbed zone.)

"*Geologic setting*. The geologic repository shall be located so that pre-waste-emplacement groundwater travel time along the fastest path of likely radionuclide travel from the disturbed zone to the accessible environment shall be at least 1,000 years or such other travel time as may be approved or specified by the Commission.

"The release rate of any radionuclide from the engineered barrier system following the containment period shall not exceed one part in 100,000 per year of the inventory of that radionuclide calculated to be present at 1,000 years following permanent closure, or such other fraction of the inventory as may be approved or specified by the Commission; provided, that this requirement does not apply to any radionuclide which is released at a rate less than 0.1% of the calculated total release rate limit. The calculated total release rate limit shall be taken to be one part in 100,000 per year of the inventory of radioactive waste, originally emplaced in the underground facility that remains after 1,000 years of radioactive decay." [49]

The Resource Conservation Recovery Act (RCRA) listed hazardous waste in the INTEC tank solids/heels is significant both in fact and from a regulatory perspective.

The RCRA listed hazardous waste in the INTEC tank solids is significant because of their high concentration level and from a regulatory perspective because EPA and IDEQ have more authority to regulate hazardous waste than radioactive waste. Both agencies have been avoiding exercising that authority for decades despite the fact that mixed hazardous/radioactive falls under RCRA.

Table 9 RCRA listed hazardous waste in INTEC waste tank solids [50]

Tank	**Total (mg/kg)**	**Tank**	**Total (mg/kg)**
WM-180	1,148,196	WM-187-1	786,112
WM-181	518,623	WM-187-3	745,154
WM-182	537,778	WM-188-1	519,452
WM-183	484,801	WM-188-2	509,130
WM-186	1,000,000	Total	6,249,246

[49] 10 CFR Part 60.1 and 60.2; (Disposal of High-level Radioactive Waste in Geologic Repository).

[50] Feed Composition for Sodium-Bearing Waste Treatment Process, 6/04, INEEL/EXT-2000-01378, Table 30, pg. 50. Table 30 "Comparison of Tank Solids Composition" lists ~45 hazardous materials with a total at the bottom of the listed tanks. See 40 CFR-264 Subpart 0 or 40 CFR 265 Subpart O for Universal Treatment Standards for each of the above Table 30 hazardous materials.

D: Problems with Grouting Waste Tanks

DOE's own studies show that the grout cannot mix with the tank sediments and therefore cannot provide a waste disposal medium that meets regulatory compliance. [51] This internal INL document indicates comments by INL officials that show grouting cannot be appropriately accomplished because (1) the tanks sit on a sand bed; (2) grouting under the tanks will be necessary, but the grouting of the non-RCRA compliant concrete tank vault containment structures will float the tanks and bend and distort the tank bottoms so that the grouting may bend or break the wastes grouted inside the tanks so that the waste will not be immobilized; and (3) there will not be any homogenous mixture formed within the tanks between the grout and the wastes; (4) the side panels and side walls and floors of the vaults are contaminated with radioactive and mixed (RCRA) wastes; (5) Vessel Off-gas Systems (VOG) problems are avoided as "outside the scope of this study"; (6) nine out of eleven tanks do not meet seismic criteria. The DOE report shows that mixing of the grout and the tank sediments will not occur. The displacement grout will simply "roll over" the solids, leaving potential High-Level Waste, Transuranic, and/or Greater than Class C Low Level Waste at the tank bottoms which is not immobilized. Comments indicate that adequate hydraulic studies have not been performed. Also see Attachment B below for IEER analysis on why grouting does not work.

One DOE official comment states "since the new grout in the vault will not travel under the tanks and nine of them sit on sand, will this be a problem when the regulators see it or should we say right now that the sand will be contained by the grout and the old floor and therefore any waste or leakage will be contained, or something similar to this?" Another DOE commenter states, "The grout will roll over the solids." Another commenter states, "The grout will not encase the solids, they will sandwich them between the grout and the bottom of the tank. Underneath the tank is sand. Under the sand is the existing tank vault. The vault has been proven to leak from the infiltration of rainwater." The clear indication of these comments is that Idaho will not be protected by grouting from the High Level Waste contained in the tanks.

Numerous comments address problems which exist respecting how to "wash down" the tanks, i.e., removal of solids from the tanks by the use of a "mixing pump". No backup plan exists for solids removals from the tanks in case the mixing pump plan doesn't work. The mixing pump will not likely be sufficient to remove a significant fraction of the potential solids. There is no backup for solids removal from the tanks in case the mixing pump plan doesn't work. The mixing pump will not likely be sufficient to remove a significant fraction of the potential solids and the mixing pump design has not been established. One commenter states in part, "This clean/wash/rinse activity will have little or no effect on the chemical composition of the solids since they are insoluble even in 2-3 molar nitric acids. This activity may or may not physically move the solids inside the tank or remove them from the tank. This clean/wash/rinse activity may also have little effect on the liquid SBW [Sodium Bearing Waste] held interstitially by the solids depending on the turbulence involved."

The lack of a mixing pump design comment is resolved by stating that "Establishing the actual agitation and mixing effectiveness is beyond the scope of this study." [52]

DOE comments state that double containment should be required by IDEQ. The existing concrete vaults do not qualify with the double containment required by Resource Conservation Recovery Act.

A reference in the document was deliberately deleted to avoid the problems about 30,000 gallon tanks which sit on a gravel bed. Any liquid that might accumulate on top of the grout is handled as "being beyond the scope of work for this study." None of the tanks initially passed a seismic analysis and analyses have not been performed. Corrosion rates may be well beyond design value for INTEC liquid waste storage tanks.

Comments in the document also disclose that the grout will not commingle/mix with the tank heels and

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[51] DOE INTEC Remedial Investigation/Feasibility Study**,** INTEC RI/FS, DOE/NE-ID-11227, page 4-1.

[52] DOE INTEC Remedial Investigation/Feasibility Study; INTEC RI/FS, DOE/NE-ID-11227, page 4-1.

therefore will not meet any of the EPA Land Disposal Regulations applicable to this waste even for deep geologic burial (i.e. Waste Isolation Pilot Project/Waste Acceptance Criteria). The most egregious DOE action is trying to change the high-level tank waste classification to a lesser category DOE concocted an arbitrary class called "incidental waste." [53]

EDI continues to advocate for the environmentally responsible tank cleanup solution of exhuming **all** of the tank solids/heels and directly vitrifying the waste together with the high-level calcine waste into road-ready containers for eventual shipment to a permanent/permitted geologic repository. These shipping containers – currently in use for interim (above ground) storage of INL spent nuclear fuel can also be used for the vitrified tank waste.

If DOE proceeds with grouting over the tank solids and WHEN it leaks into the Snake River Aquifer, it will be extremely difficult to remediate past mistakes because of all the concrete dumped on top of the tank solids. Best do the job right the first time! But more importantly, why leave such a big mess for future generations? And, it’s almost an irreversible decision once the grout is added to the tanks! DOE’s position that it’s just not economically feasible to clean up all the soil they have contaminated in other ways or will contaminate with these tanks is unacceptable.

Table 10: Summary Radioisotopic Results from INTEC SFE-20 Tank Characterization

(pCi/smear) (pCi/L liquid)(pCi/g wet solids) [54]

Sample Location	Co-60	Cs-137	Cs-134	Eu-152	Eu-154	Eu-155	Sb-125	Sr-90	Pu	U
Pipes Access (pCi/smear)	ND	7.7E+02	ND	ND	ND	ND	ND			
Pump Pit (pCi/smear)	ND	9.0E+03	ND	ND	ND	ND	ND			
Walls Floor (pCi/smear)	55.4	1.4E+04	59.2	584	570	121	ND			
Vault Wall (pCi/smear)	--	2.2E+03	---	-----	-----	-----	-----	-----	-----	-----
Sample Location	Co-60	Cs-137	Cs-134	Eu-152	Eu-154	Eu-155	Sb-125	Sr-90	Pu	U
Tank Exterior (pCi/smear)	1.51	5.8E+04	98.4	1.2E+03	770	204	ND	-----	-----	-----
Seepage Vault Walls (pCi/smear)	95.1	4.2E+04	ND	ND	ND	ND	ND	-----	-----	-----
Floor South End Vault (pCi/L)	5.8E+03	9.1E+05	1.4E+03	ND	ND	ND	ND	-----	-----	-----
Floor Center (pCi/L	1.1E+05	2.5E+08	1.6E+03	ND	ND	ND	ND	1.7E+08	1.0E+05	0.2
SFE-20 Tank Interior (pCi/L)	7.4E+04	2.1E+06	7.8E+03	ND	ND	ND	7.3E+04	9.7E+06	1.8E+07	0.2
Floor North (pCi/g)	2.2E+04	8.9E+06	1.1E+04	1.5E+05	1.3E+05	4.7E+04	ND	1.7E+06	7.9E+04	--
Tank Sludge (pCi/g)	3.3E+05	5.5E+07	1.6E+05	1.4E+05	1.2E+05	ND	ND	4.7E+06	9.4E+04	8.4 E+04

[53] For more information see EDI Comments on INTEC Cleanup, 9/21/07, submitted to IDEQ/DOE/EPA; available on EDI’s website; http://environmental-defense-institute.org/publications

[54] Comprehensive Remedial Investigation Feasibility Study (RI/FS) for the Idaho Chemical Processing Plant OU-3-13 at the INEEL – Part B, FS Supplemental Report, Volume 1, October 1998, Table 5-28,DOE/ID-10619 Revision 2, page 5-106.

Pump Pit Sludge (pCi/g)	2.4E+04	2.3E+06	1.3E+04	5.7E+04	4.6E+04	2.1E+04	4.7E+04	5.9E+06	3.0E+03	--
Pump Pit Sump (pCi/L)	ND	7.6E+04	ND	ND	ND	ND	ND	ND	-----	---

E: CPP-VES-SFE-20 Hot Waste Tank System (Group 7)

The above table for just one ancillary tank (SFE-20), not even listed as one of the high-level waste tanks, still contains significant radioactive contamination that puts the underlying aquifer at risk. "In 1984, liquid and sediment samples were taken from the tank interior, vault floor, and pump pit.

The reported concentrations of Cs-137, total strontium, and plutonium isotopes in the single tank liquid sample were 2,050,000; 9,700,000; and 17,600,000 pCi/L respectively (WINCO 1984). For the same radionuclides, the concentrations in the tank sediment sample were reported at 55,400,000,000; 4,700,000,000; and 93,500,000 pCi/L respectively.

The three samples were collected from the floor (two liquid and one sediment). The reported concentrations in the two liquid floor samples for Cs-137 9 analysis for total strontium and plutonium isotopes were not requested) taken from the south and center vault floor locations were 905,000 and 248,000,000 pCi/L respectively. The reported concentrations in the two liquid floor samples for Cs-137, total strontium and plutonium isotopes in the sediment sample collected on the north end of the vault were 8,920,000; 1,720,000; amd79, 200 pCi/g respectively. For the same radionuclides, the concentrations in the pump pit sediment sample were 2,290,000; 9,890,000 and 3,010 respectively (WINCO 1984)." [INTEC Record of Decision, DOE/ID-10660, 1999, pg. 5-77]

There are ~ 136 INTEC tanks listed in Appendix A below that equally pose a risk if the cleanup process is not through. None of the regulators (IDEQ or EPA) show any interest in enforcing the law and forcing DOE to do a comprehensive cleanup.

Section III

EDI Cleanup Recommendations

EDI recommends implementing a **MODIFICTION** of what DOE calls "Alternative 3a hot spot removal, capping, and monitoring that would be completed before interfering infrastructures are removed or while they are still in use." EDI believes that **ALL** INTEC contaminated tanks and soils must be removed (at minimum to the depth of the bottom of the high-level waste tanks) along with all the high-level waste tank service lines in conjunction with full cleanout of **ALL** of the tank sediments and vaults prior to grouting. Cleanup alternatives absolutely must be considered within the context of other INTEC and ATRC contaminate sources that threaten the underlying aquifer and ultimately the public. DOE refuses to commit to these cleanup criteria so the public must demand that DOE implement a **NEW** credible cleanup of the INTEC that will minimize the ongoing contaminate migration into the Snake River Aquifer.

DOE continues to claim that the cleanup will be adequate to return INL to "unrestricted industrial uses, government –controlled industrial and unrestricted areas for at least the next 100 years." [55] "Future groundwater use from contaminated portions of the SPA outside the current INTEC security fence will be restricted by institutional controls until 2095" Yet earlier in this same DOE report it states: "The predicted maximum aquifer concentration [of I-129] is predicted to exceed the 10-6 risk level until well beyond the year 2095 and exceed the MCL until about the year 2167." [56] These claims are categorically false given the fact that DOE intends to leave most of the waste in place and turn INL into "nuclear sacrifice zone" and no consideration of future generations of Idahoans.

[55] INTEC Record of Decision, DOE/ID-10660, 1999, pg. 6-1

[56] DOE/ID-10619, pg. B 2-1.

In other words, this contamination - if not adequately cleaned up (isolated from the environment), will be a health hazard for every living thing for millennia.

For more information on this issue see EDI's "Aquifer at Risk" report on our website. http://environmental-defense-institute.org

Attached Separately

Attachment A: EDI's compellation of the ~ 136 INTEC Liquid Waste Management System Tanks that apparently are not all being evaluated in DOE's cleanup plans.

Attachment B: Institute for Energy and Environmental Research Report: "What the DOE Knows it Doesn't Know about Grout: Serious Doubts Remain About the Durability of Concrete Proposed to Immobilize High-Level Nuclear Waste in the Tank Farms at the Savannah River Site and other DOE Sites"