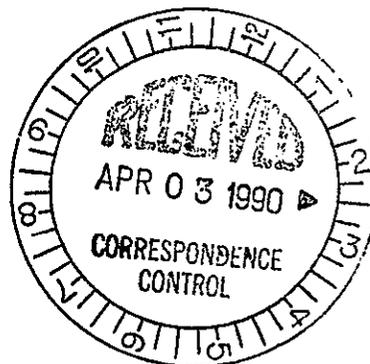




Department of Energy

Richland Operations Office  
P.O. Box 550  
Richland, Washington 99352

MAR 2 1990



START

Mr. Roger F. Stanley  
Program Manager  
State of Washington  
Department of Ecology  
Mail Stop PV-11  
Olympia, WA 98504-8711

Dear Mr. Stanley:

RESPONSE TO ECOLOGY SIMULATED HIGH-LEVEL WASTE SLURRY UNIT CLOSURE PLAN  
NOTICE OF DEFICIENCY

Attached are responses to your January 16, 1990, Closure Plan for the Simulated High-Level Waste Slurry Treatment and Storage (SHLWS T/S) Unit Notice of Deficiency. In addition to responding directly to your comments, we have included recommended changes in the sampling plan that are expected to significantly reduce the cost and time of analysis without reducing the quality of the results. These additions are appropriately identified. In addition, a Quality Assurance Project Plan (QAPjP) is attached. This submission fulfills the second event milestone following Milestone M-20-19 under the Hanford Federal Facility Agreement and Consent Order, dated May 1989.

Should you have any questions, please contact D. L. Duncan of the Department of Energy, Richland Operations Office on (509) 376-9333, or H. W. Slater of Pacific Northwest Laboratory on (509) 376-0575.

Sincerely,

*Steven H. Wisness*  
Steven H. Wisness  
Hanford Project Manager



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Attachments:

1. Response to WDOE Review Comments for SHLWS T/S Closure Plan
2. Quality Assurance Project Plan (QAPjP)

cc w/o atts:

- P. T. Day, EPA
- M. T. Gordon, Ecology
- T. D. Chikalla, PNL
- W. J. Bjorklund, PNL
- H. W. Slater, PNL
- Administrative Record



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## Response to WDOE Review Comments for SHLWS T/S Closure Plan

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1	1-6	A revised Part A permit application has been prepared which indicates that the waste slurries are EHW toxic waste mixtures (WT01). The revised Part A will be submitted with the revised Closure Plan.
2	1-9	An original photograph will be submitted with the revised Closure Plan.
3	2-8	A more detailed topographic map of the area around the SHLWS T/S facility will be provided in the revised Closure Plan. The second paragraph in Section 2.3 will be revised as follows:  A topographic map of the area around the SHLWS T/S unit is shown in Figure 2-5. A number of elevation reference points in the area of concern confirms the flatness of the area within 1000 ft of the unit.
4	3-5	Table 3-3 will be corrected to show that the total activity of the PW-7A is <261.06 pCi/g.
5	3-5	Section 3.2 will be revised to include results of acute rat toxicity testing. The title of Section 3.2.4 will be changed to "Acute Toxicity" and the following paragraph will be added:  Acute rat toxicity (Biological Testing Method No. WDOE 80-12 Part B) was determined for two composite samples of solidified PW-0. The results demonstrated that the lethal dose (LD <sub>50</sub> ) for this material was greater than 5000 mg/kg of rat body weight.
6	3-8	Table 3-5 will be corrected to show that PW7A-273 was sampled rather than PW7A-272. The identity of the container sampled was confirmed by checking the SHLWS T/S Log Book.
7	3-8	Table 3-5 will remain as is. The differences in the values of pH reported for the Corrosivity results in the Lokken report versus the value reported in Appendix E of the Compliance Notebook are mainly because the samples were prepared with different formulations. The value of 12.01 (from the Compliance Notebook) was for a grout prepared with 100% cement (no fly ash or slag). This test was conducted during the formulation stage of the project as a preliminary check of results. The 100% cement sample was chosen for

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8	4-6	<p>testing because it would have been a "worst case" for the various formulations (i.e., yielded the highest pH).</p> <p>Additional information on the sampling strategy for the treated SHLWS will be inserted to Section 3.2 since that section addresses treated waste characteristics. Two additional paragraphs will be added to Section 3.2 as follows:</p> <p>A sampling plan was developed for the treated SHLWS to ensure that at least 99.9% of the treated drums were below dangerous waste designation limits for EP toxicity and corrosivity (with 95% confidence). The number of drums to be sampled was identified based on statistical analysis of the expected variance in pH and toxic metals concentration. This analysis indicated that a minimum of 6 random samples would be required for EP toxicity analysis and 12 random samples would be required for pH analysis. The sampling plan called for sampling 24 drums at random. Half of the samples (12) were to be archived in the event that the wastes had greater variability than expected and additional analyses were required to obtain the desired confidence interval. Of the 12 samples not archived, all 12 were to be analyzed for pH and 6 for EP toxicity.</p> <p>During treatment, 306 drums of treated waste were generated. Twenty-three of these drums were sampled, 11 PW7A and 12 PW0. The total number of samples taken from these drums was 58, consisting of 22 PW7A and 36 PW0. The number of samples analyzed was 12 PW7A (from 6 drums) and 12 PW0 (from 6 drums). All samples were analyzed for both EP toxicity and pH. The total number of drums sampled for pH, therefore, was equal to the required number of 12 and the total number of drums sampled for EP toxicity was twice the required number of 6. This sampling and analysis procedure provides a 95% confidence that at least 99% of the drums of grouted waste in each waste category are below designation limits for EP toxicity and corrosivity.</p>
9	6-1	<p>The third sentence of the first paragraph of Section 6.0 will be deleted and replaced with the following:</p> <p>As required under Section 6.3 of the Hanford Federal Facility Agreement and Consent Order Action Plan, the SHLWS T/S unit will be closed under final status standards in WAC 173-303-610.</p>

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10	6-3	<p>The last paragraph in Section 6.1.1.1 will be replaced as follows:</p> <p>If it is determined to be impractical to remove all such contaminated soils or other dangerous waste residuals such that the requirements of WAC 173-303-610(2)(b) are met, post closure care will be required in accordance with WAC 173-303-610(7). In this case, the Closure Plan will be amended, as described in Section 6.1.1.3, and a Post-Closure Plan will be prepared as described in Section 6.2.</p>
11	6-9	<p>The final paragraph in Section 6.1.5 will be replaced as follows:</p> <p>"This plat describes real property in which dangerous wastes have been disposed in accordance with the requirements of WAC 173-303-610(9) and WAC 173-303-610(10). Although this dangerous waste disposal unit is now closed, regulations issued by the State of Washington in WAC 173-303-610(9) and WAC 173-303-610(10) require that the post-closure use of the property never be allowed to disturb the integrity of the final cover unless it can be demonstrated that any proposed disturbance will not increase the risk to human health and the environment."</p>
12	6-11	<p>No action required for this comment.</p>
13	6-11	<p>Sections 6.1.7, 6.1.8, 6.1.9, and 6.2 will be revised as follows:</p> <p>6.1.7 -- A closure cost estimate is not required because the DOE-RL is exempt from this requirement under WAC 173-303-620(1)(c).</p> <p>6.1.8 -- Financial assurance mechanisms are not required because the DOE-RL is exempt from this requirement under WAC 173-303-620(1)(c).</p> <p>6.1.9 -- Liability coverage is not required because the DOE-RL is exempt from this requirement under WAC 173-303-620(1)(c).</p> <p>6.2 (second paragraph) -- It is noted that if a post-closure plan is necessary, a post-closure cost estimate [WAC 173-303-620(5)] and a financial assurance mechanism for post-closure care [WAC 173-303-620(6)] will not be required</p>

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		because the DOE-RL is exempted from those requirements per WAC 173-303-620(1)(c).
14	6-15	<p>The secondary wastes were also grouted within drums. The second sentence in Section 6.3.1.4 will be revised as follows:</p> <p>The 199 drums of SHLWS and 11 drums of secondary waste have been solidified within 306 drums.</p>
15	6-15	<p>The waste inventory, in liters, will be added to the text. Section 6.3.1.4 will be revised as follows:</p> <p>5th sentence -- This inventory (43,700 liters) represents the maximum inventory of dangerous/mixed wastes stored at the SHLWS T/S container storage area during the active life of the unit.</p> <p>6th sentence -- The maximum inventory of dangerous wastes stored in the less-than-90-day storage area was 79 drums (13,500 liters).</p>
16	6-16	<p>A quality assurance project plan (QAPjP) has been prepared and will be included with the revised Closure Plan as an appendix. The QAPjP is presently submitted for review as Attachment 1.</p>
17	6-21	<p>Spent acetone from decontamination will be managed as a dangerous waste. The first sentence of the last paragraph of Section 6.3.2.2 will be revised as follows:</p> <p>Liquid decontamination wastes will be sampled and analyzed as described in Appendix A to determine the proper method of management. Sampling will not be performed if it is possible to designate the wastes as dangerous wastes by some other means (e.g., spent acetone will be designated as a dangerous waste since it is a listed spent solvent waste).</p>
18	6-23	<p>Soils which are shown to be contaminated based on sampling will also be removed. An additional sentence will be added to Section 6.3.2.4 as follows:</p> <p>In addition, all soils shown by sampling and analysis to be contaminated will be removed.</p>

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19	A-4	The reference for the toxicity of $ZrO(NO_3)_2$ is the Registry of Toxic Effects of Chemical Substances, entry number 88658, bis(Nitrato-o)oxozirconium. The oral rat $LD_{50}$ given is 2500 mg/kg.
20	A-5	Table 3 will be revised to include sodium nitrate. The equivalent concentration of sodium nitrate in the 50% mixture will be 0.00132%, which will increase the total equivalent concentration of the 50% mixture to 0.126%. This change will not affect the designation of the waste.
21	A-6	<p>The designation limit for toxic waste constituents will be defined as 10% of the limit for single constituents. No cleanup levels were identified in the "How Clean is Clean" guidance document which are more stringent than those given in the SAP. The paragraph beginning on the bottom of page A-5 will be revised as follows:</p> <p>The designation limit for waste constituents is not strictly defined. Under the WAC 173-303-084 procedure for waste designation, concentrations must be adjusted for toxicity to determine equivalent concentration. For wastes having a single constituent, the maximum concentration of the constituent that would cause the waste to be designated as dangerous would be the minimum equivalent concentration of 0.001% multiplied by the toxicity weighting factor. The toxicity weighting factor is 1 for Category X; 10 for Category A; 100 for Category B; 1,000 for Category C; and 10,000 for Category D. Because multiple constituents may be present in the soils at the SHLWS T/S unit, the designation limit for defining compliance with WAC 173-303-610(2)(b)(ii) will be taken as 10% of the limit for a single constituent waste. These limits, for each constituent toxicity category, are:</p> <p>Category X -- 1 ppm Category A -- 10 ppm Category B -- 100 ppm Category C -- 1,000 ppm Category D -- 10,000 ppm</p>
22	A-9	Table 4 is presented to define the detection limits that are required in order to determine whether the cleanup levels (i.e., background or designation limits) have been met. The designation limits given in Columns 2 and 3 are based on all toxic waste constituents known to have been present at the

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		<p>SHLWS T/S unit (i.e., those specific compounds identified in Tables 1 and 2). Designation limits cannot be defined for other constituents since the toxicity category must first be known.</p>
		<p>Table 4 does not identify the specific analyses which will be performed on specific samples. That information is presented in Table 7. As shown in Table 7, all soil samples will be analyzed for metals (including arsenic, lead, and selenium) and semivolatile organics. If specific constituents are identified other than those in Tables 1 and 2, the toxicity category of the constituent will be determined and an evaluation will be made whether the constituent is present at greater than 10% of its designation limit. Table 7 will be revised to clarify that pH of all soil samples will be determined (see response to item 26).</p>
23	A-9	<p>Table 4 presents detection limits required in order to determine whether the nitrate salts of barium, cadmium, chromium, and silver are present at greater than 10% of their designation limits. Because, with the exception of silver nitrate, these salts are in toxicity categories C or D, they have relatively high designation limits (i.e., 1000 ppm of category C salts and 10,000 ppm of category D salts). As a result, the detection limits required to determine whether designation limits are exceeded are rather high. Table 4 does not present detection limits required to determine whether barium, cadmium, chromium, or silver are present above background because the background concentrations of these metals are not currently known.</p> <p>Since the original submission of the SAP, data have been obtained on the use of X-Ray Fluorescence (XRF) for analysis of metals in Hanford soils. This method appears capable of meeting detection limit requirements and would result in significant time and cost savings over the use of ICP. Therefore, the Sampling Plan will be revised to indicate the use of XRF as the primary method for analysis of metals in soils. Table 5 will be revised, as shown below, to present data on the typical detection limits for XRF for soils. In addition, to aid in evaluation of detection limits versus requirements, method detection limits in Table 5 for soil background and soil designation have been revised to ug/kg from ug/L. A revised Table 5 is presented below.</p>

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Table 5. Summary of Analytical Methods and Typical Detection Limits<sup>1</sup>

<u>Analysis</u>	<u>XRF Detection Limit<sup>2</sup></u>	<u>Soil Background (-090)<sup>3</sup></u>	<u>Soil Designation Limits (-084)</u>	<u>Waste Designation Toxic Mixtures (-084)</u>	<u>Waste Designation EP Toxic Characteristic (-090)</u>
Arsenic	2 mg/kg	N/R <sup>4</sup>	N/R	N/R 53 ug/L	6010
Barium	7 mg/kg	7081 200 ug/kg	6010 200 ug/kg	6010 2 ug/L	6010 2 ug/L
Cadmium	5 mg/kg	7131 10 ug/kg	6010 400 ug/kg	6010 4 ug/L	6010 4 ug/L
Cobalt	12 mg/kg	N/R	6010 700 ug/kg	6010 7 ug/L	N/R
Chromium	40 mg/kg	7191 100 ug/kg	6010 700 ug/kg	6010 7 ug/L	6010 7 ug/L
Iron	20 mg/kg	N/R	6010 700 ug/kg	6010 7 ug/L	N/R
Lead	5 mg/kg	N/R	N/R	N/R	6010 42 ug/L
Mercury	--	N/R	N/R	N/R	7470 0.2 ug/L
Molybdenum	2 mg/kg	N/R	6010 800 ug/kg	6010 8 ug/L	N/R
Nickel	6 mg/kg	N/R	6010 1500 ug/kg	6010 15 ug/L	N/R
Nitrate	--	N/R	N/A <sup>5</sup>	9200 <sup>6</sup> 100 ug/L	N/R
Potassium	60 mg/kg	N/R	6010 Varies <sup>7</sup>	6010 Varies	N/R
Selenium	2 mg/kg	N/R	N/R	N/R	7740 2 ug/L
Silver	4 mg/kg	7761 2 ug/kg	6010 700 ug/kg	6010 0.7 ug/L	7761 0.02 ug/L

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Table 5. (Continued)

<u>Analysis</u>	<u>XRF Detection Limit<sup>2</sup></u>	<u>Soil Background (-090)<sup>3</sup></u>	<u>Soil Designation Limits (-084)</u>	<u>Waste Designation Toxic Mixtures (-084)</u>	<u>Waste Designation EP Toxic Characteristic (-090)</u>
Sodium	--	N/R	6010 290 ug/kg	6010 2.9 ug/L	N/R
Strontium	3 mg/kg	N/R	6010 300 ug/kg	6010 0.03 ug/L	N/R
Zirconium	2 mg/kg	N/R	N/A	N/A	N/R
Volatile Organics	--	502.2 Varies	N/R	N/R	N/R
Semivolatile Organics	--	8270 <sup>8</sup> Varies	N/R	N/R	N/R

Notes:<sup>1</sup>

1 Analytical Methods are identified by EPA Method numbers per SW-846. Typical detection limits are for waters/extracts (ug/L) or for soils/sediments (ug/kg).

2 PNL Procedure PNL-SP-19, Energy Dispersive X-Ray Fluorescence Spectrometry.

3 For soils, method detection limits for liquid extracts (ug/L) were converted to detection limits for soils (ug/kg) by multiplying by 100, assuming a 100:1 dilution during extraction.

4 N/R indicates analysis is not required.

5 N/A indicates that no method is available.

6 Method 9200 will be used to determine concentration of nitrate in liquid wastes. No EPA method is available for solid wastes.

7 Detection limit for potassium varies depending on operating conditions.

8 Detection limits vary depending on constituents but are generally in the low mg/kg range.

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		<p>It is currently expected that XRF and ICP will be sensitive enough to determine background. If not, more sensitive AA methods will be used. This determination will be made based on the results of analysis of the background soil samples (i.e., whether constituents in background samples are below detection limits). The first paragraph in Section 3.1 will be revised as follows:</p>
		<p>No required method detection limit could be identified with respect to background levels of metals in soils since background values have not been established. (National average values have been established for many metals, but because of great regional variability these values are not useful for establishing cleanup levels.) For these samples, therefore, the following approach will be used. Soil samples will be analyzed by X-Ray Fluorescence (XRF). If the concentration of the metals listed in Table 4 is less than the detection limit of the XRF method (listed in Table 5) the soil will be digested according to SW-846 methods and analysis will be by more conventional SW-846 methods [inductively coupled plasma spectroscopy (ICP), graphite furnace atomic absorption (GFAA), cold vapor atomic absorption (CVAA)] to determine the concentration in the soil.</p>
		<p>Because XRF is being proposed for use in analysis of metals in soils, XRF results will also be used for designation of toxic waste mixtures. Therefore, Section 3.2 will be revised. The second paragraph of Section 3.2 will be deleted because XRF is capable of analyzing for zirconium. The first paragraph of Section 3.2 will be revised as follows:</p>
		<p>The detection limits required for designation of soils or wastes under WAC 173-303-084 are generally much higher than those required for comparison to background levels. XRF detection limits are low enough to satisfy requirements for designation under WAC 173-303-084. To verify XRF results, duplicates from 20% of the samples will be digested according to SW-846 methods and analyzed by ICP using EPA Method 6010.</p>
		<p>Since submission of the SAP, a procedure for analysis of nitrate in soils has been identified. Therefore, the third paragraph of Section 3.2 will be revised as follows:</p>

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		<p>No method is available in SW-846 for analysis of nitrate in soils. Therefore, a procedure using 15 grams of soil and 10 grams of water to extract the soil will be used. Analysis using EPA Method 300.0 (Anions by Ion Chromatography) will be used to analyze the extract for nitrate. Nitrate in liquid waste will be determined using Method 9200 or 300.0 where appropriate. pH of aqueous wastes resulting from equipment decontamination activities will be determined using the Method in Attachment 1 to Appendix B of WDOE 83-13.</p>
		<p>With respect to revision of Section 3.3, ICP is proposed for analysis of EP leachate for arsenic, barium, cadmium, chromium, and lead. The method detection limits for ICP for these metals (Table 5) are all less than the required limits (Table 4) (note that the detection limits given in Table 4 are in mg/L while those in Table 5 are in ug/L). Because the detection limits for ICP are sufficiently low, no revision of Section 3.3 is believed to be necessary.</p>
24	A-11	<p>Footnote 6 was based upon the information present in SW-846 (i.e., 660 to 3300 ug/kg). It is our interpretation that 600 to 3300 ug/kg (0.66 to 3.3 mg/kg) is in the low mg/kg range.</p>
25	A-12	<p>The third sentence of the second paragraph of Section 3.2 will be revised as follows:</p> <p>The absence of zirconium analysis is not expected to affect waste designation since zirconium is only a minor contributor to the overall equivalent concentration for PW-0.</p>
26	A-12	<p>All soil samples will be analyzed to determine pH. An additional paragraph will be added to Section 3.1 as follows:</p> <p>Soil pH will be determined using the method in Attachment 3 to Appendix B of WDOE 83-13.</p>
27	A-14	<p>The last sentence in the first paragraph of Section 4.0 will be revised as follows:</p> <p>Statistical tests will then be performed to determine whether there is a difference in estimates of mean concentration of these two populations.</p>

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28	A-14	The presence of contaminants at a concentration greater than two standard deviations greater than the mean background will be assumed to be indication of contamination. An additional paragraph will be added after the first paragraph of Section 4.0 as follows:

Another goal of the soil sampling activities is to show that soils are not contaminated significantly above background. Results of analysis of background samples will be evaluated to determine the mean concentration and standard deviation of each constituent whose cleanup level is background. This information will then be used to determine whether any constituents in soil samples from waste units are present at concentrations greater than two standard deviations above the mean. If a sample indicates that presence of such contaminants at greater than two standard deviations above the mean, the soil surrounding the sample location will be removed. The area will then be resampled to determine whether the cleanup goal has been achieved.

29	A-14	The rationale for sampling near-surface soils is that soil contamination will have occurred by surface spills or leaks. The metal contaminants present in the SHLWS are relatively immobile and are expected to remain near the surface, especially given the basic pH of Hanford soils. For this reason, soil sampling in the top foot of the soil profile is recommended. To identify the presence of narrow bands of contamination, the sampling procedure will be modified to call for the sampler to excavate to a depth of one foot and observe the soil profile, looking for obvious signs of contamination.
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Because organic contaminants, particularly volatiles, may be more mobile than metals, the sampling and analysis plan will be modified to call for determination of volatile organics by soil gas analysis. The procedure being used for the RI/FS at the adjacent 1100-EM-1 operable unit will be used (this procedure has been approved by EPA Region X).

The second paragraph of Section 4.0 will be revised, and a new third paragraph added, as follows:

Initially, sampling will be limited to surface soils (i.e., 0 to 12 inches in depth). The top 12 inches of the soil profile will be exposed by excavation to identify any zones of apparent subsurface contamination. If such zones are

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30	A-15	<p data-bbox="483 374 1440 680">noted, the sample will be collected from them. Otherwise, samples will be composited from the 12-inch profile. All samples will be analyzed for XRF metals (includes all EP toxic metals except mercury), semi-volatile organics, and pH. If surface samples are found to be uncontaminated, samples from greater depths will not be collected. If surface contamination is found, additional samples will be collected from the initial sample locations at successive 12 inch increments to determine the extent of any vertical downward contaminant migration.</p> <p data-bbox="483 711 1440 956">Contamination of soils with volatile organics will be determined through the use of soil gas sampling. Soil gas probes will be used to collect soil gas samples from the top 4 ft of the soil profile. If contamination is detected, subsequent samples will be collected from additional locations to locate the source of the contamination or, if necessary, from greater depths to define the vertical extent of contamination.</p> <p data-bbox="483 987 1341 1048">The second paragraph of Section 3.1 will be revised as follows:</p> <p data-bbox="483 1079 1440 1457">Similarly, background levels of volatile and semivolatile organics are not known. As described in Section 4.0, soil gas sampling will be used to determine the presence of volatile organics. Methods 502.2 and Modified 502.2 will be used to analyze soil gas samples. These GC methods are more sensitive than GC/MS methods. Volatile organics having background cleanup levels would be those present in listed waste solvent. The target compounds for Method 502.2 includes all of these listed solvent waste constituents. For semivolatile organics, Method 8270 will be used. This GC/MS method was selected because of its large number of target compounds.</p> <p data-bbox="483 1483 1440 1667">The sampling program is designed around sampling two populations (i.e., the background area and the waste management area) and performing a statistical test to determine whether there is a significant difference between the estimates of the population means. The second paragraph on page A-15 will be replaced as follows:</p> <p data-bbox="483 1698 1440 1790">The number of samples was determined by evaluating the number needed to perform a statistical test between the estimates of the mean concentrations of the two populations</p>

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		<p>sampled (i.e., the background area and the waste management area). The statistical test to be used is the test concerning the difference between two means (Mendenhall 1975). The sample size was chosen so that the confidence interval on the estimate of the difference between the means was equal to one pooled standard deviation (i.e., the pooled estimate of the common variance). Because the sampling also has the objective of determining whether there are "hot spots" in the waste management area, it is desirable to take more samples from the waste management area than from the background area. For this analysis, it was assumed that the number of samples from the waste management area would be twice the number from the background area. Using this condition, the confidence interval was solved for in terms of the number of samples. A table of Student's t values was then used to determine the number of required samples, which is 7 background samples and 14 samples from the waste management area.</p>
31	A-15	<p>As described in the response to item 30, more samples are taken from the waste management area so that there is a greater chance of identifying "hot spots." As described in the last paragraph on page A-18, after sampling, the variances of the two populations will be estimated using the analytical data to and compared to determine whether they are approximately equal.</p>
32	A-16	<p>The sampling approach is based on the assumption that all contaminated soils have been removed and that the soils in the three waste management areas are all at background. Simple random sampling is appropriate if this assumption is true. The analytical results will be evaluated to determine whether this assumption is valid. As discussed in the response to item 35, the use of stratified random sampling will be considered based on a review of the analytical results.</p>
33	A-16	<p>Activities within the individual waste management areas could potentially contaminate soils outside the areas. The last sentence of the second paragraph on page A-16 will be replaced as follows:</p> <p>The waste management area is defined as the SHLWS T/S storage area, SHLWS T/S treatment area, and less-than-90-day storage area (see Figure 1). The area to be gridded for</p>

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34	A-16	<p>sampling encompasses these areas and an additional 5 ft buffer around each area.</p> <p>The results of the sampling will be evaluated to determine whether local background includes any contaminants at levels that appear to be of concern. The third paragraph on Page A-16 will be revised as follows:</p> <p>The background area was selected because it is close to the waste management area, is comprised of similar soils, surrounds the waste management area to the extent possible, and is outside the predominant wind direction from the SHLWS T/S unit (see Figure 2-6 of the Closure Plan for wind roses). It is noted that the background area may not be reflective of true environmental background because the surface material is not all native soil (i.e., much is imported gravel) and the area is located within an industrial area. It is recognized that other activities within the 3000 Area may have resulted in background levels above native environmental background.</p> <p>The sampling is intended to determine whether waste management activities have resulted in contamination of soils in the waste management area above the background levels in adjacent surface materials. In addition, the results of the sampling will be reviewed to determine whether any hazardous constituents, particularly synthetic organics, are present in the local background at levels greater than would be expected for natural background. The background analyses for the SHLWS T/S unit will be compared to analyses performed at the nearby 1100-EM-1 operable unit to determine whether they are approximately the same. If it appears that local background for man-made hazardous constituents at the SHLWS T/S unit is much greater than for other areas of the Hanford Site, it may be necessary to amend the closure plan.</p>
35	A-18	<p>Once the analytical data are available, they will be used to estimate the mean and variance of the concentrations for the two populations. The estimates of the population variances will be compared to ensure that they are approximately equal, a necessary condition of the statistical test. A statistical test will then be used to determine whether there is a significant difference between the estimates of the two means. The last paragraph on page A-18 will be replaced as follows:</p>

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		<p>Following collection and analysis of samples, the analytical data will be used to estimate the mean and variance for each contaminant for the background and waste management areas. The estimates of the population variances will be compared to determine whether they are approximately the same. If so, the data will then be used to perform a statistical test to determine whether there is a significant difference between the estimates of the two populations means at a 95% level of confidence.</p> <p>If the populations variances are not the same, the results will be evaluated to determine the suspected cause of the difference. If the results suggest variability between the three waste management areas (i.e., SHLWS storage, SHLWS treatment, less-than-90-day storage), resampling using a stratified random sampling approach will be considered. If the results suggest high variability due to contamination, soil at locations of expected contamination will be removed and the locations resampled.</p>
36	A-21	<p>As noted in the response to item 26, all soil samples will be analyzed for pH. As explained in the response to item 23, XRF is proposed for analysis of metals in soil. In the first paragraph of page 21, therefore, "ICP metals" will be replaced by "XRF metals."</p>
37	A-23	<p>As noted in the response to item 29, the top 12 inches of soil will be exposed and samples collected at any apparently contaminated areas. If no contamination is apparent, a composite sample will be collected. The first paragraph of Section 5.1 will be revised as follows:</p> <p>Soil samples will be collected according to the provisions outlined in this Section. Soil samples will be taken at any locations in the top 12 inches of the soil profile which appear to be contaminated. If no contamination is apparent, a homogenized composite sample of the top 12 inches of soil will be collected. If contamination is found at any sample locations, these same locations will be resampled at successive 12 inch increments to determine the extent of any vertical downward contaminant migration.</p>

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ADDITIONAL REVISIONS

A-1      A-22      The XRF method is also suitable for analysis of wood chips from waste pallets. This method, therefore, will be used to screen pallet samples to determine whether EP testing is needed. The pallets samples will be analyzed by XRF and the results for total EP toxic metals (except mercury) used to determine whether the samples could exceed EP limits. This determination will be made by comparing the concentration of any metal in mg/kg is greater than 20 times the EP leachate limit in mg/L. (20 times the solid concentration is the maximum possible leachate concentration since ratio of mass of solid to mass of leachate in the EP test is 1:20.) Any samples exceeding this limit will be tested using the EP toxicity procedure. The last paragraph on page A-22 will be revised as follows:

Samples will be collected from 10 pallets chosen at random (i.e., pallets will be numbered and a random number table used to select ten for sampling). Subsamples will be collected by removing approximately 10 grams of wood from each of six locations on each pallet. The locations will primarily include the working surfaces of the pallets (upper surface and lower surface of the skids) which are most likely to be contaminated. In addition, areas that appear to be contaminated as indicated by discoloration or other surface irregularities will be sampled. These subsamples will be composited to form a sample for each pallet. The samples will be analyzed by XRF for EP toxic metals (except mercury). Samples with EP toxic metals present at levels greater than 20 times the limit for EP toxic leachate will be analyzed using the EP toxicity procedure. Based on these results, the mean and variance of the concentrations of toxic metals will be calculated and used to determine if the pallets are dangerous waste. The mean and variance data will also be evaluated using the procedures given in SW-846 (i.e., Section 9.1.1.3.1) to determine if additional random samples must be collected for statistical purposes. If this analysis indicates that additional samples are required, they will be obtained in the same manner as the original samples. The pallet samples will not be analyzed for organics because the SHLWS stored on the pallets does not contain organics.

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<u>Item No.</u>	<u>Page</u>	<u>Response</u>
A-2	A-24	Because of the changes in methods (replacement of volatiles analysis by soil gas and replacement of ICP by XRF) Table 6 will be revised as shown below.
A-3	A-25	Based on further evaluation of the decontamination procedures given on page A-25, step 5 is not believed to be necessary to prevent cross contamination. Furthermore, this step will result in generation of additional decontamination waste. Step 5, therefore, will be deleted.
A-4	A-26	<p>Because soil samples will no longer be collected for volatiles analysis, filling sample jars with no head space is no longer required. The results of the soil gas survey will be used to determine whether volatiles analysis is necessary. Section 5.6 will be revised as follows:</p> <p>The number and amounts of samples to be collected is summarized in Table 7. Each sample container for aqueous and soil samples will be filled with sample material to minimize head space in the container. Large stones or cobbles will be removed from the sample by sieving or screening if necessary. If sieving or screening is necessary, soil will be transferred directly to the sieve or screen and will be shaken into a collection bucket until enough material has been collected for the sample. The material will then be transferred directly into the sample container. If sampling for volatile organics is required, EPA Method 5030 will be used (10 mL methanol per 4 g soil). Each sample container will be sealed tightly, the sample label information completed, the lid of the sample sealed with tape, and the sample placed into the ice chest. Sample container lids will not be interchanged. Samples will be delivered to the laboratory at the conclusion of each work day. In the case an off-site analytical laboratory is to be utilized, each day's samples will be prepared for delivery or shipment to the analytical laboratory and will be transported the following work day. Regardless of the laboratory to be utilized, all samples will be packed in suitable containers to provide the required environmental conditions outlined in Table 8.</p>
A-5	A-27	Because of the changes in methods (replacement of volatiles analysis by soil gas and replacement of ICP by XRF) Table 7 will be revised as shown below.

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Table 6. Summary of Sample Containers Required

<u>Sample Type</u>	<u>Analysis</u>	<u>Required Container</u>	<u>Number of Containers per Sample</u>
Soils	Metals (XRF)	16 oz. Glass w/ Teflon cap seal	2
	EP Toxicity Leaching	16 oz. Glass w/ Teflon seal	2
	Semi-Volatile Organics	16 oz. Glass w/ Teflon cap seal	2
Liquid Waste	Metals/anion	16 oz. Polyethylene	2
Pallet Chips	Metals (XRF)	16 oz. Glass w/ Teflon cap seal	1
	EP Toxicity (if required)	16 oz. Glass w/ Teflon cap seal	1

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Table 7. Number and Amounts of Samples to be Collected

<u>Sample Type</u>	<u>Number of Samples<sup>1</sup></u>	<u>Sample Size</u>
Soil Background		
Metals	7	2 - 16 oz. Glass Jar
EP Toxicity <sup>2</sup>	7	2 - 16 oz. Glass Jar
Soil Gas	7	500 mL Sample Bulb
Semivolatile Organics	7	2 - 16 oz. Glass Jar
Soil at Waste Management Areas		
Metals	14	2 - 16 oz. Glass Jar
EP Toxicity <sup>2</sup>	14	2 - 16 oz. Glass Jar
Soil Gas	14	500 mL Sample Bulb
Semivolatile Organics	14	2 - 16 oz. Glass Jar
Wood From Pallets		
Metals/EP Toxicity <sup>2</sup>	10	1 - 16 oz. Glass Jar
Liquid Waste		
Metals/anions	TBD <sup>3</sup>	2 - 16 oz. Polyethylene Bottle

Notes: <sup>1</sup> Initial number of samples to be collected. Additional samples could be required based on analysis of mean and variance data. Numbers in table do not include quality control (QC) samples described in Section 5.9.

<sup>2</sup> EP toxicity testing will be performed on soils and solid wastes only if XRF analysis indicates the presence of EP toxic metals at greater than 20 times the EP toxic limits.

<sup>3</sup> To be determined based on volume of decontamination waste generated. One sample will be collected from each drum of waste.

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<u>Item No.</u>	<u>Page</u>	<u>Response</u>
A-29		Because of the changes in methods (replacement of ICP by XRF) Table 8 will be revised as shown below.

Table 8. Sample Preservation and Holding Time

Soils

- Metals: Preserve by cooling to 4<sup>0</sup>C; holding time 6 months
- Volatile Organics: Preserve by cooling to 4<sup>0</sup>C; holding time 20 days
- Semivolatile Organics: Preserve by cooling to 4<sup>0</sup>C; holding time 7 days until extraction, 40 days after extraction

Liquid Wastes

- Metals: Preserve by acidifying with nitric acid to pH<2 and cooling to 4<sup>0</sup>C; holding time 6 months

Solid Wastes

- Metals: Preserve by cooling to 4<sup>0</sup>C; holding time 6 months
- EP Toxicity: Preserve by cooling to 4<sup>0</sup>C; holding time 6 months

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SHLWS T/S  
Section No. 1  
Revision No. 3  
Date: February 23, 1990  
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1.0 TITLE PAGE

QUALITY ASSURANCE PROJECT PLAN (QAPJP)  
SIMULATED HIGH LEVEL WASTE SLURRY TREATMENT AND  
STORAGE (SHLWS T/S) UNIT CLOSURE

Approvals:

Project Manager Pacific Northwest Laboratory	Date
Quality Engineer, Pacific Northwest Laboratory	Date
Operations Manager, Waste Technology Center Pacific Northwest Laboratory	Date
Manager, Quality Assurance Division United States Department of Energy Richland Operations Office	Date
Director, Environmental Restoration Division United States Department of Energy Richland Operations Office	Date

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## 2.0 TABLE OF CONTENTS

### 2.1 INTRODUCTION

This document is the Quality Assurance Project Plan (QAPjP) for closure of the Simulated High Level Waste Slurry Treatment and Storage (SHLWS T/S) unit. Described in this plan are quality assurance procedures for field activities associated with closure of the SHLWS T/S unit. These field activities are described in the Sampling and Analysis Plan (SAP) for the SHLWS T/S Unit Closure.

This QAPjP has been prepared in accordance with Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans, OER-QAMS-005/80. The analytical laboratory to perform the analysis of samples collected during closure will have a QAPjP in place to satisfy the requirements of this QAPjP and QAMS-005/80.

### 2.2 CONTENTS

This plan contains the sixteen QAPjP components specified in the above guidance. The plan is organized as follows:

<u>Section</u>	<u>Contents</u>
1.0	Title Page
2.0	Table of Contents
3.0	Project Description
4.0	Project Organization and Responsibility
5.0	QA Objectives for Measurement Data in Terms of Precision, Accuracy, Completeness, Representativeness, and Comparability
6.0	Sampling and Sample Preparation Procedures
7.0	Sample Custody, Preservation, and Storage
8.0	Calibration Procedures and Frequency

- 9.0 Analytical Procedures
- 10.0 Data Reduction, Validation, and Reporting
- 11.0 Internal Quality Control Checks
- 12.0 Performance and System Audits
- 13.0 Preventative Maintenance
- 14.0 Specific Routine Procedures Used to Assess Data Precision,  
Accuracy, and Completeness
- 15.0 Corrective Action
- 16.0 Quality Assurance Reports to Management

### 2.3 DISTRIBUTION

PNL

DE Knowlton  
TJ McLaughlin  
HW Slater  
JW Smith  
GT Thornton  
LE Thompson

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### 3.0 PROJECT DESCRIPTION

Pacific Northwest Laboratory (PNL) is responsible for managing the Simulated High Level Waste Slurry Treatment and Storage (SHLWS T/S) unit. This unit is located at the 3000 Area of the U.S. Department of Energy Hanford Site. The unit was used for the storage and treatment of simulated high level waste slurry (a dangerous waste) and for the accumulation of containers of dangerous waste. The unit has been operated under interim status as a storage and treatment unit and will undergo closure under interim status. Closure activities are described in the closure plan for this unit ("Closure Plan, Simulated High Level Waste Slurry Treatment and Storage (SHLWS T/S) Unit, September 13, 1989, Rev. 4).

The SHLWS T/S unit is being closed according to the requirements of WAC 173-303-610 and 40 CFR 265 Subpart G. These requirements call for the removal of all dangerous wastes and dangerous waste residuals at the time of closure. In order to verify that all dangerous wastes and residuals have been removed, sampling and analysis will be required. Specific sampling objectives related to regulatory requirements are described in the Sampling and Analysis Plan (SAP), which is Appendix A to the closure plan.

Soil samples will be taken, as described in the SAP, to determine that all soil contaminated by operation of the unit has been removed. The soil underlying areas used for dangerous waste storage and treatment and dangerous waste accumulation will be sampled to verify that contaminants are present below regulatory limits. Surface samples will be taken at random locations within waste management areas and at background areas outside the unit, using grids. Soils which appear to have been contaminated by past spills or leaks will be removed for disposal. Sampling and analysis will be required to determine the regulatory status of these soils and to ensure proper disposal.

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Some of the waste management equipment at the SHLWS T/S unit will be decontaminated. Liquid decontamination solutions will be used to decontaminate this equipment. The liquid wastes resulting from decontamination will be sampled to determine if they are dangerous wastes.

Samples will be collected by PNL staff using procedures described in the SAP. As samples are collected they will be immediately identified with a unique sample number and the chain-of-custody will be initiated. Samples will be transported to the analytical laboratory at the conclusion of each day's sampling activities for sample preparation and analysis. Laboratory analyses will be conducted according to the Laboratory QAPJP.

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#### 4.0 PROJECT ORGANIZATION AND RESPONSIBILITY

Sampling activities associated with closure will be performed by the PNL Waste Technology Center (WTC). Mr. Wayne Slater of WTC Facility Operations will serve as Project Manager. A PNL Quality Engineer will serve as Quality Assurance Officer and will be responsible for monitoring activities to ensure the requirements of this QAPjP and the analytical laboratory's QAPjP are being adhered to. Appropriate PNL staff will be selected to oversee and conduct the field activities and will programmatically report to Mr. Slater. Field activities will be under the supervision of the field team leader. An analytical laboratory will be selected from several available, depending on availability at the time of sampling. Analyses may be conducted by PNL analytical laboratories, Hanford Environmental Health Foundation, or a subcontract laboratory. The laboratory performing the analyses will have in place a QAPjP meeting the requirements of this QAPjP and OER-QAMS-005/80.

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**5.0 QA OBJECTIVES FOR MEASUREMENT DATA IN TERMS OF  
PRECISION, ACCURACY, COMPLETENESS,  
REPRESENTATIVENESS, AND COMPARABILITY**

Data Quality Objectives (DQOs) are based on the specific objectives of the project. DQOs are selected to ensure that the data collected during the project are of adequate quality to assure that project objectives are met. Additional considerations for DQOs are proven performance of analytical methods and procedures and indirect requirements, such as regulatory mandates.

This project involves collection and analysis of samples to determine whether closure performance standards have been met at the SHLWS T/S unit and to determine the regulatory status of wastes generated during closure activities. Specific data (i.e., analyses and detection limits) which are needed to satisfy regulatory requirements are identified in the SAP.

Specific QA objectives for this project are:

1. Establish sampling techniques in such a manner that the analytical data are representative of the soils and wastes being sampled.
2. Collect and analyze a sufficient number of duplicate field samples to establish sampling precision. Field duplicates will be used to establish precision among replicate samples collected from the same sample location. Laboratory duplicates of the same sample will provide a measure of precision within that sample (i.e., sample homogeneity).
3. Analyze a sufficient number of analytical duplicate samples (as specified in the analytical method) to assess the performance of the analytical laboratory.
4. Collect and analyze a sufficient number of travel blank and equipment blank samples to evaluate the potential for contamination from sampling equipment and techniques and/or transportation.

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5. Analyze a sufficient number of blank, standard, duplicate, spike, and check samples in the laboratory (as specified in the analytical method) to evaluate results against numerical QA goals for accuracy and precision.

Laboratory QA procedures to ensure that analytical data meet DQOs are discussed in detail in the laboratory QAPjP. The following sections discuss activities to be performed during field sampling to support QA objectives.

#### 5.1 ACCURACY

Accuracy refers to the difference between the reported test results and the true value of the parameter being measured. Accuracy of chemical analyses will be evaluated in the laboratory using such techniques as Percent Recovery for evaluation of spikes or known additions to sample matrices, and Percent Relative Error for evaluation of analysis of standards or other reagents of known concentration. The only potential field activities related to determination of accuracy are collection and preparation of field matrix spike samples. Use of field matrix spikes is not planned for the SHLWS T/S closure.

#### 5.2 PRECISION

Precision refers to the reproducibility of measurements under a given set of conditions and is generally expressed as the variability of a set of measurements against their average value. Precision of chemical analyses will be assessed through analysis of duplicate aliquots of samples and evaluated using such techniques as Percent Relative Difference. Field activities related to determining precision of analytical results are collection of blind duplicate samples for analysis by the laboratory.

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### 5.3 REPRESENTATIVENESS

Representativeness refers to how closely the results measured in the laboratory reflect the actual conditions in the medium sampled. The DQO for representativeness is addressed through use of appropriate sampling methods and sample handling procedures. Sampling rationale and methods are described in the SAP.

Representativeness is also evaluated through the use of equipment blanks and travel blanks. These samples will be analyzed to determine if contamination is introduced to the samples through handling in the field.

### 5.4 COMPLETENESS

Completeness refers to the percentage of measurements made which are judged to be valid measurements. The initial objective for completeness of samples is 95 percent. This objective means that at least 95 percent of the samples taken in the field will be received by the laboratory in good condition and acceptable for analysis. This objective will be met through the use of proper sample containers, proper sample packaging procedures to prevent breakage during shipment, proper sample preservation, and proper labeling and chain-of-custody procedures.

The initial DQO for completeness of chemical analyses in the laboratory is 90 percent. This objective means that usable analytical data will be produced for a minimum of 90 percent of the analyses requested on all samples submitted to the laboratory. This objective will be reviewed after actual performance data are available for each sample type analyzed. The objective may be revised upward or downward based on actual performance, but will not be revised downward without making and documenting a reasonable effort to identify and rectify the limiting factor(s). Based on actual laboratory

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performance in analysis of samples, individual completeness objectives for individual analytical methods may be developed.

Loss of analytical data will initiate a corrective action to identify the cause of the loss and prevent recurrence.

### 5.5 COMPARABILITY

Comparability refers to the ability to compare the results of various measurements. The DQO for comparability is to obtain measurements that are directly comparable. This objective will be met through the use of methods specified by USEPA in SW-846 (Test Methods for Evaluating Solid Waste -- Physical/Chemical Methods) and the State of Washington in WDOE 83-13 (Chemical Testing Methods for Complying with the State of Washington Dangerous Waste Regulation). The X-Ray Fluorescence (XRF) method specified for use in the SAP is not included in either SW-846 or WDOE 83-13. Therefore, duplicates of 20% of the XRF samples will be analyzed by SW-846 methods to verify the comparability of XRF results.

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## 6.0 SAMPLING AND SAMPLE PREPARATION PROCEDURES

Samples will be collected and preserved to help ensure that QA objectives are met. The following sections discuss sampling procedures, sample containers, and sample preservation and holding time.

### 6.1 SAMPLING PROCEDURES

Sampling procedures for soils and wastes are presented in the SAP. These procedures are designed so that samples are collected in a manner which will ensure that project objectives are met.

Quality assurance objectives for sample collection will be met through use of duplicate samples, blank samples, chain-of-custody, and laboratory QA procedures. These items are discussed below.

Duplicate samples will be used to establish precision of the data. The number of field duplicates submitted will be 10 percent of the total of each sample parameter and/or one duplicate for each sample parameter per day, whichever is more frequent. Duplicate samples will be obtained by collecting a single sample, mixing thoroughly, and splitting it into two identical sample containers.

Blank samples will consist of equipment and travel blanks which will be used to determine if contamination is introduced during sampling procedures. Since the use of soil materials for blanks is unproven and impractical, deionized/organic-free water will be used for travel blanks. A sample of the last water rinse from tool decontamination will be collected and analyzed to confirm the absence of sample cross-contamination. One equipment blank will be collected for each ten decontamination cycles, but not less than once per day.

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Chain-of-custody procedures are described in Section 7.0.

Laboratory QA procedures are described in the laboratory QAPjP. These procedures include the use of method blanks, spiked samples, duplicate samples, and check standard samples.

## 6.2 SAMPLE CONTAINERS

Sample containers to be used for soil and waste samples are described in the SAP. Precleaned analytical containers which are certified clean by the manufacturer will be used.

## 6.3 SAMPLE PRESERVATION AND HOLDING TIME

Preservation methods and holding times for the samples to be collected during SHLWS T/S unit closure are as follows:

- Soils
  - Metals: Preserve by cooling to 4°C; holding time 6 months
  - Volatile Organics: Preserve by cooling to 4°C; holding time 20 days
  - Semivolatile Organics: Preserve by cooling to 4°C; holding time 7 days until extraction, 40 days after extraction
- Liquid Wastes
  - Metals: Preserve by acidifying with nitric acid to pH<2 and cooling to 4°C; holding time 6 months
- Solid Wastes
  - Metals: Preserve by cooling to 4°C; holding time 6 months
  - EP Toxicity: Preserve by cooling to 4°C; holding time 6 months

Samples will be delivered or shipped to the laboratory daily to ensure that holding time limits are not exceeded.

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## 7.0 SAMPLE CUSTODY, PRESERVATION, AND STORAGE

Samples will be handled, preserved, and stored using procedures that help ensure that quality objectives are met. The following sections describe field activities related to sample chain-of-custody, documentation, and corrections to documentation.

### 7.1 FIELD CHAIN-OF-CUSTODY PROCEDURES

Samples chain-of-custody refers to the process of tracking the possession of a sample from the time it is collected in the field until laboratory analysis is completed. In order for a sample to be considered under a person's custody, one of the following requirements must be met:

- The sample must be in the physical possession of the person;
- The sample must be in view of the person after he has taken possession;
- The sample must be secured by the person in possession so that no one can tamper with it; or
- The sample must be secured by the person in possession in an area which is restricted to authorized personnel. In all cases involving the use of a PNL laboratory or other analytical laboratory on the Hanford Site, samples will be maintained in restricted access areas and in the possession of field or analytical staff. If the samples are sent to an off-site analytical laboratory, tamper indicating seals will be used.

Sample possession will be recorded on a chain-of-custody (COC) form. The form to be used is shown in Figure 7-1. This form also provides a record of the analyses requested for each sample. Each time possession of the sample or sample container is transferred between individuals, both the sender and receiver sign and date the COC form. Similar information will be recorded on the analytical request forms to be provided by the laboratory.

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## 7.2 FIELD SAMPLING OPERATIONS

Field sampling operations important to QA include documentation of field activities and documentation of sample information (i.e., sample location). All field activities will be documented in the field notebook or in a geologists log by the field team leader. This documentation will include the following:

- Personnel present during field operations;
- Procedures used for sampling (including any deviations from the SAP and reasons for deviations);
- Time of sample collection;
- Description of sample locations;
- Number and types of sample containers filled at each sample location; and
- Conditions or other observations during sampling (e.g., weather), especially conditions which could impact analytical results;

Each page of the field note book or geologists log will be dated and signed by the field team leader.

Documentation of sample location is very important. The location of each sample will be established according to grids which are discussed in the SAP. This information will be recorded in the field note book or geologists log. Wooden stakes marked with the sample number will be driven into the ground at each sample location. A photograph will be taken of each sample location and will include the sample identification number.

Each sample will be assigned a unique sample identification number. These numbers will be assigned in advance of the field effort and will be used to prepare sample labels for each container to be used. The sample label will contain the following information:

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- Sample identification number (entered in advance);
- Date and time of sample collection (entered in field);
- Sample location (entered in field);
- Sample type (e.g., grab or composite) and sample media (entered in advance);
- Required analysis and preservatives (entered in advance); and
- Name of sampler (entered in field).

Labels will be attached to each container before entering the field. Field information will be entered on the labels using waterproof ink. After the label is completed, it will be wrapped with waterproof, transparent tape.

### 7.3 CORRECTIONS TO DOCUMENTATION

All original data recorded in field notes, chain-of-custody records, and other forms are written with permanent, waterproof ink; erasures of data will not be made. If an error is made on a document, the individual making the entry will correct the document by crossing a line through the error, entering the correct information, and dating and initialling the correction. Any subsequent error discovered on a document is corrected in the same manner (i.e., crossed through, initialed, and dated).

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## 8.0 CALIBRATION PROCEDURES AND FREQUENCY

All instruments and equipment used during sampling will be operated, calibrated, and maintained according to manufacturer's guidelines and recommendations. Operation, calibration, and maintenance will be performed by personnel who have been properly trained in these procedures.

The only direct measurements expected to be taken in the field are distance measurements for sample location, air temperature during sampling, and pH of liquid wastes. Distance measurements necessary to establish the sample grid will be made with a steel tape. Temperature measurements will be made with a mercury or electronic thermometer which will be calibrated prior to beginning sampling. pH measurements will be made with a portable pH meter. This meter will be calibrated with standard buffer solutions prior to each measurement.

Procedures and schedules for calibration of laboratory instruments are contained in the laboratory QAPJP.

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## 9.0 ANALYTICAL PROCEDURES

The only field analytical procedure to be conducted is field measurement of the pH of aqueous wastes. These measurements will be conducted using the procedure in Attachment 1 to Appendix B of Chemical Testing Methods for Complying With the State of Washington Dangerous Waste Regulations, WDOE 83-13.

Laboratory analytical methods are identified in the SAP.

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## 10.0 DATA REDUCTION, VALIDATION, AND REPORTING

Analytical data giving concentrations of metals and organics in soils will be used to determine if the closure performance standard given in WAC 173-303-610(2)(b)(i) has been met. Data from analyses for barium, cadmium, chromium, silver, volatile organics, and semivolatile organics will be used to calculate mean concentrations of these constituents for the background area and waste management areas, as described in the SAP. The mean concentrations for these two areas will be compared using a Student's t test to determine if there is a significant difference at a 95% confidence level. Standard statistical procedures for the test of a hypothesis concerning the difference between two means will be used.

Analytical data giving the concentrations of toxic metals in soils will be used to determine if the closure performance standard given in WAC 173-303-610(2)(b)(ii) has been met. Data from analyses for metals will be used to determine if SHLWS residuals in soils are present above designation limits. The dangerous waste designation procedures given in WAC 173-303-084(5) will be used.

Analytical data giving the concentrations of toxic metals in wastes and the results of EP toxicity testing of wastes will be used to determine if wastes are designated as dangerous wastes. Data from analyses for metals and nitrate will be used to determine if SHLWS residuals in wastes are present above designation limits defined in the SAP. The procedures given in WAC 173-303-084(5) will be used. The results of EP toxicity tests will be used to determine if the wastes are characteristic dangerous wastes. The procedures in WAC 173-303-090(8) will be used to determine if the wastes are EP toxic.

All analytical data used in calculations will first be validated by the cognizant analytical supervisor. Procedures for validation of data are included in the laboratory QAPjP. The laboratory will submit backup data in

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the data package, as requested, for use in verifying data validation. These backup data will be used to confirm that the data quality objectives have been met. The results of this validation will be documented in a QA/QC report for each analytical data package received from the laboratory. This report will be maintained in the project files.

All calculations will be performed on standard calculation sheets which will include the name of the person performing the calculations and the date of the calculations. All calculations will be checked by a second person. This person's name and the date that the calculations were checked will be entered on each calculation sheet. All calculation sheets will be retained in the project file.

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## 11.0 INTERNAL QUALITY CONTROL CHECKS

Quality control of data will involve the collection of field sample duplicates and blanks (described in Section 5.0), laboratory analysis of the samples, and evaluation of the data. Internal quality control checks that will be implemented to assure that all data generated are of a known quality are as follows:

- Field Activities
  - At least one duplicate sample of each sample parameter will be collected each day.
  - The total number of duplicates collected for each sample parameter will be 10 percent of the total number of samples collected, or a minimum of three.
  - At least one equipment blank will be collected for each type of sampling device used per day.
  - One travel blank will be prepared per day for volatile organic analysis.
  - One container blank will be submitted for each lot of sample containers used.
- Laboratory Activities
  - A multipoint calibration curve will be generated for each parameter to be measured. As appropriate for each parameter, a new calibration curve will be generated daily or with each batch of samples analyzed, or a midrange calibration-curve check sample will be analyzed daily with each batch of samples analyzed.
  - One set of method blanks will be analyzed daily at a 5% frequency or one per batch of samples, whichever is more frequent.
  - At least one sample will be analyzed in duplicate with each batch of 20 or less samples.
  - At least one spiked sample will be analyzed with each batch of 20 or fewer samples.

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- An EPA QC certified sample will be analyzed.
- Surrogate spikes will be added to and analyzed with each volatile organics and semivolatile organics sample analyzed.

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## 12.0 PERFORMANCE AND SYSTEM AUDITS

The requirement for systems audits for the field activities associated with closure of the SHLWS T/S unit will be satisfied by approval of this QAPjP and the SAP by the quality assurance representative of Pacific Northwest Laboratory. The QAPjP, SAP, and all procedures referenced therein must be approved prior to conducting any field activities. In addition, field and laboratory activities will be monitored by the project QA officer to ensure compliance with the requirements of this QAPjP and the SAP. Because of the short duration of field activities, additional system audits will not be performed.

The requirements for performance audits will be satisfied by taking measures to ensure measurement accuracies are being achieved and maintained. These measures primarily include the provisions identified in Section 11 of this QAPjP including the analysis of blanks, spikes, EPA-certified samples, and duplicate samples. The performance of these activities will be witnessed, as appropriate, by the project QA officer.

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**14.0 ROUTINE PROCEDURES TO ASSESS DATA PRECISION,  
ACCURACY, AND COMPLETENESS**

Procedures to assess precision, accuracy, and completeness of laboratory data are described in the laboratory QAPjP. The only field analytical techniques to be employed are field measurement of the pH of aqueous wastes. The accuracy and precision of these data will be assessed by performing measurements in accordance with the procedures contained in the analytical method (Attachment 1 to Appendix B of Chemical Testing Methods for Complying with the State of Washington Dangerous Waste Regulations, WDOE 83-13).

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## 15.0 CORRECTIVE ACTION

Events or conditions which produce, or may produce, adverse effects on quality of data will be addressed through documented corrective action. The vehicles for identifying such events or conditions are the performance or system audits described in Section 12.0. If, during the course of an audit, the QA Officer or analytical or field staff discovers such events or conditions, corrective actions will immediately be initiated. The QA Officer may, at his discretion, order the stoppage of work until corrective actions have been identified and implemented. The QA Officer and the responsible analytical supervisor or field team leader will be responsible for the following:

- Identifying the cause of the event or condition;
- Identifying actions required to prevent reoccurrence of event or condition;
- Identifying any required changes to the QAPjP, SAP, or referenced procedures;
- Determining the impact of the event or condition on the quality of data;
- Determining if these impacts will cause the data to be unacceptable for meeting the objectives of the project; and
- Identifying unacceptable data which must be replaced through resampling or reanalysis.

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## 16.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

The QA Officer will prepare periodic reports summarizing the QA/QC status of the project and any adverse events or conditions. These reports will be submitted to the Project Manager and cognizant PNL management. Items which may be addressed in these reports include:

- Results of performance or system audits;
- Significant QA problems and recommended solutions; and
- Corrective actions taken for any problems previously identified.

Such reports will be prepared after each system audit and following discovery of any event or condition requiring corrective action.

The field team leader will prepare a report to the Project Manager and cognizant PNL management at the conclusion of sampling activities and upon discovery of any adverse event or off-normal condition. Items which may be addressed include:

- Status of field activities;
- Significant QA problems and recommended solutions; and
- Corrective actions taken for any problems previously identified.

The responsible analytical supervisor will prepare a report to the Project Manager and cognizant PNL management at the conclusion of analytical activities and upon discovery of any adverse event or off-normal condition. Items which may be addressed in these reports include:

- Results of performance or system audits;
- Significant QA problems and recommended solutions; and
- Corrective actions taken for any problems previously identified.

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