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Assessment
of
Agency Five-Year Review

Advanced Test Reactor Complex
formerly called
Test Reactor Area

CERCLA

Cleanup Plan

Submitter
by
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Rev-11

Preface

This Environmental Defense Institute Review of the Idaho National Laboratory Advanced Test Reactor Complex (ATRC) - formerly called Test Reactor Area (TRA) - CERCLA Cleanup is an updated iteration of our previous Comments (March 1997) on the three agency 1992 collective Record of Decision and subsequent Five-Year Reviews. EDI's review of the co-located Engineering Test Reactor (ETR) and Materials Test Reactor (MTR) Decommission – Decontamination is covered in separate EDI Comment on ETR – MTR CERCLA Cleanup 12/24/15.

References are imbedded in the text in [brackets] with an acronym/agency document ascension number and page ["@"] number that can be identified in the Reference section with the complete citation at the end of this report.

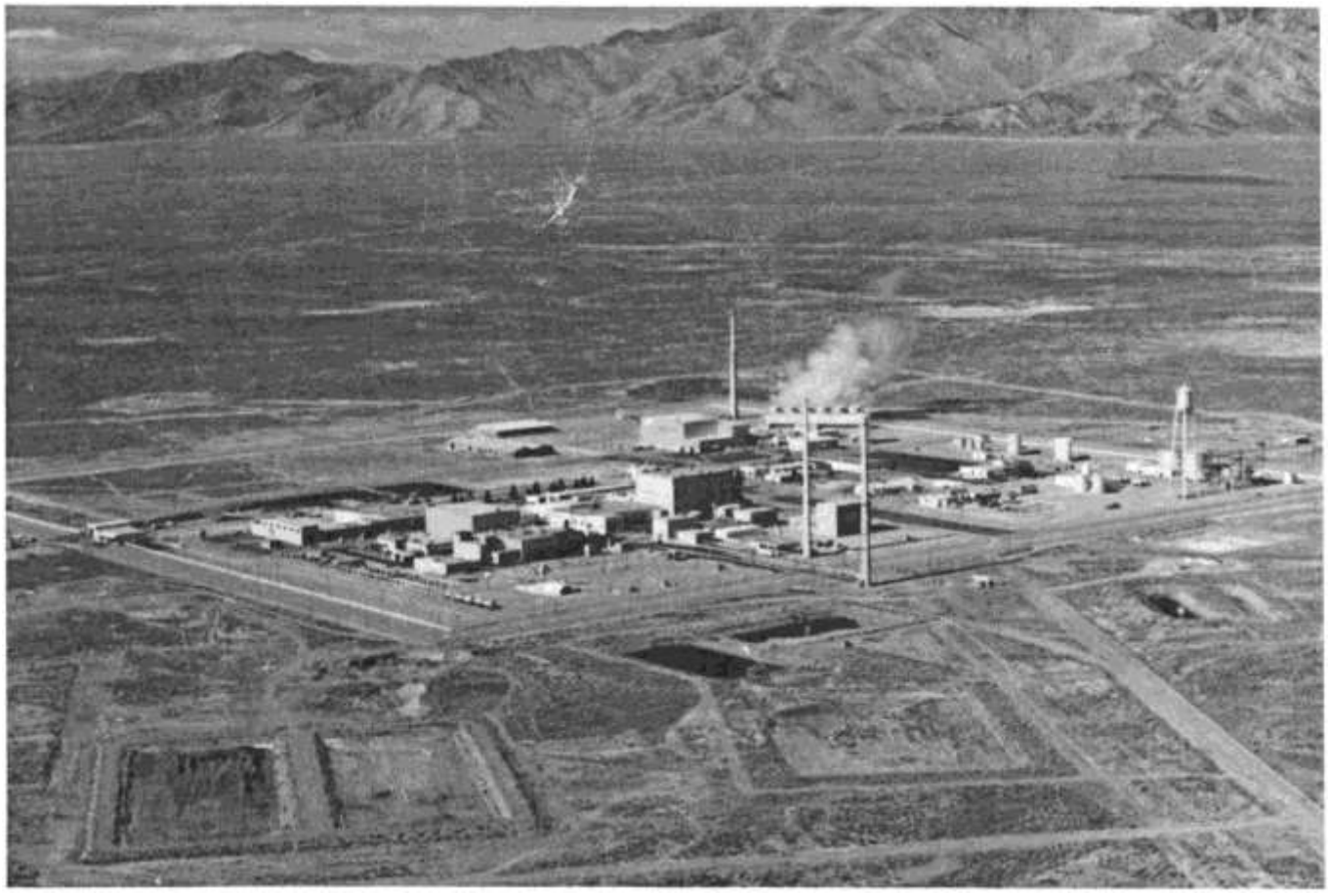
Tragically, the collective federal and state agency aversion for environmental remediation has not changed since the 1949 Atomic Energy Commission (AEC) designated National Reactor Test Station – now called the Idaho National Laboratory - in south-eastern Idaho desert as another nuclear sacrifice zone. The underlying Snake River Aquifer was perfect for providing the massive water needs for what the AEC and its successor Department of Energy required for the 52 reactors that were built/tested at the site.

In the early years, the aquifer was both the source for reactor cooling water but also the place to inject the highly radioactive hot waste water that could not be dumped in percolation ponds for fear of worker exposure. This hot waste water injected directly into the aquifer also contained carcinogenic chemicals such as hexavalent chromium used to reduce corrosion in the reactor's coolant systems. It was this chromium contamination that originally got INL on the Superfund – CERCLA priority list.

Remember, this is much like the AEC's use of Nevada desert as a sacrifice zone for testing over 1,000 nuclear bombs. These AEC and cognizant government policy makers did not care about local residents as "down-winders" or future generations using the contaminated aquifer. This same sociopathic mindset is still alive and well as EDI analyzes the current resistance to fund the resources needed to cleanup the massive contamination from legacy as well as current INL operations.

Former Idaho Governor Cecil Andrus is a remarkable exception to previous Governors and current Governor Otter with respect to the State of Idaho's holding DOE accountable to follow federal court orders to follow a 1995 Consent Agreement. Along with this Consent Agreement to move all high-level and transuranic waste out of Idaho, Andrus also forced DOE to stop using and plug all waste water injection wells at INL.

Idaho National Engineering
Laboratory Idaho Falls,
Idaho



The Perched Water System lies beneath the Test Reactor Area Facility, whose ponds are the source of perched water. DOE-ID photo.

I. Background

The U.S. Department of Energy (DOE), the Idaho Division of Environmental Quality (DEQ) and the U. S. Environmental Protection Agency (EPA) "comprehensive" decision on "cleanup" of INL's Test Reactor Area (TRA) is flawed. This is one of ten Waste Area Groups at the INL that are under investigation for environmental restoration under the CERCLA commonly called Superfund Act. DOE's cost estimates for INL site-wide cleanup range between in excess of $30 billion.

Theoretically, this comprehensive decision evaluates previous Record of Decisions on a subset of the TRA Waste Area Group called Operable Units. There are thirteen Operable Units at TRA that address 51 contaminate releases. These Operable Units range in significance across the scale from minor to major. The March 1997 Proposed Plan and Update Fact Sheet mailed out to DOE's distribution list is a continuation of the gross misrepresentation of the problem. A reader of these publications will NOT find the kind of information that will facilitate an informed public decision on the proposed alternatives. An example is the maximum contaminate levels (rarely offered) alongside the regulatory maximum concentration limits allowed in the environment are absent. This deliberate error of omission produces a false trivialized characterization of the problem. Indeed a reader may well wonder why INL was a Superfund site at all.

The Warm Waste percolation Pond is one of four unlined pits where some 80 billion gallons of radioactive and chemical wastes were dumped. EDI's research into DOE contractor sample data of the sediments in the Warm Waste Pond shows Cobalt-60 at 100,000 and Cesium-137 at 113,000 pico curies per gram.

Initially the Record of Decision on the Warm Waste Pond was to exhume the sediments and separate the contaminates so that they would not continue to migrate into the underlying Snake River Plain Aquifer. This is a sole source aquifer that over 260,000 Idahoans depend on for drinking water. After treatability studies were completed, DOE and the regulators decided to amend the Record of Decision. The contaminates gleaned from the pond sediments turned out to be so radioactive that they posed a significant storage and disposal problem. Extracted Cobalt-60 and Cesium-137 ranged 9,270,000 and 27,000,000 pico curies per gram respectively. This waste would require similar management care as the high-level reactor fuel due to the gamma radiation fields. Waste with this high activity requires extensive shielding and remote handling to protect workers.

DOE did not want to pay for these storage/disposal costs nor did they want to pay for the treatment costs. The State and EPA regulators rolled over and agreed to allow DOE simply to move the sediments from one of the three Warm Waste Pond cells over to the other two cells. All three ponds were then covered with ground. This part of the project has already been completed.

The net result is that the contaminates have not been isolated from the environment and the volume is tripled due to commingling with backfill and cap soils. DOE acknowledges in "Conceptual Model and Description of the Affected Environment for the TRA Warm Waste Pond that; "The range in transmissivity is from 120,000 to 18,000,000 gal/day/foot with a geometric mean of 2,210,000 gal/day/foot." [EGG-ER-8644, @35] This means that inevitable future environmental restoration projects will face even greater challenges and costs.

DOE has, without a doubt, a waste constipation problem due to its unwillingness to upgrade its old decrepit and leaking storage facilities and to build permanent geologic repository that will meet regulatory requirements. For over two decades DOE has promised a vitrification plant that would put radioactive waste into a glass like matrix so that

it would meet waste acceptance criteria at a repository. This treatment is essential to ensure the waste will not migrate once interned in a geologic repository. INL's vitrification plant is still not funded. Consequently, decisions are being made today that will adversely affect Idaho because the federal government and the regulators still believe no one of consequence is watching. They have managed to botch building the treatment plant for decades and continue to believe that they can thrust the problem off to future generations. [See EDI website for discussions on Integral Waste Treatment Unit (IWTU)]

The "no action" decision on the TRA Perched Water is even more egregious. This is an artificial saturated ground water zone underlying the TRA created by the dumping of billions of gallons of radioactive and chemical waste into the unlined percolation ponds. Despite the disastrous effects of groundwater contamination from this practice, DOE continues to use percolation ponds today thus adding recharge to contaminated perched water zones.

DOE and Idaho regulators have decided that Cesium-137 levels over 21 million pico curies per liter (176,000 times over EPA standards) will "dry up" and the aquifer is not at risk. These contaminates will eventually migrate into the aquifer. Only a fraction of the billions of gallons of waste dumped into the percolation ponds is still in the perched water zone. The rest has already migrated into the aquifer below and sample data show aquifer contamination considerably over drinking water standards. Remember, Idaho has only been a US state for <150 years. DOE (only < 50 years old) is claiming institutional control for millennia.

There is a limited window of opportunity while the remaining perched water is still in a discrete area, this 'contaminated water could be pumped and treated before it migrates into the aquifer only a few hundred feet below. This dispersion process will be speeded up when the next earthquake strikes because ground water systems are redistributed. Pump and treat programs work best in small defined water zones as opposed to large aquifers. DOE and the regulator's contention that the perched water will "dry up" would curl the hair of any self-respecting hydrologist. These radioactive and chemical contaminates will go nowhere but into the aquifer below. DOE's excessively optimistic prediction that "human health risks due to the low-level radionuclides at the Test Reactor Area are predicted to decline to acceptable levels within 1,000 years, when no institutional control could be legitimately guaranteed in view of the fact Idaho has not been a state for much more than 100 years.

The Test Reactor Area (TRA) is second only to the Navy (NRF) in on-site radioactive solid waste disposal relative to curie content. DOE summary data between 1952 and 1983 cite *5* million Ci of solid waste disposed. [EGG-WM-10903, @6-25] [IDO-10054-81] TRA currently supports the Advanced Test Reactor, ATR SNF Storage Canal, Advanced Reactor Critical Facility Reactor, Hot Cell Facility, Nuclear Physics Research Program, Advanced Reactivity Measurement Facility, and Coupled Fast Reactivity Measurement Facility Reactors. The reactors use chromium (VI) in the coolant (to retard corrosion) and discharged between 1952-72 55,353 lbs. of Cr (VI). [Analytica-ID-12782-1 @4-26] Accidental chemical spills have also contributed to site contamination. For instance recent disclosures by the Oil Chemical and Atomic Workers Union revealed a 680 gallon sulfuric acid spill. The union cited nine other worker health and safety violations at the Advanced Test Reactor.

1. Test Reactor Area (TRA) Groundwater

The Test Reactor Area (TRA) currently called Advanced Test Rector Complex (ATRC) has fifty-one Solid Waste Management Units. These include leaching ponds, underground tanks, rubble piles, cooling towers, waste injection wells, french drains, and assorted spills where hazardous and mixed radioactive/hazardous wastes exist. These waste sites have been in continuous use for over 40 years and have created

ground water contamination under the TRA. The culture of secrecy and non-accountability made it possible to willfully allow problems to go unsolved. For instance, the TRA's reactor fuel cooling canal at the Materials Test Reactor had a severe leak that was not drained and repaired until a decade after it was discovered. This leak allowed large quantities of contaminated coolant water to escape to the soil below the TRA, and initially was not identified in the Cleanup Plan as a contamination source. The largest contributor to groundwater contamination under the TRA was the radioactive waste injection well that was not closed until 1984.

Discontinuing the use of injection wells due to pressure from the State, increased volumes of contamination in the leach ponds proportionally. TRA also leads the list (volume and radioactivity) of INL facility areas for radioactive liquid waste discharges- 84.5 billion gallons between 1952 and 1990. [TRA ROD@5] Between 1952 and 1981, TRA released 50,840 Ci to the soil or 83% of total INL liquid discharges in that period. This figure does not include short-lived radioactivity with less than 2-3 day half-life. [TRA ROD@14] [Idaho State University monitoring found TRA higher! tritium concentrations].

TRA injection well No.53 received waste containing 31,131 lbs. of carcinogenic hexavalent chromium Cr (VI) between 1964-1982. In the same time period, TRA injection well No.05 got 55,353 lb. of Cr (VI). The size of the contamination plume under TRA is larger than DOE acknowledges. Well No. 65 south of [and beyond acknowledged plume] TRA had the highest results ranging from 43,500 to 48,200 pico curies per liter. [Oversight ®21]

Liquid Waste Volumes Disposed at TRA

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	726.00×10^8
Sanitary Waste Pond	1952- present	310.00×10^6
Injection Well -05	1964-1982	3.89×10^9
Injection Well -USGS-53	1960-1964	2.02×10^8
Totals		**8.45×10^{10} or 84.5 billion gallons**

TRA Perched Water System OU 2-12, Record of Decision(a), Table 1, @ 5]

The State challenges DOE's characterization of the size of the perched water contamination plumes because of the location and depth of the monitoring wells. The State's "review strongly suggests that wells along the north and northeast margin of the network are too deep to intercept or represent perched water levels in the perched water zone." "That is, the perched water zone may extend farther to the north and northeast than previously recognized" by DOE. [Oversight (a) ®31]

The volume of the perched water plume is estimated at 4.3 billion gallons. This plume is connected to the Big Lost River flood zone. Hydrology studies during flooding of the Big Lost River and TRA monitoring well static levels revealed that recharge to the TRA groundwater occurred at a rate of 30 - 35 feet per day. [EGG-WM-10002 ® 3-109] At this transmissivity rate, contaminates could move nearly 2 1/2 miles per year.

Other monitoring data supports these findings. "Chromium-51 was detected in monitoring well USGS-56 at a concentration of 0.33 pCi/mL [330 pCi/L]. Well USGS-56 is located in close proximity to the [TRA] Retention Basin where concentrations of up to 2,540 pCi/mL [2,540,000 pCi/L] of chromium-51 have been detected in the shallow perched zone wells. Thus, detection of chromium-51 is not considered unusual in USGS-56; however, this indicates rapid transport time from the shallow zone to the deep zone in this area." [EGG-WM-1002 @ *4*-129]

Selected TRA Perched Water Chemical Sample Data

TRA Record of Decision (ROD), 12/92@13& Analytica ID-12782-1]

Chemical	Concentration ug/L	EPA Standard ug/L
Arsenic	42.8	50
Barium	10,300.0	1,000
Beryllium	136.0	1
Cadmium	177.0	lO
Chromium	4,480.0	50
Copper	1,930.0	1,000
Iron	546,000.0	300
Lead	4,260.0	.50
Manganese	92,000.0	50
Mercury	394.0	2
Sulfate	4,880,000.0	250,000
Zinc	10,700.9	5,000
Aluminum	430,000.0	?
Xylene	31,000.0	?
Magnesium	400,000.0	?

*The Asterisk(*) on the following TRA perched water sample data table indicates EPA's new proposed Drinking Water standards (40 CFR Part 141 ::md 142). These new proposed nuclide limits in drinking water, which EPA attempted to promulgation in !993, are substantially higher than the 1976 limits. For instance, tritium MCL will be increased from 20,000 to 60,900 pCi/1. It should be noted that the federal government is the largest polluter of radionuclides so it is in their interest to raise the limits on their own waste sites. EPA attempted to raise the allowable limits in 1985, but the courts found that they were not protective of humal1 health, and EPA was forced to withdraw the standard.

Test Reactor Area Shallow and Perched Water Contaminates of Concern 1991 Sampling Results

Contaminate	Concentration	MCL
Mercury-203	1,680	2,390.0*
Plutonium-239	12	15.0
Uranium-234	520	13.9*
Strontium-90	18,000	8.0

Selected Chemical Data in TRA Shallow Perched Water Zone

Chemical	Maximum Concentration *u*g/L	MCL *u*g/L 40 CFR141.11
Hexavalent Chromium	178.0	50
Bis(2)Ethylhexyl)phthalate	35.0	?
Fluoride	430.0	2,000
Nitrate	6,230.0	10,000
Chloride	31,900.0	250,000
Sulfate	4,880,000.0	250,000

Contaminates of Concern	Shallow Perched Mean Concentration	Deep Perched Mean Concentration	Primary Maximum Concentration Level	Secondary Maximum Concentration Level
Amercium-241	2,110.0 pCi/L	25.0 pCi/L	15 pCi/L	
Arsenic	20.9 ug/L	4.9 ug/L	50 ug/L	
Beryllium	40.0 ug/L	1.3 ug/L	1.0 ug/L	
Cadmium	47.5 ug/L	3.0 ug/L	5.0 ug/L	
Cesium-137	2.63 x10 ^{6} 2,630,000 pCi/L	15.0 pCi/L	4 milli-rem/yr.	
Chromium	1360 ug/L	93.5 ug/L	100.0 ug/L	
Cobalt-60	1.53 X 10 ^{6} 1,530,000 pCi/L	14.3 pCi/L	4 milli-rem/yr.	
Cobalt	131 ug/L	10.0 ug/L		
Fluoride	561 ug/L	180 .0 ug/L		2 ug/L
Lead	864 ug/L	9.4 ug/L	50.0 ug/L	
Manganese	1.9 X 10 ^{4} 19,000 ug/L	255.0 ug/L		50 ug/L
Strontium-90	4,560 pCi/L	31.9 pCi/L	8 pCi/L	
Tritium	1.85 X 10 ^{6} 1,850,000 pCi/L	1.15 X 10 ^{5} 115,000 pCi/L	2.0 X 10 ^{5} 20,000 pCi/L	

TRA Record of Decision (ROD), 12/92@13 to 16

Reference for Above and Below Tables

Perched Water System Remedial Investigation/Feasibility Draft Study for the Idaho National Engineering Laboratory (Operable Unit 2-12) Volume 2 of 4, page 4-13, EGG-WM-10002, March 1992, 103655.

pCi/L = Pico Curie / Liter or 1-trillionth Curie/liter; *u*Ci/L = Micro Curie/ Liter or 1-millionth Curie/Liter

TRA Shallow Perched Water Contaminates of Concern 1991 Sampling Results

Nuclide	Concentration pCi/L	EPA Standard pCi/L
Cobalt-60	12,200,000	100.00
Zinc-65	105,000	300.00
Cesium-134	62,400	8.13*
Cesium-137	21,000,000	119.0*
Europium-152	108,000	60.00
Europium-154	130,000	200.00
Europium-155	20,400	600.00
Americium-241	16,700	6.34
Chromium-51	2,540,000	6,000.00
Scandium-46	4,140	863.0*
Zirconium-95	11,500	200.00
Niobium-95	12,000	300.00
Ruthenium-103	3,970	200.00
Rhodium-106	4,980	30.00
Silver-108	14,400	90.00
Ytterbium-175	3,500	300.00
Hafnium-181	136,000	200.00
Tantalum-182	31,800	100.00

The decision by the Agencies (DOE, ID, EPA) to do nothing on interim actions on the TRA perched water is an affront to common sense and demonstrates blatant disregard for Idaho's most valuable resource - groundwater. Contaminated water in the perched zones must be pumped and treated to minimize further migration into the rest of the aquifer. The federal government must never again be allowed to foul our waters and just walk away. Moneys currently being channeled into nuclear materials production would more than adequately fund environmental restoration such as pump and treat. It is unconscionable for Idaho & EPA to approve such a position. The Environmental Defense Institute recommends this pump and treat immediate action because as the Congressional Office of Technology Assessments (OTA) states:

> "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." [OTA (a) @ 38]

2. Test Reactor Area (TRA) Warm Waste Pond

A major contaminated area at TRA is the Warm Waste Pond which has three separate cells dug in 1952, 1957, and 1964 respectively. These are unlined percolation pits where contaminated waste water was dumped and allowed to absorb into the ground. Even though EPA determined that this percolation pond was in violation of federal law, DOE continued to use it up until 1995 when it was capped.

The "low levels of radioactivity" the DOE describes as going to the Warm Waste Pond are actually not so low. Three separate contractors sampled pond sediments. One found cesium-137 and cobalt-60 in concentrations of 55,750 and 50,292 pCi/g respectively. [EGG·ER-1061O ® 3-3] [EGG·WM·IOOOO@11] The second sample tests showed Cs-137 and C0-60 in concentrations of 110,000 and 100,000 pCi/g *respectively* in sediment fines. [NRT 910521-NC ® 2-5] The third treatability samples showed Co-60 and Cs-137 at 50,292 and 113,497 pCi/g. [EGG-WM-10000 ®11] Currently, "The service waste activity is allowed to average no more than three times drinking water tolerance in any isotope with the exception of very short-lived ones like Iodine-131." (ID0-14532 ® 49]

Continued use of the Warm Waste Pond up until 1995 clearly demonstrates DOE's misguided priorities and total disregard for environmental degradation. DOE continued to add radioactive contaminates to a site that has been identified for cleanup for over fifteen years. The continued use of the pond insures that water will continue leaching previous contaminates further down into the Aquifer. Moreover the Environmental Protection Agency (EPA) and the State of Idaho are remiss in their respective enforcement responsibilities for not closing down the Test Reactor Area ponds. According to the TRA Warm Waste Pond Hazardous Conditions and Incidents Report, "After November 1980 it was in violation of RCRA since we had no interim status". [TRA Hazardous. Condition and Incidents] EPA and tl1e State have full justification to declare these ponds RCRA hazardous mixed waste sites as the following paragraph illustrates.

> "EPA is authorized [under RCRA] to issue a corrective action order, which can suspend or revoke the authority to operate an interim status Treatment/Storage/Disposal facility or to seek appropriate relief (including an injunction) from a us District Court." [OTA (a) @ 28) [also see RCRA. Section 3004(v); 42 USCA ss 6924{v) (\West Supp. 1990]

"Over the past 5 years, DOE has gradually been required to acknowledge that cleanup of the Nuclear Weapons Complex [including INL] is subject to regulation by EPA (or the States) to the extent that hazardous materials are involved or a site is placed on the Superfund's National Priority List (NPL). Until 1984, DOE claimed that it was exempted from regulation under hazardous waste laws such as RCRA because of its Atomic Energy Act authority relating to national security and sovereign immunity from State regulation. A 1984 Tennessee Federal court decision rejected this claim and ordered DOE to comply with all RCRA provisions. "[OTA (a) @ 34] [citing. Legal Environmental Assistance Foundation v. Hodel. 586 F. Supp. 1163 (E.D. Tenn. 1984] Congressional passage of the Federal Facility Compliance in 1992 further clarified the law removing sovereign immunity as a federal defense against compliance with environmental laws.

TRA Warm Waste percolation pond received (5.35 x 10^{9}) 5.35 billion gal. between 1952 and 1992 at a rate of 40 gallon/minute.[TRA ROD @ 5]1 The high volumes of water were due to the once through cooling for the reactors that were then diluted before discharge. This also accounts for the high chromium contamination in the groundwater because chromium was used to retard corrosion in the reactor cooling systems. Between 1961 and 1985 a total of 32,660 curies were released to the pond. [TRA Hazardous Condition• and Incidents! Warm Waste Pond sediments at the two foot level contained 75.1 pCi/g of Plutonium-235-240. [Analytica m-t21s2-1 ® 4-33J TRA pond algae registered 100 mR/hr. Ducks (usually 25 at any one time) u-sing the pond registered the following radionuclide concentrations. ! ERDA-1536 ® m-75-761

TRA Duck Tissue Samples

Nuclide	Concentration	Nuclide	Concentration
Cesium-137	890 pCi/g	Cerium-141	390 pCi/g
Cobalt-60	540 pCi/g	Iodine-131	18 pCi/g
Zinc	1,100 pCi/g	Cesium-134	38 pCi/g

. [ERDA·1536 ® Ill-75-76]

DOE calculated in 1977 that an individual eating a duck would receive 20 mRem to the thyroid and 25 mRem whole body exposure. [ERDA-1536 III pg.-75-761 In a later 1988 study of TRA waterfowl, "Three thousand one hundred forty-one individuals representing 22 species of waterfowl were observed on the TRA ponds from January 1974 through 1978." "If each of the 3,141 waterfowl had transuranic concentrations equal to the averages in the experimental waterfowl, 1,300 nCi of transuranic (including plutonium-238/239/240) would have been removed during this period or an annual average of 305 nCi" and "... if one of the bone samples that was approximately 100 times the other samples was excluded from the average." Additionally, "...if the 3,141 individuals in the wild [duck:] population had similar [Sr-90] activity, a total of 292 uCi of Sr-90 would have been exported in the 51 month period or an annual average of 68.7 uCi."

The dose to a person eating a duck from the Sr-90 alone would be whole-body 12 mRem and thyroid 7 mrem. "The mean dose rate to experimental ducks on the TRA ponds was 69 mRad from Sr-90 and transuranic nuclides in body tissues." "Water fowl at the TRA ponds potentially export greater quantities of transuranics from this area than do other species of wildlife. The maximum yearly export of transuranic radionuclides by small mammals and coyotes at the TRA was 35 pCi (Haliford) and 70 nCi (Arthur and Markham)." [Markham @ 522] Pacific Northwest Laboratory studies on internal exposure of dogs found that there was no minimum amount of plutonium that did not cause death. [ParkgJ State radiation standard limit is 4 mRem/yr. for beta emitters. Safe limits for cesium-137 are 1O pCi/g. [EGG-WM-8804] Chromium released to TRA ponds was 500 ppb. The chromium standard at the time was .05 ppb or 10,000 times over regulatory standards.[ERDA-1536 @3-79]

3. Test Reactor Area (TRA) Summary of Site Risks

DOE remediation Plan's listing of contaminants fails to list Iodine-129 and Plutonium-238, 239 and 240 which were found in TRA leach pond plankton in concentration ranges (CRs) from 40,000 to 400,000. Distribution coefficients for Pu isotopes in sediments ranged from 13,000 to 150,000. IDOE/ID-12111 @ 39] Due to 1-129's 17 million year half-life, and Plutonium's 24 thousand year half-life, these isotopes are considered permanent contaminates.

DOE's Plan also fails to quantify the range of contamination in TRA perched water in its Community Relations Plan mailings. EDI concurs with the State's criticism of DOE for using only the MEAN concentration levels. Readers of the Plan deserve more information than they "exceed federal safe drinking water standards" or a footnote stating a standard of 4 mRem/yr. The proposed EPA standard for Cesium-137 (not stated in the plan) is 119 pCi/L.

There is no justification for DOE to eliminate from consideration in the plan, radioactive isotopes that had half-lives of less than five years. [TRA Plan @ A-6] This also holds true: or the non-inclusion of Cesium (half-life of 30 yrs.) in the exposure assessment. The current Cesium levels of 21 million pCi/L mean that by the year 2023, the concentration levels will be 10.5 million pCi/L. In other words, it will take 540 years before the cesium will decay to below proposed EPA drinking water standard of 119 pCi/L.

TRA lies immediately (less than 2 miles) up gradient to the Big Lost River. Considerable uncertainty exists as to contaminate transport time within the aquifer due to the existence of lava tubes etc. in a very non-homogeneity geology of the Snake River Plain Aquifer. Moreover, DOE's contention that "there is no current use of the perched water or contaminated Snake River Aquifer in the vicinity of TRA" and the decision to consider the potential use of the area for only a 125 years period, is unjustified and unacceptable especially when INL workers use the water.

A six member ground water study team "commissioned by EG&G, an INL contractor, was canceled after its preliminary results showed that contamination "could move from INL to the Magic Valley within months." [Aley, 1900] Their findings revealed the presence of lava tubes which move water· rapidly through the aquifer and exit at Thousand Springs on the Snake River. Under normal conditions the entire volume of the Big Lost River literally disappears into the porous Snake River Plain called the "sinks." This is about as graphic an example of the porosity of the ground under the INL. Also see EDI Citizens Guide Section I (F) on aquifer contamination.

4. TRA Risk Assessment

Human health risk information appears not to consider the combined cancer risks for non-radionuclide and radionuclide from inhalation. Since the radionuclide component already "approaches the upper National Contingency Plan (NCP) limit." [TRA Plan ®3], the combined risks (synergistic effect) may push it over the limit.

"The carcinogenic risks due to the external exposure to radionuclides were found to be significantly above the recommended NCP target risk range."[TRA Plan) This statement, as with other vague un-quantified statements, deserves specific numbers attached to it due to their obvious significance. EPA's standards are nearly two decades old and do not reflect current knowledge about. the health risks to exposure to low levels of radiation. Therefore, the conservative 1 chance in a million in getting cancer must be used, not the 1 in 10,000 industrial standard.

Human health risks assessments additionally do not consider migratory water fowl using the TRA waste ponds. 1-129 and other gamma-emitting nuclide in tissues of ducks from the Test Reactor Area (TRA) leaching ponds have been known by INL at least since 1981. [Health Physics 40, 173·181, 19811] DOE acknowledges 1-129 concentration AVERAGES

of 0.3 pCi/gm. [TRA ROD(b) @ 35]

According to the Office of Technology Assessment (OTA), INL has not attempted extensive ecological site characterization. "Although selected studies have been done on effects with potential relevance to the cleanup, there appears to be no systematic attempt to inform the cleanup process through ecological studies at INL. The routine monitoring program there, is designed primarily to determine radionuclide pathways to human receptors and includes very little biological monitoring. Routine contaminant-level monitoring in animals is limited to game animals obtained from road kills." [OTA (a) @ 205]

Since the soil ingestion assessment for "cesium approached the upper limit of the recommended N C P target risk range" [TRA Plan @ 3] DOE must specify which "worst-case conditions" were used. Since, "It could take over 400 years for the cesium to naturally decay to an acceptable level," then cesium must be given appropriate consideration. [TRA Plan @ 7]

DOE's statement that any wastes generated or isolated during remediation activities "will be properly disposed of" is not only inadequate, it is based on credibility that DOE no longer can claim. Therefore, a full discussion must describe the required "cradle to grave" waste process. "DOE's current decisions lack credibility because of past failures by DOE and its predecessor agencies to deal effectively with environmental contamination and to make full public disclosure regarding the contamination and its impacts." [OTA (a) @ S-14]

The fact that DOE has known for decades that it was contaminating the environment and deliberately avoided compliance with environmental law, warrants challenges to its credibility. According to the Office of Technology Assessment of INL, "Characterization work is proceeding at a slow pace and is probably limited by funding. Investigation and testing of more conventional stabilization and containment techniques could be pursued more aggressively." [OTA (a) @ 34]

5. Test Reactor Area Warm Waste Pond Interim Action Record of Decision

The December 1991 TRA Warm Waste Pond Record of Decision (ROD) is deficient. The ROD did not include the immediate secession of use of the TRA leach ponds. EDI supports immediate secession of use of the leach ponds in combination with pumping contaminated perched water to a water treatment system for removal of ALL contaminates. EDI supported the physical separation and vitrit1cation of pond sediment contaminates. These separated wastes must be safely stored in a monitored, retrievable form after vitrification. However, the remedy criteria for removal of sediments of 690 pCi/gm must be equal to or less than the State radiation exposure standard of 4 mRem/yr. Tragically, even the ROD plan to implement chemical extraction was revoked by a March 1993 notice of "Explanation of Signit1cant Difference for the Warm Waste Pond sediments Record of Decision." Treatability tests found that:

> "The goal of reducing cesium activity to less than 690 pCi/gm activity for the treated sediment returned to the pond would result in a dramatic increase in the amount of treatment residuals that could not be returned to the pond cells, resulting in the need for long term storage, as no disposal location had been identified. This increase in the amount of sediments requiring long- term storage would, therefore, result in a decrease

in the short-term effectiveness of this physical/ chemical treatment remedy. This increased storage would significantly elevate the project costs above the original estimates in the Proposed Plan. Further, the effectiveness of acid extraction was marginally achievable only under extremely rigorous (i.e., boiling acid and

· long retention times) conditions bringing into question the implement ability of the project" [TRA ROD(c)]

In plain English, what this. decision means is this; DOE is once again walking away from a cleanup site because they do not want to store the waste generated, and they do not want to pay the additional costs to clean up the site to safe standards. The Significant Difference Notice also states that the State and EPA have agreed to a contingency plan to exhume contaminated sediments in one of three cells within the Warm Waste Pond and dump it in the other two cells. Then DOE plans to cover all the cells with soil not an impermeable cap -just soil. "...The soil cover is to be placed over the Warm Waste Pond to reduce the radiation field and mitigate the potential for blowing dust. The need for an int1ltration barrier is not demonstrated and therefore, no cap is needed to meet this Objective." [INL Reporter 3/93 (@ 4]

EG&G's 1993 treatability study of the Warm Waste Pond sediments showed extremely effective extraction results for Co-60 that ran as high as 9,270,000 pCi/L and Cesium-137 residuals that ran as high as 27,000,000 pCi/L. [EGG-ER-10616 @ 4-51] Of course there will be increased storage costs involved with these extracted wastes due to the extreme radioactivity that by definition will require similar management that highly radioactive spent reactor fuel requires. That is, theoretically, the whole idea of cleanup - safe isolation of contaminates from the environment. DOE's final solution supported by the State and EPA was, "transfer of contaminated sediment from the 1964 [Warm Waste Pond] cell and consolidation into the 1952 cell.

Contaminated soil from the following INL sites was also clumped into the 1957 cell; 788 cubic yards (603 cubic meters cm) from ANL-W containing Cs-137@ 800 pCi/g; 1,178 cubic yards (901cm) from BORAX ditch containing Cs-137@ 95.4 pCi/g; 1,279 cubic yards (978 cm) from EBR-1 containing Cs-137@ 364 pCi/g; 1,947 cubic yards (1,489 cm) from TRA-NSA containing Sr-90@ 7,755, Eu-152@ 913, Am-241 @ 684, Cs-137@ 404, Eu-154@ 146, Co-60@ 74 pCi/g; 2,737 cubic yards (2,093 cm) from TAN Area B containing Cs-137@ 75, Sr-90 @ 160 pCi/g; 2,208 cubic yards (1,88 cm) from TAN Technical Support Facility containing Cs-137 @ 39, Sr-90@ 405 pCi/g. These percolation pond cells were then to be backfilled with six inches of soil to grade level. [DOE/ID-1O53l @3-23] A reasonable observer would conclude that DOE has created another shallow radioactive dump site and nothing has been cleaned up.

If one accepts the agency's contention that the original plan to treat the sediments in a chemical extraction process is not feasible, then EDI proposes that the sediments must be exhumed and interned in a monitored retrievable storage (MRS) facility without treatment. This MRS approach is currently being used at Hanford where large concrete vaults are built to take the exhumed waste. The worst contaminates in the top three feet would thereby be isolated from the environment. At some future time when vitrification treatment technology is developed to handle the waste then the MRS can be opened up and the material removed for treatment. After the sediments are removed from the pond, a membrane could be laid to delineate contaminate zones from backfill should the need arise to exhume additional sediments. An impermeable cap must then be placed on top of the backfilled pond to

eliminate infiltration of precipitation that could leach additional contaminates into the aquifer. Unfortunately, none of this was done.

None of the agencies dispute that the Warm Waste Pond posed a significant threat to Health and safety, and they recognized the need to initiate an interim remedial action to mitigate the threat. The agency's action consolidating the sediments in one or two cells of the pond clearly did not isolate the threatening contaminates from the environment, and therefore is not acceptable. Moreover, now the volume of the waste is tripled due to comingling of backfill and cap soils over the contaminated sediments making later cleanup actions unlikely. DOE continues to obfuscate building a vitrification waste treatment plant violating promises going back to its 1977 INL Environmental Impact Statement. Lack of treatment plants then drives this kind of misguided cleanup decision.

6. TRA Compliance with Applicable or Relevant and Appropriate Requirements (ARAR's)

Both the State and EPA have clearly turned a blind eye to enforcing ARAR's when they agreed to go along with DOE's refusal to clean up the Warm Waste Pond. In this case the term enforcement agency is an oxymoron. Corporate America should be justifiably outraged at the double standard exercised by enforcement agencies. DOE acknowledges Cesium-137 concentrations of 110,000 pCi/gm in the sediments. [NRT-91O52-NC@2-5] The standard for Cesium-137 is 10 pCi/gm. [EGG-WM-ER-88041 That represents 11,000 times over the standard that is established to protect human health and the environment. If DOE is allowed to walk away from this contaminated site like they did with the TRA perched water which contained Cesium-137 in excess of 176,470 times the standard, what will get cleaned up? What legacies do these actions leave for future generations 540 years from now when the cesium has decayed to "safe" levels?

EDI challenges the Plan's statement that, "The sediment is not hazardous waste as described in RCRA, based upon tests conducted in 1990." [TRA Plan® 11 Clearly the sediment is a hazardous mixed waste as defined by court challenges to DOE's obfuscation of RCRA definitions. The agencies contend that even though there are RCRA listed contaminates; DOE's tests show that they do not leach and therefore RCRA does not apply. No independent tests have been conducted to confirm DOE's claim to non-leachability. This begs the question as to how these contaminates got into the perched water zones in such high concentrations if it did not leach through the soil. DOE continues to circumvent RCRA requirements that specifically specify safe handling, treatment, disposal, and waste site closure standards. For instance, the Warm Waste Pond plan would not even pass EPA's Subtitle D municipal garbage landfill standards.

The TRA pilot study goals state: "Minimize or eliminate any characteristic which makes the [warm waste pond] waste RCRA hazardous, including treatment if necessary." [TRA ROD@3o] This is indisputable evidence that there are RCRA classified constituents in the pond, and DOE's goal is to avoid RCRA requirements. RCRA closure requirements are further circumvented by not providing a non-permeable cap on top of the pone! after extraction operations. This is important to keep precipitation from leaching residual contaminates still suspended in the sub-soils.

The Plan brazenly proclaims - without protest from the neither State nor EPA - that, "the new lined evaporation pond must be operational before significant cleanup can begin on cells

currently in use." This statement clearly and unequivocally identities EPA and the State with complicity with DOE's highest priority being continued operation - not protection of human health and the environment.

The Congressional Office of Technology Assessment found that," DOE's various priority systems have certain fundamental flaws and have yet to prove themselves useful in decision making. The priority scheme used in the Five-Year Plan groups activities into four very broad categories.

Most DOE activities fall into some portion of the first two categories primarily, ongoing activities ..." "Yet, at present, the greatest uncertainty concerns the variables that should be given highest priority in these systems -reducing health and environmental risks." [OTA (a)@62-631]

The priority system developed by DOE's Office of Waste Operations provides the categories in descending .order of importance for action and funding Category one DOE puts " Maintains ongoing activities. [DOE Waste Management Operations Priority System Fact Sheet, Spring! 991]

Again, DOE's priority system reflects the same misguided emphasis on continuing "operation" and "maintaining on-going activities" in priority number 1 over its legal obligations to comply with environmental regulations in priority number 3. INL's current crisis can be attributed to its historic failure to emphasize environmental compliance.

7. Other TRA Contamination Areas

Test Reactor Area had four separate groups of underground hot waste tanks (TRA-15, TRA-16, TRA-19, and TRA-603/605). TRA-15 has four tanks contained in two concrete basins that occupy about 624 square feet (58 square meters). Leaks in tanks 1 and 2 plus waste piping leaks resulted in extensive soil contamination that included the following pCi/g concentrations: alpha @ 40; beta @ 6,640; Sr-90 @ 2.280; U-234 @ 2,000. [DOE-10531 @ 3-IO] One of the tanks was removed in the 1960's after it leaked extensively.

TRA-16 is an underground hot waste storage tank. The contents of the tank were found to be ignitable waste contaminated with low levels of radionuclides, primarily uranium isotopes. The tank was emptied and excavated in 1993 and dumped at the RWMC.

TRA-19 four Materials Test Reactor (MTR) underground rad tanks service line leaks including a significant incident in August 1985 that caused extensive soil contamination. Soil samples for gamma contamination (Co-60, Cs-134, Cs-137, and Eu-154) ran as high as 1, 3000,000 pCi/g. [DOE-ID-1053@3-14] TRA-603/605 tank was used for all the warm waste from the MTR.

TRA-04 "Warm Waste Retention Basin is composed of one large rectangular underground concrete structure divided into two cells by a common concrete wall and holds 720,000 gallons (2,725,200 L). The basin received waste en route to the Warm Waste Pond, and was designed to delay passage of reactor system flush water to allow sufficient time for radionuclides with half-lives of less than a few hours to decay." "It is known that the Basin has been leaking since the 1970's.

There have been a number of documented releases from the Retention Basin in the past, including pipeline leakage and leakage from the Basin at an estimated rate of 86,000 gallons (325,526 L) per day. Contamination from the Basin enters the perched water zone beneath TRA." [DOE/ID-l053 @3·24] The Basin was not removed from service until August of 1993

despite the known leaks. Soil contamination around the Basin in pCi/g include: Cs-137@ 9,150; Co-60@ 1,320; Sr-90@ 416: Pu-238 @ 5.08; Pu-230-240 @ 3.79. [DOE/ID-10531 @13-251] "Well USGS-56 is located in close proximity to the retention basin where concentrations of up to 2,540 pCi/mL (2,540,000 pCi/L) of chromium-51 have been detected in the shallow perched zone wells. Thus, detection of chromium-51 is not considered unusual in USGS-56; however, this indicates rapid transport time from the shallow zone to the deep zone in this area." [EGG-WM-10002 @ 4-1291] Other contaminates in the deep perched zone are Co-60 at 800 pCi/L; Sr-90 at 180 pCi/L; and U-234 at 14.2 pCi/L. [ibid @4-115/4-116/4-129]

The Materials Test Reactor Canal (OU-2-8/ TRA-37) is located in the basement of the MTR. "The canal installed in 1952 leaked significant quantities of water contaminated with radionuclides for approximately eight years." [INL·94·0026 @a-8]

8. Test Reactor Area (TRA) Cleanup Cost

EPA's comments on the costs challenge DOE's estimates. "Several of the most significant costs are not adequately backed up by the cost summary and calculations." EPA lists twelve items as inflated, unsupported, or not needed [EPA (b)]

DOE contractors that knowingly violate the law and create the polluted sites requiring Superfund cleanup are now being paid to clean up their own mess. Former Congressman Mike Synar (D-OH) has stated that these contractors are "being paid at a profit to pollute." In any other Superfund situation, a private firm would be penalized for its pollution - by footing the bill itself for the cleanup. [Environmental Magazine 3/93 at 42]

The cost of actual cleanup is only part of the pork offered these polluters. Costs for remedial investigations, sampling programs, pilot studies, and community involvement put additional millions of dollars into DOE contractor profits.

Congressional Office of Technology Assessment (OTA) recommended that Congress "authorize an institution other than DOE to regulate those aspects of radioactive waste management activities not subject to DOE authority, and over which no other agency has authority, in order to enhance the credibility and effectiveness of those programs." [OTA (a) @ 141]

"By limiting DOE self-regulation and providing appropriate independent regulation of radioactive waste management at the [DOE] Weapons Complex, Congress could provide a credible and effective mechanism for addressing the issues, problems, and prospective solutions related to the safe treatment, storage, and disposal of existing and future radioactive waste." [OTA (a) 142]

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Attachment A
2005
Test Reactor Area
Groundwater
Water Sampling
Data

INL/ATR/EDIR/

ICP/EXT-05-00967

Table 2

Annual Groundwater Monitoring Status Report for Waste Area Group 2 for Fiscal Year 2005

August 2005

Idaho Cleanup Project

The Idaho Cleanup Project is operated for the
U.S. Department of Energy by CH2M • WG Idaho, LLC

2.2 Aquifer Well Sampling Results

Groundwater samples were collected from aquifer wells TRA-06, TRA-07, TRA-08, USGS-058, USGS-065, Middle-1823, and Highway-3. Aquifer wells were analyzed for chromium (filtered and unfiltered), Sr-90, gamma isotopes, and tritium. The results for the analytes are summarized in the following subsections. The results for tritium, Sr-90, and chromium are summarized in Table 2. Comparison to background concentrations at the INL Site and comparison to MCLs for detected analytes are summarized in Table 4.

Table 4. WAG 2 groundwater quality summary.

Analyte	Background [a]	Maximum	Minimum	Wells above MCL	MCL
Perched Water Wells					
Chromium (filtered)	2 to 3	105	ND	1	100 µg/L
Chromium (unfiltered)		125	ND	3	100 µg/L
Co-60	0	39.6	ND	0	200 pCi/L
Ra-226	0	117	ND	2	5 pCi/L [b]
Sr-90	0	113	0.361	8	8 pCi/L
Tritium	75 to 150	28,300	ND	1	20,000 pCi/L
Aquifer Wells					
Chromium (filtered)	2 to 3	132	ND	2	100 µg/L
Chromium (unfiltered)		193	ND	2	100 µg/L
Sr-90	0	44.3	ND	2	8 pCi/L
Ra-226	0	39.3	ND	1	5 pCi/L [b]
Tritium	75 to 150	17,200	1,330[c]	0	20,000 pCi/L

a. Background concentrations are from Knobel, Orr, and Cecil (1992).
b. Represents MCL for Ra-226 and Ra-228 combined.
c. Tritium was not detected in the Highway-3 well.

MCL = maximum contaminant level
ND = not detected

2.2.1 Chromium

Chromium was present at detectable concentrations from all aquifer wells sampled for WAG 2. Chromium concentrations were above background concentrations for all aquifer wells except for the Highway-3 well; however, the EPA-defined MCL of 100 µg/L was exceeded only in wells TRA-07 and USGS-065 (Table 2 and Figure 2). Analytical results for TRA-07 indicated a filtered chromium concentration of 129 µg/L in October 2004 and 132 µg/L in March 2005, while results for well USGS-065 showed filtered chromium concentrations of 93.3 µg/L in October 2004 and 101 µg/L in March 2005. TRA-07 and USGS-065 appear to show decreasing trends in chromium concentrations since 1999 (Figure 8).

Table 2. Summary of analytes in the WAG 2 wells for the detected constituents.[a,b]

Location	Sample Date	Sr-90 (MCL = 8 pCi/L)			Tritium (MCL = 20,000 pCi/L)			Chromium, Unfiltered (MCL = 100 µg/L)			Chromium, Filtered (MCL = 100 µg/L)			Co-60 (MCL = 200 pCi/L)		
		pCi/L	+/-	VF	pCi/L	+/-	VF	µg/L	LF	VF	µg/L	LF	VF	pCi/L	+/-	VF
Aquifer Wells																
Highway-3	10/20/04	0.00358	0.0799	U	-26.4	73.3	U	2.3	B		5.6	B		-0.901	3.63	U
Highway-3	03/14/05	**17.7**	0.602		64.6	101	U	1.43	U		1.43	U		-1.46	2.95	U
Middle-1823	10/20/04	-0.0115	0.0837	U	1,620	103		12.3			7.9	B		0.205	3.38	U
Middle-1823	03/21/05	0.262	0.0924	UJ	1,400	105		9.2	B		7	B		3.14	1.67	U
TRA-06	10/21/04	-0.0488	0.0907	U	1,710	102		8.8	B		8.9	B		6.21	3.47	U
TRA-06	03/14/05	0.193	0.196	U	2,160	131		9	B		9	B		-4.62	3.15	U
TRA-07	10/27/04	0.0553	0.174	U	17,200	289		**138**			**129**			0.223	4.67	U
TRA-07	03/15/05	0.114	0.253	U	16,200	286		**193**			**132**			-2.26	2.57	U
TRA-08	10/27/04	-0.167	0.0889	U	2,990	126		38			22.5			1.25	2.19	U
USGS-058	10/20/04	-0.15	0.112	U	1,330	98.5		14.6			14.6			-0.608	2.73	U
USGS-058	03/14/05	**44.3**	1.17		1,420	121		13.9			12.8			-1.41	2.18	U
USGS-065	10/27/04	-0.306	0.131	U	5,440	148		**103**			93.3			1.6	3.18	U
USGS-065	03/15/05	-0.14	0.18	U	6,260	183		**110**			**101**			1.22	3.08	U
Perched Wells																
PW-11	10/19/04	2.4	0.518		**28,300**	376		35.6			33.7			-0.558	3.06	U
PW-11	03/22/05	0.639	0.0941		**24,000**	347		29.2			27.5			4.56	2.44	U
PW-12	10/19/04	**83.2**	14.4		2,290	109		16.5			4.5	B		39.6	5.99	
PW-12	03/16/05	**88.9**	2.04		1,900	127		21.6			3.2	B	U	36.8	5.63	
PW-13	10/30/04	**23.7**	3.87		28.3	79.3	U	**160**			1.6	B		3.27	2.67	U
PW-13	03/16/05	**31.8**	0.947		-73.1	100	U	79.7			3.4	B	U	-1.69	2.95	U
TRA-1933	10/30/04	**37.2**	5.26		212	96.8	UJ	1.43	U		1.43	U		-2.62	2.92	U
TRA-1933	03/16/05	**60.5**	1.62		-101	97.9	U	1.43	U		1.43	U		-1.23	3.23	U
TRA-1934	10/30/04	**80.7**	13.1		161	96	U	1.43	U		3.3	B		0.266	2.99	U
TRA-1934	03/16/05	**113**	2.4		39.5	97.1	U	4.5	B	U	1.43	U		-1.64	2.31	U

Table 2. (continued).

Location	Sample Date	Sr-90 (MCL = 8 pCi/L)			Tritium (MCL = 20,000 pCi/L)			Chromium, Unfiltered (MCL = 100 µg/L)			Chromium, Filtered (MCL = 100 µg/L)			Co-60 (MCL = 200 pCi/L)		
		pCi/L	+/-	VF	pCi/L	+/-	VF	µg/L	LF	VF	µg/L	LF	VF	pCi/L	+/-	VF
USGS-053	10/21/04	**31.1**	4.91		1,810	105		10.1			9.1	B		6.83	3.09	UJ
USGS-053	03/23/05	**44.9**	0.899		1,380	103		17.9			16.1			0.449	2.17	U
USGS-054	10/19/04	**53.5**	11.8		90.6	77	U	5.6	B		4	B		0.745	2.99	U
USGS-054 (Dup)	10/19/04	**47.7**	9.26		59.3	75.1	U	4.1	B		7	B		4.05	3.24	U
USGS-054	03/22/05	**67.5**	1.27		71.6	81.7	U	5.3	B		4.6	B		-3.78	2.28	U
USGS-054 (Dup)	03/22/05	**43.4**	0.791		150	83.9	U	5.5	B		5.2	B		-4.57	2.44	U
USGS-055	10/27/04	**48.7**	7.92		6,300	180		21.8			20.8			5.12	20.7	U
USGS-055	03/15/05	**86.3**	2.09		5,190	172		36.9			36.8			5.59	4.79	U
USGS-056	10/21/04	**10.6**	1.37		17,100	264		**125**			**105**			13.5	5.66	J
USGS-068	03/24/05	0.361	0.103		209	95.3	UJ	**101**			42.2			3.84	2.12	U

a. See Appendix A for an explanation of validation and laboratory data flags.
b. Bold numbers are greater than the MCL.

Dup = duplicate
LF = laboratory flag
MCL = maximum contaminant level
VF = validation flag