5. DEVIATIONS FROM THE OU 1-10 REMEDIAL INVESTIGATION FEASIBILITY STUDY WORK PLAN

5.1 OU 1-10 Field Sampling

In this section documented and undocumented deviations to Revision 1 of the Field Sampling Plan (FSP) contained in the *Remedial Investigation/Feasibility Study (RI/FS) Work Plan* (Lewis et al. 1996), are discussed.

5.1.1 TSF-09 Deviations From the Field Sampling Plan

Appendix C of the FSP contains a complete FSP for sampling the contents of tanks at sites Technical Support Facility (TSF)-09, TSF-18, and TSF-26. When Appendix C was prepared, a remote system for sampling the V-1, V-2, and V-3 tanks was being designed, making it impossible to include specific requirements for the sampling in the FSP. These were added using the Document Action Request (DAR) process as they were developed. The changes, documented on DARs ER-DAR-170, ER-DAR-204, and ER-DAR-421 are discussed here.

It was originally planned that the tanks would be sampled in the following order: V-3, V-1, and V-2. The specified order was arbitrary with the exception that Tank V-2 was to be sampled last to prevent polychlorinated biphenyl (PCB) cross-contamination among the tanks. ER-DAR-170 specified changing the order of sampling the tanks to V-1, V-3, and V-2 to accommodate the use of a different crane needed to position a remote sampling tool in the tanks. This change had no effect because PCB contamination was suspected only in Tank V-2. The same DAR added a reference to the FSP for use of Technical Procedure (TPR) ER-TPR-138 to perform the sampling with the remote sampling tool.

The original stratified sampling scheme included in the FSP assumed that undisturbed samples from various locations in each identified tank strata would be collected. In the field, it became apparent that the vacuum sampling system created extensive disturbance of the solid and liquid phases in the tank. In addition, during the collection of samples from the solid phase, large quantities of liquid were also collected in the sample containers. Therefore, ER-DAR-204 and ER-DAR-421 specified a number of changes to the sampling strategy in the FSP. With the exception of Strata 1, only one location in each solid phase strata would be sampled instead of two. Duplicate samples would be collected at that location. From the liquid phase (Strata 4), only one sample was specified instead of two as originally planned. Instead, a second liquid phase analysis was specified for samples from Strata 1, which contained a large quantity of liquid as well as solids.

As outlined in Section 2.1, the objectives of TSF-09 sampling included determining whether a horizontal gradient in contaminant concentrations exists in the tanks. The disturbance of the samples prior to collection may make the interpretation of the data more difficult, but will not precluded the use of the data for this purpose. The disturbances created during sampling were generally limited to the immediate area [0.3 to 0.6 m (1 to 2 ft radius)], in which the sampling was being performed. Individual locations in each tank were sampled in the following order: Strata 1 (the sump), Strata 2 (in the tank center), and Strata 3 (the opposite end of the tank from the sump). These two factors would help preserve any evidence of horizontal gradation in the sampling and analysis results. Undisturbed sampling specified in the original sampling scheme was designed to ensure that the sampling and analysis results were representative of the liquid or solid phase being sampled.

The sampling technique used makes the representativeness and usability of the volatile organic compound (VOC) results for the solid phases in the tanks highly questionable. This is true for two reasons. First the injection of air and water during sampling probably volatilized many of the organic compounds, biasing the sampling and analysis results low. In addition the VOC analysis was performed on the mixed (solid and liquid) phase samples, so the results are not representative of the solid phase in the tank. For all other analyses on the solid phase the analysis was performed following gravity filtration of the samples and the sampling technique is not expected to have significantly affected the results since the two phases separated easily. Because VOC data for the solid phase is available from the 1993 sampling and analysis, the questionable 1996 results will not affect evaluation of remedial options and planning of treatability studies.

It was originally planned that the dual phase samples collected from each tank using a composite liquid waste sampler (COLIWASA) would be taken prior to beginning the stratified sampling. But because of a delay in receiving the sampling equipment, the dual phase sampling was performed a number of days after the stratified sampling was completed. The intent of performing the dual phase sampling first was to ensure that discrete, undisturbed solid and liquid phase samples were collected. Based on visual evidence, however, the solids and liquids in the tanks, easily and quickly separated following disturbance and the dual phase samples collected were not affected by the change in sampling order.

The only change in the TSF-09 sampling not documented in a DAR was the decision made in the field not to collect the rinsate sample from the remote sampling tool between the sampling of Tanks V-1 and V-3. The intent of this sample was to determine whether any cross-contamination between tanks had occurred because only a rudimentary decontamination could be performed on the sampler between tanks. However, the rinsate sample could be collected only from a very small portion of the tubing interior (the section between the vacuum chamber and the valve to the water rinsate line). Therefore, the rinsate sample was considered inadequate for the cross-contamination check, and was not collected. The impact of the deletion of this quality assurance/quality control (QA/QC) sample is considered negligible because as planned the resulting data would not have been representative of cross-contamination between the two tanks. In addition, the impact of any cross-contamination is expected to be insignificant because the 1993 data indicate that the tanks contain very similar contaminants and that concentrations of most of the contaminants (e.g., metals, VOCs, and radionuclides) are very high. The only exception to this is the known presence of PCBs in Tank V-2, which may or may not be present in Tanks V-1 and V-3. To ensure that any PCBs detected in these two tanks are not a result of cross-contamination, Tank V-2 was sampled last during both the stratified and dual-phase sampling.

5.1.2 TSF-18 Deviations to the FSP

Appendix C of the FSP contains a complete FSP for sampling the contents of tanks at sites TSF-09, TSF-18, and TSF-26. When Appendix C was prepared, there was little information available on the 11,514-L (400-gal) underground storage tank (UST) at TSF-18. This resulted in numerous field changes to the FSP during the course of the investigation. These changes are discussed here.

Until the UST was accessed in March 1996, it was assumed to contain primarily liquid and only a limited solid phase, both of an unknown nature. In reality, the 2.1-m (7-ft) tall conical tank contains approximately 0.9 m (3 ft) of a sludge-like material and 0.9 m (3 ft) of liquid. Because of difficulties in determining depths in the tank without disturbing the material to be collected, the liquid sample from Location No. 2 was collected from a location approximately 0.3 m (1 ft) deeper in the tank than originally planned. The sample was collected in accordance with the procedure in Appendix B of the FSP with one exception. All of the sample material was collected into an Erlenmeyer flask using the modified pump configuration specified in the procedure. It was then transferred into sample containers including the volatile organic analysis (VOA) 40-mL vials. It was planned to collect sample material directly into the 40-mL vials without modifying the pumping system, because the modification creates airflow and sample disturbance that may cause a loss of VOCs. However, given the high concentrations of the VOCs detected in the liquid samples from Tank V-9, this change (implemented to reduce the risks of a spill of the highly radioactive liquid) does not appear to have compromised the quality of the VOC data collected.

The consistency of the material in the tank precluded collection of liquid any deeper than where the one sample was collected using a peristaltic pump. Therefore, as documented in changes to the FSP (DARs ER-DAR-103 and ER-DAR-171), the second planned liquid sample (from Location No. 1) was not collected. Instead a duplicate sample of the sludge material at Location No. 3 was collected. Because of the high radiation levels found in the tank in March 1996, it was planned that the sludge samples would be collected with a remote handling device consisting of a 11.4-cm (4.5-in.) long sample bomb attached to a long handle. After being inserted into the sludge, a T-handle was used to slide an aluminum housing over the sludge collected in the sample bomb. Sample material was then transferred from the bomb to sample containers inside a glove box. During two sampling events, the sludge samples were collected as planned in Revision 1 of the FSP.

5.1.3 TSF-26 Deviations to the FSP

Sampling at TSF-26 was performed in accordance with Revision 1 of the FSP with some notable exceptions. It was originally planned that core samples would be collected from locations directly below the manholes in the two 189,290-L (50,000-gal) tanks at the site. The cores were to be either composited or grab samples of distinct phases collected. At a minimum, one composite sample or one grab sample of each phase in each tank was to be analyzed. However, during sample collection, very little evidence of a sludge phase was found in Tank V-13, and none was found in Tank V-14. The cores collected from Tank V-14 during the first sampling event were discarded. The laboratory was instructed to perform one analysis suite on the three cores collected from Tank V-13.

The sampling scheme discussed above as well as the sampling procedures included in the FSP were revised. As documented in ER-DAR-171, a remote sampling system was to be devised that would allow collection of cores from locations other than below the manway in each tank. It was planned that during a second sampling event, cores of the materials in the tanks would be collected from locations deeper in the tanks. A full laboratory analysis was to be performed on the sludge phase in the present cores from each tank. The analysis was to be in duplicate for the material from Tank V-14. The revised FSP also included provisions for collecting samples using an auger system if the coring device failed. It was assumed that the sampling device (core or auger) would be inserted into the tanks approximately 7.6 m (25 ft) using an extension arm.

Instead, the sampling device was mounted on tracks and "driven" remotely into the tanks (see Section 3.3). During the second stage of sampling, the large amount of diatomaceous earth mounded in the tank below the manhole prevented movement of the sampler in Tank V-14, and no samples were collected. Four cores were collected from three locations in Tank V-13. A full analysis will be performed in duplicate of the sludge material collected from Tank V-13 in the four cores. The failure to collect any sample material from Tank V-14 is not expected to have a significant impact on the characterization of the material for evaluation of treatment options because it is known that the two tanks received the same waste streams and the materials in the tanks should be of the same composition.

5.1.4 WRRTF-05 Deviations to the FSP

The Water Reactor Research Test Facility (WRRTF)-05 injection well sampling and analysis were performed as planned in Revision 1 of the FSP, with few deviations. The FSP included provisions for sampling a nonaqueous phase in the well if one were present (i.e., Sample No. 1TPA08 was established). Because a nonaqueous phase was not present in the well, this sampling was not performed. The only undocumented change to the FSP was the addition of samples from the WRRTF-05 well for polynuclear aromatic hydrocarbon (PAH) analysis by SW846 Method 8310. The FSP specified the collection of samples for Contract Laboratory Program (CLP) semivolatile organic compound (SVOC) and VOC analyses [by Environmental Protection Agency (EPA) Method 524.2] only. The PAH analysis was added to ensure that the detection limits for compounds of interest were at least as low as potential risk-based levels (see Section 3.6.3).

5.1.5 WRRTF-13 Deviations to the FSP

The WRRTF-13 sampling and analysis was performed as planned in Revision 1 of the FSP with few deviations. Although it was noted in Revision 1 of the FSP that the WRRTF-13 boreholes would be sampled at 0.8-m (2.5-ft) intervals, the sampling and analysis plan table in Appendix A of the FSP specified 0.6-m (2-ft) sampling intervals. This resulted in the discrepancies (shown in Table 5-1) between information given in Appendix A on sample depth and what the sampling depths actually were. During the sampling, the actual sample depths were recorded on the sample labels, in the sample logbook and on the sample chains-of-custody (CoCs).

There were two changes to the WRRTF-13 sampling and analysis scheme not documented in the FSP. Soil samples from the intervals shown in Table 5-1 were subjected, in addition to the FSP-specific analyses, to PAH analysis to achieve reasonably low detection limits (see Section 3.6.3). During the field investigation, the project leader in the field made a decision to drill two additional boreholes in the WRRTF-13 area (see Section 3.5). The decision was based on the immediate availability of the drilling equipment and personnel, and the existence of a current company-approved permit for subsurface disturbance in the area. As discussed in Section 3.5, the results of field screening for volatile organic vapors in soils from the two additional boreholes were used to further characterize the extent of contamination below tanks Test Area North (TAN)-787 and TAN-738.

5.2 Risk Assessment Deviations from the RI/FS Work Plan

The Operable Unit (OU) 1-10 baseline risk assessment (BRA) contains nine deviations from the RI/FS Work Plan. These deviations were included in the BRA for one of two reasons. First, some deviations resulted from the availability of new information that had not been gathered when the RI/FS Work Plan was written. Examples of this type of new information include additional sampling results that were not evaluated in the RI/FS Work Plan, and new guidance documents that have been published since the RI/FS Work Plan was written. Second, some deviations resulted from the need to make the OU 1-10 BRA as consistent as possible with BRAs that have been developed for other Idaho National Engineering and Environmental Laboratory (INEEL) Waste Area Groups (WAGs). Examples of this type of deviation include the use of contaminant screening steps that were not included in the RI/FS Work Plan, and elimination of exposure scenarios that have been shown to be of limited usefulness in other BRAs.

Table 5-1. FSP sampling depth discrepancies.

Sample ID	Sample Depth Interval as Specified in FSP (ft)	Actual Depth
1TB60101	4.0 to 6.0	4.0 to 6.5
1TB60102	4.0 to 6.0	4.0 to 6.5
1TB61201	26.0 to 28.0	26.5 to 28.5
1TB61801	4.0 to 6.0	4.0 to 6.5
1TB62801	24.0 to 26.0	31.5 to 34.0
1TB63501	4.0 to 6.0	4.0 to 6.5
1TB64301	20.0 to 22.0	21.5 to 24.0
1TB64601	26.0 to 28.0	26.5 to 27.0

The risk assessment deviations from the RI/FS Work Plan are listed below and described further in the following paragraphs:

- The site screening analysis was reevaluated and five release sites (see Section 6.2) [TSF-08, TSF-27, TSF-38, Loss-of-Fluid Test Facility (LOFT)-12, and WRRTF-04] were added to the retained site list
- Additional sampling results were included in the analysis of nine sites: LOFT-12, TSF-06, TSF-07, TSF-08, TSF-09/18, TSF-10, TSF-21, TSF-26, and TSF-37
- Only the residual contamination that will be left in the TSF-05 groundwater plume after the OU 1-07B groundwater remediation is complete was included in the groundwater pathway analysis.
- The 30-, and 1000-year residential exposure scenarios were not evaluated in the BRA.
- Soil concentrations at the 0 to 0.1 m (0 to 0.5 ft), 0 to 1.2 m (0 to 4 ft), and 0 to 3 m (0 to 10 ft) intervals were calculated by volume weighting the sampling results at each retained site.
- A risk-based concentration screen was added to the contaminant screening process, and the frequency of detection screening step was removed from the process.
- The 95%/95% upper tolerance level (UTL) concentrations for grab samples listed in *INEL Background Guidance Document* (Rood, Harris, and White 1995) were used for the background comparisons in the contaminant screening process.

- The TSF-06 soil contamination site was divided into 10 individual release locations. Each of these locations was evaluated separately in the BRA.

- The pre-1958 pond at TSF-29 was added to site TSF-06: Area 10. Only the post-1958 pond was evaluated as site TSF-29.

The five sites that were added to the retained site list were eliminated in the RI/FS Work Plan because their sources of contamination were considered to be insignificant. This decision was reevaluated in the BRA, and the sites were returned to the retained site list to ensure completeness of the BRA. The BRA contaminant screening process determined that two of the five sites (TSF-08 and LOFT-12) have contaminants at levels capable of affecting human health (see Section 6.2). These two sites are quantitatively evaluated in the BRA for both human health (see Section 6) and ecological risks (see Section 7). The other three sites (TSF-38, WRRTF-04, and TSF-27) have only low levels of contamination that can be screened out by the human health contaminant screening process. As a result, these sites are evaluated only for ecological risks.

Some sampling results that were not evaluated in the RI/FS Work Plan are included in the BRA source-term development. These sampling results were either collected after the RI/FS Work Plan was completed, or collected as part of site investigations that were not included in the Environmental Restoration Information System (ERIS) database. The sample results were evaluated to ensure that they have a sufficient level of quality to be used in the risk assessment, and then added to the BRA database.

OU 1-10 BRA groundwater pathway analysis calculates risks from the predicted residual contaminant concentrations that will be left in the aquifer after the OU 1-07B groundwater remediation is complete. In the RI/FS Work Plan, groundwater risks were calculated based on all contamination in the TSF-05 plume, and no credit was taken for the OU 1-07B remedial action. This change in the groundwater pathway analysis is necessary to make the OU 1-10 BRA consistent with the OU 1-07B Record of Decision (ROD).

The 30-year and 1,000-year residential exposure scenario evaluations were not performed in the BRA. These scenarios were omitted because they would add little information to the BRA that can be used for risk management decisions. For example, the 30-year residential scenario was omitted because the INEEL is predicted to remain under the U.S. Department of Energy (DOE) control for the next 100 years (DOE-ID 1995), and the 1,000-year residential scenario was omitted because risk management decisions are generally based on protecting residents who may move to the site when DOE institutional controls are no longer in place.

The average soil concentrations evaluated in the BRA were calculated by volume weighting sampling results in 0.3-m (1-ft) increments. Volume weighting was used in the BRA because such weighting tends to produce a realistic estimate of average contaminant concentrations with depth. The concentrations evaluated in the RI/FS Work Plan were developed by taking the maximum concentration or the 95% UCL concentration on the mean, whichever was less, for all samples collected in each of four depth ranges, 0 to 0.1 m (0 to 0.5 ft), 0 to 1.2 m (0 to 4 ft), 0 to 3 m (0 to 10 ft), and greater than 3 m (10 ft); (see Section 6.3). This calculation method can give unrealistic average concentration results because a concentration detected in a relatively small volume of soil can dominate the averaging calculation. In the BRA, the concentrations were developed by determining the maximum or 95% UCL concentration in each 0.3-m (1-ft) depth increment beneath a retained site, and averaging these incremental concentrations to derive concentrations in the four depth ranges.

A risk-based concentration screen was added to the contaminant screening process, and the frequency of detection screen was removed from the process. These changes make the OU 1-10 contaminant screening process consistent with the OU 3-13 BRA screening process, and help the OU 1-10 BRA to more closely focus on contaminants that are likely to cause adverse human health and ecological impacts. The risk-based concentration screen was added to eliminate contaminants that have been detected at concentrations that are too low to cause human health risks. A discussion of how this screening step is applied is included in Section 5.2. The frequency of detection screen was removed because most WAG 1 sites do not have more than 20 sample results for a given contaminant, and at least 20 samples are required for a contaminant to have a frequency of detection of less than 5%.

The BRA contaminant screening process was also revised to base the background screening step on comparison against the 95%/95% UTL of grab sample results presented in *INEL Background Guidance Document* (Rood, Harris, and White 1995). The background screening included in the RI/FS Work Plan was based on comparison against the 95%/95% UTL of composite sample results, because these values are more conservative than the grab sample results. The INEEL Background Guidance Document recommends the use of the grab sample results; therefore, the contaminant screening process was revised to be consistent with the guidance document.

TSF-06 was divided into 10 individual release sites because the contaminant release mechanisms, depths of contamination, and types of contaminants are not consistent throughout the TSF-06 soil area. For example, TSF-06 includes contaminated soil sites, disposal pond sites, buried material sites, and contaminated material storage sites. The risks from these sites are better evaluated individually rather than as a whole because each site has unique characteristics that affect the risk assessment. Section 4.1.5 provides more information about the release sites contained within TSF-06.

The TSF-29 acid disposal pond site actually consists of two disposal ponds: a pre-1958 pond and a post 1958 pond. Most of the pre-1958 pond sits under the reactor vessel storage site, which has been designated as TSF-06: Area 10. Therefore, in the BRA, the contamination contained in the pre-1958 pond was evaluated with the contamination detected at TSF-06: Area 10. As a result, the TSF-29 site evaluated in the OU 1-10 BRA is smaller than the TSF-29 site evaluated in the RI/FS Work Plan. Section 4.1.4 provides more information about the TSF-29 site.

5.3 References

Lewis et al., 1996, *Work Plan for Waste Area Group Operable Unit 1-10 Comprehensive Remedial Investigation/Feasibility Study,* DOE/ID-10527, March.

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