0082874

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
3100 Port of Benton Blvd • Richland, WA 99354 • (509) 372-7950

August 18, 2009

Ms. Shirley J. Olinger, Manager
Office of River Protection
United States Department of Energy
P.O. Box 450, MSIN: H6-60
Richland, Washington 99352

Mr. David A. Brockman, Manager
Richland Operations Office
United States Department of Energy
P.O. Box 550, MSIN: A7-50
Richland, Washington 99352

Re: The Path Forward to Terminate the Grout Treatment Facility in Respect to the *Hanford Facility Dangerous Waste Permit*

Dear Ms. Olinger and Mr. Brockman,
This letter contains the determination from the Department of Ecology (Ecology) for a path forward to close the Grout Treatment Facility (GTF). Ecology's evaluation of the status of the phosphate-sulfate waste (PSW) grout disposed at GTF vault confirmed that it does not pose any immediate threat to human health and the environment. We also understand that United States Department of Energy (USDOE) does not have any immediate plans to treat, store, or dispose of dangerous waste in the GTF.

Therefore, Ecology is terminating the regulatory identity of the GTF waste management unit by denying the unit specific permit application.

Two suitable pathways were considered to terminate the regulatory identity of GTF. They were as follows:

- Approve a closure plan in the permit based on the draft closure plan already submitted to Ecology.
- Deny the unit-specific permit application for the GTF unit.

The option of approving a closure plan would involve a considerable amount of time, effort, and money for a facility that did not and is not planned for future use to manage dangerous waste. That option was, therefore, abandoned. The option to deny the unit-specific permit for the GTF was adopted instead and will be implemented. If USDOE does not agree with this determination, Ecology will meet and clarify our intent. Ecology intends to include in the Statement of Basis of the Hanford Facility Permit, text indicating the termination of the GTF unit in the Permit.

RECEIVED
AUG 25 2009
EDMC

Find attached a copy of the report detailing the technical and regulatory basis for the decision to terminate the unit specific permit for the GTF in the Hanford Facility Permit.

If you have any questions, please contact Greta Davis at 509-372-7894, or me at 509-372-7924.

Sincerely,

RL Skinnarland

Ron Skinnarland
Manager, Waste Management Section
Nuclear Waste Program

pll

Enclosure

cc w/enc:

Dave Bartus, EPA
Lori Huffman, USDOE
Stephen Weil, USDOE
Moses Jaraysi, CHPRC
A. E. Carvo, WRPS
Felix Miera, WRPS
Stuart Harris, CTUIR
Gabriel Bohnee, NPT
Russell Jim, YN
Susan Leckband, HAB
Ken Niles, ODOE
Administrative Record: HSWP
Environmental Portal
HF OR Gen File

GROUT TREATMENT FACILITY REGULATORY CLOSURE FINAL REPORT

July 27, 2009

Asopuru Okemgbo, Ph.D.

Executive Summary

The Grout Treatment Facility (GTF) is a collection of dangerous waste management units (DWMUs) that were constructed and qualified for interim status before the Hanford Resource Conservation and Recovery Act (RCRA) Permit was issued in 1994. Although they were built, none of the DWMUs accepted or managed dangerous or mixed waste, nor are they expected to accept or manage dangerous waste. A complete permit application was provided to the Department of Ecology (Ecology), but no decision has been made with respect to the final status of the GTF DWMU permit. As a result, the existing Hanford Facility Dangerous Waste Permit does not include operating authorization or closure requirements for GTF. Similarly, the existing Hanford Facility Dangerous Waste Permit does not include a process or schedule for terminating the regulatory identity of the GTF DWMUs.

The United States Department of Energy (USDOE) grouted and disposed approximately one million gallons of liquid phosphate-sulfate waste (PSW) to demonstrate grouting to be stored at the GTF DWMUs. PSW was N Reactor's decontamination waste and was chosen because it was a low-level radioactive waste that contained source term radioactivity of 1.10×10^8pCi/L. Also, the chemical component of the waste stream was not considered to designate as a dangerous waste according to the requirements of the Washington Administrative Code (WAC) 173-303-070.

Ecology's extensive review of historical data on PSW and its grout core and current literature on grout treatment for information necessary to determine the closure path, post closure path, or both for the GTF seems to be adequate in making a regulatory closure decision for the GTF. The path to termination of the regulatory identity of the GTF DWMUs should be based on the following criteria:

- Dangerous waste regulatory requirements.
- Intended future use (or lack thereof) of the units.
- Associated human health issues.
- Associated environmental safety issues.

Two potential regulatory pathways considered to meet the criteria above:

- Establish an approved closure plan in the permit, based on the draft closure plan already submitted to Ecology.
- Deny the unit specific permit application for the GTF DWMUs.

The first option would entail a considerable investment of time, efforts, and money to establish and implement a closure plan to re-issue the permit. Therefore, the second option was adopted and recommended for implementation. Ecology would prepare text to be included in the statement of basis to indicate the denial of the unit specific permit application for the GTF in the draft re-issued Hanford Facility Dangerous Waste Permit. A letter indicating the tentative decision to deny a unit specific permit for the GTF DWMUs according to WAC 173-303-840(2) will then be issued. USDOE will have the option of reapplying for a DWMU permit in case of future use of the empty vaults.

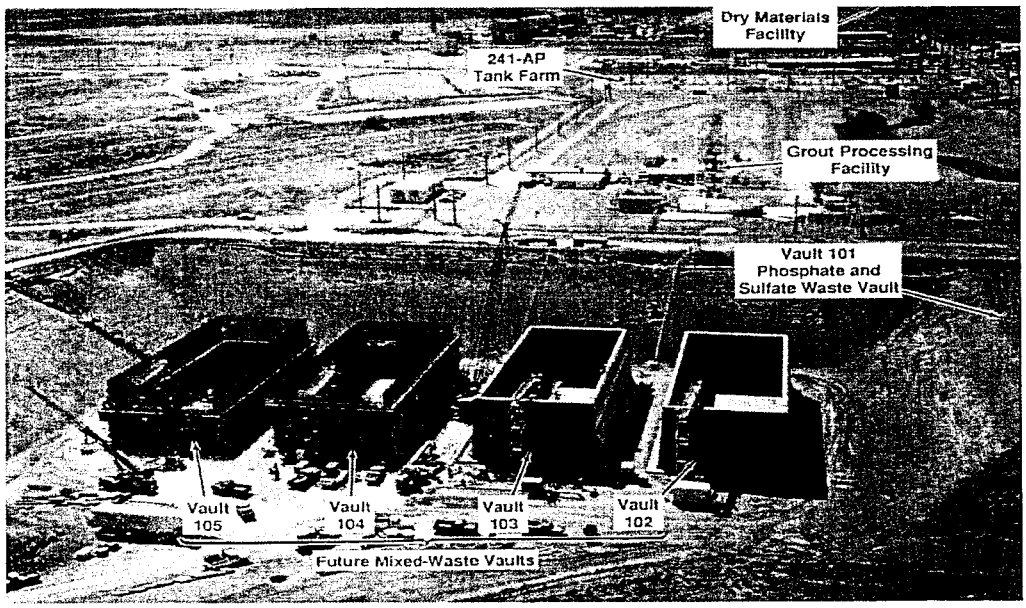
In the remote chance that new information becomes available to Ecology in the future to warrant a substantive response action concerning the GTF, Ecology retains the corrective action authority to establish such requirements under WAC 173-303-646. In other words, even if the regulatory identity of these units as DWMUs is terminated, the units will still be solid waste management units and subject to corrective action authority.

1.0 Background Information

In the early 1980s, USDOE evaluated the use of grout as an appropriate waste disposal method for low-level radioactive tank waste. In the late 1980s, USDOE selected a disposal site and built the GTF. It is a collection of DWMUs that were constructed and qualified for interim status before the Hanford RCRA Permit was issued in 1994. A complete permit application was provided to Ecology, but no decision has been made with respect to the final status of these units. The GTF was intended to be a permitted facility to treat the liquid waste from the Double Shell Tank (DST). The processing of DST waste was to occur in batches of about one million gallons (3,785,400 liters) of waste for each campaign. The grouted waste was to be disposed in near surface underground vaults (see figure 1). The GTF vaults were constructed between 1985 and 1988, but none of the dangerous waste management units accepted or managed dangerous or mixed waste.

For the demonstration of grouting concept, USDOE used the liquid PSW from the decontamination of the N Reactor. The PSW was stored in Tank 241-AP-104. The PSW was chosen because it was considered non-hazardous, and hence, non-regulated waste. The waste was later transferred to Tank 241-AP-102 for the grouting campaign.

Figure 1: Grout Treatment Facility Vaults Under Construction



1.1 PSW Characteristics

There were initial concerns that the waste from the decontamination of the N-Reactor contained regulated amounts of contaminants and high radioactivity. N-Reactor decontamination waste characterization activities were carried out between 1987 and 1988. The issues of regulated amounts of contaminants was resolved for the grouting demonstration through the mixing of phosphate and sulfate waste, and the subtraction of acid contributions to the test results from the tank characterization of Tank 241-AP-102 (see Table 1). PSW became non-hazardous, and

hence, non-regulated. The PSW grouted waste was a low-level radioactive waste and contained source term radioactivity of 1.10×10^8 pCi/L dominated by Co-60 (1.10×10^8 pCi/L) and leachable Tc-99 (5.5×10^4 pCi/L) and Sr-90 (3.3×10^4 pCi/L). (see Table 2). In terms of total alpha and total beta, it contained 7.79×10^3 pCi total alpha and 9.26×10^{12} pCi total beta during the grouting campaign.

Table 1: INORGANIC COMPONENTS OF TANKS AP-102 AND AP-104

(From: Grout Disposal Program Phosphate/Sulfate Waste Startup DOE-RL Readiness Review, PSW-88-021, 1988)

ION	TANK 241-AP-104 CONCENTRATION (MG/L)	TANK 241-AP-102 CONCENTRATION (MG/L)
Ag	<0.1	6.37E-01
Al	<1	
As	<0.05	<8.24E-01
Ba	<0.5	<2.06E-02
Be	<0.02	<2.06E-02
Bi	<3	
Ca	0.90	6.58E+00
Cd	<0.2	<4.12E-02
~~Cr~~	~~1.7~~	~~1.52E+00~~
Cu	<0.2	9.82E-02
Fe	1.9	2.21E+00
Hg	0.0004	<1.03E-03
K	<10	2.45E+01
Mg	1.4	2.15E+00
Mn	0.1	1.50E-01
Mo	<0.5	<2.29E-03
Na	11,600	1.06E+04
Ni	<0.2	<1.57E-01
Pb	<4	8.56E-02
Sb	<8	<5.15E-01
Se	<0.05	
Si	2.4	3.81E+00
Sn	<5	
Ti	<0.1	<2.06E-02
U	0.22	
V	<0.3	<1.03E-01
W	<5	
Zn	<5	<2.06E-01
Zr	<5	<8.24E-02
PO_4	16,300	20,100
SO_4	1,620	1,920
NO_2	1.1	<5.
NO_3	1.9	<5.
CO_3	1987	1940

Note: < values indicate level of detection of the analytical method

TABLE 2: PHOSPHATE-SULFATE WASTE RADIOLOGICAL SOURCE TERM

(From: Grout Disposal Program Phosphate/Sulfate Waste Startup DOE-RL Readiness Review, PSW-88-021, 1988)

	COLUMN 1 SOURCE TERM[1] (Ci/L)	COLUMN 2 SOURCE TERM USED IN HI&E[2] (Ci/L)	COLUMN 3 MODIFIED SOURCE TERM[3] (Ci/L)	COLUMN 4 MODIFIED SOURCE TERM (Ci/gal)[4]
3-H	5.01×10^{-8}	6.6×10^{-8}	6.6×10^{-8}	1.4×10^{-7}
54-Mn	1.24×10^{-6}	1.6×10^{-6}	1.6×10^{-6}	6.1×10^{-6}
59-Ni	1.28×10^{-10}	1.7×10^{-10}	1.7×10^{-10}	6.4×10^{-10}
60-Co	8.1×10^{-5}	1.1×10^{-4}	1.1×10^{-4}	4.2×10^{-4}
63-Ni	1.09×10^{-7}	1.4×10^{-7}	1.4×10^{-7}	5.3×10^{-7}
90-Sr	1.74×10^{-8}	2.3×10^{-8}	3.3×10^{-8}	1.2×10^{-7}
99-Tc	4.23×10^{-8}	5.5×10^{-8}	5.5×10^{-8}	2.1×10^{-7}
106-Ru	7.35×10^{-7}	9.6×10^{-7}	9.6×10^{-7}	3.6×10^{-6}
106-Rh	7.35×10^{-7}	9.6×10^{-7}	9.6×10^{-7}	3.6×10^{-6}
129-I	2.07×10^{-11}	2.7×10^{-11}	2.7×10^{-11}	1.0×10^{-10}
134-Cs	1.02×10^{-8}	1.3×10^{-8}	1.3×10^{-8}	4.9×10^{-8}
137-Cs	4.72×10^{-7}	6.1×10^{-7}	6.1×10^{-7}	2.3×10^{-6}
234-U	4.14×10^{-11}	5.4×10^{-11}	5.4×10^{-11}	2.0×10^{-10}
235-U	2.39×10^{-12}	3.1×10^{-12}	3.1×10^{-12}	1.2×10^{-11}
238-U	3.62×10^{-11}	4.7×10^{-11}	4.7×10^{-11}	1.8×10^{-10}
237-Np	7.21×10^{-13}	9.4×10^{-13}	9.4×10^{-13}	3.6×10^{-12}
238-Pu	9.73×10^{-10}	1.3×10^{-9}	1.3×10^{-9}	4.9×10^{-9}
239/240-Pu	1.54×10^{-9}	2.0×10^{-9}	2.0×10^{-9}	7.6×10^{-9}
241-Am	1.96×10^{-10}	2.6×10^{-10}	2.6×10^{-10}	9.8×10^{-10}
242-Cm	8.47×10^{-10}	1.1×10^{-9}	1.1×10^{-9}	4.2×10^{-9}
244-Cm	1.33×10^{-9}	1.7×10^{-9}	1.7×10^{-9}	6.4×10^{-9}
Total	8.44×10^{-5}	1.1×10^{-4}	1.1×10^{-4}	4.4×10^{-4}

Footnote: Other short-lived radionuclides were identified in the 100-N analyses but not found in 104-AP and not included in the source term due to their short half-life.

1.2 PSW Grout Campaigns

The USDOE carried out three-part PSW grouting campaigns in 1988 and 1989 in which about one million gallons of PSW was grouted. The PSW grout was disposed as a monolithic solid waste located in vault V-101 of the GTF. The vault constructed for the disposal of the PSW was the original design that had a reinforced concrete vaults with double High Density PolyEthylene (HDPE) liners to meet RCRA requirements but was not built to meet the requirement for additional barriers to control the release of long-lived soluble radioactive constituents to the soil column and groundwater. This issue is important because PSW grout contains long-lived Tc-99, albeit, in low amounts. Tc-99 is known to be in its highly mobile pertechnetate ion which easily leaches, and even in its immobile form is still leachable by diffusion controlled mechanism.

1.3 PSW Grout Characteristics

The GTF vaults design had a leachate collection system for periodic leachate removal. The leachate came from the curing of the grout. The leachates collected during grouting were managed by pumping them back to the 241-AP-102. The PSW starting material contained 1.6 mg/L of chromium. The PSW grout campaign leachate contained four times higher amount of chromium (6.7 mg/L) than in the PSW starting materials. During the pilot scale test, an increase

in the concentration of chromium was also observed in the test leachate. The increase in chromium concentration in the leachate raises the question of whether the initial PSW was non-hazardous in composition with respect to chromium, unless the grouting mechanism concentrated chromium in the leachate.

The PSW grout core samples were collected and analyzed for leachability of aluminum, calcium, silicon, sulfate, cobalt-60, and cesium-137, in addition to other physical characteristic of the grout. The American Nuclear Society (ANS 16.1) leachability index for the analytes, though not a true indicator of leachability was above the U.S. Nuclear Regulatory Commission (NRC) minimum leachability standard of ≥ 6. However, the studies did not adequately address issues concerning leachability of Tc-99 because no data were reported. Studies have shown that leachability ofTc-99 in cementitious media depends on the moisture contents and other co-analytes in the media. Tc-99 is easily leached from grouts. In addition, the leach resistance of PSW grout has been reported to decrease over time due to microcracks, fractures, and intrinsic ionizing radiation causing drastic effects on mechanical properties of the grout.

2.0 USDOE GTF Closure Process

The GTF waste treatment was abandoned in the 1990s for vitrification due to the issues caused by the presence of the following contaminants of concern: transuranic (TRU) isotopes, ^{137}Cs, ^{90}Sr, ^{99}Tc, ^{129}I, NO_2^-, NO_3^-, organic constituents, and complexants. The issues were summarized as:

- The leachability of grout.
- The difficulty of formulating grout that meets all physical and regulatory requirements.
- Oregon and Washington petitioned the NRC to amend regulations requiring the removal of all radioisotopes, to the extent technically feasible, from waste to be disposed of near surface.
- Ecology's requirement to remove or minimize nitrite (classified as extremely hazardous waste (EHW).
- U.S. Environmental Protection Agency's (EPA) land disposal restrictions (LDR) requirement for organic materials in some of the DST waste.

3.0 GTF Regulatory Closure Process

EPA and Ecology held meetings in February and June 2009, to determine the best path forward for GTF closure. The GTF dangerous waste management units still retain their regulatory identity, even though it did not manage or treat dangerous waste. The PSW grout obtained from the initial demonstration is a monolith solid waste placed in one of the grout vaults, but the remaining constructed vaults are empty. The question of administrative disposition of the permit application with respect to the GTF DWMUs remains the key issue in terminating the regulatory identity of the GTF DWMUs.

This process of termination of the regulatory status of GTF should be based on the following criteria:

- Dangerous waste regulatory requirements.
- Intended future use (or lack thereof) of the units.
- Associated human health and environmental safety issues.

The two potential regulatory pathways that could be followed for the GTF DWMUs considering the above criteria are:

- Establish an approved closure plan in the permit based on the draft Closure Plan already submitted to Ecology.
- Deny the permit application for the GTF DWMUs.

The first option is capable of meeting all the three criteria cited above. Under this option, the facility would follow the requirements of the approved closure plan in the permit. Following certification of completion of closure (and Ecology acceptance of the closure certification), the regulatory identity of the GTF DWMUs would be terminated. However, the units have never accepted or managed dangerous waste. In addition, Ecology determined that there are no health and environmental issues associated with the GTF DWMUs that require any further action. Therefore, this option would entail a considerable resource investment to establish and implement a closure plan in the re-issue permit with no real benefit.

The second option is a more streamlined and pragmatic approach that is also capable of meeting all three of the above criteria. Under this option, Ecology would draft a letter indicating the tentative decision to deny a unit-specific permit for the GTF DWMUs according to WAC 173-303-840(2). Assuming there is no adverse comment from USDOE and the public, Ecology's final permit decision to deny the unit specific permit would terminate the regulatory identity of the GTF DWMUs. No closure plan would be necessary under this option since no substantive action would be required through implementation of a closure plan.

Technically speaking, the above approach would not fully address the general closure performance standard of WAC 173-303-610(2)(a)(iii), which states, "Return the land to the appearance and use of surrounding land areas to the degree possible given the nature of the previous dangerous waste activity." However, because the land use surrounding the GTF DWMUs is highly industrialized, and has been prior to the construction of the GTF DWMUs, the technical issue posed by WAC 173-303-610(2)(a)(iii), is considered relatively minor, if not inconsequential. Therefore, satisfaction of this regulatory requirement requires no substantive action.

Denial of the GTF DWMU permit application can be done very efficiently as part of the draft Hanford Facility Dangerous Waste Permit that will be prepared for re-issuance of the Hanford Dangerous Waste permit. If USDOE endorses the recommendation to pursue Option 2, the next step would be to prepare a paragraph or two that can be included in the statement of basis indicating the denial of the unit specific permit for GTF DWMUs in the draft re-issue permit.

The USDOE has not indicated any future use of the empty GTF vaults. Nevertheless, Ecology will encourage USDOE to follow the option of reapplying for a unit specific DWMU permit if USDOE finds any future use of the empty vaults. The reapplication will depend on the designation of the disposal waste and follow the due process for timely approval.

Ecology will continue to retain the authority to establish the requirements of corrective action of WAC-173-303-646. This is important if any new information becomes available to Ecology in the future that might warrant a substantive response action concerning the GTF. In other words, even if the regulatory identity of these units as dangerous waste management units is terminated, the units will still be solid waste management units subject to corrective action authority.

References

1. *Characterization of Simulated Low-Level Waste Grout Produced in a Pilot-Scale Test,* by R. O. Lokken, M. A. Reimus, P. F. C. Martin, and S. E. Geldart. PNL-6396, February 1988.
2. *Hazardous Waste Characterization of Five N-Reactor Radioactive Liquid Waste Streams,* An Internal Memorandum from Westinghouse Hanford Company, March 1988.
3. *Analytical Results for Tank 241-AP-104 Phosphate/Sulfate Waste,* by W.I. Winters, SD-RE-TI-212, Revision 0, March 1988.
4. *Physical Characterization and Leach Resistance of Grouts Prepared from Tank 104-AP Phosphate/Sulfate,* by J. M. Conner and T. V. Rebagay, SD-WM-TI-329, Revision 1, March 1988.
5. *Miscellaneous Facilities Readiness Review by Grout Engineering Unit,* Westinghouse Hanford Company Internal Memo 133221-WGR-88-146, Revision 1, June 1988.
6. *Grout Disposal Program Phosphate/Sulfate Waste Startup DOE-RL Readiness Review,* PSW-88-021, 1988.
7. *Analyses of Grout Process Product* (Internal Memo12715-ASL88-047), WHC-IP-0711, by D. A. Dodd, December 6, 1988.
8. *Management of Phosphoric Acid Decontamination Wastes from N-Reactor*, Letter 8953871 from Westinghouse Hanford Company to Mr. R. O. Izatt, USDOE, June 28, 1989.
9. *Recommendation to Resume Processing of Phosphate/Sulfate Waste (PSW) at the Grout Treatment Facility (GFT)*, USDOE memorandum from Kenneth W. Bracken to Michael J. Lawrence, June 30, 1989.
10. *Phosphate Sulfate Waste Grout Campaign Report by M. W. Cline,* WHC-SD-WM-ER-059, Revision 0, November 1989.
11. *Internal Memo* by Cline, May 18, 1990.
12. *White Paper Grout Feed Contaminant Removal* by R. E. Worthington, WHC-SD-WM-ES-184, Revision 0, July 1991.
13. *Effective and Safe Waste Management,* edited by Robert L. Joley and Rhonda G. M. Wang, CRC Press, 1992.

14. *Grout For Closure of the Demonstration Vault at the USDOE Hanford Facility,* by Lillian D. Wakeley and James J. Ernzen, DOE/OR/21921-T2 (SL-92-21), August 1992.

15. *Durability of Double-Shell Tanks Waste Grouts,* by R. O. Lokken, P. F. C. Martin, and J. W. Shadet, PNL-7835, December 1992.

16. *Characterization of Double-Shell Slurry Feed Grout Produced in A Pilot-Scale Test,* by R. O. Lokken, P. F. C. Martin, and J. W. Shade, PNL-7979, December 1992.

17. *Characterization of a Low Level Radioactive Waste Grout: Sampling and Test Results,* by P.F.C. Martin and R. O. Lokken, PNL-8067, December 1992.

18. *Characterization of Grouted Low Level Waste to Support Performance Assessment,* by R. J. Serna, R. O. Lokken, and L. J. Criscenti, Waste Management 12, 271-287, 1992.

19. *Low-Level Waste Disposal – Grout Issue and Alternative Waste Form Technology,* by J. L. Epstein, J. H. Westsil, Jr., WHC-SA-1708-FP, February 1993.

20. *Analysis of RCRA Closure for Grout Vaults 102, 102, 104, and 105,* by K. W. Bledsoe, WHC-SD-WM-PLN-049, Revision 0, March 1993.

21. *Characterization of Phosphate/Sulphate Waste Grout Cores,* by P.F.C. Martin and R. O. Lokken, PNL-8620, September 1993.

22. *Low-Level Radioactive Hanford Wastes Immobilized by Cement-Based Grouts,* by Frank H. Huang, Dolores E. Mitchell, and John M. Conner, Nucl. Tech. 107, 254-271, 1994.

23. *Hazardous and Radioactive Waste Treatment Technologies Handbook,* Chang Ho Oh, Editor-in-Chief, CRC Press, 2001.

24. *Summary of Grout Development and Testing for Single Shell Tank Closure at Hanford,* by John R. Harbour, WSRC-TR-2005-00195, Revision 0, April 2005.

25. *Waste Form Release Calculations for the 2005 Integrated Disposal Facility Performance Assessment,* by D. H. Bacon and B. P. McGrail, PNNL-15198, July 2005.

26. *Diffusion of Iodine and Rhenium in Category 3 Waste Encasement Concrete and Soil Fill Material,* by D. M. Wellman, S. V. Mattigod, G. A. Whyatt, L. Powers, K. E. Parker, L. N. Clayton, and M. I. Wood, PNNL-16268, December 2006.

27. *Concrete Property and Radionuclide Migration Tests,* by D. M. Wellman, S. V. Mattigod, L. Powers, K. E. Parker, L. N. Clayton, and M. I. Wood, PNNL-17676, September 2007.

28. *Effect of Concrete Waste Form Properties on Radionuclide Migration,* by D. M. Wellman, C. C. Bovaird, S. V. Mattigod, K. E. Parker, R. M. Ermi, and M. I. Wood, PNNL-17808, September 2008.

29. *Saltstone and Concrete Interactions with Radionuclides: Sorption (K_d), Desorption, and Reduction Capacity Measurements,* by Daniel Kaplan, Kimberly Roberts, John Coates, Matthew Siegfried, and Steve Serkiz, SRNS-STI-2008-00045, October 2008.

30. *Dangerous Waste Regulations Chapter 173-303 WAC, Washington State Department of Ecology, Publication # 92-91, Amended O*ctober 2007.