Y/ER/MS-7

Proposed Modifications to the RCRA Post-Closure Permit for the Chestnut Ridge Hydrogeologic Regime at the U.S. Department of Energy Y-12 Plant, Oak Ridge, Tennessee

Permit Number TNHW-088
EPA ID No. TN3 89 009 0001

May 1997

Prepared by

GRAM, INC.
and
AJA TECHNICAL SERVICES, INC.
Under Subcontract 18Y-JVC11C

for the

Y-12 Surveillance and Maintenance Program,
Environmental Restoration Program,
and the
Water Compliance Department
Environmental Compliance Organization
Oak Ridge Y-12 Plant
Oak Ridge, Tennessee 37831

Managed by

LOCKHEED MARTIN ENERGY SYSTEMS, INC.
for the U.S. Department of Energy
Under Contract No. DE-AC05-84OR21400

DISCLAIMER

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LIST OF ACRONYMS AND ABBREVIATIONS

ARAR	Appropriate, relevant, and applicable requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	Contract Laboratory Program
CRHR	Chestnut Ridge Hydrogeologic Regime
CRSDB	Chestnut Ridge Sediment Disposal Basin
CRSPs	Chestnut Ridge Security Pits
DOE	Department of Energy
FS	Feasibility Study
GWPP	Groundwater Protection Program
KHQ	Kerr Hollow Quarry
LMES	Lockheed Martin Energy Systems, Inc.
MCL	Maximum Contaminant Level
MDA	minimum detectable activity
mg/L	milligrams per liter
ORR	Oak Ridge Reservation
PCE	tetrachloroethene
PCP	Post-Closure Permit
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
TDEC	Tennessee Department of Environment and Conservation
TDS	total dissolved solids
UEFPC	Upper East Fork Poplar Creek
UTL	upper tolerance limit
1,1,1-TCA	1,1,1-trichloroethane

CERTIFICATION
Ref: 1200-1-11-.07(2)(a)10

I certify under penalty of law that this document and all attachments were prepared under my direction and supervision in accordance with a system designed to ensure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, and those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

[signature]	5/7/97
Department of Energy Owner and Operator	Date Signed
[signature]	5/7/97
Lockheed Martin Energy Sytems, Inc. Co-Operator	Date Signed

The Department of Energy (DOE) and its operating contractor, Lockheed Martin Energy Systems, Inc., (LMES) have jointly signed this permit modification request as the operator of the permitted facility. The Department has determined that dual signatures best reflect the actual apportionment of responsibility under which the Department's Resource Conservation and Recovery Act (RCRA) responsibilities are for policy, programmatic, funding and scheduling decisions, as well as general oversight; and the contractor's RCRA responsibilities are for the day-to-day operations, including but not limited to the following responsibilities: waste analysis and handling, monitoring, recordkeeping, reporting, and contingency planning. For purposes of the certification required by Tennessee Rule 1200-1-11-.07(2)(a)10, the Department's and LMES' representatives certify, to the best of their knowledge and belief, the truth, accuracy, and completeness of the permit modification request for their respective areas of responsibility.

This statement is attached hereto for the purpose of clarifying the roles and responsibilities of DOE and LMES with respect to the permitted facility and it shall not be construed as altering or limiting the certification.

1.0 INTRODUCTION

This report presents proposed modifications to several conditions of the Resource Conservation and Recovery Act (RCRA) Post-Closure Permit (PCP) for the Chestnut Ridge Hydrogeologic Regime (CRHR) (permit number TNHW-088, EPA ID No. TN3 89 009 0001). These permit conditions define the requirements for RCRA post-closure detection groundwater monitoring at the Chestnut Ridge Sediment Disposal Basin (CRSDB) and Kerr Hollow Quarry (KHQ), and RCRA post-closure corrective action groundwater monitoring at the Chestnut Ridge Security Pits (CRSPs). Modification of these PCP conditions is requested to: (1) clarify the planned integration of RCRA post-closure corrective action groundwater monitoring at the CRSPs with the monitoring program to be established in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) record of decision (ROD), (2) revise several of the current technical requirements for groundwater monitoring based on implementation of the RCRA monitoring programs during 1996, (3) replace several of the technical procedures included in the PCP with updated versions recently issued by the Y-12 Plant Groundwater Protection Program (GWPP), and (4) correct inaccurate regulatory citations and references to permit conditions and permit attachments. With these modifications, the Y-12 Plant will continue to meet the full intent of all regulatory obligations for post-closure care of these facilities.

Section 2.0 provides the technical justification for each proposed permit modification. Section 3.0 contains proposed changes to Section II of the PCP. Modifications to site-specific permit conditions are presented in Section 4.0 (CRSDB), Section 5.0 (CRSPs), and Section 6.0 (KHQ). Sections 7.0 and 8.0 reference updated and revised procedures for groundwater sampling, and monitoring well plugging and abandonment, respectively. Appendix A includes all proposed revisions to the permit attachments.

2.0 TECHNICAL JUSTIFICATION

This section provides descriptions of technical justifications for the proposed modifications to the PCP for the CRHR. As shown in the following summary, the proposed changes include Class 1 and Class 2 permit modifications, as specified in Appendix I to 40 CFR § 270.42 - Classification of Permit Modifications.

Proposed Modification	Classification of Permit Modification	
	Class 1	Class 2
Clarify Detection Monitoring Sampling Requirements	●	
Modify the Groundwater Target Compound List for KHQ		●
Clarify Annual Reporting Requirements for Groundwater Monitoring Data	●	●
Revise Statistical Procedure for the KHQ Detection Monitoring Program	● (1)	
Clarify the RCRA/CERCLA Integration Strategy for the CRSP	●	
Revise Data Evaluation Procedure for the CRSP Corrective Action Monitoring Program	● (1)	
Update Technical Field Procedures	● (1)	
Editorial/Clarification Modifications	●	

(1) Class 1 modifications requiring prior approval of the commissioner.

Table 1 lists all the proposed modifications to site-specific conditions of the PCP. The following sections describe the technical justification for the proposed modifications.

2.1 Clarify Detection Monitoring Sampling Requirements

Applicable site-specific permit conditions should be revised to clearly specify collection of four replicate groundwater samples during semiannual sampling for RCRA post-closure detection monitoring at the CRSDB and KHQ. This is a Class 1 permit modification.

Collection of four replicate groundwater samples during each semiannual sampling event is required under RCRA detection monitoring by 40 CFR § 264.98(d). This sampling requirement is not explicitly stated in the permit, but parenthetical references to four consecutive daily replicate samples are included in descriptions of the statistical analysis procedures presented in Permit Attachment 2, Section H (CRSDB) and Permit Attachment 4, Section H (KHQ). However, daily replicate sampling is not appropriate for CRSDB background well GW-159 and KHQ background well GW-142 because the static water levels in these wells do not fully recover between daily sampling events and the wells often yield non-representative, highly turbid groundwater samples when water levels are low.

Table 1.
Summary of Proposed Modifications to the Post-Closure Permit for the Chestnut Ridge Hydrogeologic Regime

PROPOSED PERMIT MODIFICATION		CLASSIFICATION OF MODIFICATION					
		40 CFR § 270.42 Appendix I Citation				Class 1	Class 2
		Permit Condition					
Type	Description	CRSDB	CRSP	KHQ			
Editorial	Revise reference to the Groundwater Sampling Procedure.	II.A	II.A	II.A	A.1	●	
Editorial	Reference annual reporting of groundwater monitoring data and applicable statistical analysis results.	II.C.6(c)	II.C.6(c)	II.C.6(c)	A.1	●	
Technical	Specify replicate sampling protocol for RCRA detection monitoring at the CRSDB and KHQ.	IV.D.6 (New)	---	VI.D.6 (New)	A.1	●	
Editorial	Revise reference to point of compliance wells and Groundwater Target Compound List.	IV.F.2	---	---	A.1	●	
Editorial	Clarify time frame for completion of statistical evaluation.	IV.F.3	---	VI.F.3	A.1	●	
Editorial	Clarify statistical evaluation performance and reporting requirements	IV.G.5	---	VI.G.5	A.1	●	
Technical	Remove the September 1 reporting requirement.	---	---	VI.H.1	A.4.b		●
Editorial	Consolidate and clarify annual reporting requirements.	IV.H.3 (New)	V.H.5 (New)	VI.H.3 (New)	A.1	●	
Editorial	Revise reference to the components of the RCRA post-closure corrective action monitoring well network for the CRSPs.	---	V.A	---	A.1	●	
Editorial	Clarify criteria for selection of the point of compliance well(s) for semi-annual sampling.	---	V.C.2	---	A.1	●	
Technical	Clarify planned integration of RCRA post-closure corrective action monitoring and CERCLA ROD-driven groundwater monitoring.	---	V.D.2	---	A.1	●	
Editorial/ Technical	Clarify the purpose for and objective of groundwater monitoring data evaluation for point of compliance wells.	---	V.D.3	---	A.1	●	
Editorial	Renumber Permit Condition V.D.4 to V.D.5.	---	V.D.4	---	A.1	●	
Editorial	Clarify the purpose for and objective of the groundwater monitoring data evaluation for the plume delineation wells.	---	V.D.4 (New)	---	A.1	●	

Table 1 (cont'd)

PROPOSED PERMIT MODIFICATION		CLASSIFICATION OF MODIFICATION					
		Permit Condition			40 CFR § 270.42 Appendix I Citation	Class 1	Class 2
Type	Description	CRSDB	CRSP	KHQ			
Editorial	Clarify reporting requirement.	---	V.G.3	---	A.1	●	
Technical	Define the trend analysis approach for evaluation of groundwater monitoring data for the plume delineation wells.	---	V.G.4	---	C.3	●(1)	
Editorial	Clarify action required if plume delineation wells no longer monitor downgradient plume boundary.	---	V.G.5	---	A.1	●(1)	
Technical	Define the trend analysis approach for evaluation of groundwater monitoring data for the point of compliance wells.	---	V.G.6 (New)	---	C.3	●(1)	
Editorial	Clarify the performance of specified laboratory analyses.	---	V.H.4	---	A.1	●	
Technical	Replace the well inspection and well depth measurement procedures with more recent versions issued by the Y-12 Plant GWPP.	Attach. 2 Section C	Attach. 3 Section C	Attach. 4 Section C	C.2	●(1)	
Editorial/ Technical	Remove reference to daily replicate sampling.	Attach. 2 Section H	---	Attach. 4 Section H	A.1	●	
Editorial/ Technical	Insert an option for statistical outlier testing of gross alpha and gross beta results prior to trending. Delete reference to boron and strontium.	---	---	Attach. 4 Section H	C.3	●(1)	
Technical	Delete boron and strontium from Groundwater Target Compound List.	---	---	Attach. 4 Section E	C.5.b		●
Technical	Rename title of Attachment 6 and replace the groundwater sampling procedure.	Attach. 6	Attach. 6	Attach. 6	A.1 C.2	● ●(1)	
Technical	Replace the well plugging and abandonment procedure.	Attach. 7	Attach. 7	Attach. 7	C.2	●(1)	

Note:

CRSDB - Chestnut Ridge Sediment Disposal Basin
CRSP - Chestnut Ridge Security Pits
KHQ - Kerr Hollow Quarry
--- - Not Applicable
1 - Requires prior Commissioner approval.

New permit conditions should be included under Permit Sections IV.D (CRSDB) and VI.D (KHQ) to specify collection of a sequence of four replicate samples, but not define the sampling frequency between replicates. This approach is consistent with general groundwater monitoring requirements specified under 40 CFR § 264.97(g), which specify collection of a sequence of four replicate samples but define the sampling interval as one that assures collection of independent replicate samples. Also, the parenthetical references to four consecutive daily replicate samples should be deleted from the statistical procedure descriptions in Permit Attachment 2, Section H (CRSDB) and Permit Attachment 4, Section H (KHQ).

2.2 Modify the Groundwater Target Compound List for Kerr Hollow Quarry

The Groundwater Target Compound List for KHQ (Attachment 4, Section E) includes the following constituents:

Constituent		
~~Boron~~	Nickel	Carbon Tetrachloride
Cadmium	~~Strontium~~	Tetrachloroethene
Chromium	Uranium	Chloroform
Lead	Gross alpha	
Mercury	Gross beta	

Boron and strontium should be removed from the list of constituents specified in the Groundwater Target Compound List for KHQ. Changes to the constituent list for the detection monitoring program are a Class 2 permit modification.

Boron and strontium are not RCRA-regulated constituents. Moreover, post-closure statistical data for monitoring wells at the site show that although the concentrations of both metals are higher than typical of groundwater elsewhere in the CRHR, the following characteristics of the data for these metals suggest that the elevated concentrations are not a result of past disposal of wastes in the quarry:

- Similar total (and dissolved) boron and strontium concentrations occur in the groundwater upgradient and downgradient of the site.

- The highest concentrations of boron and strontium do not occur in the active flow zone. Concentrations of both metals are highest in samples of mineralized (total dissolved solids [TDS]>300 milligrams per liter [mg/L]) groundwater from wells completed in low-yield (matrix) intervals within the upper Knox Group. For instance, strontium concentrations in sulfate-enriched groundwater samples collected from well GW-146, which purges dry and recovers very slowly, are two orders-of-magnitude higher than in the less mineralized (TDS < 150 mg/L) groundwater samples from well GW-144, which intercepts a productive water-bearing fracture.

- Total isotopic strontium (^{89}Sr and ^{90}Sr) concentrations reported from the groundwater samples collected from all the monitoring wells at the site have not exceeded the minimum detectable activity (MDA) or were otherwise characterized by large proportional counting errors (i.e., high analytical uncertainty). Therefore, the strontium detected in groundwater does not include measurable concentrations of the ^{89}Sr and ^{90}Sr radioisotopes.

The boron and strontium concentrations characteristic of the groundwater samples from low-yield wells at KHQ probably reflect hydrochemical processes related to the types of secondary minerals within the upper Knox Group. Long term dissolution of celestite ($SrSO_4$), for example, may explain the high strontium (and sulfate) concentrations. Whatever the natural geochemical cause, boron and strontium concentrations in the groundwater at the site do not reflect contamination and should therefore be removed from the Groundwater Target Compound List.

2.3 Clarify the Annual Reporting Requirements for Groundwater Monitoring Data

Permit Condition II.C.6 requires preparation and submittal of an annual report to the Commissioner by March 1 of each year, but does not address the monitoring data obtained at each site addressed in the PCP. Reporting requirements specified in Permit Condition II.C.6(c) currently address only the groundwater monitoring data and statistical analysis results for the CRSDB. This permit condition should be modified to also reference groundwater monitoring data for the CRSPs, and the groundwater data and statistical analysis results for KHQ. This is a Class 1 permit modification.

The September 1 semiannual reporting requirement specified in Permit Condition VI.H.1 for KHQ detection monitoring data should be deleted. A corresponding requirement for the CRSDB detection monitoring data is not specified under Permit Condition IV.H.1. The annual reporting requirements of Permit Condition II.C.6 and the Permit Condition VI.H.2 requirement for written notification to the Commissioner within 7 days of statistically significant increases above background levels for the specified indicator parameters provide for timely reporting of all groundwater and statistical analysis data for the site. Therefore, the September 1 semiannual report for KHQ appears redundant and should be deleted from Permit Condition VI.H.1. This is a Class 2 permit modification.

2.4 Revise Statistical Procedure for the Kerr Hollow Quarry Detection Monitoring Program

The statistical analysis procedure in Permit Attachment 4, Section H currently specifies trend analysis of time-series data for boron, strontium, gross alpha and gross beta results obtained for the purposes of RCRA post-closure detection monitoring at KHQ. Trend analysis of the data for boron and strontium should be removed from the description, per the request to remove these constituents from the Groundwater Target List for the site as described in Section 2.2.

Additionally, the procedural description should be revised to include the option for statistical outlier testing of results for gross alpha and gross beta before trending the data for these parameters. This is a Class 1 permit modification requiring prior consent of the Commissioner.

Gross alpha and gross beta results represent summary statistics rather than direct measurements, and previous monitoring results for groundwater wells at KHQ (and elsewhere in the CRHR) show substantial variation. Statistical outlier testing is therefore appropriate to exclude from the trend analysis the gross alpha and gross beta results that differ significantly (too high or too low) from historical data for each applicable monitoring well. If a measurement that is significantly different is used for trending, a false trend (increasing or decreasing) will result.

2.5 Clarify the RCRA/CERCLA Integration Strategy for the Chestnut Ridge Security Pits

The CRSPs are regulated under RCRA and CERCLA. In April 1993, DOE, Lockheed Martin Energy Systems, Inc. (LMES), and the Tennessee Department of Environment and Conservation (TDEC) signed an Agreed Order, which formally established CERCLA as the lead regulatory program with regard to remedial action on the Oak Ridge Reservation (ORR), with RCRA as an applicable or relevant, and appropriate requirement (ARAR). Under this agreement, RCRA will be applied as an ARAR to the extent that post-closure maintenance and care of the CRSPs will be conducted in compliance with the terms of the PCP, but RCRA-driven groundwater cleanup is deferred to the CERCLA Remedial Investigation (RI)/Feasibility Study (FS) process.

Following completion of the RI/FS process for the CRSPs, a final ROD will establish remediation objectives and cleanup goals, and present a plan for remedial actions and the criteria for implementing those actions. Implementation of remedial actions specified in the ROD will be an iterative process, with the effectiveness of previous actions determining the selection, timing or modification of future actions needed to achieve the specified remedial objectives. Additionally, the final ROD will establish a groundwater, surface water, and ecological monitoring program intended to gauge remedial action effectiveness. Results of this ROD-driven monitoring program will be evaluated annually in a Remediation Effectiveness Report, which will also serve as a mechanism to modify the groundwater, surface water, and ecological components of the program as needed. Once the ROD-driven monitoring program has been implemented, a permit modification request to integrate the ROD-driven groundwater monitoring and reporting requirements with those specified in the PCP may be submitted if the groundwater component of the ROD-driven monitoring program satisfies the RCRA post-closure corrective action monitoring objectives. Permit Condition V.D.2 should be revised to more fully describe this RCRA/CERCLA integration approach. This is a Class 1 permit modification.

2.6 Revise Data Evaluation Procedure for the Chestnut Ridge Security Pits Corrective Action Monitoring Program

Applicable permit conditions for the CRSPs should be revised to clarify the technical approach for evaluating corrective action groundwater monitoring data. Permit Conditions V.C.1 and V.C.2 require semiannual sampling of at least one point-of-compliance well and all the plume delineation wells. Permit Conditions V.D.3 and V.H.2 identify a trend analysis approach for evaluating the decreasing contaminant concentrations evident in the designated point of compliance well. Conversely, Permit Condition V.D.2 specifies a background comparison approach for evaluating the semiannual monitoring data for the plume delineation wells. A trend analysis approach should be used for evaluating data for both the point of compliance wells and plume delineation wells. This approach should also include the option for statistical outlier testing of results for inorganics to exclude from the trend analysis results that differ significantly (too high or too low) from historical data for the applicable monitoring well. If a measurement that is significantly different is used for trending, a false trend (increasing or decreasing) will result.

Permit Condition V.D.2 for the CRSPs infers a simple background-comparison approach (based on data for well GW-521) for evaluating the semiannual monitoring data for the plume delineation wells GW-301, GW-557, GW-798, GW-799, GW-801, and GW-831. This type of background comparison approach is more appropriate to detection monitoring data evaluation than corrective action monitoring data evaluation, and is not consistent with the trend analysis approach specified in Permit Condition V.D.3 for evaluation of monitoring data for the point of compliance wells at the site. Permit Condition V.G.4 should be revised to specify trend-analysis of results for tetrachloroethene and 1,1,1-trichloroethane as the data evaluation approach for the plume boundary monitoring wells. Both of these constituents are: (1) Groundwater Target List Compounds specified in Permit Attachment 3, Section E, (2) primary components of the plume of dissolved volatile organic compounds in the groundwater at the site, (3) mobile in groundwater, and (4) reliable indicators of contaminant migration from the CRSPs. These are Class 1 permit modifications requiring prior consent of the Commissioner.

2.7 Update Technical Field Procedures

The following technical field procedures should be replaced with the most recent versions issued by the Y-12 Plant GWPP. These are a Class 1 permit modifications requiring prior consent of the Commissioner.

- The well inspection procedure (Appendix A-1) and the well depth measurement procedure (Appendix A-2) included in Permit Attachment 2, Section C (CRSDB); Permit Attachment 3, Section C (CRSPs); and Permit Attachment 4, Section C (KHQ).

- The groundwater sampling procedure included in Permit Attachment 6 (Appendix A-6). Also, the title for Attachment 6 should be changed from "Sampling and Analysis Plan" to "Groundwater Sampling Procedure." Technical updates and modifications in the revised version include a procedural description of low-flow sampling. The specified-low flow sampling procedure will apply to most of the monitoring wells sampled for the multiple programmatic purposes of the Y-12 Plant GWPP.

- The well plugging and abandonment procedure included in Permit Attachment 7 (Appendix A-7).

Revised versions of these technical procedures will not be implemented until this permit modification request is approved.

2.8 Editorial/Clarification Modifications

Based on review of the permit, additional modifications are proposed to clarify the intent of the permit conditions. All editorial changes are Class 1 permit modifications.

3.0 PERMIT SECTION II: GENERAL FACILITY CONDITIONS

This section contains the current and revised text for the proposed modifications of two General Facility Conditions specified in Section II of the PCP. These editorial corrections are Class 1 permit modifications (Table 1).

3.1 Permit Condition II.A — Sampling, Analysis, and Monitoring

Current: Procedures for sampling contaminated media must be those identified in the most recent edition of EPA Region IV Environmental Compliance Branch's Standard Operating Procedures and Quality Assurance Manual (SOP) or the methods specified in the attached Sampling and Analysis Plan, Attachment 6. Laboratory methods must be those specified in the most recent edition of Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846, CERCLA Contract Laboratory Program (CLP) Methods, or the methods found in conditions and/or attachments specified in this permit.

Revised: Procedures for sampling contaminated media must be those identified in the most recent edition of EPA Region IV Environmental Compliance Branch's Standard Operating Procedures and Quality Assurance Manual (SOP) or the methods specified in the most recent version of the attached Groundwater Sampling Procedure, Attachment 6. Laboratory methods must be those specified in the most recent edition of Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846, CERCLA Contract Laboratory Program (CLP) Methods, or the methods found in conditions and/or attachments specified in this permit.

3.2 Permit Condition II.C — Recordkeeping and Reporting

II.C.6.(c) Current: The groundwater monitoring results, inclusive of the analytical results and statistical analyses, as specified in Permit Section IV, Groundwater Monitoring and Corrective Action; and

Revised: The groundwater monitoring results, inclusive of the analytical results and applicable statistical analyses, as specified in Permit Section IV, Groundwater Detection Monitoring — Chestnut Ridge Sediment Disposal Basin; Permit Section V, Groundwater Monitoring — Chestnut Ridge Security Pits; and Permit Section VI, Groundwater Detection Monitoring — Kerr Hollow Quarry; and

4.0 PERMIT SECTION IV: GROUNDWATER DETECTION MONITORING — CHESTNUT RIDGE SEDIMENT DISPOSAL BASIN

This section contains revised text for the proposed modifications to the Groundwater Detection Monitoring requirements specified for the CRSDB in Permit Conditions IV.D, IV.F, IV.G, and IV.H, including references to updated versions of the procedures in Permit Attachment 2, Section C, and revised text for Permit Attachment 2, Section H. These changes include Class 1 and Class 2 permit modifications (see Table 1, page 2-2).

4.1 Permit Condition IV. D — Sampling and Analysis Procedures

IV.D.6 New: For each semi-annual sampling event, a sequence of at least four replicate samples shall be collected from each upgradient well and point of compliance well listed in Attachment 2, Section D. The replicate groundwater samples will be taken from each well at an interval that assures, to the greatest extent technically feasible, that an independent sample is obtained, as required by 40 CFR 264.97(g)(1), incorporated by reference in Rule 1200-1-11-.06(6)(a)1.

4.2 Permit Condition IV.F — Statistical Procedures and Evaluations

IV.F.2 Current: The Permittee shall compare the groundwater quality at each monitoring well in Attachment 2 at the point of compliance for each parameter or constituent specified in Attachment 2 to the background value for the parameter or constituent according to the statistical procedures specified in Permit Condition IV.F.4.

Revised: The Permittee shall compare the groundwater quality at each monitoring well in Attachment 2, Section D at the point of compliance for each parameter or constituent specified in Attachment 2, Section E to the background value for the parameter or constituent according to the statistical procedures specified in Permit Condition IV.F.4.

IV.F.3 Current: The Permittee must determine whether there has been a statistically significant increase at each monitoring well listed in Attachment 2 at the compliance point within 90 days after completion of semi-annual sampling.

Revised: The Permittee must determine whether there has been a statistically significant increase at each monitoring well listed in Attachment 2, Section D at the point of compliance within 90 days after completion of each semi-annual sampling event.

4.3 Permit Condition IV.G — Monitoring Program and Data Evaluation

IV.G.5 Current: The Permittee shall perform the evaluations described in Permit Condition IV.G.4 within 90 days after completion of the semi-annual sampling.

Revised: The Permittee shall perform the statistical evaluation required in permit condition IV.G.4 within 90 days after completion of each semi-annual sampling event. Results of the evaluations will be included in the annual narrative report required in Permit Condition IV.H.3.

4.4 Permit Condition IV.H — Reporting and Recordkeeping

IV.H.3 New: The Permittee shall prepare an annual narrative report as required in Permit Condition II.C.6. This report shall evaluate the groundwater flow rate and direction as required in Permit Condition IV.G.3, and present the statistical evaluation as specified in Permit Condition IV.G.4. The narrative report will accompany the sampling information and analytical data required in Permit Condition IV.H.1.

4.5 Permit Attachment 2, Section C — Inspections

The most recent versions of the Y-12 Plant GWPP technical field procedures for well inspections and well depth measurements are included in Appendices A-1 and A-2, respectively.

4.6 Permit Attachment 2, Section H — Statistical Procedures

A revised version of the statistical procedure is provided in Appendix A-3. The first sentence in Step 1 of the procedure description has been revised as shown below.

1. Current: For each semiannual sampling event, analysis of variance (ANOVA), or the nonparametric equivalent, will compare the mean (or median) target list constituents concentrations (derived from four consecutive daily replicate samples) to the corresponding mean (or median) concentrations in the upgradient well (GW-159).

   Revised: For each semiannual sampling event, analysis of variance (ANOVA), or the nonparametric equivalent, will compare the mean (or median) target list constituent concentrations derived from the four replicate samples from each point of compliance well (GW-156, GW-731, and GW-732) to the corresponding mean (or median) concentrations derived from the four replicate samples from the upgradient well (GW-159).

5.0 PERMIT SECTION V: GROUNDWATER MONITORING — CHESTNUT RIDGE SECURITY PITS

This section contains the current and revised text for the proposed modifications to Permit Conditions V.A, V.C, V.D, V.G, and V.H for the CRSPs, and a reference to the revised procedures included in Permit Attachment 3, Section C. These changes include Class 1 and Class 2 permit modifications (see Table 1, page 2-2).

5.1 Permit Condition V.A — Unit Identification

V.A <u>Current</u>: The groundwater monitoring well network consists of thirteen monitoring wells. Six are downgradient point of compliance wells, six are downgradient plume delineation (non-detect) wells and one well serves as background. Information detailing well location and construction is provided in Attachment 3, Section D. The monitoring constituents are outlined in Attachment 3, Section E.

<u>Revised</u>: The groundwater monitoring well network consists of thirteen wells. Six are downgradient point of compliance wells: GW-175, GW-177, GW-514, GW-608, GW-609, and GW-796; six are downgradient plume delineation (non-detect) wells: GW-301, GW-831, GW-557, GW-798, GW-799, and GW-801; and well GW-521 is a background well. Details regarding the depth and construction of each well are provided in Attachment 3, Section D. The monitoring parameters and constituents are specified in Attachment 3, Section E. Locations of the wells are shown on the Site Map presented in Attachment 3, Section F.

5.2 Permit Condition V.C — Groundwater Protection Standards

V.C.2. <u>Current</u>: The Permittee shall monitor the groundwater from at least one of the point of compliance wells, GW-175, GW-177, GW-514, GW-608, GW-609, and GW-796 semi-annually for all parameters and constituents specified in Attachment 3, Section E. During the work required under CERCLA, comprehensive sampling of surface water and groundwater will be integrated with the attributes of the geologic and hydrogeologic environment to evaluate the effectiveness of the closure activities and evaluate additional actions required to ensure the resources of the Reservation are acceptable for their intended uses.

<u>Revised</u>: The Permittee shall monitor the groundwater from at least one of the point of compliance wells, GW-175, GW-177, GW-514, GW-608, GW-609, and GW-796 semi-annually for all parameters and constituents specified in Attachment 3, Section E. Selection of the point of compliance well(s) for semi-annual monitoring will be based on the data needed for the evaluation

required in Permit Condition V.D.5 and integration with CERCLA requirements.

5.3 Permit Condition V.D — Corrective Action Program

V.D.2 Current: The corrective action monitoring well network includes wells located downgradient of the CRSPs that do not exhibit contamination. If contamination above background values is detected in these wells, the priority of the CRSPs HWDU under CERCLA will be reevaluated, as well as the need for the installation of additional monitoring wells to characterize changes in groundwater conditions. A CERCLA remedial investigation/ feasibility study will aid in the selection of remedial action alternatives derived from the risk-based cleanup strategies available under CERCLA. Subsequently, a groundwater monitoring program would be developed as part of the remedial action program to assess the effectiveness of the selected remedial alternative.

Revised: The CRSPs are regulated under RCRA and CERCLA. In April 1993, the U.S. Department of Energy, Lockheed Martin Energy Systems, Inc., and the Tennessee Department of Environment and Conservation signed an Agreed Order, which formally established CERCLA as the lead regulatory program. Under this agreement, RCRA will be applied as an applicable or relevant, and appropriate requirement (ARAR) to the extent that post-closure maintenance and care of the CRSPs will be conducted in compliance with the terms of the PCP, but RCRA-driven groundwater cleanup is deferred to the CERCLA Remedial Investigation (RI)/Feasibility Study (FS) process.

Following completion of the RI/FS process, a final record of decision (ROD) will establish remediation objectives and cleanup goals for the CRSPs derived from the risk-based cleanup strategies, and present a plan for remedial actions and the criteria for implementing those actions. The ROD also will establish a groundwater, surface water, and ecological monitoring program intended to gauge the effectiveness of remedial action at the site. If the groundwater component of this monitoring program satisfies the RCRA post-closure corrective action monitoring objectives at the CRSPs, the Permittee may submit a permit modification request to integrate the ROD-driven groundwater monitoring and reporting requirements with those of RCRA specified for the site.

If, before the RI/FS process is completed and prior to the final ROD, results of the data evaluation required under Permit Conditions V.G.4 and V.G.6 indicate additional migration of the groundwater contaminant plume at the site, the priority of the CRSPs HWDU under CERCLA will be re-evaluated, including the need for the installation of additional monitoring wells to characterize changes in groundwater conditions. Additionally, the Permittee must re-evaluate the corrective action groundwater monitoring program under this permit, and assess the need for additional actions under CERCLA to ensure that the resources of the regime are acceptable for the intended uses.

V.D.3 Current: At least one well from the list of point of compliance wells will be sampled during each sampling event. Because a trend of decreasing contaminant concentrations has been observed in the point of compliance wells since the closure of the site, the wells(s) selected for sampling will be based on the data needs to evaluate continued decreasing contaminant concentrations at the site. If there is a reverse in the decreasing contaminant concentrations trend, the CRSPS HWDU will be reevaluated in accordance with permit condition V.D.2.

Revised: At least one well from the list of point of compliance wells will be sampled during each sampling event. Because a trend of decreasing contaminant concentrations has been observed in the point of compliance wells since the closure of the site, the wells(s) selected for sampling will be based on the data needed to evaluate the decreasing contaminant concentrations at the site, as specified in Permit Condition V.G.6. If there is a reverse in the decreasing contaminant concentrations trend, the Permittee will re-evaluate the corrective action groundwater monitoring program under this permit as required under Permit Condition V.D.2.

V.D.4 Current: After the work called for under CERCLA has been completed, the need for any further corrective action, under this permit, shall be evaluated. Such further corrective actions shall be limited to action required based on new information or conditions not available at the time of the remedy selection under CERCLA, that render the record of decision no longer protective of human health and the environment.

Revised: Renumber Permit Condition V.D.4. as V.D.5.

V.D.4 New: The semi-annual monitoring data required under Permit Condition V.C.1 for the plume delineation wells listed in Attachment 3, Section D will be evaluated annually, as described in Permit Condition V.G.4, for evidence of contaminant plume migration from the CRSPs. If migration of contaminants from the site is indicated, the Permittee must notify the Commissioner that the plume delineation monitoring wells no longer serve to monitor the edge of the contaminant plume, and, as required under Permit Condition V.D.2, re-evaluate the corrective action groundwater monitoring program under this permit.

5.4 Permit Condition V.G — Monitoring Program and Data Evaluation

V.G.3 Current: The Permittee shall determine the groundwater flow rate and direction in the upper-most aquifer at least annually, as required by 40 CFR 264.99(e) incorporated by reference in Rule 1200-1-11-.06(6)(a). A narrative report shall accompany this information to describe how these determinations were made.

Revised: The Permittee shall determine the groundwater flow rate and direction in the upper-most aquifer at least annually, as required by 40 CFR 264.99(e) as incorporated by reference in Rule 1200-1-11-.06(6)(a). This information, along with a description of how these determinations were made, shall be included in the narrative report required in Permit Condition V.H.5.

V.G.4 Current: The Permittee must notify the Commissioner after determining that the plume delineation monitoring wells no longer serve to monitor the edge of the contaminant plume.

Revised: Semi-annual monitoring data for the plume delineation wells listed in Attachment 3, Section D will be evaluated annually for evidence of contaminant migration from the CRSPs, as required in Permit Condition V.D.4. This evaluation will be based on the semi-annual monitoring results for 1,1,1-trichloroethane (1,1,1-TCA) and tetrachloroethene (PCE). These constituents are the primary components of the contaminant plume in groundwater at the CRSPs; are representative of the most mobile constituents listed in Attachment 3, Section E; and are reliable indicators of contaminant migration from the site. Results of this evaluation will be included in the annual report required under Permit Condition V.H.5. The Permittee must notify the Commissioner after determining that the plume delineation monitoring wells no longer serve to monitor the edge of the contaminant plume.

V.G.5 Current: If monitoring of constituents pursuant to Permit Condition V.C.1. detects any constituent above background level, the Permittee shall install additional wells to determine the extent of the groundwater contaminant plume.

Revised: If the monitoring data evaluation required in Permit Condition V.D.2. indicates that the plume delineation wells specified in Permit Condition V.B. no longer monitor the downgradient boundary of the groundwater contaminant plume in the CRSPs, the Permittee will re-evaluate the corrective action groundwater monitoring program under this permit. The Permittee will assess the need for additional actions under CERCLA to ensure that the resources of the regime are acceptable for the intended uses.

V.G.6 New: Monitoring data for the point of compliance well(s) listed in Attachment 3, Section D that are selected for semi-annual sampling under Permit

Condition V.C.2 will be evaluated annually to determine if contaminant concentrations continue to decrease, as required under Permit Condition V.D.3. This evaluation will be based on trend analysis of the results for selected organics, and all inorganic constituents listed in Attachment 3, Section E detected above analytical reporting limits. Available results for these constituents will be plotted versus time after each semiannual sampling event. Statistical trend analysis will be applied to the time-series plots to identify trends of concentration versus time. Because of the characteristic variability of results for many of the inorganic constituents, statistical outlier testing may be performed prior to trending to exclude results that differ significantly (either too high or too low) from historical results. If a measurement that is significantly different is used for trending, a false trend (increasing or decreasing) will result. The trend analysis will be included in the annual report required under Permit Condition V.H.5.

5.5 Permit Condition V.H — Reporting and Recordkeeping

V.H.4 Current: The Permittee shall perform the evaluations described in Permit Condition V.G.2. within 60 days after completion of the semi-annual sampling.

Revised: The Permittee shall perform the laboratory analyses required in Permit Condition V.G.2. within 60 days after completion of each semi-annual sampling event.

V.H.5 New: The Permittee shall prepare an annual narrative report as required in Permit Condition II.C.6. This report shall evaluate the groundwater flow rate and direction as required in Permit Condition V.G.3, and evaluate the monitoring data for the plume delineation wells as specified in Permit Condition V.G.4, and the point of compliance well(s) as specified in Permit Condition V.G.6. The narrative report will accompany the sampling information and analytical data required in Permit Condition V.H.1.

5.6 Permit Attachment 3, Section C — Inspections

The most recent versions of the Y-12 Plant GWPP technical field procedures for well inspections and well depth measurements are included in Appendices A-1 and A-2, respectively.

6.0 PERMIT SECTION VI: GROUNDWATER DETECTION MONITORING — KERR HOLLOW QUARRY

This section contains the current and revised text (where applicable) for the proposed modifications to Permit Conditions VI.D, VI.F, VI.G, and VI.H; Permit Attachment 4, Section C; Permit Attachment 4, Section E; and Permit Attachment 4, Section H. These changes include Class 1 and Class 2 permit modifications (see Table 1, page 2-2).

6.1 Permit Condition VI. D — Sampling and Analysis Procedures

VI.D.6 New: For each semi-annual sampling event, a sequence of at least four replicate samples shall be collected from each upgradient well and point of compliance well listed in Attachment 4, Section D. The replicate groundwater samples will be taken from each well at an interval that assures, to the greatest extent technically feasible, that an independent sample is obtained, as required by 40 CFR 264.97(g)(1), incorporated by reference in Rule 1200-1-11-.06(6)(a)1.

6.2 Permit Condition VI.F — Statistical Procedures and Evaluations

VI.F.3. Current: The Permittee must determine whether there has been a statistically significant increase at each monitoring well listed in Attachment 4, Section D, at the compliance point within 90 days after completion of semi-annual sampling.

Revised: The Permittee must determine whether there has been a statistically significant increase at each point of compliance groundwater monitoring well listed in Permit Condition VI.B. within 90 days after completion of each semi-annual sampling event.

6.3 Permit Condition VI.G — Monitoring Program and Data Evaluation

VI.G.5 Current: The Permittee shall perform the evaluations described in Permit Condition VI.G.4 within 90 days after completion of the semi-annual sampling.

Revised: The Permittee shall perform the statistical evaluation required in permit condition VI.G.4 within 90 days after completion of each semi-annual sampling event. Results of the evaluations will be included in the annual narrative report required in Permit Condition VI.H.3.

6.4 Permit Condition VI.H — Reporting and Recordkeeping

VI.H.1 Current: The Permittee shall enter all monitoring, testing, and analytical data obtained in accordance with Permit Condition VI.G in the operating record, as required by 40 CFR 264.73(b)(6), as incorporated by reference in Rule 1200-1-11-.06(5)(a)1. The Permittee shall submit all monitoring, testing, and analytical data obtained pursuant to Permit Condition VI.F to the Commissioner on March 1 and September 1 after completion of sample testing and/or analytical data.

Revised: The Permittee shall enter all monitoring, testing, and analytical data obtained in accordance with Permit Condition VI.G in the operating record, as required by 40 CFR 264.73(b)(6), as incorporated by reference in Rule 1200-1-11-.06(5)(a)1. The Permittee shall submit all monitoring, testing, and analytical data obtained pursuant to Permit Condition VI.F to the Commissioner on March 1. ~~and September 1 after completion of sample testing and/or analytical data~~.

VI.H.3 New: The Permittee shall prepare an annual narrative report as required in Permit Condition II.C.6. This report shall evaluate the groundwater flow rate and direction as required in Permit Condition VI.G.3, and present the statistical evaluation as specified in Permit Condition VI.G.4. The narrative report will accompany the sampling information and analytical data required in Permit Condition VI.H.1.

6.5 Permit Attachment 4, Section C — Inspections

The most recent versions of the Y-12 Plant GWPP technical field procedures for well inspections and well depth measurements are included in Appendices A-1 and A-2, respectively.

6.6 Permit Attachment 4, Section E — Groundwater Target Compound List

The revised Groundwater Target Compound List constituent list is presented in Appendix A-4.

6.7 Permit Attachment 4, Section H — Statistical Procedures

A revised version of the statistical procedures for Kerr Hollow Quarry detection monitoring data is provided in Appendix A-5. The procedures have been revised to (1) remove references to boron and strontium, which have been deleted from the target compound list; (2) remove the paranthetical reference to daily replicate sampling; and (3) incorporate a statistical outlier test prior to trending gross alpha and beta results. The revisions to the statistical procedures are indicated below.

STATISTICAL PROCEDURES

For post-closure detection monitoring, concentrations of the groundwater target list constituents listed in Attachment 4, Section E (with the exception of ~~boron, total strontium,~~ gross alpha and gross beta) from downgradient point of compliance wells will be compared to upgradient values and to past monitoring results within each well. Downgradient analytical data will be compared to corresponding upgradient data for a given sampling event using an appropriate variance test as described below. If the variance test shows that no difference exists between downgradient and upgradient target list concentrations, no further statistical tests will be performed and routine detection monitoring will continue. If the variance test for a specific sampling event shows that downgradient values are significantly higher than the upgradient values for a target list constituent, then the results will be compared to the derived background upper tolerance limit (UTL).

The UTLs shall be derived from the available pool of historical interim status detection monitoring data obtained between 1986 and 1994. In cases where UTLs could not be calculated because the percentage of detected values was less than 10% (cadmium, chromium, mercury, and nickel), the practical quantitation limit (PQL) will be used as a surrogate background value. The PQL for each of these four target list parameters will be set at 10 times the instrument detection limit for water. The PQL will be based on the analytical method used during the current sampling event. ~~Quantitative trend analysis of boron and total strontium will be conducted in lieu of variance tests, because these two compounds represent unregulated constituents of concern. Also,~~ Quantitative trend analysis of gross alpha and gross beta will be conducted. These tests will form the basis for determining if a release of contaminants to groundwater has occurred.

A description of the statistical tests is as follows:

1. For each semiannual sampling event, analysis of variance (ANOVA), or the nonparametric equivalent, will compare the mean (or median) target list constituent concentration ~~(~~derived from the four ~~consecutive daily~~ replicate samples~~)~~ from each point of compliance well (GW-143, GW-144, and GW-145) to the corresponding mean (or median) concentration derived from the four consecutive samples from the upgradient wells (GW-142 and GW-231).

   The ANOVA test will be conducted in accordance with guidelines contained in Sections 4.1 and 4.2 of OEPA/530-SW89-026, Statistical Analysis of Groundwater at RCRA Facilities (U.S. EPA 1989). The variance test will determine, for a particular sampling event, if downgradient target list constituent concentrations are statistically different that those observed in the upgradient wells. If the variance test indicates that statistically significant differences exist, multiple comparison tests will also be performed to determine which wells are different from each other.

2. Upper tolerance limits calculated in accordance with Section 4.3 of EPA/530-SW89-026 will be used as comparative background reference criteria for the groundwater target compound data. As discussed previously, where UTLs could not be calculated from the pool of 1986 through 1994 interim status detection monitoring data (chromium, cadmium, mercury, and nickel), PQLs will be used as surrogate background values. Comparisons to

PQLs will be conducted in accordance with Section 5.2.1.1 of EPA/530-SW89-026. Concentrations of the groundwater target list constituents in each of the four replicate samples from the downgradient monitoring wells will be compared to their reference criteria. The comparisons to the reference criteria will determine if downgradient target list constituent concentrations are elevated above the maximum value expected to be observed in groundwater upgradient of the facility.

3. Within-well comparisons will be conducted using t-tests, or the nonparametric equivalent, applied to past data obtained from each well during interim status monitoring. The t-test will determine if the results from a particular monitoring well are significantly different (higher or lower) than past results from that well.

If the ANOVA test (or nonparametric equivalent) shows a statistically significant increase in downgradient target list constituent levels versus upgradient concentrations for a sampling event:

1. The statistically significant result will be compared to the corresponding UTL or PQL to determine if it exceeds background values (or reference standards);

2. The statistically significant result will be compared to past results within the point of compliance well to determine if it exceeds historical data.

If these two conditions are met (show an exceedance), then a release is assumed to have occurred and confirmation sampling will be conducted and the results evaluated. Should confirmation sampling indicate that a release has occurred, the priority of the site under CERCLA will be reviewed and potentially elevated.

~~Boron and total strontium are not regulated; thus, no MCLs or other applicable groundwater reference standards exist for these constituents. Calculation of representative UTLs cannot be conducted due to the fact that concentrations in each well at the KHQ are significantly different from every other well. In addition,~~ Gross alpha and gross beta results represent summary statistics rather than direct measurements; thus, UTLs also cannot be calculated for these parameters. Therefore, all available concentration data (since about CY 1990) will be plotted versus time after each semiannual sampling event. If a constituent concentration measured in a well during the current sampling event is not comparable with historical concentrations (either high or low), an outlier test may be performed. If the concentration is determined to vary significantly from historical data, the data will not be included in the trend analysis. If a measurement that is significantly different is used for trending, a false trend (increasing or decreasing) will result. A quantitative trend ~~Linear regression~~ analysis will be applied to the time-series plots to ~~derive a line equation representing concentration versus time. Statistical testing to~~ determine if a significant slope exists ~~will be conducted~~. If a statistically significant positive slope for concentration versus time becomes evident from this evaluation, then the priority of the site under CERCLA will be reviewed and potentially elevated.

7.0 PERMIT ATTACHMENT 6 — SAMPLING AND ANALYSIS PLAN

Appendix A-6 contains a copy of the most current version of the Y-12 Plant GWPP technical procedure for groundwater sampling. In addition, the title of the Permit Attachment is revised as shown below.

Current: ATTACHMENT 6 — SAMPLING AND ANALYSIS PLAN

Revised: ATTACHMENT 6 — GROUNDWATER SAMPLING PROCEDURE

8.0 PERMIT ATTACHMENT 7 — Y-12 GROUNDWATER PROTECTION PROGRAM WELL PLUGGING AND ABANDONMENT PROCEDURES

Appendix A-7 contains the most recent version of the Y-12 Plant GWPP technical procedures for groundwater monitoring well plugging and abandonment.

APPENDIX A
REVISED PERMIT ATTACHMENTS

APPENDIX A-1
Well Inspection Procedure

Permit Attachment 2, Section C, Appendix 2C-1
(Chestnut Ridge Sediment Disposal Basin)

Permit Attachment 3, Section C, Appendix 3C-1
(Chestnut Ridge Security Pits)

Permit Attachment 4, Section C, Appendix 4C-1
(Kerr Hollow Quarry)

Oak Ridge Y-12 Plant
Groundwater Protection Program
Standard Practice Procedure

Monitoring Well Inspection Procedure
G-001
Rev. 2., May 1997

Approved by: W. Kevin Jago Date: 4-28-97

Effective Date: 5-1-97

Record of Changes

Change No.	Affected Pages	Approved Date	Expiration Date	Change No.	Affected Pages	Approved Date	Expiration Date

Next 3-year review required no later than: May 2000.

CONTENTS

1.0 PURPOSE

This is a procedure intended to establish a systematic method for inspecting the physical condition of a monitoring well and to identify monitoring well maintenance needs that will extend its life and ensure the collection of representative groundwater quality samples and hydrologic data.

2.0 APPLICABILITY

This procedure is applicable to all monitoring wells located at the Y-12 Plant.

3.0 DEFINITIONS

Annular Seal - a grout seal installed between the well casing and borehole wall or outer casing.

Christy Box - steel or plastic box installed below the ground surface that allows access to the top of casing in a flush-mounted monitoring well design.

Concrete Pad - typically a neat cement or concrete pad at ground surface that surrounds the well casing or protective surface casing.

Constructed Depth - the distance from the top of the innermost well casing to the bottom of the screened or open interval as reported in: Updated Subsurface Data Base for Bear Creek Valley, Chestnut Ridge, and Parts of Bethel Valley on the U.S. Department of Energy Oak Ridge Reservation, Y/TS-881(R3), July 1995 (or most recent version).

Flush-Mounted Well - monitoring well head completion where the top of casing is below the ground surface.

Groundwater Protection Program (GWPP) - a program developed per DOE Order 5400.1 to characterize the hydrogeology and monitor and protect groundwater quality at the Y-12 Plant.

GWPP Manager - person responsible for day-to-day management of the Y-12 Plant GWPP.

Guard Posts - posts placed around a monitoring well to prevent vehicular collision damage.

Hasp - a welded fastening that allows a monitoring well cap to be locked to the well casing, or a hinged steel lid to be locked to the protective casing.

Incrustation - deposition of mineral matter on the well screen and/or casing, typically through chemical or biological reactions.

Lock - a waterproof, steel or brass fastening device that secures the well cap or protective-casing lid and prevents unauthorized access to the well.

Measured Depth - the distance from the top of the innermost well casing to the bottom of the well as measured in the field.

Monitoring Well - a well installed to enable collection of groundwater samples and/or hydrologic data (i.e., static water level).

Open-Hole Interval - a portion of a monitoring well designed so that groundwater enters the well through a segment of borehole that is open to the water-bearing formation.

Primary Inspection Items - those components of a monitoring well that are critical to the collection of representative groundwater quality samples and hydrologic information. Primary inspection items include the well casing and screen, annular grout seal, hasp, lock, cap, well identification, and condition of the screened or open-hole interval.

Protective Surface Casing - a section of large-diameter steel or polyvinyl chloride (PVC) pipe that is emplaced over the surface extension of a smaller diameter well casing to provide structural protection to the well and restrict unauthorized access to the well. A weep (hole) is usually located near the base of the casing to serve as a drain and prevent water from collecting inside the protective surface casing.

Screened Interval - A portion of a monitoring well that contains a slotted, perforated, or wire-wound section of casing (e.g., screen) through which groundwater enters the monitoring well and samples are obtained.

Secondary Inspection Items - those components of a monitoring well which generally do not affect collection of representative groundwater quality samples or hydrologic information; these include well access, guard posts, and concrete pad.

Sediment Accumulation - accumulation of sand, silt, precipitates, or other debris in the bottom of the monitoring well.

Well Access - the means by which a monitoring well is accessible (e.g., gravel road).

Well Cap - a removable cap or hinged steel lid used to cover a well casing.

Well Casing - steel, stainless steel or PVC pipe which provides unobstructed access to the monitored interval.

Well Identification - a stainless steel plate that is engraved with the monitoring well identification number and is attached to the outermost casing.

4.0 REFERENCES

4.1 Use References

4.1.1 "Comprehensive Groundwater Monitoring Plan for the Department of Energy Y-12 Plant Oak Ridge, Tennessee," Y/SUB/90-00206C/5, September 1990.

4.1.2 "Calendar Year 1996 Annual Groundwater Monitoring Report for the Bear Creek Hydrogeologic Regime at the U.S. Department of Energy Y-12 Plant, Oak Ridge, Tennessee," Y/SUB/97-KDS15V/1, Parts 1 and 2.

4.1.3 "Calendar Year 1996 Groundwater Quality Report for the Chestnut Ridge Hydrogeologic Regime at the U.S. Department of Energy Y-12 Plant, Oak Ridge, Tennessee," Y/SUB/97-KDS15V/2, Parts 1 and 2.

4.1.4 "Calendar Year 1996 Groundwater Quality Report for the Upper East Fork Poplar Creek Hydrogeologic Regime at the U.S. Department of Energy Y-12 Plant, Oak Ridge, Tennessee," Y/SUB/97-KDS15V/3, Parts 1 and 2.

4.1.5 "Oak Ridge Y-12 Plant Groundwater Protection Program Management Plan (Revised)," Y/SUB/96-KDS15V/1, June 1996 (or most recent revision).

4.1.6 "Updated Subsurface Data Base for Bear Creek Valley, Chestnut Ridge, and Parts of Bethel Valley on the U.S. Department of Energy Oak Ridge Reservation," Y/TS-881(R3), July 1995 (or most recent revision).

4.1.7 "Monitoring Well Inspection and Maintenance Plan, Y-12 Plant, Oak Ridge, Tennessee (Revised)," Y/TS-1215, September 1996.

4.2 Source References

4.2.1 Aller, Linda, Truman W. Bennett, Gene Hackett, Rebecca J. Petty, Jay H. Lehr, Helen Sedoris, and David M. Nielsen "Handbook of Suggested Practices for the Design and Installation of Groundwater Monitoring Wells", NWWA, Dublin, Ohio, 398 p.

4.2.2 Driscoll, Fletcher G., 1986, "Groundwater and Wells", Johnson Division, St. Paul, Minnesota, 1089 p.

4.2.3 "Environmental Surveillance Quality Control Program," ES/ESH/INT-14, February 1988.

4.2.4 Gass, Tyler E., Truman W. Bennett, James Miller and Robin Miller, 1980, "Manual of Water Well Maintenance and Rehabilitation Technology", NWWA, Dublin, Ohio, 247 p.

4.2.5 Nielsen, David M., 1991, "Practical Handbook of Groundwater Monitoring", Lewis Publishers, Chelsea, Michigan, 717 p.

4.2.6 U.S. Department of Energy, "Procedures for the Collection and Preservation of Groundwater and Surface Water Samples and for the Installation of Monitoring Wells", GJ/TMC-08 (Second Edition) UC-70A, October 1985.

4.2.7 U.S. Environmental Protection Agency, "Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual", Region IV, Athens, Georgia, February 1991.

4.2.8 U.S. Environmental Protection Agency, "RCRA Comprehensive Groundwater Monitoring Evaluation Document" (RCRA Groundwater Monitoring Systems), RCRA Enforcement Division, March 1988.

4.2.9 U.S. Environmental Protection Agency, "RCRA Facility Investigation (RFI) Guidance, Volumes I-IV", OSWER Directive 9502.00-6C, July 1987.

4.2.10 U.S. Environmental Protection Agency, "RCRA Groundwater Monitoring: Draft Technical Guidance," EPA/530-R-93-001, November 1992.

5.0 PRECAUTIONS AND LIMITATIONS

5.1 Annular Seal

The downhole condition of the annular seal cannot be determined without geophysical techniques. Such evaluation is beyond the scope of this procedure.

5.2 Constructed Well Depth

The reported constructed depth of a monitoring well may require confirmation or may be inaccurate as recorded in original well construction records.

5.3 Incrustation

The downhole condition of a well screen cannot be determined without remote sensing. Such evaluation is beyond the scope of this procedure.

5.4 Limits of Tape Measure

Some monitoring wells are completed at depths (i.e., > 300 ft) that cannot be measured with a flat, weighted steel or fiberglass measuring tape. Additionally, the depth of monitoring wells, which contain large water columns (i.e., greater than 100 ft) also may not be measurable with a flat, weighted measuring tape. A circular, stainless steel or coated steel measuring cable shall be used for all monitoring wells greater than a 300 ft depth and is preferable for all monitoring wells.

5.5 Measurement Accuracy

Increased depth and large water columns decrease the accuracy of the monitoring well depth measurements.

5.6 Safety

Established safety standards and requirements of Lockheed Martin Energy Systems, DOE, and OSHA will apply to the inspection and maintenance of a monitoring well. All field personnel will be provided with appropriate safety clothing, equipment, and training.

5.7 Well Access

A monitoring well may be deemed inaccessible because of site conditions or operations.

6.0 PREREQUISITES

6.1 Initial Inspection

If a monitoring well is currently scheduled for Plugging and Abandonment (P/A), inspection and maintenance is not performed.

6.2 Subsequent Inspections

If a monitoring well is currently included in the comprehensive groundwater monitoring program, it is classified as active and an inspection is performed annually. If not, the monitoring well is classified as inactive and an inspection is performed every three years. Monitoring wells for which the status changes from inactive to active will be inspected prior to monitoring.

7.0 EQUIPMENT, TOOLS AND SUPPLIES

7.1 Documentation

Updated Subsurface Data Base (Y/TS-881/R3 or most recent revision), Well Inspection Maintenance Summary, Monitoring Well Construction Summary, Well Inspection Checklist, Well Maintenance Request Form, Monitoring Well Depth Measurement Procedure (G-002), Active Well Status Checklist, and Daily Activity Log.

7.2 Field Equipment

Well locks, keys to unlock wells, weighted steel or fiberglass measuring tape and/or cable, pens, indelible markers, and clip-board.

7.3 Personal Protective Equipment

Required: Rubber gloves, protective eye-wear.
Optional: Safety shoes, tyvek coveralls, and hard hat.

7.4 Decontamination Equipment

Plastic ground cover, distilled water, wash bottles, mild detergent, and collection vessels for wash and rinse water.

8.0 ACTION STEPS

8.1 Preparation

8.1.1 Identify monitoring wells to be inspected from the Well Inspection/Maintenance Summary.

8.1.2 Review Well Location Map(s) and Monitoring Well Construction Summary to determine:

a. the monitoring well location;
b. the constructed depth; and
c. length of the screen or open-hole interval.

8.2 Inspection

8.2.1 On the Well Inspection Checklist, enter the inspection number for the monitoring well. The Y-12 Plant GWPP Manager or authorized designee will assign the inspection number using the following format: two-digit number denoting the year followed by a dash followed by a three-digit number (example: 91-001). Inspection numbers should be assigned consecutively (i.e., 91-001, 91-002, 91-003,...) as each monitoring well is inspected. Complete the Well Information section of checklist using information from the Updated Subsurface Data Base and the Monitoring Well Construction Summary (for site, screened or open-hole interval length, and constructed depth).

8.2.2 Verify that the monitoring well is accessible by vehicle (active monitoring wells only). If construction, fencing, fallen trees, or site operation or closure activities have isolated the well, note on the Well Inspection Checklist and report the finding to the Y-12 GWPP Manager or authorized designee. Otherwise, note any maintenance needs for access roads on the Well Inspection Checklist.

8.2.3 Inspect guard posts for damage, physical deterioration, paint degradation, and proper positioning (active monitoring wells only). Each post should be painted high-traffic yellow, and be a height above ground that is adequate to prevent vehicular collision damage. The guard posts should be situated between the monitoring well and each direction of traffic approach. Complete appropriate section of Well Inspection Checklist.

8.2.4 Confirm that a stainless steel plate engraved with a legible identification number is attached to the outermost casing of the monitoring well. Through a comparison with the Updated Subsurface Data Base, confirm that the identification number is correct. Complete appropriate section of Well Inspection Checklist.

8.2.5 Inspect the concrete pad for cracks and deterioration (active monitoring wells only). The top of the pad should be level or slope away from the casing to prevent ponding of rain water around the well casing. Complete appropriate section of Well Inspection Checklist.

8.2.6 Inspect the lock for corrosion and operation of the locking mechanism. If a lock is corroded and difficult to open, replace it. **Do not** use any lubricant to improve lock performance. Complete appropriate section of Well Inspection Checklist.

8.2.7 Inspect the integrity of the hasps, making certain that they are firmly welded to the well cap and/or the metal casing. Complete appropriate section of Well Inspection Checklist.

8.2.8 Inspect the condition of the well cap or hinged steel lid. Complete appropriate section of Well Inspection Checklist.

8.2.9 Inspect all above-ground well casings and protective surface casings (if present) for cracks, corrosion, breaks, bends, or any other signs of deterioration that may effect structural integrity. Inspect base of protective surface casing to locate weep. Complete appropriate section of Well Inspection Checklist.

8.2.10 For flush-mounted monitoring wells, inspect traffic covers for presence of fasteners (bolts), excessive rust or deterioration, or any other notable damage. Covers should be securely bolted to the christy box.

8.2.11 For flush-mounted monitoring wells, inspect christy box for excessive rust or other damage. The concrete pad surrounding the christy box should be sloped to minimize the potential for water accumulation inside of the box.

8.2.12 For flush-mounted monitoring wells, inspect the water-tight well cap for tightness and condition of the rubber seal. Caps should fit securely so that they cannot be turned by hand.

8.2.13 Inspect the annular seal for cracks, if visible, and by shaking the well casing. The casing should not easily move. Complete appropriate section of Well Inspection Checklist.

8.2.14 Put on rubber gloves and protective eye-wear.

8.2.15 Remove lock and well cap.

8.2.16 Verify that an established reference mark (measuring point) is on the top of the innermost well casing. If not, establish a mark with indelible marker on the well casing for future reference and notify the Y-12 Plant GWPP Manager or authorized designee.

8.2.17 Measure the monitoring well depth from the established reference mark and record on the checklist to the nearest 0.1 foot. Perform measurement in accordance with Y-12 Plant Monitoring Well Depth Measurement Procedure (G-002).

8.2.18 Compare measured depth to the constructed depth of the monitoring well by using the equation: Sediment Accumulation = Constructed Depth - Measured Depth. The sediment accumulation divided by the screen or open-hole interval length must be less than 0.2. Complete appropriate section of Well Inspection Checklist.

8.2.19 If any shaded yes/no answer box for each item on the Well Inspection Checklist is checked, complete the Well Maintenance Request section of the checklist noting if maintenance is needed for Primary or Secondary Inspection Item(s), or both. Enter the Well Maintenance Request number on the Well Inspection Checklist and Maintenance Request Form. The Y-12 Plant GWPP Manager or authorized designee will assign Well Maintenance Request numbers using the following format: a two-digit number denoting the year followed by a dash followed by a three-digit number with a "P" (for Primary Inspection Item), or "S" (for Secondary Inspection Item), or "PS" (for both Primary and Secondary Inspection Items) suffix (examples: 91-001P, 91-001S, 91-001PS). Consecutive maintenance request numbers for each well should be assigned (example: 91-001P, 91-002S, 91-003S,...).

8.2.20 Sign and date Well Inspection Checklist.

9.0 ACCEPTANCE CRITERIA

If none of the inspection items require maintenance, inspection of the monitoring well is complete.

10.0 POST PERFORMANCE WORK ACTIVITIES

10.1 Documentation

Compile Well Inspection Checklists and Well Maintenance Request Forms. Transfer appropriate data from checklists and forms to the Well Inspection/Maintenance Summary. Submit all checklists, forms, and the completed Well Inspection/Maintenance Summary to the Y-12 Plant GWPP Manager or authorized designee.

10.2 Maintenance Work Inspection

The Y-12 Plant GWPP Manager or authorized designee will schedule and coordinate all well maintenance activities. When requested maintenance has been completed, obtain original Well Maintenance Request Form from the Y-12 Plant GWPP Manager or authorized designee and inspect maintenance work performed.

10.3 Plugging and Abandonment Requests

If the Y-12 Plant GWPP Manager or authorized designee determines that, based upon consultations with field inspection personnel and a well site visit (if needed), a Primary Inspection Item is damaged or deteriorated beyond practical repair, the well may require plugging and abandonment. The Y-12 Plant GWPP Manager or authorized designee will prepare all Plugging and Abandonment Request Forms and schedule and coordinate all related activities.

11.0 RECORDS

The documentation listed in items 11.1 through 11.3 below will be included in the annual well inspection documentation report and become part of the administrative record for the Y-12 Plant GWPP.

11.1 Well Inspection Checklist

11.2 Well Maintenance Request Form

11.3 Plugging and Abandonment Request Form

11.4 Daily Log

A daily log of field inspection activities shall be maintained. This log will be placed in the administrative record of the Y-12 Plant GWPP.

APPENDIX A-2
Well Depth Measurement Procedure

Permit Attachment 2, Section C, Appendix 2C-2
(Chestnut Ridge Sediment Disposal Basin)

Permit Attachment 3, Section C, Appendix 3C-2
(Chestnut Ridge Security Pits)

Permit Attachment 4, Section C, Appendix 4C-2
(Kerr Hollow Quarry)

Oak Ridge Y-12 Plant
Groundwater Protection Program
Standard Practice Procedure

Monitoring Well Depth Measurement Procedure
G-002
Rev. 2., May 1997

Approved by: W. Kevin Jago Date: 4-28-97

Effective Date: 5-1-97

Record of Changes

Change No.	Affected Pages	Approved Date	Expiration Date	Change No.	Affected Pages	Approved Date	Expiration Date

Next 3-year review required no later than: May 2000.

CONTENTS

1.0 PURPOSE

This procedure is a standardized method for determining the measured depth of a groundwater monitoring well. The measured depth of a monitoring well, when compared to the constructed depth, provides an indication of sediment accumulation or obstructions.

2.0 APPLICABILITY

Monitoring well depth measurement is applicable to all monitoring wells located at the Y-12 Plant.

3.0 DEFINITIONS

Constructed Depth - the distance from the top of the innermost well casing to the bottom of the screened or open interval as reported in: Updated Subsurface Data Base for Bear Creek Valley, Chestnut Ridge, and Parts of Bethel Valley on the U.S. Department of Energy Oak Ridge Reservation, Y/TS-881(R3), July 1995 (or most recent revision).

Groundwater Protection Program (GWPP) - a program developed per DOE Order 5400.1 to characterize the hydrogeology and monitor and protect groundwater quality at the Y-12 Plant.

GWPP Manager - person responsible for day-to-day management of the Y-12 Plant GWPP.

Measured Depth - the distance from the top of the innermost well casing to the bottom of the monitoring well as measured in the field.

Sediment Accumulation - accumulation of sand, silt, precipitates, or other debris in the bottom of the monitoring well.

Well Cap - a removable cap used to cover a well casing.

Well Casing - steel, stainless steel, or PVC pipe which provides unobstructed access to the monitored interval.

Well Identification - a steel plate embossed with the monitoring well identification number that is attached to the outermost casing.

4.0 REFERENCES

4.1 Use References

4.1.1 "Updated Subsurface Data Base for Bear Creek Valley, Chestnut Ridge, and Parts of Bethel Valley on the U.S. Department of Energy Oak Ridge Reservation", Y/TS-881(R3), July 1995 (or most revision).

4.1.2 "Monitoring Well Inspection and Maintenance Plan, Y-12 Plant, Oak Ridge, Tennessee (Revised)", Y/TS-1215, September 1996.

4.1.3 "Oak Ridge Y-12 Plant Groundwater Protection Program Management Plan (Revised)," Y/SUB/96-KDS15V/1, June 1996 (or most recent revision).

4.2 Source References

4.2.1 Driscoll, Fletcher G., 1986, "Groundwater and Wells", Johnson Division, St. Paul, Minnesota, 1089 p.

4.2.2 "Environmental Surveillance Quality Control Program", ES/ESH/INT-14, February 1988.

4.2.3 Gass, Tyler E., Truman W. Bennett, James Miller and Robin Miller, 1980, "Manual of Water Well Maintenance and Rehabilitation Technology", NWWA, Dublin, Ohio, 247 p.

4.2.4 U.S. Environmental Protection Agency, "A Compendium of Superfund Field Operations Methods", EPA/540/P-87/001, 1987.

4.2.5 U.S. Environmental Protection Agency, "RCRA Groundwater Monitoring: Draft Technical Guidance," EPA/530-R-93-001, November 1992.

5.0 PRECAUTIONS AND LIMITATIONS

5.1 Constructed Depth

The reported constructed depth of the monitoring well may require confirmation or may be inaccurate as recorded in original construction records.

5.2 Limits of Tape Measure

Some monitoring wells are completed at depths (i.e., > 300 ft) that cannot be measured with a flat, weighted steel or fiberglass measuring tape. Additionally, the depth of monitoring wells, which contain large water columns (i.e., greater than 100 ft.) also may not be measurable with a flat, weighted measuring tape. A stainless steel or coated steel measuring cable shall be used for all monitoring wells greater than a 300-foot depth and is preferable for all monitoring wells.

5.3 Measurement Accuracy

Increased depth and large water columns decrease the accuracy of the monitoring well depth measurement.

5.4 Safety

Established safety standards and requirements of Lockheed Martin Energy Systems, DOE, and OSHA will apply to the process of obtaining the measured depth of a monitoring well. All field personnel will be provided with appropriate safety clothing, equipment, and training.

5.5 Well Access

A monitoring well may be deemed inaccessible because of site conditions or operations.

6.0 PREREQUISITES

All monitoring wells will have the measured depth determined during a scheduled well inspection.

7.0 EQUIPMENT, TOOLS AND SUPPLIES

7.1 Documentation

Monitoring Well Construction Summary, Updated Subsurface Data Base, Y/TS-881(R3) (or most recent version), Daily Activity Logbook, and Well Inspection Checklist.

7.2 Personnel Protection Equipment

Required: rubber gloves, protective eye-wear.
Optional: safety shoes, tyvek coveralls, and hard hat.

7.3 Field Equipment

Keys to unlock wells, indelible marker, pen, clipboard, and weighted fiberglass or steel measuring tape(s) and/or cable (the weight will be stainless steel or other approved inert material and have a blunt end facing down).

7.4 Decontamination Equipment

Plastic ground cover, de-ionized water, mild detergent, and wash and rinse water collection vessels.

8.0 ACTION STEPS

8.1 Preparation: Review the Monitoring Well Construction Summary and Updated Subsurface Data Base to determine the monitoring well location and obtain the constructed depth of the monitoring well.

8.2 Record well identification and date.

8.3 Put on rubber gloves and protective eye-wear.

8.4 Remove the lock and well cap.

8.5 Locate the reference mark at the top of the innermost well casing. If a reference mark is not present, make one with indelible marker, and notify Y-12 Plant GWPP Manager or authorized designee.

8.6 Select the appropriate length measuring tape and/or cable.

8.7 Slowly lower the weight into the monitoring well until the bottom of the monitoring well is encountered as indicated by slack in the tape measure or a solid impact.

8.8 When slack or impact occurs, slowly lift the tape until the tape becomes taut. Raise and lower the tape until the point of tension release becomes clearly defined.

8.9 Hold the tape to the reference mark on the casing and note the measurement.

8.10 Repeat steps 8.7 - 8.9 several times to ensure an accurate measurement. Readings should remain constant (i.e., within 0.1 ft).

8.11 Record the final measurement to the nearest 0.1 ft as the measured depth in the Daily Activity Logbook and/or Well Inspection Checklist.

8.12 Remove the measuring tape from the monitoring well and decontaminate in accordance with ESP-900.

8.13 Close well cap and replace lock.

9.0 ACCEPTANCE CRITERIA

An acceptable measured depth of a monitoring well is achieved when the range of three or more consecutive measurements are within 0.1 ft.

10.0 POST PERFORMANCE ACTIVITIES

Report to the Y-12 GWPP Manager or authorized designee those wells with significant (i.e., greater than 20% of the length of the monitored interval) differences between the constructed depth and the measured depth.

11.0 RECORDS

11.1 Well Inspection Checklist

The Well Inspection Checklist will be included in the annual well inspection documentation report and become part of the administrative record for the Y-12 Plant GWPP.

11.2 Daily Log

A daily log of field inspection activities shall be maintained. This log will be placed in the administrative record of the Y-12 Plant GWPP.

APPENDIX A-3

Permit Attachment 2, Section H — Statistical Procedure

(Chestnut Ridge Sediment Disposal Basin)

STATISTICAL PROCEDURES

For post-closure detection monitoring, concentrations of the groundwater target list constituents (Attachment 2, Section E) from downgradient point of compliance wells will be compared to upgradient values and to the past monitoring results within each well. Downgradient analytical data will be compared to corresponding upgradient data for a given sampling event using an appropriate variance test as described below. If the variance test shows that no difference exists between downgradient and upgradient target list concentrations, no further statistical tests will be performed and routine detection monitoring will continue. If this variance test shows that downgradient values are significantly higher than the upgradient values for a target list constituent, then the results will be compared to upgradient tolerance limits and historical data from the particular well (within-well comparison). These tests will form the basis for determining if a release of contaminants to groundwater has occurred.

A description of the statistical tests is as follows:

1. For each semiannual sampling event, analysis of variance (ANOVA), or the nonparametric equivalent, will compare the mean (or median) target list constituent concentration derived from the four replicate samples from each point of compliance well (GW-156, GW-731, and GW-732) to the corresponding mean (or median) concentration derived from the four replicate samples from the upgradient well (GW-159).

   The ANOVA test will be conducted in accordance with guidelines contained in Sections 4.1 and 4.2 of "PB89-151047 Statistical Analysis of Groundwater a RCRA Facilities" (U.S. EPA 1989). The variance test will determine, for a particular sampling event, if downgradient target list constituent concentrations are statistically different that those observed in the upgradient wells. If the variance test indicates that statistically significant differences exist, multiple comparison tests will also be performed to determine which wells are different from each other.

2. Upper tolerance limits will be calculated for the groundwater target list constituents in accordance with Section 4.3 of PB89-151047. A sufficient population of historical upgradient results will be used (including all data from the upgradient well [GW-159] to derive upper tolerance limits with a confidence coefficient of 95 percent and a coverage of 95 percent. Wells will be chosen to represent the geochemical variability present in groundwater upgradient of the facility. Concentrations of the groundwater target list constituents in each of the four replicate samples from the downgradient monitoring wells will be compared to their corresponding upper tolerance limits calculated from the upgradient data. The comparisons to the upper tolerance limits will determine if downgradient target list constituent concentrations are elevated above the maximum value expected to be observed in groundwater upgradient of the facility.

3. Within-well comparisons will be conducted using t-tests, or the nonparametric equivalent, applied to data obtained from each well for the period beginning September 1991 and

ending October 1995 (four calendar years). This time period represents the available pool of historical data collected under interim status for two of the three downgradient wells at the facility. The t-test will determine if the results from a particular monitoring well are significantly different (higher or lower) than past results from that well.

If the ANOVA test (or nonparametric equivalent) shows a statistically significant increase in downgradient target list constituent levels versus upgradient concentrations for a sampling event:

1. The statistically significant result will be compared to the corresponding UTL to determine if it exceeds background values; and

2. The statistically significant result will be compared to past results within the point of compliance well to determine if it exceeds historical data.

If these two conditions are met (show an exceedance), then a release is assumed to have occurred and confirmation sampling will be conducted and the results evaluated. Should confirmation sampling indicate that a release has occurred, the priority of the site under CERCLA will be reviewed and potentially elevated.

APPENDIX A-4

Permit Attachment 4, Section E — Groundwater Target Compound List

(Kerr Hollow Quarry)

Groundwater Target Compound List
Kerr Hollow Quarry

Constituents
Cadmium
Chromium
Lead
Mercury
Nickel
Uranium
Gross alpha
Gross beta
Carbon Tetrachloride
Tetrachloroethene
Chloroform

APPENDIX A-5
Permit Attachment 4, Section H — Statistical Procedure
(Kerr Hollow Quarry)

STATISTICAL PROCEDURES

For post-closure detection monitoring, concentrations of the groundwater target list constituents listed in Attachment 4, Section E (with the exception of gross alpha and gross beta) from downgradient point of compliance wells will be compared to upgradient values and to past monitoring results within each well. Downgradient analytical data will be compared to corresponding upgradient data for a given sampling event using an appropriate variance test as described below. If the variance test shows that no difference exists between downgradient and upgradient target list concentrations, no further statistical tests will be performed and routine detection monitoring will continue. If the variance test for a specific sampling event shows that downgradient values are significantly higher than the upgradient values for a target list constituent, then the results will be compared to the derived background upper tolerance limit (UTL).

The UTLs shall be derived from the available pool of historical interim status detection monitoring data obtained between 1986 and 1994. In cases where UTLs could not be calculated because the percentage of detected values was less than 10% (cadmium, chromium, mercury, and nickel), the practical quantitation limit (PQL) will be used as a surrogate background value. The PQL for each of these four target list parameters will be set at 10 times the instrument detection limit for water. The PQL will be based on the analytical method used during the current sampling event. Quantitative trend analysis of gross alpha and gross beta will be conducted. These tests will form the basis for determining if a release of contaminants to groundwater has occurred.

A description of the statistical tests is as follows:

1. For each semiannual sampling event, analysis of variance (ANOVA), or the nonparametric equivalent, will compare the mean (or median) target list constituent concentration derived from the four replicate samples from each point of compliance well (GW-143, GW-144, and GW-145) to the corresponding mean (or median) concentration derived from the four consecutive samples from the upgradient wells (GW-142 and GW-231).

   The ANOVA test will be conducted in accordance with guidelines contained in Sections 4.1 and 4.2 of OEPA/530-SW89-026, Statistical Analysis of Groundwater at RCRA Facilities (U.S. EPA 1989). The variance test will determine, for a particular sampling event, if downgradient target list constituent concentrations are statistically different that those observed in the upgradient wells. If the variance test indicates that statistically significant differences exist, multiple comparison tests will also be performed to determine which wells are different from each other.

2. Upper tolerance limits calculated in accordance with Section 4.3 of EPA/530-SW89-026 will be used as comparative background reference criteria for the groundwater target compound data. As discussed previously, where UTLs could not be calculated from the pool of 1986 through 1994 interim status detection monitoring data (chromium, cadmium, mercury, and nickel), PQLs will be used as surrogate background values. Comparisons to PQLs will be conducted in accordance with Section 5.2.1.1 of EPA/530-SW89-026. Concentrations of the

groundwater target list constituents in each of the four replicate samples from the downgradient monitoring wells will be compared to their reference criteria. The comparisons to the reference criteria will determine if downgradient target list constituent concentrations are elevated above the maximum value expected to be observed in groundwater upgradient of the facility.

3. Within-well comparisons will be conducted using t-tests, or the nonparametric equivalent, applied to past data obtained from each well during interim status monitoring. The t-test will determine if the results from a particular monitoring well are significantly different (higher or lower) than past results from that well.

If the ANOVA test (or nonparametric equivalent) shows a statistically significant increase in downgradient target list constituent levels versus upgradient concentrations for a sampling event:

1. The statistically significant result will be compared to the corresponding UTL or PQL to determine if it exceeds background values (or reference standards);

2. The statistically significant result will be compared to past results within the point of compliance well to determine if it exceeds historical data.

If these two conditions are met (show an exceedance), then a release is assumed to have occurred and confirmation sampling will be conducted and the results evaluated. Should confirmation sampling indicate that a release has occurred, the priority of the site under CERCLA will be reviewed and potentially elevated.

Gross alpha and gross beta results represent summary statistics rather than direct measurements; thus, UTLs also cannot be calculated for these parameters. Therefore, all available concentration data (since about CY 1990) will be plotted versus time after each semiannual sampling event. If a constituent concentration measured in a well during the current sampling event is not comparable with historical concentrations (either high or low), an outlier test may be performed. If the concentration is determined to vary significantly from historical data, the data will not be included in the trend analysis. If a measurement that is significantly different is used for trending, a false trend (increasing or decreasing) will result. A quantitative trend analysis will be applied to the time-series plots to determine if a significant slope exists. If a statistically significant positive slope for concentration versus time becomes evident from this evaluation, then the priority of the site under CERCLA will be reviewed and potentially elevated.

APPENDIX A-6
Permit Attachment 6 — Groundwater Sampling Procedure

Lockheed Martin Energy Systems, Inc.
Analytical Services Organization

APPROVAL SIGNATURE PAGE FOR

SESD-TP-8204, Rev. 3

GROUNDWATER SAMPLING

Author: M. E. Cleveland

Procedure Owner: M. E. Cleveland

IPC? Yes ___ No _X_

R. E. Slayle
Manager, Sample & Waste Management Department

3/14/97
Date

This procedure has been reviewed by an Authorized Derivative Classifier and has been determined to be UNCLASSIFIED.

W. O. Tucker
Authorized Derivative Classifier

14 Mar 97
Date

Title: GROUNDWATER SAMPLING (R)

M. E. Cleveland is responsible for the accuracy, compliance, and usability of this procedure.

THE USER OF THIS PROCEDURE IS RESPONSIBLE FOR VERIFYING THAT THIS IS THE CURRENT REVISION.

1.0 SCOPE

To provide a method for the Sampling and Environmental Support Department (SESD) personnel in the collection of representative groundwater samples from monitoring wells on the Oak Ridge Reservation (ORR). This procedure applies to wells specified in the customer's annual Sampling and Analysis Plan (SAP). The procedure is a compilation of Lockheed Martin Energy System's (LMES) Environmental Surveillance Procedures (ESPs) and the U.S. EPA's Technical Guidance document pertinent to groundwater sampling. This procedure does not replace manufacturer's instrument operation manuals.

2.0 REFERENCED DOCUMENTS

2.1 ASO-QAP-0001, entitled *Quality Assurance Plan for the Analytical Services Organization.*

2.2 ASO-AP-0002, entitled *Chemical Hygiene Plan for the Analytical Services Organization.*

2.3 ASO-AP-0007, entitled *Analytical Services Organization Procedures.*

2.4 SESD-TP-8005, entitled *Temperature Meter Operation and Calibration.*

2.5 SESD-TP-8007, entitled *pH Meter Operation and Verification.*

2.6 SESD-TP-8008, entitled *Dissolved Oxygen Meter Operation and Verification.*

2.7 SESD-TP-8201, entitled *Redox Meter Operation and Verification.*

2.8 SESD-TP-8202, entitled *Conductivity Meter Operation and Verification.*

2.9 SESD-TP-8009, entitled *Sample Transportation.*

2.10 SESD-TP-8020, entitled *Labelling Bottles.*

2.11 SESD-TP-8055, entitled *Chain-of-Custody Protocol for the Sampling and Environmental Support Department.*

2.12 SESD-TP-8203, entitled *Trip Blank Preparation.*

2.13 SESD-TP-8206. entitled *Steam Cleaning Bennett Sample Pumps.*

2.14 SESD-TP-8065. entitled *Neutralization of Acid and Base Waste Solutions.*

2.15 Job Hazard Analysis Documentation for SESD Groundwater Sampling.

2.16 Environmental Surveillance Quality Control Program Procedures (ESPs).

2.16.1 ESP-302-1. entitled *Water Level Measurements Using Water Level Indicator.*

2.16.2 ESP-302-2. entitled *Guidelines for Well Purging.*

2.16.3 ESP-302-3. entitled *Using a Bailer.*

2.16.4 ESP-302-4. entitled *Using a Gas Driven Piston Pump.*

2.16.5 ESP-302-5. entitled *Using a Bladder Pump.*

2.16.6 ESP-307-1. entitled *Temperature.*

2.16.7 ESP-307-2. entitled *pH (Hydrogen Ion Concentration).*

2.16.8 ESP-307-5. entitled *Oxygen/Reduction Potential of Water.*

2.16.9 ESP-307-8. entitled *Specific Conductance.*

2.16.10 ESP-505. entitled *Sample Packaging, Transporting, and Shipping.*

2.16.11 ESP-801. entitled *Cleaning and Decontaminating Sample Containers.*

3.0 RESPONSIBILITIES

3.1 Customer Sampling and Analysis Coordinator (e.g., Y-12 GWPP, K-25 GWPP, ER Project Manager)

3.1.1 Ensures the implementation of current approved SAP. Ensures monitoring requirements are met and completed in accordance with required schedules.

3.1.2 Records and issues any changes to the SAP through addenda.

3.1.3 Provides SESD with quarterly Groundwater Well Monitoring Schedules (GWMS), site maps, current bottle list, well information, site access, and any other pertinent information.

3.1.4 Coordinates with SESD to schedule sampling personnel at determined well locations.

3.1.5 Acts as primary point of contact for SESD personnel concerning monitoring and Health and Safety activities while on site.

3.1.6 Coordinates with waste management organization to provide and dispose of containment vessels for specified wells.

3.1.7 Coordinates with laboratory to receive and perform analyses as listed in the SAP.

3.1.8 Ensures proper implementation of this procedure through oversight of field activities and quarterly assessments of SESD personnel.

3.2 SESD Sampling Supervisor

3.2.1 Maintains communication with customer representatives and laboratory for information that could affect the performance of this procedure.

3.2.2 Provides trained field technicians for monitoring performed on ORR groundwater wells. Trains, approves, and documents training of field technicians in performance of this procedure.

3.2.3 Provides field technicians with all required documentation and information to effectively carry out this procedure.

3.2.4 Interfaces with customer and project manager to obtain scheduling information, containment availability, well access or entry requirements, and site-specific information concerning unusual conditions.

3.2.5 Provides field quality assurance through planning and use of established and approved procedures.

3.2.6 Ensures that materials and equipment are available for use, decontaminated, and properly maintained.

3.2.7 Coordinates with project management to receive samples.

3.2.8 Ensures quality in sampling through review of the technician's field data sheets and training reviews.

3.2.9 Ensures complete chain-of-custody through review of chain-of-custody documentation.

3.2.10 Implements corrective action for nonconformance with this procedure.

3.3 Laboratory Project Manager

3.3.1 Maintains communication with customer to convey information that could affect the performance of this procedure.

3.3.2 Acts as primary interface for all individual laboratories concerning analysis performed on groundwater samples.

3.3.3 Ensures samples are analyzed according to the most current applied and approved analytical procedure for the requested analyte in the SAP.

3.3.4 Ensures laboratory QA/QC measures are in place and documentation provided.

3.3.5 Ensures sample holding times are not exceeded.

3.3.6 Prepares Bottle List for SESD for specified monitoring locations in the SAP.

3.3.7 Prepares Bottle Menus for Sample & Waste Management personnel to receive samples.

3.3.8 Coordinates with DOE's contractor Sample Management Organization (SMO) for all outside laboratory work, if required.

3.3.9 Issues hard copy and electronic copy of analytical data to customers. Maintains archive copy.

3.4 Field Technician

3.4.1 Is properly trained in performance of this procedure under the supervision of the SESD Sampling Supervisor or qualified trainer.

3.4.2 Performs groundwater sampling according to this procedure. Conducts sampling operations in a safe and efficient manner, as to not injure themselves or others.

3.4.3 Documents all field measurements, field conditions, samples collected, and off-normal conditions, as required by this procedure.

3.4.4 Ensures sample quality and integrity are maintained at all times.

3.4.5 Ensures chain-of-custody is maintained at all times.

3.4.6 Relinquishes all samples to laboratory Sample & Waste Management personnel within the prescribed holding times.

3.4.7 Decontaminates and maintains well monitoring equipment.

3.4.8 Maintains (in the field) the most current approved version of this procedure, field copies of LMES ESPs and SESD technical procedures, and the following documents:

3.4.8.1 Bottle Lists: The list of analyte-specific sample containers required for the samples to be collected at a well site.

3.4.8.2 Field Data Sheets: The field record of monitoring activities at a well. Completed by SESD personnel to include well depths, water level measurements, purge volume calculations, purge rates, field measurements, and field comments. Field Data Sheets are numbered and bound to become part of the permanent administrative record for customer.

3.4.8.3 Groundwater Well Monitoring Schedule (GWMS): The schedule of groundwater wells to be monitored which is issued by customer. The GWMS is derived from the customer's current approved SAP for the groundwater and/or surface water monitoring on the ORR.

3.4.8.4 Site Maps: Maps that show the location of groundwater wells and surface water sites.

3.4.8.5 Bottle List Tracking Sheet (as required by the customer): Tracks the current revisions made throughout the calendar year to the Bottle List.

3.4.8.6 A current and approved copy of this procedure.

4.0 TERMINOLOGY

4.1 AOC: Additional organic compounds.

4.2 ASTM: American Society for Testing and Materials.

4.3 DOT: Department of Transportation.

4.4 ESP: Environmental Surveillance Procedure.

4.5 GWPP: Groundwater Protection Program (ORR).

4.6 GWMS: Groundwater Monitoring Schedule.

4.7 LMES: Lockheed Martin Energy Systems, Inc.

4.8 MSDS: Material Safety Data Sheet.

4.9 ORR: Oak Ridge Reservation [i.e., Y-12 Plant, Oak Ridge National Laboratory, East Tennessee Technology Park (formerly K-25 Site)].

4.10 PPE: Personal protective equipment.

4.11 SAP: Sampling and Analysis Plan.

4.12 SESD: Sampling and Environmental Support Department.

4.13 SMO: DOE's Sample Management Office.

4.14 TOC: Total organic carbon.

4.15 TOX: Total organic halides.

4.16 VOA: Volatile organic compound.

5.0 SUMMARY OF TEST METHOD

Groundwater samples are collected after an appropriate well purge by using a bailer or pump. If required, the purge water from the wells is transferred into collection containers and transported to the plant for appropriate water treatment. Field determinations which include pH, specific conductance, oxidation-reduction potential, dissolved oxygen, and temperature are obtained on an initial sample from the well. Additional measurements of the same type are taken for each well volume purged and after the final purge volume. All samples are preserved in the field according to EPA protocol as defined in the current SAP. The samples are then delivered to the Sample & Waste Management group or to the SMO for transfer to a contract laboratory.

6.0 SIGNIFICANCE AND USE

This method is applicable to the sampling of groundwater wells on the Oak Ridge Reservation. This procedure supplements instrument operating manuals from manufacturers and provides field sampling technicians with additional sampling instructions. In the event of an emergency sampling event or other unforseen occurrence. SESD has the option of calibrating any instrument in inventory according to the manufacturer's instructions.

7.0 INTERFERENCES

Not applicable.

8.0 APPARATUS

8.1 Personal Protective Equipment (PPE): Company-issued clothing (including cold weather apparel and rain suits), steel-toed safety shoes, safety glasses with side shields, rubber gloves (nitrile for work with reagents), hearing protection, and if required, Tyvek coveralls or rubber aprons, hard hat, and cotton gloves.

NOTE: Additional PPE may be warranted due to changing site-specific conditions or for specific projects. Additional PPE requirements will be specified by the site Health and Safety Officer or by the customer in project-specific Health and Safety Plans.

8.2 Safety Equipment

8.2.1 Cellular phone and pager with emergency contact numbers

8.2.2 Fire extinguisher.

8.2.3 Insect repellant.

8.2.4 Respirator.

8.2.5 Face shield.

8.2.6 Four-wheel drive vehicle.

8.2.7 Eye-wash solutions.

8.2.8 Insulated water cooler with potable drinking water.

8.2.9 DOT-approved containers.

8.2.10 Approved cylinder racks with safety bars (chains) for transporting nitrogen cylinders.

8.3 Consumables

8.3.1 pH paper.

8.3.2 Nylon cord.

8.3.3 Plastic bags.

8.3.4 Paper towels.

8.3.5 Tape.

8.3.6 Rinse bottles.

8.3.7 Wet ice (enough to preserve samples to 4°C).

8.3.8 Polyethlyene ground cloth.

8.3.9 10 gal of non-phosphate soap solution.

8.3.10 10 gal of ASTM Type II deionized, distilled water.

8.4 Field Instrumentation

8.4.1 Temperature meter (thermistor or thermometer, centigrade).

8.4.2 Redox (oxidation/reduction) meter (mV).

8.4.3 pH meter.

8.4.4 Dissolved oxygen meter (ppm or mg/L).

8.4.5 Specific conductance meter (μohm/cm).

8.4.6 Hunter/Keck Model KIR-89 or equivalent portable device for measuring the level and thickness of inorganic layers and groundwater monitoring well layers.

8.4.7 In-line water analyzer, if required (should include features in Steps 8.4.1 through 8.4.5).

8.4.8 Electronic water level indicator.

8.4.9 Turbidity meter.

8.5 Field Equipment

8.5.1 Well Wizard™ controller box with fittings and air lines.

8.5.2 Bottom loading Teflon or stainless steel bailer.

8.5.3 Compressed nitrogen gas cylinders with appropriate regulators or gasoline powered oil-less compressor with high pressure hoses and fittings.

8.5.4 Bennett pump (reel, pump head, and tubing bundle of sufficient length).

8.5.5 Electronic calculator.

8.5.6 Insulated ice chest.

8.5.7 Tools and tool box.

8.5.8 Graduated cylinder.

8.5.9 Large plastic trays.

8.5.10 Filtration apparatus equipped with 0.45 or 0.10 μm membrane filter.

8.5.11 Bottle labels.

8.5.12 Chain-of-custody seals (if applicable).

8.5.13 Chain-of-custody forms, equipment calibration forms, DOT approved packaging, labels, and shipping papers, and field data sheets.

8.6 Sample Containers: Sample bottles of assorted sizes and types as required by the analytes specified for each well as defined in the current SAP and Bottle List.

9.0 REAGENTS AND MATERIALS

9.1 Purity of Water: ASTM Type II distilled deionized water. (Refer to Section 19.0 of Ref. 2.12.)

9.2 Purity of Reagents: Reagent grade chemicals shall be used in all analyses. Unless otherwise indicated, it is intended that all reagents conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society where such specifications are available. Other grades of chemicals may be used, provided it is first documented that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

9.3 A Chemical Inventory Sheet is required for the Groundwater Sampling Group and is located in the Groundwater Laboratory, K-1004-H Dock, and each of the sampling vehicles.

NOTE: The following is a list of standard reagents; other reagents may be required for specific activities.

NOTE: Visually inspect preservatives for discoloration or degradation before use to ensure reagent quality.

NOTE: Replace standard solutions in each field instrument box at the beginning of each quarter.

		DOT Hazard Class Shipping Code
9.4	Sulfuric acid (H_2SO_4), 96.4%.	UN 1830 PGII LTD-QTY*†
9.5	Hydrochloric acid (HCl), 36.5 to 38.0%.	UN 1789 PGII LTD-QTY*†
9.6	Sodium hydroxide (NaOH), 50.0%.	UN 1824 PGII LTD-QTY*†
9.7	Nitric acid (HNO_3), 69.0 to 71.0%.	UN 2031 PGII corrosive*†
9.8	Nitrogen (N), compressed.	UN 1066 Nonflammable Gas*†
9.9	Ascorbic acid.	
9.10	Wasp and hornet spray.*	
9.11	Buffer solutions, pH 7 and pH 10.*	
9.12	Formula 409™ or equivalent.	

9.13 Isopropyl alcohol.

9.14 Lava™ soap or equivalent.

9.15 Liqui-Nox™ detergent or equivalent.

9.16 Micro™ soap or equivalent.

9.17 Potassium chloride (KCl).

9.18 Potassium ferricyanide.

9.19 Potassium ferrocyanide.

9.20 Sodium sulfite.*

9.21 Softcide™ hand wash.

9.22 Zinc acetate.

9.23 <u>0.01 *N* KCl Standard Solution</u>: Record each lot prepared in reagent logbook.* Dissolve 1.4873 g of KCl in 2000 mL of Type II water.

9.24 <u>Zobell Standard Solution</u>: Record each lot prepared in reagent logbook.* Dissolve 7.460 g of KCl, 1.270 g of potassium ferrocyanide, and 0.99 g of potassium ferricyanide in 1000 mL of Type II water.

9.25 Lead-free gasoline.*

9.26 10W-30W motor oil.*

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*Materials maintained in the sampling vehicle.
†DOT shipping label required for transfer.

10.0 HAZARDS

> **WARNING!**
>
> Serious injury could occur if the H_2SO_4, HCl, NaOH, or HNO_3 comes in contact with the skin or eyes. Nitrile gloves and safety glasses with side shields must be worn AT ALL TIMES when handling such reagents. Contact should be avoided. Should skin contact occur, flush the area of the skin IMMEDIATELY with water. Should eye contact occur, flush eyes IMMEDIATELY with water from the emergency eye baths mounted in the vehicles. Contact emergency personnel.

> **WARNING!**
>
> Any employee has stop work authority for sampling activities. If site conditions appear unsafe for any reason, or if health and safety requirements do not appear adequate for a site, immediately stop work and leave the site. Contact supervision or the customer representative.

> **WARNING!**
>
> Changing site conditions can pose hazards. Site conditions vary from well to well and from season to season. Wells located in isolated field areas may have hazards associated with the flora and fauna, trip and fall hazards. and hazardous road conditions. Wells located near plant areas have hazards associated with the general area of the plant or the associated building. Personnel should be aware and notify the customer representative or supervision of any off-normal conditions, or if site maintenance is required.

10.1 Refer to the ASO Chemical Hygiene Plan (Ref. 2.2) for important safety information on chemicals, laboratory hoods, and personal protective equipment.

10.2 Consult Material Safety Data Sheets (MSDSs) for information on chemical incompatibilities, specific hazards, or spill cleanup steps for any hazardous materials used in this procedure. Manufacturers' MSDSs are available through the Lockheed Martin Energy Systems Material Safety Reference Sheet computer data base.

10.3 Make sure at least two persons are present during well sampling operations.

10.4 No sampling operations shall be conducted during thunderstorms.

10.5 Have some form of communication in the field for use during sampling operations.

10.6 Follow posted site conditions for entry and safety considerations.

10.7 On weekends or overtime hours, contact the Plant Shift Superintendent at the specific site at the beginning and end of the work shift.

10.8 Carry an adequate supply of Type II water to rinse and clean equipment.

10.9 Use adequate protective clothing during cold weather sampling operations. During hot weather, carry an adequate supply of drinking water, insect repellent, and wasp spray.

10.10 Be familiar with and alert for hazardous flora and fauna.

10.11 Use the proper technique for moving and lifting heavy equipment.

10.12 Always remove the regulator and replace the cylinder cap before operating the vehicle.

10.13 Use proper technique for the safe operation of well pumps, portable gasoline engine-driven electric generators, portable air compressors, and high pressure compressed gas cylinders and regulators.

NOTE: Refer to Ref. 2.2 and/or appropriate customer Health and Safety Plans for environmental health and safety applications.

10.14 Store, transport, and use hazardous and flammable reagents in accordance with instructions in each chemical's MSDS and with DOT regulations.

10.15 Always wear steel-toed shoes, company-issued clothing, gloves, and safety glasses with side shields while performing sampling operations.

10.16 In accordance with ESP-505 (Ref. 2.16.10), have all samples taken from customer groundwater wells surveyed and green-tagged by Radiological Control before shipping to an off-site contract laboratory. Retain a copy of the green tags for records.

10.17 Dispose of waste according to project documentation or the project-specific Waste Management Plan.

11.0 SAMPLING, SUBSAMPLES, AND TEST SAMPLES

Covered in Section 15.0.

15.1.4 Calibrate instruments according to Refs. 2.4 through 2.8.

15.1.5 Record calibration results in designated and numbered calibration logbook.

15.1.6 Record the calibration logbook number on all field data sheets for all wells sampled each day.

15.1.7 Gather and prepare the appropriate sample bottles according to the most current Bottle List and SAP.

15.1.8 Prepare the required trip blanks or field blanks as specified in the bottle list and according to SESD-TP-8203 (Ref. 2.12).

15.1.9 Review the current GWMS for information on access restrictions, well depth and diameter, purge volume, purge method, type of sampling equipment needed, containment requirements, and other well information.

15.1.10 Check site maps for well locations.

15.1.11 Load vehicle with all required sampling equipment, and secure for transport.

WARNING!

Valve stem covers on the compressed gas cylinders MUST BE in place before operation of the vehicle. Severe injury could occur should the valve stem be severed in an accident.

Ensure that compressed gas cylinders are secured in an upright position. Unsecured compressed gas cylinders can overturn during transport.

15.1.12 Load/replace nitrogen gas cylinders for the day's use in truck.

15.2 <u>Well-Site Preparation</u>

15.2.1 Locate and identify monitoring well (refer to site maps).

12.0 PREPARATION OF APPARATUS

12.1 All field analytical equipment is calibrated at the beginning of each day in accordance with Refs. 2.4 through 2.8. Results are recorded in calibration logbooks, with the sheet number is recorded on the field data sheet. All temperature meters are calibrated and verified against a National Institute of Standards certified thermometer, which is calibrated annually by the Metrology, Testing, and Equipment Laboratory. If an instrument is thought to be out of calibration while in the field, the technician must recalibrate the instrument. If the instrument is found to be out of calibration, the supervisor must be contacted so the customer and program management can determine if the previous data are valid or if a resample is required. If an instrument is not calibrated on the proper schedule, the instrument will be treated as out-of-calibration and will be tagged with a "Do Not Operate" tag. Immediate action should be taken to ensure the instrument is recalibrated (see Refs. 2.4 through 2.8).

NOTE: Do not use the balance if the certification has expired.

12.2 The laboratory analytical balance must be certified annually by the Metrology, Testing, and Equipment Laboratory and the standard weight checked and recorded in the reagent logbook by the technician each time it is used. The balance certification date must also be recorded in the reagent logbook.

13.0 CALIBRATION AND STANDARDIZATION

See Refs. 2.4 through 2.8.

14.0 CONDITIONING

Not applicable.

15.0 PROCEDURE

15.1 <u>Field Preparation</u>

15.1.1 Don the necessary PPE and safety equipment.

15.1.2 Decontaminate all pumps, bailers, water level indicators, and other down-hole equipment before use according to this procedure and as specified in ESP-801 (Ref. 2.16.11).

15.1.3 Check with SESD Supervisor for daily sampling instructions.

WARNING!

Off-road, non-paved surfaces are subject to change between monitoring events. Caution and discretion SHOULD BE USED when off-road driving is required to access a well. Notify supervision or customer of any hazardous conditions or blocked access requiring immediate attention. Fill out and submit a well maintenance request form for off-normal road maintenance as required.

15.2.2 Record well number, date, project number, weather conditions, arrival time, well depth and diameter, serial numbers of instruments, purging method, and trip blank preparation location on the field data sheet. Record any problems with site access and visitors at the well in the comments section of the field data sheet.

15.2.3 Don the necessary PPE.

NOTE: Customer will notify SESD when conditions warrant additional PPE.

NOTE: When removing sampling equipment from the tailgate area, use plastic trays and/or sheeting to prevent possible contamination. Discard the plastic sheeting after each use, along with any other disposable items, in accordance with the SAP or Area-Specific Waste Disposal Guide.

15.2.4 Unlock and open the well by removing the well cap. Note condition of the well and any strange odors.

15.2.5 Sample the air in the well head for organic vapors, if required by the SAP (contact customer representative for further instructions on sampling protocol).

15.2.6 Locate the reference mark on the well casing (if not present, contact customer or supervision) and note the diameter of the well.

NOTE: Nitrile gloves must be worn during sample collection and field reading activities to prevent cross-contamination. Gloves must be changed between sampling wells. Leather or work gloves may be worn while performing non-sampling activities (opening the well, preparing the Bennett pump, loading/unloading equipment, etc.).

15.3 Depth to Water (DTW) Measurement

15.3.1 Measure the DTW in the well casing using an electronic water level indicator according to ESP 302-1 (Ref. 2.16.1).

15.3.2 Check the battery on the water level indicator.

15.3.3 Lower the indicator probe into the well until the buzzer sounds (or indicator light flashes).

15.3.4 Pull up on the cable till the buzzer no longer sounds.

15.3.5 Lower the probe slowly and stop at the instant the buzzer sounds again.

15.3.6 Mark the cable with thumb and forefinger where it touches the reference mark.

15.3.7 Record on the field data sheet the measurement to the nearest 0.01ft from the increments on the cable. If the cable is not graduated to 0.01ft, measure with a ruler or measuring tape from the nearest increment to the position marked on the cable with the thumb.

15.3.8 Repeat Steps 15.3.3 through 15.3.7 two times.

15.3.9 Record on the field data sheet the average value of the three readings to the nearest 0.01ft.

15.3.10 Remove the water level indicator from the well.

15.3.11 Wipe the cable down with a paper towel soaked with ASTM Type II distilled deionized reagent grade water as the cable is being reeled up out of the well. Clean the probe tip with soap solution, and rinse with Type II water.

15.3.12 Place the water level indicator in a clean plastic bag to prevent contamination during transport.

NOTE: Accurate well depth data will be provided annually by the customer.

15.3.13 Record the well depth from the GWMS on the field data sheet.

15.3.14 Subtract DTW from the well depth to determine the height of the water column in the well. Record on the field data sheet.

15.3.15 Calculate the volume of the water column in the well casing as follows:

2-in. ID well: 0.1632 gal/ft × height of the water column = gallons

4-in. ID well: 0.6528 gal/ft × height of the water column = gallons

6-in. ID well: 1.4688 gal/ft × height of the water column = gallons

10-in. ID well: 4.0800 gal/ft × height of the water column = gallons

15.4 Three Well Volume Removal—Purging and Sampling Using a Bennett Pump (ESP-302-2 and ESP-302-4)

NOTE: Refer to the GWMS for the purge and sample method to be used at each individual well.

NOTE: A groundwater well is required to be purged a minimum of three well volumes before the collection of representative groundwater samples from the surrounding geological formation. Intermittent field measurements are collected throughout the purge cycle.

15.4.1 Multiply the volume of the water column by three. Record the value on the field data sheet under "Purge Volume."

NOTE: For nitrogen gas cylinders, remove valve stem cover, connect appropriate regulator, and attach air line to pump.

NOTE: For gasoline powered air compressor, connect appropriate hoses and fittings. Follow manufacturer's instructions in starting and operating the compressor. Place the compressor in a **downwind** position.

15.4.2 Connect air lines from the compressed air source to the Bennett pump.

NOTE: If the well's purge water exceeds containment criteria established by the customer, the water is to be collected in containment vessels. Notify customer or supervision if the containment vessels are not in place.

15.4.3 Connect and secure the discharge line of the pump to the containment vessel, if required (see the GWMS). If not required, discharge water to the ground surface.

15.4.4 Start the air flow to the pump. Use the pressure regulator on the pump to regulate the pump's flow rate.

NOTE: Bennett pumps have a maximum pump rate of 2 gpm.

15.4.5 Lower the pump to the air–water interface in the well, and check the pump's footage counter against the measured DTW. Reset counter if needed.

15.4.6 Lower the pump 10 to 20 ft below the air–water interface to begin purging.

15.4.7 Record purge start time on the field data sheet.

15.4.8 Purge a volume of water greater than one tubing volume.

15.4.9 Collect a sample for the initial field determinations of pH, specific conductance, dissolved oxygen, oxidation/reduction potential, and temperature (see Refs. 2.4 through 2.8). Dispose of the sample in the appropriate containment vessel, if required.

15.4.10 Determine the flow rate of the pump by performing the following steps:

15.4.10.1 Place the discharge line into a 1-L graduated cylinder.

15.4.10.2 Record in seconds the time required to fill the cylinder.

15.4.10.3 Convert liters to gallons by the following formula to obtain purge rate:

$$\frac{15.85}{\text{no. of seconds to fill cylinder}} = \text{gpm}$$

15.4.10.4 Record the flow rate in gpm on the field data sheet under "Purge Rate."

15.4.11 On the field data sheet, divide the " Purge Volume" (gallons) by the "Purge Rate" (gpm) to obtain the "Purge Time" (minutes). This is the minimum amount of time a well must purged in order to clear three casing volumes. Record the purge time on the field data sheet.

NOTE: The flow rate will need to be rechecked for wells that drawdown > 200ft, then rechecked every 100 ft subsequently. Recalculate the " Purge Time" on the field data sheet if there is >20% difference between the flow rates.

15.4.12 Divide the purge time by three. This is the time interval at which to collect the intermittent field measurements, as stated in ESP-302-2 (Ref. 2.16.2).

15.4.13 Lower the pump as needed as the water level in the well continues to drop. Always chase down the water in the well from the top.

15.4.14 Collect intermittent field measurements (according to Refs. 2.4 through 2.8) at the time intervals calculated in Step 15.4.12. Record the field measurements on the field data sheet.

15.4.15 Purge the well the required three well volumes. The well is ready to sample when three well volumes have been removed from the well casing or the well purges dry. Record the "Purge Stop" time on the field data sheet.

NOTE: Do not purge the well to dryness more than once.

NOTE: If a well purges dry (i.e., the pumphead is located at or below the midpoint of the monitored interval) before the removal of three well volumes, proceed as follows:

15.4.16 Allow the water level in the well to recover at least 30 min, and perform a water level measurement. Record the measurement on the field data sheet.

15.4.17 Calculate the volume of the water column in the well as described in Step 15.3.15. Record the measurement on the field data sheet.

15.4.18 If the well has recovered a sufficient volume (enough to collect the total volume of the sample set) then proceed with sampling. A standard 8-L volume of water to collect would required a minimum of 12 ft of water in a 2-in. well, 3 to 4 ft in a 4-in. well, and 1 ft in a 6-in. well.

15.4.19 If the water column has not recovered a sufficient volume, let the well recover for a period of time not to exceed 24 h.

15.4.20 Collect samples if sufficient volume is present.

NOTE: Do not place the pump below the midpoint of the monitored level.

NOTE: If insufficient volume is present, then start in the sequence listed in Step 15.4.22 and collect as many samples as the well will allow. Return at intervals not to exceed 24 h, and collect as many samples as the well will allow. Continue this process until the set of samples is complete.

15.4.21 Collect and record a final measurement of field parameters.

NOTE: It is recommended to reduce the flow rate to <300 mL/min in order to decrease agitation of the well.

15.4.22 Decrease the pumps flow rate as low as possible. Collect the following nonvolatile samples in sequence from the pump's discharge hose:

Turbidity
Anions
Carbonate/bicarbonate
Total coliform bacteria
Total suspended solids
Total dissolved solids
Total metals
Filtered metals

Radiochemistry samples:
- Gross alpha, gross beta activity
- Isotopic uranium (^{234}U, ^{235}U, ^{238}U)
- ^{129}I, ^{241}Am, ^{238}Pu, ^{237}Np
- Tritium, total strontium, ^{99}Tc
- Total radium
- Gamma spectrum

Total petroleum hydrocarbons
COD
Cyanide
Ammonia nitrogen
Base-neutral-acid extractable

NOTE: Collect duplicate samples concurrently (e.g., collect both total metal samples—the original and the duplicate—at the same time).

15.4.23 If required by the GWMS, collect a duplicate sample.

15.4.24 If insufficient water is present to collect all samples at one time, record the sample type and collection time for each recovery period on the field data sheet.

15.4.25 Ensure that all samples are labeled properly with the project and subproject numbers, well number, date, time, sampler's initials, analysis requested, preservative used, and any other pertinent information.

15.4.26 Collect the sample for filtered metals through an in-line 0.45-μm filter.

NOTE: The pH should be <2 for samples requiring the addition of an acid. The pH should be >12 for samples requiring addition of a base.

15.4.27 Add the appropriate preservative to the samples as specified in the most current approved Bottle List and GWMS.

NOTE: Do not insert the pH paper or pH meter probe into the sample.

15.4.28 Verify the pH of the preserved samples (except for preserved volatiles) by pouring a small amount of sample over narrow-range pH paper (litmus paper) or by using the calibrated pH meter. Document the pH adjustment on the field data sheet.

15.4.29 Wash the outside of each sample bottle with ASTM Type II water before packing samples in a cooler with ice.

NOTE: Field Blanks give an indication of any contaminants from the surrounding environment (i.e., any volatile present in the atmosphere).

15.4.30 If specified on the GWMS, collect a field blank sample by performing the following:

15.4.30.1 Review the most current approved bottle list to determine bottle type, size and preservative needed.

15.4.30.2 Bring the appropriate amount of ASTM Type II water to the field in a sealed glass jar. Prevent exposure to air until opened at site.

15.4.30.3 At the well site, open the glass jar and fill the specified containers under the same environmental condition in which the samples from the well were collected.

15.4.30.4 Label containers, and place in cooler with ice and trip blank.

15.4.30.5 Fill out separate field data sheet for field blank sample for submittal to ASO.

15.4.31 After collecting the nonvolatile portion of the sample set, pull the Bennett pump from the well.

NOTE: If required, collect rinse water waste from decontamination activities into appropriate containment vessels for disposal.

15.4.32 Conduct a field equipment rinse on the pump.

15.4.33 Place the pump head in a plastic bag filled with 2 gal of nonphosphate soap solution. Rinse outside of the pump head, and pump the soap solution through the tubing bundle.

15.4.34 Fill another plastic bag with 2 gal of ASTM Type II water, and flush soap solution from the pump head and tubing bundle.

15.4.35 Repeat Step 15.3.34.

15.4.36 If noted on the GWMS, collect an equipment rinsate (nonvolatile sample) from the pump at this time by completing the following steps:

15.4.37 Review the most current approved Bottle List to determine bottle type, size, and preservative needed.

15.4.38 Bring the appropriate amount of ASTM Type II water to the field in a sealed glass jar or carboy. Prevent exposure to air until opened at site.

15.4.39 Fill a plastic bag with 1 to 2 gal of ASTM Type II water.

15.4.40 Pump the ASTM Type II water through the pump and tubing, and collect appropriate bottles from the discharge tube of the pump.

15.4.41 Label the containers, preserve (if required), and place in cooler with ice.

15.4.42 Fill out a separate field data sheet for the equipment rinsate sample .

15.4.43 Seal the pump head in a plastic bag. Pump is ready to be used on the next well.

15.4.44 Remove a clean Teflon or stainless steel bottom loading bailer from the vehicle.

NOTE: If noted on the GWMS, collect an equipment rinsate (volatile portion) sample by completing the following steps:

15.4.46 Repeat Steps 15.4.37 and 15.4.38.

15.4.47 Fill the bailer with ASTM Type II water.

15.4.48 Pour the contents of the bailer into the appropriate container.

15.4.49 Label containers, preserve if required, and place in cooler with ice.

15.4.50 Fill out a separate field data sheet for the equipment rinsate sample.

15.4.51 Attach and secure a nylon cord to the top of the bailer. Lower the bailer slowly into the well to minimize agitation of the well water.

15.4.52 Lower the bailer to the screened/open interval of the well to collect samples.

15.4.53 Allow the bailer to fill with water. Gently raise the bailer to the surface (a hand-held crank reel or downrigger may be used) making sure not to allow the cord to touch the ground.

15.4.54 Fill the bottles for the required volatile samples by carefully pouring the contents of the bailer down the inside of the sample bottle. Minimize agitation to the sample as much as possible. Collect samples in the following order:

Volatile organic compounds (VOA)
Total organic carbon (TOC)
Total organic halides (TOX)
Additional organic compounds (AOC)
Phenols

NOTE: If required, dispose of the unused bailed portion of water into the proper containment vessel. To prevent spillage of bailer contents onto the ground surface, fill sample bottles in a plastic tray (non-leaking) and discard the tray's contents into the containment vessel.

15.4.55 Collect all volatile samples with zero headspace in the sample bottle. Check for air bubbles by inverting the bottle and tapping gently.

15.4.56 If the nonvolatile portion of the sample set could not be collected with the Bennett pump, collect samples using bailer in sequence as in Step 15.4.22.

NOTE: The bailed sample for filtered metals will have to be filtered and preserved at the lab. Label the sample bottle accordingly.

15.4.57 Pack all samples in the cooler with ice and the trip blank.

15.4.58 Dispose of the nylon cord, and return all sampling equipment to the vehicle.

15.4.59 Replace the well cap on the casing, and secure with lock.

15.4.60 Sign the field data sheet (both sampling personnel), and enter departure time. Note any required maintenance items in the comments section of the field data sheet, and complete a well maintenance request form, if applicable. Submit maintenance request form to customer or supervision.

15.5 <u>Three Well Volume Removal—Purging and Sampling Using a Dedicated Bladder Pump (ESP-302-5)</u>

NOTE: Refer to GWMS for the purge and sample methodology to be used at each individual well.

NOTE: A groundwater well must be purged a minimum of three well volumes before the collection of representative groundwater samples from the surrounding geological formation. Intermittent field measurements are collected throughout the purge cycle.

15.5.1 Purging

15.5.1.1 Connect air lines from the compression source to the Well Wizard™ bladder pump as follows:

15.5.1.1.1 Connect the air line from the compression source to the "Inlet" nipple on the Well Wizard™ controller box.

15.5.1.1.2 Connect an air line from the "Outlet" on the controller box to the corresponding nipple on the well cap.

15.5.1.1.3 Attach discharge tubing with an elbow fitting to protruding discharge tubing on the well cap. If required, connect discharge line to the appropriate containment vessel.

15.5.1.2 Calculate the "Purge Volume" on the field data sheet. Record the value on the field data sheet.

15.5.1.3 Start the air flow to the Well Wizard™ controller box.

NOTE: If known, use previous settings to achieve the same purge rate.

15.5.1.4 Set the controller box's discharge and refill cycles based on total depth of the well and the DTW. Refer to manufacturer's instructions printed on the controller.

15.5.1.5 Increase the throttle on the controller box to maximize flow rate from the pump (bladder pumps have a flow rate no greater than 1 gpm).

15.5.1.6 Determine the flow rate of the pump as in Step 15.4.10.

15.5.1.7 Calculate the purge time as in Steps 15.4.11 and 15.4.12. Record on field data sheet.

15.5.1.8 Collect intermittent field measurements (see Refs. 2.4 through 2.8) at the calculated time intervals. Record field measurements on field data sheet.

15.5.1.9 Purge the well the required three well volumes. Record the "Purge Stop" time on the field data sheet. The well is ready to sample when three well volumes have been removed from the well casing or the well purges dry.

NOTE: If well purges dry before the removal of three well volumes, follow Steps in 15.4.16 through 15.4.19.

NOTE: Reduced flow rates decrease the agitation of the well's water. Recommended flow rate is <300 mL/min.

15.5.1.10 When purging is complete, cut the flow rate on the pump down as low as possible.

15.5.1.11 Collect samples in the following sequence (collect all volatile samples using precautions described in Steps 15.4.54 and 15.4.55):

VOA
TOC
TOX
AOC
Phenols
Turbidity, pH, conductivity
Anions
Carbonate/Bicarbonate
Total coliform bacteria
Total suspended solids

Total dissolved solids
Total metals
Filtered metals
Radiochemistry samples
  Gross alpha, gross beta activity
  Isotopic uranium (^{234}U, ^{238}U, ^{235}U)
  ^{129}I, ^{241}Am, ^{238}Pu, ^{237}Np
  Tritium, total strontium, ^{99}Tc
  Total radium
  Gamma spectrum
Total petroleum hydrocarbons
COD
Cyanide
Ammonia nitrogen
Base-neutral-acid extractable

NOTE: Collect duplicate samples concurrently (e.g., collect both total metal samples—original and duplicate—at the same time).

15.5.1.12 If required, collect a duplicate sample.

15.5.1.13 If insufficient water is present to collect all samples at one time, record the sample type and collection time for each recovery period on the field data sheet.

15.5.1.14 Ensure that all samples are labeled properly as in Step 15.4.25.

15.5.1.15 Collect the sample for filtered metals through an in-line 0.45-μm filter.

15.5.1.16 Add the appropriate preservative to the samples as listed in the current approved SAP and Bottle List.

NOTE: The pH should be <2 for samples requiring the addition of an acid. The pH should be >12 for samples requiring the addition of a base.

NOTE: Do not insert the pH paper into the sample.

15.5.1.17 Verify the pH of the preserved samples (except for preserved volatile samples) by pouring a small amount of sample over narrow-range pH paper, or use a calibrated pH meter. Document the pH adjustment on the field data sheet.

15.5.1.18 Wash the outside of the sample bottles with ASTM Type II water before packing samples in the cooler with ice.

15.5.1.19 Pack all samples in cooler with ice along with the trip blank.

15.5.1.20 If specified on the GWMS, collect a field blank as described in Step 15.4.30.

15.5.1.21 Clean up around well site, and return all sampling equipment to the vehicle.

15.5.1.22 Replace well cap or covering on well casing, and secure with lock.

15.5.1.23 Sign the field data sheet (both sampling personnel), and enter departure time. Note any required maintenance items on a well maintenance request form, if applicable, and submit to customer or supervision.

15.6 <u>Low Flow Minimal Drawdown Sampling—Purging and Sampling Using a Dedicated Bladder Pump</u>

NOTE: Refer to the GWMS for the purge and sample method to be used at each individual well.

NOTE: Low flow minimal drawdown sampling requires the well to be purged and sampled at low flow rates with a minimal drawdown of the well water level. Minimal drawdown of the water level prevents mixing of the stagnant water column with groundwater within the well's monitored interval. The end point of purging is determined when drawdown is in a steady state and field parameters have stabilized.

15.6.1 Purging

15.6.1.1 Connect air lines from the compression source to the Well Wizard™ bladder pump as in Steps 15.5.1.1.1 through 15.5.1.1.3.

NOTE: If using the in-line water analyzer, follow manufacturer's instructions for setup, calibration, and operation. Use a separate line for sampling separated from the water passing through the unit.

15.6.1.2 Insert the water level indicator into the well. Follow Steps 15.3.2 through 15.3.9, and record the "Depth to Water" on the field data sheet.

15.6.1.3 Leave the water level indicator in the well to monitor the drawdown of the well water throughout the purge cycle.

15.6.1.4 Set the controller box discharge and refill cycles based on total depth of the well and the DTW.

15.6.1.5 Start air flow to the pump at the lowest possible flow rate. Record the start time on the field data sheet.

NOTE: The optimal flow rate of the pump should be between 200 and 300 mL/min, and should not exceed 300 mL/min.

15.6.1.6 Use the throttle on the controller box to control the pump flow rate.

15.6.1.7 Determine the flow rate of the pump by following Step 15.4.10.

NOTE: Use 2-min increments if less than 5 ft of water is present in the well.

15.6.1.8 Once a consistent flow rate has been achieved, begin monitoring and recording the DTW in the well at 5-min intervals with the water level indicator.

15.6.1.9 Collect a sample for the initial field determinations as in Step 15.4.9.

15.6.1.10 When the drawdown in the well has stabilized to <0.05 ft to 0.10 ft over a 15-min interval, the well is considered to be in steady state drawdown.

15.6.1.11 Start collecting and recording field readings (see Refs. 2.4 through 2.8) in 5-min increments on the field data sheet.

NOTE: Contact customer if the following conditions are not reasonably achievable for a well.

15.6.1.12 Continue collecting and recording field readings until the readings have stabilized over three 5-min intervals as follows:

pH readings stable within ±0.1 pH unit

Temperature readings stable within ±1.0°C

Specific conductance readings stable within ±10%

Redox readings stable within ±10 mV

Dissolved oxygen readings stable within ±10%

15.6.1.13 The well is considered ready to sample when the following two conditions have been met:

(1) Water levels are stable.

(2) All field readings have stabilized.

15.6.1.14 Record the "Purge Stop" time and the estimated purged volume of water on the Field data sheet.

15.6.2 Sampling

15.6.2.1 Collect and record the final field readings and water level measurement on the Field data sheet.

NOTE: Collect VOA samples with minimal agitation. Hold discharge tubing in a near vertical position such that the water does not cascade down the tubing.

15.6.2.2 Collect the samples in the order indicated in Step 15.5.1.11, with the exception of filtered metals, which should be collected last in sequence.

15.6.2.3 If required, collect a duplicate sample concurrently.

15.6.2.4 If insufficient water is present to collect all samples at one time, record the sample type and collection time for each recovery period on the field data sheet.

15.6.2.5 Ensure that all sample bottles are labeled properly according to Step 15.4.25.

NOTE: Pump pressure may have to be increased when using in-line filters, and this may affect flow rates.

15.6.2.6 Collect the sample for filtered metals through an in-line 0.45-μm filter.

15.6.2.7 Add the appropriate preservative to the samples listed in the most current approved SAP and Bottle List.

NOTE: Do not insert pH paper into the sample.

15.6.2.8 Verify the pH of the preserved samples according to Step 15.5.1.17.

15.6.2.9 Wash the outside of each sample bottle with ASTM Type II water before packing samples in cooler with ice.

15.6.2.10 Remove water level indicator from the well and clean as in Steps 15.3.11 through 15.3.12. Replace well cap or covering on well casing, and secure with lock.

15.6.2.11 Pack all samples in cooler with ice along with the trip blank.

15.6.2.12 If specified on the GWMS, collect field blank as described in Step 15.4.30.

15.6.2.13 Clean up around well site, and return all sampling equipment to the vehicle.

15.6.2.14 Sign the field data sheet (both sampling personnel), and enter departure time. Note any required maintenance items on a well maintenance request form and submit to customer, if needed.

15.7 Equipment Decontamination

15.7.1 As indicated on the GWMS, when all wells in a well grouping have been completed, return all nondedicated sampling equipment to the laboratory to be decontaminated.

15.7.2 Decontaminate the non-dedicated pumps as follows:

15.7.2.1 Steam clean the exterior of the pumphead and entire tubing bundle according to Ref. 2.13.

15.7.2.2 Bring the pump into the laboratory to perform the internal rinse.

NOTE: To minimize waste of 10% nitric acid solution, use ≈0.7 gal of solution for the 125-ft pump; ≈1.4 gal for the 250-ft pump; and ≈2.8 gal for the 500-ft pump.

15.7.2.3 Run a rinse solution consisting of 10% nitric acid and ASTM Type II water. Make sure entire tubing bundle is filled with the solution.

15.7.2.4 Neutralize and dispose of the nitric acid solution according to Ref. 2.14.

15.7.2.5 Run a sufficient tap water rinse through the pump to completely remove all of the nitric acid solution and any other residue within the tubing bundle. Check the pH of the tap rinse to ensure the solution is neutral. Neutralize if necessary.

15.7.2.6 Pump at least two tubing bundles of ASTM Type II water through the pump.

15.7.2.7 Ensure pump head is clean. Wash with nonphosphate soap and rinse, if necessary.

15.7.2.8 Wipe down pump head with a paper towel, and wrap in aluminum foil for laboratory to field transport. Store pump in an area free of possible external contamination.

15.7.3 Decontaminate the bailers as follows:

15.7.3.1 Disassemble and wash the exterior and interior parts with nonphosphate soap solution and warm water. Allow time for parts to soak for easier cleaning.

15.7.3.2 Rinse with ASTM Type II water.

15.7.3.3 Rinse with reagent-grade isopropyl alcohol, taking care to contain any spillage in a containment tray or sink. Allow parts to air dry in hood.

15.7.3.4 Conduct a final rinse with Type II water, and allow to air dry in hood.

15.7.3.5 When completely dry, reassemble the parts and wrap in aluminum foil for laboratory to field transport and storage.

16.0 CALCULATION/INTERPRETATION OF RESULTS

The volume of water in a well casing is calculated using the formulas listed in Step 15.3.15.

17.0 REPORT

17.1 All field activities are recorded by field sampling technicians on a field data sheet. A field data sheet is completed for each well sampling event and contains the following information:

Well identification number.
Calibration logbook number.
Date and time of sample collection.
Well-specific information and volume calculations.
Field measurements of pH, specific conductance, redox, dissolved oxygen, and temperature.
Signatures of all field sampling personnel.
Assigned lab sample identification number.
Chain-of-custody record of all samples collected.
Record of field comments and off-normal occurrences encountered at well site.

17.2 Field data sheets are reviewed and signed off by the SESD supervisor. The field data sheets are numbered and permanently bound into logbooks for permanent record storage.

18.0 PRECISION AND BIAS

Not applicable.

19.0 QUALITY ASSURANCE/QUALITY CONTROL

19.1 The well sampling frequency, the required analyses, and the well location will be listed in the current Sampling and Analysis Plan.

19.2 The quality assurance and quality control measures described in Ref. 2.1 apply to this procedure.

20.0 APPENDIXES

Not applicable.

End of document

APPENDIX A-7
Permit Attachment 7 — Y-12 Groundwater Protection Program Well Plugging and Abandonment Procedures

Oak Ridge Y-12 Plant
Groundwater Protection Program
Standard Practice Procedure

Monitoring Well Plugging and Abandonment Procedure

G-003
Rev. 2., May 1997

Approved by: W. Kevin Jago Date: 4-28-97

Effective Date: 5-1-97

Record of Changes

Change No.	Affected Pages	Approved Date	Expiration Date	Change No.	Affected Pages	Approved Date	Expiration Date

Next 3-year review required no later than: May 2000

CONTENTS

1.0 PURPOSE

This procedure contains guidelines and methods for monitoring well plugging and abandonment (P&A) at the Oak Ridge Y-12 Plant. Wells of similar construction materials and design are classified into one of four groups, and a specific P&A method is defined for each group. The methods are designed to remove all well components, seal the borehole to prevent fluid migration into or between water-bearing zones, and to minimize the amount of waste-materials generated during P&A operations.

2.0 APPLICABILITY

This procedure applies to all monitoring wells at the Y-12 Plant, which are designated for P&A by the Y-12 Plant Groundwater Protection Program Manager (GWPPM) or authorized designee.

3.0 DEFINITIONS

Annular Seal - material (grout or cement) which prevents fluid migration through the space between the well casing and borehole wall or outer casing.

Conductor Casing - an initial casing, typically steel or PVC, installed in the unconsolidated zone to support the borehole and provide drilling rig stability. This casing may be removed during completion of the monitoring well or grouted in place.

Containment System - excavated pit, drums, tanks or other containers used to collect and contain drill cuttings and fluids generated during P&A.

Diverter Assembly - apparatus used to direct drill cuttings and fluids to the containment system.

Groundwater Protection Program (GWPP) - a program developed per DOE Order 5400.1 to characterize the hydrogeology and monitor and protect groundwater quality at the Y-12 Plant.

GWPP Manager (GWPPM) - person responsible for day-to-day management of the Y-12 Plant GWPP.

On-Site Geologist - a geologist or professional geologist, registered in the State of Tennessee, responsible for field supervision of P&A operations.

Open-Hole Interval - a portion of a monitoring well designed so that groundwater enters the well through a segment of borehole that is open to the water-bearing formation.

Primary Inspection Item - those components of a monitoring well that are critical to the collection of representative groundwater quality samples and hydrologic information. Primary inspection items include the well casing and screen, annular grout seal, hasp, lock, cap, well identification, and condition of the screened or open-hole interval.

Protective Surface Casing - a section of large-diameter steel or polyvinyl chloride (PVC) pipe that is emplaced over the surface extension of a smaller diameter well casing to provide structural protection to the well and restrict unauthorized access to the well.

Surface Casing - steel or PVC piping set from the ground surface into the top of bedrock to support the unconsolidated section of the borehole. The surface casing in a core hole extends into bedrock to the top of the open-hole interval.

Tremie Method - a method for placing cement in the borehole. Cement is pumped through a small diameter pipe (usually 2-in or less) extending to at least 1-ft above the bottom of the borehole or the top of a previously placed annular seal. The pipe is raised as the cement is emplaced. Use of this method reduces the potential for the cement to bridge and ensures placement of cement along the entire length of the borehole.

Washover Pipe - a drill pipe which fits over the well casing and is used to drill out the annular grout seal.

Well Casing - steel, stainless steel or PVC piping which provides unobstructed access to the monitored interval.

4.0 REFERENCES

4.1 Use References

4.1.1 "Environmental Surveillance Quality Control Program," ES/ESH/INT-14, Martin Marietta Energy Systems, Inc. 1988.

4.1.2 "Monitoring Well Inspection and Maintenance Plan, Y-12 Plant, Oak Ridge, Tennessee (Revised)," Y/TS-1215, Lockheed Martin Energy Systems, Inc. 1996.

4.1.3 "Halliburton Cementing Tables," Little's, Duncan, Oklahoma, Halliburton Services, Inc., 1981.

4.1.4 "Updated Subsurface Data Base for Bear Creek Valley, Chestnut Ridge, and Parts of Bethel Valley on the U.S. Department of Energy Oak Ridge Reservation," Y/TS-881/R3, July 1995 (or most recent revision).

4.2 Source References

4.2.1 Aller, Linda, Truman W. Bennett, Gene Hackett, Rebecca J. Petty, Jay H. Lehr, Helen Sedoris, and David M. Nielsen. Handbook of Suggested Practices for the Design and Installation of Groundwater Monitoring Wells, National Water Well Association, Dublin, Ohio, 398 p.

4.2.2 Driscoll, Fletcher G. 1986. Groundwater and Wells, Johnson Division, St. Paul, Minnesota, 1089 p.

4.2.3 Martin Marietta Energy Systems, Inc. 1987. Plugging and Abandonment Procedures for the Oak Ridge Y-12 Plant, Y/TS-531.

4.2.4 "Oak Ridge Y-12 Plant Groundwater Protection Program Management Plan (Revised)," Y/SUB/96-KDS15V/1, June 1996 (or most recent revision).

5.0 PRECAUTIONS AND LIMITATIONS

5.1 Cavities and Fractures

Cavities, fractures, joints, bedding planes, or other voids may be encountered during removal of the well casing and reaming of the borehole, resulting in a greater volume of cement to plug the borehole than calculated from the borehole depth and diameter. Additionally, lost-circulation additives may be required to minimize fluid loss during P&A operations.

5.2 Method Selection

Because of differences in monitoring well construction and conditions that may occur during drilling operations, not all of the monitoring wells at the Y-12 Plant can be classified into one of the four categories of well construction. A flexible policy is necessary to determine the most appropriate P&A method for each monitoring well and to allow some deviation from the specified method as conditions warrant.

5.3 Safety

Established general safety standards and requirements of Lockheed Martin Energy Systems, Inc., the Department of Energy (DOE), and the Occupational Safety and Health Administration (OSHA) will apply to all P&A field operations. Specific safety requirements applicable to P&A are outlined in *Health and Safety Plan for Well Installation and Plugging and Abandonment Activities, Y-12 Plant, Oak Ridge, Tennessee*, Y/SUB/92-99928C(Y11)/1, July 1992.

5.4 Cement Slurry Weights and Curing Schedules

The length of the column of cement emplaced at one time should not exceed 300 ft so that the weight of the cement is less than the fracture pressure of the monitored formation. This will also minimize infiltration of cement into the formation. Cement cure times shall be determined by the on-site geologist. Cure times will be specified depending on temperature and required compressive strength using guidelines established in Reference 4.1.3.

5.5 Casing Extraction

Certain monitoring wells have been constructed using substandard annular seals or no annular seal. In such cases, casings may be extracted without use of overwashing techniques. In cases where the construction of the well allows, an attempt to extract the well casing may be made using the drilling rig head and appropriate lifting device, such as lifting bell, clevis, wire rope, or chain. Casing extraction jacks may alternately be used. Drilling rig leveling jacks or winches shall not be used to attempt to extract casings prior to overwashing. The decision to attempt to extract a well casing shall be made by the on-site geologist, in conjunction with the GWPPM or authorized designee, and documented as specified in Section 7.0.

5.6 Monitoring Well Construction Information

Data contained in Reference 4.1.4 is compiled from best available records. However, erroneous and missing construction data exists, particularly for older wells that pre-date the GW Series. Where monitoring well construction data is unavailable, best technical judgment as to casing set points or monitoring well depths will be employed by the on-site geologist in consultation with the GWPPM or authorized designee. As a result, deviations from the standard P&A likely will be required. All deviations shall be recorded as outlined in Section 9.0.

5.7 Setting Cement Plugs

Grout column height within a borehole is not a critical concern so long as potential cross-migration of groundwater is eliminated. A 4-ft depth for a completed plug is a standard target depth. Depths more or less than 4-ft may be technically justified and/or economically feasible.

6.0 EQUIPMENT, TOOLS AND SUPPLIES

6.1 Drilling Equipment

Drilling equipment includes, but is not limited to, drill bits, washover pipe, diverter assembly, etc.

6.2 Grouting Supplies and Equipment

Required items include, but are not limited to, cement, additives, potable water, mixer, pump, and tremie pipe.

6.3 Containment System

As directed by the Waste Management Plan, pits, drums, tanks, and/or other containers may be required.

6.4 Safety Equipment

Standard safety equipment is denoted in a site-specific health and safety checklist and includes, but is not limited to, safety shoes, company work clothes or tyvek coveralls, protective eye-wear, hard hat, and rubber gloves.

6.5 Decontamination Equipment

Includes steam cleaner, potable water, and mild detergent.

7.0 DOCUMENTATION

7.1 Well Plugging and Abandonment Request Form

This form is used to initiate P&A activities, and is completed by the Y-12 Plant GWPPM or authorized designee if: (1) a monitoring well impedes site operations, construction or closure, (2) inspection of a monitoring well has indicated significant damage to or deterioration of a Primary Inspection Item, or (3) the Y-12 Plant GWPPM or authorized designee determines that P&A of a monitoring well is warranted for other reasons. The completed form is transmitted to the on-site geologist when P&A operations are scheduled.

7.2 Well Plugging and Abandonment Waste Management Plan

This form is completed by the Y-12 Plant GWPPM or authorized designee. The plan includes: (1) the estimated volume of cuttings and fluids that will be generated during P&A, (2) the types and concentrations of contaminants (if any) known to be present in the monitoring well, (3) the appropriate waste containment method required during P&A operations (i.e., discharge to ground surface or containment system), (4) an estimate of the number and types of samples (e.g., cuttings) to be collected during P&A and the required analyses of the samples prior to disposal or treatment, and (5) the proposed disposition or treatment of any containerized materials.

7.3 Well Plugging and Abandonment Diagram

This form is completed by the Y-12 Plant GWPP Manager or authorized designee, and the on-site geologist. Before P&A operations begin, the Y-12 Plant GWPP Manager or authorized designee completes the following sections of the diagram: (1) the monitoring well location (site), (2) the drilling subcontractor, (3) the rationale for P&A of the monitoring well, (4) the P&A method (including any proposed deviations from the specified method), and (5) applicable monitoring well construction details (e.g., borehole diameter). During P&A operations, the on-site geologist completes the diagram with specific P&A details for the monitoring well (e.g., depth to the top of the cement plug).

7.4 Well Plugging and Abandonment Activity/Progress Report

This report is completed by the on-site geologist and includes descriptions of the daily activities performed during P&A operations.

8.0 PLUGGING AND ABANDONMENT

8.1 Site Preparation

8.1.1 Confirm the monitoring well identification and site access, and mobilize drilling and grouting equipment to the work site.

8.1.2 Remove the surface components of the monitoring well (lock, well cap, guard posts, surficial concrete pad, protective well casing or manhole cover) as applicable.

8.1.3 If specified in the Well Plugging and Abandonment Waste Management Plan, set up the diverter assembly and the containment system.

8.2 Equipment Decontamination

If specified in the Well Plugging and Abandonment Waste Management Plan, decontaminate the drilling and associated equipment (e.g., drill bits, drill rods, tremie pipe) when P&A operations at each monitoring well have been completed.

8.3 Method A

Method A is for monitoring wells constructed of 7 inch (in) outside diameter (OD) or smaller steel or stainless steel well casing, and typically completed with 5 to 20-ft well screens and sand filter packs. Monitoring wells completed in bedrock may also have 8- to 12-in-OD steel or PVC surface casing extending from ground surface to the top of bedrock. Some monitoring wells may also be completed with a conductor casing.

8.3.1 Remove the Well Casing

Drill out the annular grout seal using a washover pipe advanced to the bottom of the borehole. Retrieve the washover pipe and remove the well casing. Staged removal of the casing string may be necessary if it cannot be removed in one operation. Stainless steel casing may be drilled out (milled) with a tri-cone drill bit and the borehole conditioned simultaneously. If this approach is feasible, the bit size must be at least 0.25-in larger than the original borehole diameter to ensure that the casing and annular grout seal are completely removed.

8.3.2 Condition the Borehole

If the monitoring well was completed in bedrock, ream the borehole to the total depth with a tri-cone drill bit that is at least 0.25-in larger in diameter than the original borehole. This will expose fresh bedrock and help ensure an effective bond between the cement plug and the borehole wall. Monitoring wells completed within the unconsolidated zone do not require borehole conditioning.

8.3.3 Set the Plug

Tremie API Class A neat cement, mixed with potable water to a slurry density of 12 to 15 pounds per gallon (lbs/gal), from the bottom of the borehole. If no surface/conductor casing is present, tremie the cement to within approximately 4 ft of ground surface. If a surface/conductor casing is present, tremie the cement to the bottom of the casing.

8.3.4 Remove the Surface/Conductor Casing

If the monitoring well was completed with surface/conductor casing, drill out the annular grout seal using a washover pipe advanced to the bottom of the casing. Retrieve the washover pipe and remove the casing. Using a tri-cone drill bit at least 0.25-in larger in diameter than that of the original borehole, ream the borehole to the top of the existing cement plug. Tremie cement, mixed to a density of 12 to 15 lbs/gal, from the top of the existing plug to within approximately 4 ft of the ground surface (or to the bottom of the conductor casing, if removing a surface casing).

It may be possible to remove PVC surface/conductor casing by milling with a tri-cone drill bit. If this approach is feasible, the bit size must be at least 0.25-in larger than the original borehole diameter to ensure that the casing and annular grout seal are completely removed.

8.3.5 Verify Plug Depth

Measure the depth to the top of the cement plug to verify that it is within approximately 4 ft of the ground surface. If not, add more cement until the specified depth is reached.

8.3.6 Cap the Plug

Fill the remainder of the borehole to ground surface with compacted non-contaminated soil.

8.4 Method B

Method B is for monitoring wells constructed of 7-in-OD or smaller steel or PVC well casing completed with open-hole intervals in competent bedrock. The well casing typically extends from the ground surface to the top of the open-hole interval, which typically extends from 5 to 100 ft below the bottom of the well casing. The monitoring wells may also be completed with 8- to 12-in-OD steel or PVC surface casing extending from ground surface to the top of bedrock. Some monitoring wells may also be completed with a conductor casing.

8.4.1 Condition the Open-Hole Interval

Lower a drill string and tri-cone drill bit into the monitoring well to the bottom of the open-hole interval. Circulate air and potable water containing additives such as QUIK-GEL or QUICK-MUD to remove any old cuttings and debris that may have accumulated at the bottom of the well.

8.4.2 Set the Lower Plug

Tremie API Class A neat cement, mixed with potable water to a slurry density of 12 to 15 lbs/gal, from the bottom of the open-hole interval to the bottom of the well casing.

8.4.3 Remove the Well Casing

Drill out the annular grout seal surrounding the well casing using a washover pipe advanced to the top of the open-hole interval. Retrieve the washover pipe and remove the casing. Staged removal of the casing string may be necessary if it cannot be removed in one operation.

It may be possible to remove PVC well casing by milling with a tri-cone drill bit. If this approach is feasible, the bit size must be at least 0.25-in larger than the original borehole diameter to ensure that fresh bedrock is exposed and that the casing and annular grout seal are completely removed.

8.4.4 Condition the Borehole

Ream the borehole with a tri-cone drill bit that is at least 0.25-in larger in diameter than the original borehole. This will expose fresh bedrock and help ensure an effective bond between the cement plug and the borehole wall.

8.4.5 Set the Upper Plug

Tremie cement, mixed to a density of 12 to 15 lbs/gal, from the top of the lower plug. If no surface/conductor casing is present, tremie the cement to within approximately 4 ft of ground surface. If a surface/conductor casing is present, tremie the cement to the bottom of the casing.

8.4.6 Remove the Surface/Conductor Casing

If the monitoring well was completed with surface/conductor casing, drill out the annular grout seal using a washover pipe advanced to the bottom of the casing. Retrieve the washover pipe and remove the casing. Using a tri-cone drill bit at least 0.25-in larger in diameter than the original borehole, ream the borehole to the top of the existing cement plug. Tremie cement, mixed to a density of 12 to 15 lbs/gal, from the top of the existing plug to within approximately 4 ft of the ground surface (or bottom of the conductor casing, if removing a surface casing).

It may be possible to remove PVC surface/conductor casing by milling with a tri-cone drill bit. If this approach is feasible, the bit size must be at least 0.25-in larger than the original borehole diameter to ensure that the casing and annular grout seal are completely removed.

8.4.7 Verify Plug Depth

Measure the depth to the top of the cement plug to verify that it is within approximately 4 ft of the ground surface. If not, add more cement until the specified depth is reached.

8.4.8 Cap the Plug

Fill the remainder of the borehole to ground surface with compacted non-contaminated soil.

8.5 Method C

Method C is for monitoring wells constructed of 7-in-OD or smaller PVC well casing, and typically completed with 5 to 20-ft well screens and sand filter packs. Monitoring wells completed in bedrock may also have 8 to 12-in-OD steel or PVC surface casing extending from ground surface to the top of bedrock. Some monitoring wells may also be completed with a conductor casing.

8.5.1 Remove the Well Casing

Remove the PVC well casing and annular grout seal by milling with a tri-cone drill bit. The bit size must be at least 0.25-in larger than the original borehole diameter to ensure that fresh bedrock is exposed (bedrock wells only) and that the casing and annular grout seal are completely removed.

If milling is not feasible, drill out the annular grout seal around the well casing using a washover pipe advanced to the bottom of the borehole. Retrieve the washover pipe and remove the well casing. Staged removal of the casing string may be necessary if it cannot be removed in one operation.

8.5.2 Condition the Borehole

If the monitoring well was completed in bedrock and washover techniques were used, ream the borehole with a tri-cone drill bit that is at least 0.25-in larger in diameter than the original borehole. This will expose fresh bedrock and help ensure an effective bond between the cement plug and the borehole wall.

8.5.3 Set the Plug

Tremie API Class A neat cement, mixed with potable water to a slurry density of 12 to 15 lbs/gal, from the bottom of the borehole. If no surface/conductor casing is present, tremie the cement to within approximately 4 ft of ground surface. If a surface/conductor casing is present, tremie the cement to the bottom of the casing.

8.5.4 Remove the Surface/Conductor Casing

If the monitoring well was completed with surface/conductor casing, drill out the annular grout seal using a washover pipe advanced to the bottom of the casing. Retrieve the washover pipe and remove the casing. Using a tri-cone drill bit at least 0.25-in larger in diameter than the original borehole, ream the borehole to the top of the existing cement plug. Tremie cement, mixed to a density of 12 to 15 lbs/gal, from the top of the existing plug to within approximately 4 ft of the ground surface.

It may be possible to remove PVC casing by milling with a tri-cone drill bit. If this approach is feasible, the bit size must be at least 0.25-in larger than the original borehole diameter to ensure that the casing and annular grout seal are completely removed.

8.5.5 Verify Plug Depth

Measure the depth to the top of the cement plug to verify that it is within approximately 4 ft of the ground surface. If not, add more cement until the specified depth is reached.

8.5.6 Cap the Plug

Fill the remainder of the borehole from the top of the cement plug to ground surface with compacted non-contaminated soil.

8.6 Method D

Method D is for exploratory core holes constructed of 4.5-in-OD or smaller steel surface casing, which typically extends from ground surface into competent bedrock, with an open-hole interval below the bottom of the casing. The core holes may also have 8 to 12-in-OD steel or PVC conductor casing extending through the unconsolidated material.

8.6.1 Condition the Open-Hole Interval

The open-hole interval of the core holes will not be conditioned (i.e., fluid circulation or reamed to expose fresh bedrock). This would require the prior removal of the 4.5-in-OD surface casing, which may risk collapse of the upper portion of the core hole before P&A operations are completed. In addition, core hole diameters are normally 3.5-in. or less, which are smaller than standard tri-cone bits.

8.6.2 Set the Lower Plug

Tremie API Class A neat cement, mixed with potable water to give a slurry density of 12 to 15 lbs/gal, from the bottom of the open-hole portion of the core hole. Because of the long open hole intervals in typical core holes, the cement must be installed in stages of approximately 300 ft or less. During placement, tremie the cement from the bottom to the top of the particular interval being plugged, and allow the cement to cure according to cementing schedules. In the final stage, tremie the cement to the bottom of the surface casing.

8.6.3 Remove the Surface Casing

Drill out the annular grout seal around the surface casing using a washover pipe advanced to the bottom of the casing. Retrieve the washover pipe and remove the casing. Staged removal of the casing may be necessary if it cannot be removed in one operation.

8.6.4 Condition the Borehole

Ream the borehole to the top of the existing cement plug using a tri-cone drill bit that is at least 0.25 larger than the original borehole diameter. This will expose fresh bedrock and help ensure an effective bond between the cement plug and the borehole wall.

8.6.5 Set the Upper Plug

Tremie cement, mixed to a density of 12 to 15 lbs/gal, from the top of the lower plug. If no conductor casing is present, tremie the cement to within approximately 4 ft of ground surface. If a conductor casing is present, tremie the cement to the bottom of the conductor casing.

8.6.6 Remove the Conductor Casing

If the core hole was completed with conductor casing, drill out the annular grout seal using a washover pipe advanced to the bottom of the conductor casing. Retrieve the washover pipe and remove the conductor casing. Using a tri-cone drill bit at least 0.25-in larger in diameter than the original borehole, ream the upper portion of the borehole to the top of the existing cement plug. Tremie cement, mixed to a density of 12 to 15 lbs/gal, from the top of the existing plug to within approximately 4 ft of the ground surface.

It may be possible to remove PVC conductor casing by milling with a tri-cone drill bit. If this approach is feasible, the bit size must be at least 0.25-in larger than the original borehole diameter to ensure that the casing and annular grout seal are completely removed.

8.6.7 Verify Plug Depth

Measure the depth to the top of the cement plug to verify that it is within approximately 4 ft of the ground surface. If not, add more cement until the specified depth is reached.

8.6.8 Cap the Plug

Fill the remainder of the borehole to the ground surface with compacted non-contaminated soil.

9.0 ACCEPTANCE CRITERIA

The on-site geologist will verify that P&A operations were performed in accordance with the specified method. Any deviations from the specified P&A method must be pre-approved by the Y-12 Plant GWPPM or authorized designee. Requests for deviations may be verbal, but must be recorded immediately in the field log book and include date, time, and authorizing personnel. Deviations will also be noted on Activity/Progress Forms and P&A Diagrams as appropriate.

10.0 POST PERFORMANCE WORK ACTIVITIES

10.1 The on-site geologist will submit the well P&A documentation to the Y-12 Plant GWPPM or authorized designee.

10.2 Waste materials generated during P&A will be disposed of in accordance with the Well Plugging and Abandonment Waste Management Plan.

11.0 RECORDS

The documentation listed in items 11.1 through 11.4 below will be included in the annual well plugging and abandonment report and become part of the administrative record for the Y-12 Plant GWPP.

11.1 Well Plugging and Abandonment Request Form

11.2 Well Plugging and Abandonment Waste Management Plan

11.3 Well Plugging and Abandonment Diagram

11.4 Well Plugging and Abandonment Activity/Progress Report

11.5 Daily Log

A daily log of field P&A activities shall be maintained. This log will be placed in the administrative record of the Y-12 Plant GWPP.