Draft
POST-CLOSURE PERMIT

For Post-Closure Care
of three Closed
Hazardous Waste Surface Impoundments
and
Facility Wide Corrective Action

Issued To

United States Steel Corporation (USS)
and
Anderson Geneva, LLC and
Ice Castle Retirement Fund, LLC

EPA #UTD009086133

Issued
May 14, 2004
Updated
January 26, 2010

UTAH HAZARDOUS WASTE POST-CLOSURE PERMIT

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STATE OF UTAH PERMIT
Permittee:
United States Steel Corporation (USS)
and
Anderson Geneva, LLC and Ice Castle Retirement Fund, LLC
Utah County, Utah
EPA Identification Number UTD009086133

Pursuant to the Utah Solid and Hazardous Waste Act, (the Act), 19-6-101, et. seq., Utah Code Annotated (UCA) 1953, as amended and the Utah Administrative Rules (R315-1 through R315-13, R315-50, and R315-101) as adopted by the Utah Solid and Hazardous Waste Control Board, (the Board), a permit is issued to United States Steel Corporation (USS) and Anderson Geneva, LLC and Ice Castle Retirement Fund, LLC thereafter called the Permittee, to conduct Post-Closure Care of three hazardous waste surface impoundments closed in place and to conduct facility-wide corrective action at Anderson Geneva Development Inc., 99 North Geneva Road, Vineyard, Utah, 84057. The U.S. Environmental Protection Agency (U.S. EPA) has authorized the Executive Secretary to issue such a permit under Section 3006(b) of the Resource Conservation and Recovery Act (RCRA).

The Permittee shall comply with all the terms and conditions of this permit, including all reports and attachments, which are hereby incorporated by reference. The Permittee shall also comply with the applicable portions of R315-1 through R315-13, R315-50, and R315-101. Applicable rules are those, which are in effect on the date of issuance of this permit.

This permit is based on the premise that the information submitted in the application dated November 3, 1986 as modified by subsequent amendments dated July 18, 1987 and September 30, 1988 and in the request for reissuance of December 22, 1998, (hereafter referred to as the application), is accurate, except as modified by the conditions herein. Any inaccuracies or misrepresentations found in the application may be grounds for the termination, modification, revocation or reissuance of this permit (see R315-3-4). The Permittee must inform the Control Board of any deviation from, or changes in the information in the application, which would affect the Permittee's ability to comply with the applicable regulations or permit conditions.

This permit is effective as of **May 14, 2004** and shall remain in effect until **May 14, 2014**, unless revoked and reissued (R315-3-4.2) or terminated (R315-3-4.4), or continued in accordance with R315-3-5(d).

Signature: **SIGNED BY DENNIS DOWNS** Date: **ON MAY 14, 2004**

Dennis R. Downs
Executive Secretary
Utah Solid and Hazardous Wastes Control Board

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LIST OF ATTACHMENTS

The following documents are hereby incorporated, in their entirety, by reference, into this permit.

Attachment 1

SWMU list with Responsible Permittee List

Attachment 2

Inspection Check List, Schedules And Procedures, Interceptor Trench Maintenance procedures

Attachment 3

Facility Maps

- Hazardous Waste Impoundments with monitoring well locations
- Facility Map with Approximate SWMU and SWMUG Boundaries, January 2010

Attachment 4

Sampling Procedures, Test Methods and Quality Control/Quality Assurance Program

Attachment 5

Statistical Analysis

Attachment 6

Monitoring Well Sampling Requirements

DEFINITIONS

For purposes of this permit, the following definitions shall apply:

"**Approved or Approval"** means written approval from the Executive Secretary of the Utah Solid and Hazardous Waste Control Board.

"Control Board" means the Utah Solid and Hazardous Waste Control Board.

"Executive Secretary" means the Executive Secretary of the Utah Solid and Hazardous Waste Control Board.

"Facility" means all contiguous land, and structures, other appurtenances, and improvements on the land, used for treating, storing, or disposing of hazardous waste. A facility may consist of several treatment, storage, or disposal operational units (e.g., one or more landfills, surface impoundments, or combinations of them). For the purpose of implementing corrective action under R315-8-6.12, facility means all contiguous property under the control of the owner or operator seeking a permit under subtitle C of RCRA. This definition also applies to facilities implementing corrective action under RCRA Section 3008(h). A remediation waste management site is not a facility that is subject to R315-8-6.12, but is subject to corrective action requirements if the site is located within such a facility.

"Hazardous waste constituent" means a constituent that caused the Board to list the hazardous waste in R315-2-3 and R315-2-10.

"**Hazardous Waste Impoundments"** (HWI) means all structures, and other appurtenances, and improvements on the land at the three Closed Hazardous Waste Impoundments, including the groundwater collection system and the groundwater monitoring system at those Impoundments, and all other appurtances and fixtures associated with post-closure care of the Impoundment. .

"**Closed Hazardous Waste Impoundments**" (CHWI) means the closed Acid Waste Impoundment, the closed Tar Decanter Sludge Impoundment, and the closed Miscellaneous Waste Impoundment. The property description of these impoundments is presented on the survey maps in Attachment 3.

"Permittee" means United States Steel Corporation (USS) and Anderson Geneva Steel, LLC. And Ice Castle Retirement Fund, LLC. The "Responsible Permittee" is that Permittee who is accountable to the Executive Secretary of the Utah Solid and Hazardous Waste Control Board for satisfying those Permit conditions for which it is so designated. With respect to these conditions, the Permit designates either Anderson Geneva Steel, LLC. And Ice Castle Retirement Fund, LLC.

or USS or both to be the responsible Permittee.

"Precipitation" means rain, sleet, snow or hail.

"RCRA" means the Resource Conservation and Recovery Act of 1976, as amended by The Solid and Hazardous Waste Amendments (HSWA) of 1984.

"Solid Waste Management Unit" (SWMU) means any discernible unit at which solid wastes have been placed at any time, irrespective of whether the unit was intended for the management of solid or hazardous waste. Such units include any area at a facility at which solid wastes have been routinely and systematically released.

"Solid Waste Management Unit Group" (SWMUG) means SWMUs grouped together based on facility process unit areas.

"Spill" means the accidental discharging, spilling, leaking, pumping, pouring, emitting, emptying, or dumping of hazardous wastes or materials which, when spilled, become hazardous wastes, into or on any land or water.

"Submit" or "Submission" means to be received by hand delivery, mail, certified mail, express mail, facsimile, or computer diskette and logged in at the offices of the Division of Solid and Hazardous Waste.

"Utah Registered Professional Engineer" means any individual who is registered as a Professional Engineer by the Utah Department of Business Regulation.

All definitions contained in R315-1, R315-2, R315-3, R315-8, and R315-9 are hereby incorporated, in their entirety, by reference into this permit, except that any of the definitions used above shall supersede any definition of the same term given in R315. Where terms are not defined in the regulations or the permit, the meaning associated with such terms shall be defined by a standard dictionary reference or the generally accepted scientific or industrial meaning of the term.

MODULE I - STANDARD CONDITIONS

I.A.1 This Post-Closure Care Permit (Permit) is issued to both Anderson Geneva, LLC and Ice Castle Retierment Fund, LLC (Anderson Geneva) and United States Steel Corporation (USS) as Co-Permittees for the Anderson Geneva facility.

I.A.2 The Permit acknowledges that the parties have by contract allocated responsibilities and liabilities for post-closure care and corrective action for solid waste management units (SWMUs) and affixes responsibilities and duties under the Permit to USS, to Anderson Geneva, or, in some cases, to both of them based on those contractual arrangements.

I.A.3 Modules I through IV address post-closure care of three closed hazardous waste surface impoundments (Acid Sludge Impoundment, Tar Decanter Sludge Impoundment, and Miscellaneous Waste Impoundment, (CHWI) including the groundwater collection system and the groundwater monitoring system at those HWI, and all other appurtances and fixtures associated with post-closure care of the HWI. The Permit makes USS the Responsible Permittee with respect to post-closure care of the HWI. Anderson Geneva, nevertheless, is Responsible for certain support activities relating to post-closure care as expressly set forth in pertinent conditions in Modules I through IV.

I.A.4 Module V addresses corrective action for SWMUs at the Anderson Geneva facility. The Permit allocates responsibility based on certain contractual arrangements between Anderson Geneva and USS as outlined in Attachment 1.

I.B EFFECT OF PERMIT

I.B.1 USS shall provide post-closure care and monitoring for the CHWI in accordance with the conditions of this Permit. Any treatment, storage, or disposal of hazardous waste at the HWI not authorized in this Permit or applicable rules is prohibited.

I.B.2 Compliance with this Permit constitutes compliance with the conditions of the Utah Solid and Hazardous Waste Act and the Utah Hazardous Waste Management Rules setting forth the requirements for the CHWI, with the exceptions provided in R315-3-1.4

I.B.3 Anderson Geneva is the registered property owner and shall provide reasonable cooperation to USS to enable USS to comply with the applicable provisions of this Permit.

I.B.4 Issuance of this Permit does not convey any property rights of any sort or any exclusive privilege; nor does it authorize any injury to persons or property, any invasion of other private rights, or any infringement of State or local law or regulation.

I.C ENFORCEABILITY

I.C.1 Violations of this Permit, the Utah Solid and Hazardous Waste Act, or the Utah Hazardous Waste Management Rules may result in penalties of up to $10,000 per calendar day per violation.

I.D OTHER AUTHORITY

I.D.1 The Utah Department of Environmental Quality expressly reserves any right of entry provided by law and all authority under applicable law to order or perform emergency or other response activities as authorized by law.

I.E PERMIT ACTIONS

I.E.1 This Permit may be modified, revoked and reissued, or terminated for cause as specified in R315-3-4.

I.E.2 The filing of a request for a Permit modification, revocation and reissuance, or termination, or a notification of planned changes, requiring prior agency approval, or anticipated noncompliance on the part of Responsible Permittee(s) does not stay the applicability or enforceability of any Permit condition.

I.E.3 If a conflict exists between conditions within this Permit, the Executive Secretary shall determine which condition shall be met. In the event that such a conflict is discovered, the Executive Secretary shall provide written notice of his determination and shall allow the Responsible Permittee(s) reasonable time to meet the condition.

I.E.4 Any change to this permit constitutes a modification. The permit may be modified at the request of the Permittee in accordance with the procedures of R315-3-4.3.

I.E.5 In accordance with the Utah Solid and Hazardous Waste Act, UCA, 19-6-108 (13), this Permit shall be reviewed five years after the effective date and modified as deemed necessary by the Executive Secretary.

I.F SEVERABILITY

I.F.1 The provisions of this Permit are severable and if any provision of this Permit, or the application of any provision of this Permit to any circumstance, is held invalid, the application of such provision to other circumstances and the remainder of this Permit shall not be affected thereby. Invalidation of any state or federal statutory or regulatory provision, which forms the basis for any condition of this Permit, does not affect the validity of any other state or federal statutory or regulatory basis for said condition.

I.G DUTIES TO COMPLY

I.G.1 USS and Anderson Geneva shall comply with all applicable conditions of this Permit consistent with the division of responsibility set forth herein, except to the extent and for the duration such noncompliance is authorized by an emergency permit issued in accordance with R315-3-6.2(a). Any Permit noncompliance, other than noncompliance authorized by an emergency permit, constitutes a violation of the Utah Solid and Hazardous Waste Act, and is grounds for enforcement action; for Permit termination, revocation and reissuance, or modification; or for denial of a Permit approval renewal application, or a combination of enforcement action and any other remedies provided by law.

I.H DUTY TO REAPPLY

I.H.1 The Permittees shall submit an application for a new Permit on or before **November 15, 2013**.

I.I PERMIT EXPIRATION

I.I.1 This Permit shall be effective for ten years from the date of issuance.

I.J CONTINUATION OF EXPIRING PERMIT

I.J.1 This Permit and all conditions herein shall continue in force until the effective date of a new permit if the Permittees have submitted a timely application pursuant to R315-3-2.5 and the applicable requirements of R315-3-5.2 and R315-3-2.5(c); the application for a permit is complete; and, through no fault of the Permittees, the Executive Secretary has not issued a new permit under R315-3-5 on or before the expiration date of this Permit.

I.K NEED TO HALT OR REDUCE ACTIVITY NOT A DEFENSE

I.K.1 It shall not be a defense for the Permittees in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this Permit.

I.L DUTY TO MITIGATE

I.L.1 In the event of noncompliance with this Permit, the Permittee(s) responsible for such noncompliance shall take all reasonable steps to minimize releases to the environment resulting from the noncompliance, and shall carry out such measures as are reasonable to prevent significant adverse impact on human health or the environment.

I.M PROPER OPERATION AND MAINTENANCE

I.M.1 Each Permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances, machinery, and equipment) which are installed or used by that Permittee to achieve compliance with the conditions of this Permit. This provision requires the operation of back-up or auxiliary equipment or similar systems only when necessary to achieve compliance with the conditions of this Permit.

I.N DUTY TO PROVIDE INFORMATION

I.N.1 Each Permittee shall furnish to the Executive Secretary within a reasonable time any relevant information in the possession or control of that Permittee which the Executive Secretary may request to determine compliance with this Permit, or to determine whether cause exists for modifying, revoking, reissuing, or terminating this Permit. Each Permittee shall also furnish to the Executive Secretary, upon request, copies of records that such Permitee is required by this Permit to keep.

I.N.2 Failure to submit the information required by the conditions of this Permit or falsification of any submitted information is grounds for enforcement action under the terms of the Utah Solid and Hazardous Waste Act.

I.N.3 The Responsible Permittee(s) shall ensure that all plans, reports, notifications, and other submissions to the Executive Secretary as required by this Permit are signed and certified in accordance with this Permit.

I.N.4. The Responsible Permittee(s) shall submit one copy of all plans, reports, notifications, or other submissions, required by the Permit to be submitted to the Executive Secretary unless otherwise agreed upon.

I.N.5 All plans and schedules including revisions to previously submitted plans and schedules required by the conditions of this Permit are, upon written approval by the Executive Secretary, incorporated into this Permit by reference and become an enforceable part of this Permit. This incorporation does not require a permit modification. Any noncompliance with such approved plans and schedules shall constitute noncompliance with this Permit.

I.N.6. The Executive Secretary may grant written approval in response to requests for extensions of due date(s) by the Responsible Permittee(s).

I.N.7 If the Executive Secretary determines that further actions beyond those provided by the Permit conditions or changes to that which is stated herein are warranted, the Executive Secretary may seek to modify the Permit consistent with applicable laws and regulations.

I.N.8. All raw data, such as laboratory reports, drilling logs, bench-scale or pilot-scale data, and other supporting information gathered or generated during activities undertaken pursuant to the Permit shall be maintained at Anderson Geneva throughout the post-closure period.

I.O INSPECTION AND ENTRY

I.O.1 Pursuant to R315-2-12 and UAC 19-6-109, Anderson Geneva shall allow the Control Board, the Executive Secretary, or an authorized representative, upon the presentation of appropriate credentials and other documents as may be required by law to:

I.O.1.a Enter at reasonable times upon the premises where a regulated facility or activity is located or conducted, or where records are kept as required by the conditions of this Permit;

I.O.1.b Have access to and copy, at reasonable times, any records that must be kept under the conditions of this Permit;

I.O.1.c Inspect at reasonable times any portion of the CHWI equipment (including monitoring and control equipment), practices, or operations regulated or required under this Permit;

I.O.1.d Sample or monitor at reasonable times for the purposes of assuring Permit compliance or as otherwise authorized by the Utah Solid and Hazardous Waste Act any substances or parameters at any location; and

I.O.1.e Make record of inspections by photographic, electronic, videotape, or any other reasonable medium.

I.P MONITORING AND RECORDS

I.P.1 USS shall retain records of all CHWI monitoring information at Anderson Geneva, including all calibration and maintenance records and, where applicable, all original strip chart recordings (or equivalent recordings) for continuous monitoring instrumentation, copies of all reports and records required by this Permit, and records of all data used to complete the application for this Permit for a period of at least three years from the date of the sample, measurement, report, or application unless a longer retention period for certain information is required by other conditions of this Permit. This period may be extended by request of the Executive Secretary at any time prior to expiration of document retention period by written notification to the Permittees. Anderson Geneva will provide for storage and access to all records that the Permittees are responsible for maintaining on the Anderson Geneva facility.

I.P.2 Pursuant to R315-3-3.1(j), records of monitoring information shall include:

I.P.2.a The date, exact place, and times of sampling or measurements;

I.P.2.b The individual(s) who performed the sampling or measurements;

I.P.2.c The date(s) analyses were performed;

I.P.2.d The individual(s) who performed the analyses;

I.P.2.e The analytical techniques or methods used; and

I.P.2.f The results of such analyses.

I.P.3 Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity. Laboratory methods shall be the appropriate method from R315-50-6, or, alternatively, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods SW-846* (current edition) (hereinafter "SW-846") or *Standard Methods of Examination of Water and Wastewater* (current edition). Other methods will be allowed if approved by the Executive Secretary.

I.P.4 When requesting substitute or additional analytical methods, the Responsible Permittees shall submit to the Executive Secretary a request for substitution of analytical methods which are equivalent to the methods specifically approved for use in this Permit, in accordance with R315-3-4.3. The request shall provide information demonstrating that the proposed methods requested to be substituted are equivalent or superior in terms of sensitivity, accuracy, and precision (i.e., reproducibility).

I.Q REPORTING PLANNED CHANGES

I.Q.1 USS shall give written notice to the Executive Secretary of any planned physical alterations or additions to the HWI in accordance with R315-3-3 and R315-3-4.3.

I.R REPORTING ANTICIPATED NONCOMPLIANCE

I.R.1 USS shall give advance notice to the Executive Secretary of any planned changes or activity at the HWI which may result in noncompliance with requirements of this Permit. Advance notice shall not constitute a defense for any noncompliance.

I.S TRANSFER OF PERMIT

I.S.1 This Permit may be transferred to a new owner or operator only if it is modified or revoked and reissued pursuant to R315-3-4. Prior to transferring ownership of the facility, Anderson Geneva shall notify the new owner or operator in writing of all applicable requirements of R315 and this Permit.

I.T TWENTY-FOUR HOUR REPORTING

I.T.1 Responsible Permittee shall report to the Executive Secretary any noncompliance with this Permit. Anderson Geneva shall immediately advise Responsible Permittee orally in the event that Anderson Geneva is the first to detect such noncompliance. Responsible Permittee shall report such noncompliance orally within 24 hours from the time Responsible Permittee becomes aware of the circumstances. This report shall include, but not be limited to, the following:

I.T.1.a Name, address, and telephone number of the reporting Permitee;

I.T.1.b Name, address, and telephone number of the Anderson Geneva facility;

I.T.1.c Name and telephone number of the reporting individual;

I.T.1.d Date, time and type of incident;

I.T.1.e Name and quantity of material(s) involved;

I.T.1.f The extent of injuries, if any;

I.T.1.g An assessment of actual or potential hazard to the environment and human health; and

I.T.1.h Estimated quantity and disposition of recovered material that resulted from the incident.

I.T.2 A written submission shall also be provided within five working days of the time the Responsible Permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and the steps taken or planned to reduce, eliminate and prevent reoccurrence of the noncompliance. The Executive Secretary may waive the five-day written notice requirement in favor of a written report within 15 calendar days of the time Responsible Permittee becomes aware of the circumstances.

I.U OTHER NONCOMPLIANCE

I.U.1 The Responsible Permittee(s) shall report all other instances of noncompliance with this Permit not otherwise required to be reported in accordance with the conditions of this Permit at the time Progress Reports as required in Condition V.H are submitted. The report shall contain the information listed in Condition I.T of this Permit.

I.V OTHER INFORMATION

I.V.1 If a Permittee becomes aware that any relevant material facts in the Permit application were omitted or that incorrect information in the Permit application or in any report was submitted to the Executive Secretary, such Permittee shall submit such facts or corrected information within thirty calendar days from the time the omission or incorrect submittal is discovered.

I.W SIGNATORY REQUIREMENT

I.W.1 All applications, reports, or other information required by this Permit to be submitted to the Executive Secretary shall be signed and certified by the Responsible Permittee(s) in accordance with R315-3-2.2 and R315-3-3.1(k).

I.X REPORTS, NOTIFICATIONS, AND SUBMISSIONS

I.X.1 All reports, notifications, or other submissions which are required by this Permit to be transmitted to the Executive Secretary shall be sent by certified mail or other means providing proof of delivery to:

Executive Secretary
Utah Solid and Hazardous Waste Control Board
195 North 1950 West
Post Office Box 144880
Salt Lake City, Utah 84114-4880
Phone: (801) 536-0200
Facsimile: (801) 536-0222

Required oral notifications shall be given to the Executive Secretary or his representatives (Environmental Manager, Environmental Scientist, or Environmental Engineer) during normal business hours (8 am to 5 pm, Monday through Friday, except state or federal holidays). Notifications made at other times shall be made to the twenty-four hour answering service at 801-536-4123. Notifications made to the twenty-four hour answering service shall include all applicable information required by this Permit. The reporting party shall give oral notification to the Executive Secretary or his representatives on the first business day following notification to the twenty-four hour answering service.

I.Y DOCUMENTS TO BE MAINTAINED ONSITE

I.Y.1 USS shall maintain, for the duration of the post-closure care period at the Anderson Geneva Site, the following documents, amendments, revisions, and modifications to these documents pertaining to the HWI:

I.Y.1.a The post-closure Permit and Permit application;

I.Y.1.b The cost estimate for post-closure care, to be provided by USS as required by R315-8-8 and this Permit;

I.Y.1.c Post-closure monitoring records, to include groundwater monitoring records, groundwater potentiometric maps, and analytical results, as required by this Permit;

I.Y.1.d The closure certification, as required by R315-8-7 and this Permit;

I.Y.1.e Personnel training documents and records, as required by R315-8-2.7(d) and this Permit, for current personnel, or for a period of three years for former personnel in accordance with R315-8-2.7(e);

I.Y.1.f A Contingency Plan as required by R315-8-4.2(a) and this Permit until completion of post closure care is certified;

I.Y.1.g Inspection logs, as required by R315-8-2.6(b) and this Permit for a period of three years in accordance with R315-8.2.6(d).

I.Z PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

I.Z.1 Pursuant to Section 3005(c)(3) of RCRA (Section 212 of HSWA) codified as 40 CFR 270.32(b) and R315-3-3.3(b)(2) , this Permit contains those terms and conditions determined necessary to protect human health and the environment.

MODULE II - GENERAL FACILITY STANDARDS AND POST-CLOSURE CARE

II.A POST-CLOSURE CARE OF HWI

II.A.1 USS shall maintain and monitor the HWI throughout the Post-Closure Care Period in accordance with this Permit and with the provisions of R315-8-7 as in effect on May 14, 2004**.**

II.A.2 Monitoring by USS shall ensure detection of a release of hazardous waste, hazardous waste constituents, leachate, contaminated runoff or hazardous waste decomposition products to the soil, groundwater, or surface water from the CHWI. USS shall maintain all containment and monitoring equipment throughout the Post-Closure Care Period in accordance with this Permit.

II.A.3 USS shall maintain the groundwater interception trench in accordance with the procedures contained in Attachment 2 of this Permit.

II.A.4 The CHWI were certified as closed on July 29, 1991. The Post-Closure Care Period began on July 29, 1991 and shall continue for a minimum of 30 years after that date.

II.A.5 Certification of Completion of Post-Closure Care. USS shall certify that the post-closure care was performed in accordance with the specifications in the Post-Closure Plan, as required by R315-8-7.

II.B POST-CLOSURE MAINTENANCE

II.B.1 USS shall:

II.B.1.a Maintain the integrity and effectiveness of the final cover in accordance with this Permit, including making repairs to the cap as necessary to correct the effects of settling, subsidence, erosion, or other events.

II.B.1.b Prevent run-on and run-off from eroding or otherwise damaging the final cover in accordance with R315-8-11.5(b)(4).

II.B.1.c Inform Anderson Geneva and the Executive Secretary upon discovery of any post-closure use of the property which will disturb the integrity of the final cover, containment systems, or monitoring system in accordance with Attachment 2 and R315-8-11.5(b)(1).

II.B.1.d Protect and maintain survey benchmarks used in complying with R315-8-14.4.

II.C SECURITY

II.C.1 USS shall comply with the following security conditions:

II.C.1.a USS shall provide a fence with locking gates surrounding the CHWI, to prevent unauthorized entry and shall maintain such fence throughout the post-closure care period.

II.C.1.b USS shall post signs which read "DANGER, UNAUTHORIZED PERSONNEL KEEP OUT" at the entrance gate and every 300 feet along the fence and shall maintain such signs throughout the post-closure care period. The signs must be legible from a distance of at least 25 feet in compliance with R315-8-2.5(c). All security equipment shall be inspected throughout the post-closure care period in accordance with Attachment 2.

II.C.1.c USS shall note all damaged security equipment in the inspection checklist and shall complete repairs as soon as practicable.

II.D GENERAL INSPECTION REQUIREMENTS

II.D.1 USS shall follow the inspection schedule found in Attachment 2.

II.D.2 USS shall remedy any deterioration or malfunction in accordance with Attachment 2 and R315-8-2.6(c).

II.D.3 USS shall keep records of inspections as required by Attachment 2.

II.D.4 USS may make revisions to the Inspection Procedures in Attachment 2 of this permit in accordance with the procedures for permit modifications of R315-3-4.3.

II.E PERSONNEL TRAINING

II.E.1 USS shall conduct personnel training as required by R315-8-2.7. New personnel working at the HWI shall complete the required personnel training on or within six months after their hire date or assignment to the HWI. In addition, USS shall comply with the following conditions:

II.E.1.a HWI personnel shall receive an annual review of their initial training in both contingency procedures and the hazardous waste management procedures relevant to the work at the HWI.

II.E.1.b USS shall maintain training documents and records as required by R315-8-2.7(d) and R315-8-2.7(e).

II.E.1.c USS shall maintain a copy of the training plan at Anderson Geneva until completion of the post-closure care period.

II.F CONTINGENCY PLAN

II.F.1 When dictated by the Contingency Plan for the HWI, USS, or such other individuals or entities designated in the contingency plan, shall immediately carry out the emergency procedures described by R315-8-4.7. USS shall comply with R315-9 in reporting releases from the HWI to the Executive Secretary.

II.F.2 USS shall maintain a copy of the Contingency Plan for the HWI at Anderson Geneva.

II.F.3 USS shall review and amend, if necessary, the Contingency Plan for the HWI in accordance with R315-8-4.5.

II.G RECORDKEEPING AND REPORTING

II.G.1 USS shall submit reports as required to the Executive Secretary documenting post-closure groundwater monitoring activities and results from analyses of samples collected in compliance with post-closure monitoring requirements. Copies of all appropriate records will be maintained at Anderson Geneva.

II.H FINANCIAL ASSURANCE FOR FACILITY POST-CLOSURE CARE

II.H.1 USS shall maintain continuous compliance with the financial assurance requirements of R315-8-8.

II.I COST ESTIMATES FOR POST-CLOSURE CARE

II.I.1 USS shall maintain continuous compliance with cost estimate requirements of R315-8-8.

II.J LIABILITY REQUIREMENTS

II.J.1 USS shall maintain continuous compliance with R315-8-8, including documentation requirements, and liability coverage for sudden accidental occurrences in the amount of at least one million U.S. dollars per occurrence with an annual aggregate of at least two million U.S. dollars, exclusive of legal defense costs for the Post-Closure Care Period.

II.J.2 USS shall maintain continuous coverage for non-sudden accidental occurrences in the amount of at least three million U.S. dollars per occurrence, with an annual aggregate of at least six million U.S. dollars, exclusive of legal defense costs, for the HWI.

II.K INCAPACITY OF OWNER OR OPERATORS, GUARANTORS, OR FINANCIAL INSTITUTIONS

II.K.1 USS shall comply with R315-8-8.

II.L POST-CLOSURE GROUNDWATER MONITORING

II.L.1 USS shall maintain and monitor the HWI. Within 60 calendar days of Permit issuance, USS shall submit maintenance procedures for the interceptor trench which shall be included in Attachment 2.

II.L.2 USS shall maintain a groundwater monitoring system as specified in Condition II.L.3 and in accordance with R315-8-6.8.

II.L.3 USS shall maintain and monitor the groundwater monitoring systems in compliance with Module III. Monitoring wells in the systems are those identified in Module III. During the Post-Closure Care period, water level measurements at the monitor wells shall be conducted in accordance with this Permit. USS shall maintain groundwater monitoring wells specified in Module III, at the locations specified on the facility maps in Attachment 3. USS may add or delete wells as specified in this Permit.

MODULE III – POST-CLOSURE GROUNDWATER MONITORING AT THE HWI

III.A POST-CLOSURE GROUNDWATER MONITORING

III.A.1 During the compliance period defined in Condition IV.A.8, USS shall monitor groundwater in the uppermost aquifer as described below and in a manner that will detect the release of hazardous constituents from the units outlined below in compliance with R315-8-11.9 and R315-8-6.

III.A.1.a Acid Sludge Impoundment;

III.A.1.b Tar Decanter Sludge Impoundment; and

III.A.1.c Miscellaneous Waste Impoundment.

III.A.2 USS shall follow all of the provisions of R315-8-6, Groundwater Protection, and the conditions of this Permit. The present HWI and Compliance Point wells are presented in Attachment 3 (Facility Maps).

III.A.3 The Point of Compliance is a vertical surface located at the hydraulically downgradient boundary of the CHWI as defined in R315-8-6.6.

III.A.4 USS shall maintain the groundwater monitoring system to continue to demonstrate background groundwater conditions. Monitoring Well # MW-1 shall represent the upgradient background condition in the shallow, uppermost aquifer and # MW-19 shall serve as the deep upgradient background well. If any of the monitoring wells are found to be inadequate, USS shall, upon notification by the Executive Secretary, install acceptable new monitoring wells.

III.A.5 USS shall maintain the downgradient compliance groundwater monitoring well system shown in Attachment 3 (Facility Maps) consisting of the following wells: MW-17D, MW-21, MW-22, MW-23, and MW-24.

III.B DETECTION MONITORING

III.B.1 Upon termination of any corrective action under R315-8-6.11 at the HWI, USS shall institute and maintain a detection monitoring program under R315-8-6.9.

III.C GROUNDWATER PROTECTION STANDARD

III.C.1 USS shall monitor the groundwater according to the frequency outlined in Attachment 6, Table 1, at the HWI to determine compliance with the groundwater protection standard under R315-8-6.3. The following hazardous waste constituents and their concentration limits, and in addition to standards under R315-8-6.3 shall

comprise the groundwater protection standards, unless USS has applied for and the Executive Secretary has approved Alternative Concentration Limits.

III.C.2 The following Groundwater Protection Standards only apply to the monitoring wells identified in III.A.5.

Compound	Method	Concentration Limit (µg/l)
VOLATILES		
Benzene	8260B	5
Toluene	8260B	5
Ethylbenzene	8260B	5
Xylenes	8260B	5
SEMI-VOLATILES		
2,4-dimethylphenol	8270C	10
2-picoline	8270C	10
Acenaphthylene	8270C	10
Naphthalene	8270C	10
o-cresol (2-methylphenol)	8270C	10
p-cresol (4-methylphenol)	8270C	10
Phenol	8270C	10
Pyridine	8270C	10
METALS		
Arsenic	6010B	50
Barium	6010B	1000
Chromium	6010B	50
Lead	6010B	50
Nickel	6010B	50
GENERAL PARAMETERS		
Cyanide	335.2	40
Nitrate	353.4	NR
Sulfate	375.2	NR
pH	Field Measurement	NR
Specific conductance	Field Measurement	NR
Total Organic Carbon (TOC)	415.1	NR

Total Organic Halogen (TOX)	9020	NR

NR = None required

III.D GROUNDWATER MONITORING REQUIREMENTS

III.D.1 USS shall comply with the following general requirements for groundwater monitoring at the HWI:

III.D.1.a The groundwater monitoring system shall consist of a sufficient number of wells installed at appropriate locations and depths to yield groundwater samples from the uppermost aquifer that:

III.D.1.a.i Represent the quality of background water that has not been affected by leakage from the Impoundments; and

III.D.1.a.ii Represent the quality of groundwater passing the compliance point as defined in Condition III.A.3.

III.D.1.b USS shall construct all monitoring wells in accordance with the provisions in R315-8-6.8(c) and Condition III.D.2.

III.D.1.c USS shall follow the sampling and analysis procedures defined in Attachment 4 and R315-8-6.8(d) and (e) for the groundwater monitoring program.

III.D.1.d USS shall follow the requirements for measurement of the groundwater surface elevation in R315-8-6.8(f).

III.D.1.e USS shall survey once in every three years the top surface apron elevation and top of casing elevation of all existing groundwater monitoring wells.

III.D.1.f USS shall notify the Executive Secretary at least ten calendar days prior to any sampling event required under this Permit

III.D.2 USS shall install and maintain a groundwater monitoring system in consideration of the results of the statistical analysis performed as specified below:

III.D.2.a Well construction shall follow the techniques described in the *Technical Enforcement Guidance Document (TEGD), OSWER-9950.1*, (current edition). All monitoring wells shall be cased in a manner that maintains the integrity of the monitoring well bore hole. This casing shall be screened or perforated and packed with gravel or sand where necessary, to enable collection of groundwater samples. The annular space, the space between the bore hole and well casing above the

sampling depth must be sealed to prevent contamination of samples and the groundwater.

III.D.2.b USS shall construct and maintain new monitoring wells in accordance with plans and specifications approved by the Executive Secretary.

III.D.2.c USS shall install additional groundwater monitoring wells to maintain compliance if subsurface conditions significantly change or as required by the Executive Secretary. Such changes may include, but are not limited to, water level elevation or apparent flow direction changes, or detection of organic constituents in a well. If at any time hazardous waste constituents exceeding the groundwater protection standard concentration limits, as defined in Condition III.C. are detected in the furthest most hydraulically downgradient monitoring well(s), USS shall install additional groundwater monitoring wells further downgradient so that there is always at least one well beyond, but in the path of, the plume.

III.D.2.d If new information or unforeseen circumstances reveal a need for additional monitoring to protect human health and the environment, USS may be required to install and sample additional wells at any time during post-closure or compliance periods.

III.D.2.e USS shall submit monitoring well completion reports which include boring logs, sieve analysis (grain size), standard penetration tests, analytical tests performed on soils (Atterberg limits, etc.), water level elevations, groundwater contour maps, well development results including recharge rates, and cross sections or fence diagrams within 90 calendar days after completion of any new well installation.

III.D.2.f USS shall maintain monitoring wells in a fully operational condition for the duration of this Permit. USS shall notify the Executive Secretary within fifteen (15) working days when a well is no longer properly functioning (including a marked change in pumping rate, presence of sandy or silty materials, and cracked or broken casings) or when USS intends to close one or more wells associated with the HWI. The Executive Secretary shall approve the conditions for replacement or correction of improperly operating wells.

III.D.2.g USS shall determine on an annual basis the depth to the bottom of all groundwater monitoring wells. This information shall be recorded on well purging volume calculation sheets as required. If a problem is observed, USS shall follow the procedures described above in Condition III.D.2.f regarding notification and corrective procedures.

III.D.2.h All wells deleted from the monitoring program shall be plugged and abandoned in such a manner as to prevent vertical movement of water within the borehole and to prevent the annular space surrounding the well casing from becoming a conduit for possible contamination of the groundwater supply. Well abandonment shall be

accomplished in accordance with R655-4-12 and 13 of the Utah Administrative Code.

III.D.3 Sampling and Analysis Procedures.

III.D.3.a USS shall include and maintain consistent sampling and analysis procedures in the groundwater monitoring program that are designed to ensure reliable monitoring results of groundwater quality below the Impoundments. As required by Attachment 4 and R315-8-6.8(d), the program shall include procedures and techniques for:

III.D.3.a.i Sample collection;

III.D.3.a.ii Sample preservation and shipment;

III.D.3.a.iii Analytical procedures;

III.D.3.a.iv Chain-of-custody control; and

III.D.3.a.v Quality assurance and control.

III.D.3.b The sampling and analytical methods shall be appropriate for groundwater sampling and shall accurately measure hazardous waste constituents in groundwater samples, as required by R315-8-6.8(e).

III.D.3.c USS shall use the following techniques and procedures when obtaining samples and analyzing samples from the groundwater monitoring wells:

III.D.3.c.i USS shall collect groundwater samples by the technique described in Attachment 4 and as required by R315-8-6.8(e).

III.D.3.c.ii USS shall preserve and transport groundwater samples in accordance with the procedures specified in Attachment 4 and as required by R315-8-6.8(d).

III.D.3.c.iii Samples shall be analyzed according to SW-846, using methods delineated in Condition III.C. or an equivalent EPA-approved method that has been pre-approved as per Condition I.P.3, and the procedures specified in Attachment 4. In addition, USS shall comply with the following requirements:

III.D.3.c.iii.A The use of quality control sample data shall be explained in full detail, except that USS shall provide at least one field blank, one equipment blank, one set of replicates representing 10% of the total number of samples, and one trip blank for analysis at each sampling event performed under the groundwater monitoring program. Any field, trip, or equipment blanks exceeding a value equal to three (3) times the method detection limit for any organic parameter may result in rejection of the data for that parameter. This may require resampling of all wells sampled during that particular sampling event that are associated with the affected blank,

for the specified compounds. Qualifiers shall be indicated on all organic laboratory reports when blanks indicate contamination above the method detection level.

III.D.3.c.iii.B The Executive Secretary may request at any time all laboratory QA/QC documentation and supporting data on any sampling episode. The laboratory QA/QC documentation shall be retained at Anderson Geneva throughout the Post-Closure Care Period.

III.D.3.c.iii.C Samples shall be tracked and controlled using the chain-of-custody procedures specified in Attachment 4 and as required by R315-8-6.8(d).

III.D.3.c.iii.D In the case of sample breakage (e.g. during shipping), resampling shall take place within fifteen (15) working days of USS being notified of such breakage. Notification in accordance with Condition III.D.1.f is not required for this type of resampling event.

III.D.4 Groundwater Elevation.

III.D.4.a USS shall determine the groundwater surface elevation in all groundwater wells and piezometers each time the groundwater is sampled as required by R315-8-6.8(f).

III.D.4.b USS shall determine the groundwater flow rate and direction in the uppermost aquifer based on groundwater surface elevation measurements and on re-surveyed well apron elevations. An updated groundwater contour map shall be submitted to the Executive Secretary not later than September 30th of each year in which the groundwater wells are resurveyed.

III.E MONITORING PROGRAM

III.E.1 USS shall determine groundwater quality at the HWI as follows:

III.E.1.a USS shall collect, preserve, and analyze groundwater samples pursuant to Condition III.D.

III.E.1.b USS shall determine the flow rate and direction in the uppermost aquifer pursuant to Condition III.D.4.

III.E.1.c USS shall analyze samples from all groundwater monitoring wells at the HWI in accordance with Table I of Attachment 6, which lists the parameters, analytical methods, and monitoring frequency applicable to each well. The data gathered and generated during each sampling event shall be submitted to the Executive Secretary in accordance with Condition III.F.

III.F REPORTING AND RECORDKEEPING

III.F.1 USS shall enter all monitoring, testing and analytical data obtained pursuant to Condition III.D.3 in the HWI operating record.

III.F.2 USS shall submit to the Executive Secretary the analytical results required by Condition III.E.1.c, and in accordance with the following schedule:

	Sampling Events	**Results Due To The Executive Secretary**
_		
	December - May	July 15
_		
	June - November	January 15

MODULE IV - GROUNDWATER PROTECTION STANDARDS AT THE HWI

IV.A EXCEEDANCE OF HWI GROUNDWATER PROTECTION STANDARDS

IV.A.1 USS shall notify the Executive Secretary in writing within fifteen days of receipt of verified analytical data if the groundwater protection standard in Condition III.C.2. has been exceeded in any of the following monitoring wells: MW-17D, MW-21, MW-22, MW-23, and MW24. The notification shall indicate which concentration limits have been exceeded. This notification is not required for the indicator parameters of pH, TOC, TOX, nitrates, sulphates, and specific conductance listed in Condition III.C.

IV.A.2 Within 180 calendar days after issuance of this Permit, USS shall submit a Statistical Analysis Methodology to be utilized for evaluation of groundwater data generated in accordance with Module III. Upon approval by the Executive Secretary, the statistical methodology that will be included as Attachment 5 (Statistical Analysis Methodology). The Groundwater Protection Standard shall be considered exceeded when any hazardous constituent listed in Condition III.C. shows a statistically significant increase over its background value.

IV.A.3 USS may make a demonstration that the groundwater protection standard was exceeded due to sources other than the CHWI or to errors in sampling, analysis or evaluation.

IV.A.4 USS shall notify the Executive Secretary in writing, if demonstration will be made.

IV.A.5 USS shall submit a report to the Executive Secretary, within 90 days of the notice in Condition IV.A.4, demonstrating that a source other than the HWI caused the groundwater protection standard to be exceeded as provided by Condition IV.A.1.

IV.A.6 USS shall continue the compliance monitoring program in accordance with R315-8-6.10.

IV.A.7 The Groundwater Protection Standard shall not be considered to be exceeded if USS makes a demonstration in accordance with Condition IV.A.3 and the demonstration is accepted by the Executive Secretary.

IV.A.8 Except as provided in Module IV, the compliance period during which the groundwater protection standard applies will be the 30 years following certification of closure of the CHWI (July 29, 1991). If USS is conducting corrective action at the HWI at the end of the compliance period specified, or has not demonstrated for three consecutive years that the groundwater protection standard has not been exceeded, except as provided in Module IV, then the compliance period shall be extended until USS demonstrates in accordance with Module IV that the groundwater protection standard has not been exceeded for three consecutive years at the HWI compliance point wells as defined in

Condition III.A.3 which shall include downgradient compliance monitoring wells MW-5, MW-8, MW-9, MW-10, MW13, and MW-14D.

MODULE V - CORRECTIVE ACTION FOR SOLID WASTE MANAGEMENT UNITS AND SCHEDULE OF COMPLIANCE

V.A RCRA FACILITY ASSESSMENT

V.A.1 The RCRA Facility Assessment (RFA) has been completed for this facility. The final RFA report was completed on March 3, 1989. The revised Solid Waste Management Units (SWMUs) list with Identification Number, Description of Units and allocation of responsibility is contained in Attachment 1.

V.B RCRA FACILITY INVESTIGATION

V.B.1 RCRA Facility Investigations (RFI) have been conducted in accordance with approved work plans to determine the nature and extent of known and suspected releases of hazardous wastes or hazardous waste constituents from each SWMU at the facility. Reports submitted to date include the following:

V.B.1.a Task I, Description of Current Activities (approved March 5, 1992)

V.B.1.b Task II, RFI Work Plan (approved March 31, 1992)

V.B.1.c Task III, RFI Reports, including:

V.B.1.c.i Part 1, Investigation of Environmental Setting (approved April 23, 1993).

V.B.1.c.ii Part 2, Characterization of Potential Sources of Contamination and Prioritization of SWMUs (approved July 13, 1993).

V.B.1.c.iii Part 3, Identification and Description of Potential Receptors (approved February 25, 1993)

V.B.1.c.iv Part 4, Characterization of Existing Contamination - Screening Investigation Report (SI Report) approved March 13, 1996.

V.B.1.c.v Part 4, Verification Investigation Work Plan approved October 13, 2000 (VIWP).

V.B.2 The RFI has identified SWMUs that require additional investigation in accordance with the VIWP.

V.B.3 Three general SWMU categories have been identified as a result of the SI Report of the RFI. These SWMUs will be investigated in accordance with the VIWP.

V.B.3.a **Category A SWMUs.** These are SWMUs that appear to be candidates for No Further Action (NFA).

V.B.3.b **Category B SWMUs.** These are SWMUs that appear to require minimal remediation to qualify as candidates for NFA.

V.B.3.c **Category C SWMUs.** These are SWMUs that require additional data to characterize and appropriately categorize each SWMU or that require additional investigation to support a site specific risk evaluation or engineered remediation.

V.C INTERIM MEASURES

V.C.1 If, during the course of any activity initiated in compliance with the conditions of this Permit the responsible Permittee(s) as defined in Attachment 1, the Permittee or the Executive Secretary determines that a release or potential release of hazardous waste or hazardous waste constituents from a SWMU poses a threat to human health and the environment, the responsible Permittee(s) may request or the Executive Secretary may specify interim measures.

V.C.2 The Executive Secretary shall notify the responsible Permittee(s) in writing of the requirement to perform the interim measures.

V.C.3 Within 30 calendar days of receiving the written notification requiring the Interim Measures as specified in Permit Condition V.C.2., the responsible Permittee(s) shall submit an Interim Measures Plan for approval.

V.C.4 The Interim Measures Plan shall specify action(s) that shall be taken to implement the interim measure, including potential permit modifications and the schedule for implementing the required measures. The Interim Measures Plan shall include the following:

V.C.4.a Time required to develop and implement a final remedy;

V.C..4.b Actual and potential exposure of human and environmental receptors;

V.C.4.c Actual and potential contamination of drinking water supplies and sensitive ecosystems;

V.C.4.d The potential for further degradation of the medium absent interim measures;

V.C.4.e Presence of hazardous waste in containers that may pose a threat of release;

V.C.4.f Presence and concentration of hazardous waste including hazardous waste constituents in soils that have the potential to migrate to groundwater or surface water;

V.C.4.g Weather conditions that may affect the current levels of contamination;

V.C.4.h Risks of fire, explosion, or accident; and

V.C.4.i Other situations that may pose threats to human health and the environment.

V.C.5 The Interim Measures Plan shall be incorporated into this Permit in accordance with Condition I.N.5.

V.D NOTIFICATION REQUIREMENTS FOR AND ASSESSMENT OF PREVIOUSLY UNIDENTIFIED SOLID WASTE MANAGEMENT UNITS

V.D.1 When the Permittee discovers any SWMU not previously identified in the Permit, the Permittee shall notify the Executive Secretary within 30 calendar days of discovering the SWMU(s). The notification shall include the location of the new SWMU(s) and information on the suspected or known wastes at the site, and identify the responsible Permittee for the new SWMU in Attachment 1.

V.D.2 Within 90 calendar days following discovery of the SWMU(s), the Responsible Permittee shall submit a SWMU Assessment Plan to the Executive Secretary.

V.D.3 The SWMU Assessment Plan shall include the following:

V.D.3.a The identification number for the new SWMU(s) and information concerning past and present operations at the SWMU(s); and

V.D.3.b Any groundwater, surface water, soil (surface or subsurface strata), or air sampling and analysis data needed to determine whether a release of hazardous waste or hazardous waste constituents from the SWMU(s) is likely to occur. The SWMU Assessment Plan shall demonstrate that the sampling and analysis program, if applicable, is capable of yielding representative samples and must include parameters sufficient to identify migration of hazardous waste and hazardous constituents from the newly discovered SWMUs to the environment.

V.D.4 The Executive Secretary shall approve the SWMU Assessment Plan or shall notify the Responsible Permittee of the SWMU Assessment Plan's deficiencies and specify a due date for submittal of a revised Plan.

V.D.5 The SWMU Assessment Plan shall be incorporated into this Permit in accordance with Condition I.N.5.

V.D.6 The Responsible Permittee shall implement the approved SWMU Assessment Plan within 30 days of approval.

V.D.7 The SWMU Assessment Plan shall contain a schedule, including the submission date for a SWMU Assessment Report.

V.D.8 The SWMU Assessment Report shall describe all results obtained from the implementation of the approved SWMU Assessment Plan. At a minimum, the Report shall provide the following information for each previously unidentified SWMU:

V.D.8.a The SWMU location, identified on a map;

V.D.8.b The type and function of the SWMU, including general dimensions and a structural description;

V.D.8.c The period during which the SWMU was operated; and

V.D.8.d All wastes that were or are being managed at the SWMU including results of any sampling and analysis used to determine whether releases of hazardous wastes or hazardous waste constituents have occurred, are occurring, or are likely to occur from the SWMU.

V.D.9 Based on the results of SWMU Assessment Report, the Executive Secretary shall determine the need for further investigations at specific SWMUs included in the SWMU Assessment Report. If the Executive Secretary determines that such investigations are needed, the Executive Secretary may require the Responsible Permittee to prepare a plan for such investigations in accordance with the VIWP. The Executive Secretary shall review the plan and either approve it or notify the Responsible Permittee of its deficiencies.

V.D.10 The Responsible Permittee shall notify the Executive Secretary of any release(s) of hazardous waste or hazardous waste constituents discovered during the course of groundwater monitoring, field investigation, environmental auditing, or other

activities undertaken during the RFI. The written notification shall be received by the Executive Secretary no later than 15 working days after discovery. Such releases may be from already documented or previously unidentified SWMUs. The Executive Secretary may require a plan for further investigation of the new release(s). The Executive Secretary shall review the plan and either approve it or notify the Responsible Permittee of its deficiencies.

V.E DETERMINATION OF NO FURTHER ACTION

V.E.1 If, upon investigation of any SWMU, the Responsible Permittee determines that corrective action would not be necessary, in accordance with the VIWP, the Responsible Permittee may petition the Executive Secretary in writing for a determination that no further action is necessary. The Executive Secretary shall either approve or disapprove the petition in writing.

V.E.2 A determination of no further action shall not preclude the Executive Secretary from requiring further investigations, or remediation at a later date, if new information or subsequent analysis indicates that a release or likelihood of a release from a SWMU at the facility is likely to pose a threat to human health or the environment. In such a case, the Executive Secretary shall initiate major permit modification in accordance with R315-3-4.3 or rescind the determination made in accordance with Condition V.E.1.

V.F CORRECTIVE ACTION PLAN

V.F.1 The VIWP, provides the bases for implementation of corrective action at SWMUs. As described in the VIWP such corrective action may include investigation, remediation, or both.

V.F.2 Investigation and remediation plans, including sampling plans required by the VIWP shall be submitted to the Executive Secretary for approval prior to implementation with schedules for implementation.

V.F.3 Within 60 days of completion of investigations or remediation required by Condition V.F.2, the Responsible Permittee shall submit, for approval, reports which summarize final sampling activities, investigative results, risk evaluation results, further corrective action to be implemented, and a schedule for further corrective action implementation.

V.G CORRECTIVE ACTION IMPLEMENTATION

V.G.1 The responsible Permittee(s) shall implement Corrective Action Plans (CAP) in accordance with the schedule approved in each VIWP Report as described in Conditions V.F.2 and V.F.3. Work will commence in accordance with the schedule for corrective action implementation described in Conditions V.F.2. and V.F.3.

V.G.2 On November 13, 2000, USS and Anderson Geneva submitted applications for three Corrective Action Management Units (hereinafter "CAMUs"). By letter dated November 17, 2000, the Executive Secretary accepted that application as substantially complete. Use of these CAMUs is integral to performance of work required by this Permit. Consequently, USS and Anderson Geneva shall submit to the Executive Secretary CAMU designs and CAMU operation and maintenance plans. Upon approval by the Executive Secretary, the designs and plans will be incorporated in this Permit. The CAMUs shall be constructed, operated, and maintained in accordance with the approved design and plans.

V.G.3 Perimeter groundwater monitoring, additional groundwater investigations, and the Tier 2 Ecological Risk Assessment described in the VIWP will be performed in accordance with Table 1 of Module V.

V.H REPORTING REQUIREMENTS

V.H.1 USS and Anderson Geneva shall submit to the Executive Secretary signed semi-annual progress reports of all activities for which each is responsible, either individually or collectively, (e.g., Interim Measures, RFI, Corrective Action) conducted pursuant to the Permit conditions of Module V.

V.H.2 The progress reports shall contain the following:

V.H.2.a A description of the work completed;

V.H.2.b Summaries of all findings and all raw data;

V.H.2.c Summaries of all problems or potential problems encountered during the reporting period and actions taken or to be taken to rectify problems; and

V.H.2.d Projected work for the next reporting period including a list of SWMUs for which Notification Letters will be submitted.

V.H.3 The responsible Permittee(s) shall maintain copies of all required reports, drilling logs, etc. at Anderson Geneva, during the effective period of this Permit.

V.H.4 The Executive Secretary may require the responsible Permittee(s) to conduct new or more extensive assessments, investigations, or studies, as needed, based on information provided in these progress reports or other supporting information.

V.I FINANCIAL ASSURANCE FOR CORRECTIVE ACTION

V.I.1 The Permittee shall be financially responsible for completing facility-wide corrective action.

ANDERSON GENEVA/USS
Tier 1 SWMU List

RCRAInfo Name	SWMU Name	C-Action Complete	Status/Comments
Tier 1 SWMUs			
1.01 - BP-10	Benzol Plant Underground Tanks**		Additional Field Activities, see 200800732.doc
1.01 - BP-13	Interceptor Trench and Wastewater		
1.01 - BP-14	Crude Still Residue/Tar Line Cleanout		
1.01 - BP-15	Wash Oil Lines Cleanout Area		
1.01 - BP-2A	Benzol Still Area		
1.01 - BP-2B	Benzol Still Area		
1.01 - BP-3	Wash Oil Cooler Area		
1.01 - BP-4	Benzol Decanter Tank		
1.01 - BP-6	Former Spent Caustic Sump		
1.01 - BP-7	Benzol Sump		
1.01 - BP-8	Benzol Muck Tank Area		
1.01 - BP-9	Former Sludge Buggy Loading Facility		
1.01 - BP-A1	Crude Kettle Tank Area		
1.01 - BP-A2	Tank #19 Wash Oil Sump Area		
1.01 - BP-A3	Acid Sludge Tanks		
1.01 - CBP-1	Heat Exchanger Area		
1.01 - CBP-10	West Sump Area		
1.01 - CBP-11	Tar Decanter Sump (CBP-11)		
1.01 - CBP-12	Tar Decanters (CBP12-14) Area		
1.01 - CBP-13	Tar Decanters (CBP12-14) Area		
1.01 - CBP-14	Tar Decanters (CBP12-14) Area		
1.01 - CBP-15	AKJ Sludge Reclamation Area		
1.01 - CBP-16	North Excess Flushing Liquor Tanks		
1.01 - CBP-17	South Excess Flushing Liquor Tank		
1.01 - CBP-18	South Excess Flushing Liquor Tank		
1.01 - CBP-19	South Excess Flushing Liquor Sump		
1.01 - CBP-2	Heat Exchanger Area		
1.01 - CBP-20	ESP Seal Pots and Mother Liquor Sump		
1.01 - CBP-21	ESP Seal Pots and Mother Liquor Sump		
1.01 - CBP-22	ESP Seal Pots and Mother Liquor Sump		
1.01 - CBP-23	Mother Liquor Tanks Area		
1.01 - CBP-24	Mother Liquor Tanks Area		
1.01 - CBP-25	ESP Seal Pots and Mother Liquor Sump		
1.01 - CBP-26	Acid Tar Bins Area		
1.01 - CBP-27	Final Cooler and Wash Oil Sump Area**		
1.01 - CBP-28	East Sump Area		
1.01 - CBP-29	Final Coolers Cooling Tower Area		
1.01 - CBP-3	Heat Exchanger Area		
1.01 - CBP-30	Final Coolers Cooling Tower Area		
1.01 - CBP-31	Final Cooler and Wash Oil Sump Area**		
1.01 - CBP-33	Former Flushing Liquor Flume Area		
1.01 - CBP-34	Tar Tank Bottoms Disposal Area		
1.01 - CBP-4	Heat Exchanger Area		
1.01 - CBP-5	Heat Exchanger Area		
1.01 - CBP-6	Heat Exchanger Area		

ANDERSON GENEVA/USS
Tier 1 SWMU List

RCRAInfo Name	SWMU Name	C-Action Complete	Status/Comments
1.01 - CBP-7	Heat Exchanger Area		
1.01 - CBP-8	Heat Exchanger Area		
1.01 - CBP-9	Heat Exchanger Area		
1.01 - CBP-C	Heat Exchanger Area		
1.01 - CBP-D	Solvent Tank Area		
1.01 - CBP-E	Former Ammonia Still Area		
1.01 - CBP-G	Saturators Area		
1.01 - CBP-H	Saturators Area		
1.01 - CP-10	North and South Quench Tower & Sump		
1.01 - CP-11	North and South Quench Tower & Sump		
1.01 - CP-12	Excess Flushing Liquor Surface		Additional Field Activities, see 200800732.doc
1.01 - CP-7	Quench Pond**		
1.01 - CP-8	North and South Quench Tower & Sump		
1.01 - CP-9	North and South Quench Tower & Sump		
1.01 - CBP-B	Circulating Liquor Tank Area**		
1.02 - OR-21	Oil Reclamation Sludge Piles		Approval of interim action, see 200900094.doc
1.02 - OR-22	Oil Reclamation Sludge Piles		Approval of interim action, see 200900094.doc
2.01 - BF-24	Blast Furnace Slag Pile		
2.01 - BF-31	Heckett Pond and Ditch		NL approval 200800046.doc
2.01 - OH-4	Open Hearth Slag Pile (Now Q-BOP		
2.02 - RM-7A	Rolling Mill Clarifier Area		
2.02 - RM-7B	Rolling Mill Clarifier Area		
2.02 - RM-8A	Clarifier Underground Oil Drainpipe		
2.02 - RM-8B	Clarifier Oil Sump		
2.02 - RM-8C	Clarifier Oil Skimmer**		
2.02 - RM-8D	Overhead Oil Drainpipe**		
2.02 - RM-9A	Former Clarifier Waste Oil Pond		
2.02 - RM-9B	Current Clarifier Waste Oil Pond**		
2.04A - OH-1C	AKJ Tank "C" Catch Basin Area**		7/3/08 letter - 200800519.doc.
2.15A - MS-5A North	North Area Wastewater Sewers		
2.06 - MS-16	Lake Bottom Canal Dredging Pile Area		
2.06 - MS-2A	Lake Bottom Canal (area south of 800 North)		NL approval 20080074.doc
2.06 - MS-2B	Lake Bottom Canal (area north of 800 North)		
2.08 - BF-10	Blast Furnace Gas Washer Overflow		
2.08 - BF-11	Blast Furnace Gas Washer Overflow		
2.08 - BF-12	Blast Furnace Gas Washer Overflow		
2.08 - BF-F	Blast Furnace Ladle Burnout Station		
2.11 - RM-14A	Areas Adjacent to 2 Active Scale Pits		
2.11 - RM-14B	Areas Adjacent to 2 Inactive Scale Pits		
2.12 - SI-5B	Treated Water Cooling Pond and Pipeline		Approval of interim action, see 200900094.doc
2.13 - MS-1	Blast Furnace and Coke Plant Ditch		NL approval let 200700604.doc/200800046.doc

ANDERSON GENEVA/USS
Tier 1 SWMU List

RCRAInfo Name	SWMU Name	C-Action Complete	Status/Comments
2.18 - CP-13B	Coke Oven Gas Drip Leg Areas (area north of 800 N.)**		2/25/09 - AGD proposed to divide this SWMU into two SWMUs. See TN200800682.pdf. Approve division of SWMU see 200900296.doc.
2.19 - BF-25	Slag Pile Tar Pond		
2.19 - BF-26	Blast Furnace General Dump Area		
2.19 - BF-27	Blast Furnace Slag Cooling Pits and		
2.19 - BF-28	Blast Furnace Slag Cooling Pits and		
2.19 - BF-29	Blast Furnace Slag Cooling Pits and		
2.19 - BF-30	Blast Furnace Slag Cooling Pits and		
2.19 - BF-32	Blast Furnace Slag Cooling Pits		
2.19 - BF-38	Discrete Areas of Tar		
2.19 - BF-38B	Discrete Areas of Tar		
2.19 - BF-38C	Discrete Areas of Tar		
2.19 - BF-38D	Discrete Areas of Tar		Notification of new SWMU received 6/15/09, see 200901943.pdf
2.19 - SP-14A	Sinter Plant and Open Hearth Sludge		
2.19 - SP-14B	Sinter Plant and Open Hearth Sludge		
3.01 - MS-24	Waste Oil/Grease Drum Storage Area(s)		
3.10 - SI-4	Final Retention Pond		VI Approval let 200700521.doc
MS-28	PCBs by power plant		New SWMU per NL dated 8/24/06. Field work to be conducted in 2008. PCBs by power plant
3.20 - 3.20A	Front-End Oil Tanks		

ANDERSON GENEVA/USS
Tier 2 SWMU List

RCRAInfo Name	SWMU Name	C-Action Complete	Status/Comments
Tier 2 SWMUs			
ND - SI-1	Closed Hazardous Waste Impoundments		Closed HW Impoundments. Post-Closure Care Permit. CACWC concurred on the (DATE) 200900864.doc
ND - SI-2	Closed Hazardous Waste Impoundments		Closed HW Impoundments. Post-Closure Care Permit. CACWC concurred on the (DATE) 200900864.doc
ND - SI-3	Closed Hazardous Waste Impoundments		Closed HW Impoundments. Post-Closure Care Permit. CACWC concurred on the (DATE) 200900864.doc
ND - BF-36	Abandoned Mixed Gas Line		NFA approved under TIER-2 - CACWOC concurred on the (DATE) 200900864.doc
ND - BF-G	Rubber-tired Slag Hauler Loading Areas		NFA approved under TIER-2 - CACWOC concurred on the (DATE) 200900864.doc
ND - CBP-32	Tar Cleanout Area		NFA approved under TIER-2 - CACWOC concurred on the (DATE) 200900864.doc
ND - CP-15	Biological Wastewater Treatment Plant		NFA approved under TIER-2 - CACWOC concurred on the (DATE) 200900864.doc
ND - MS-12	Untreated Water Control/Screening Facility		NFA approved under TIER-2 - CACWOC concurred on the (DATE) 200900864.doc
ND - MS-23	New Hazardous Waste Control Collection Area		NFA approved under TIER-2 - CACWC concurred on the (DATE) 200900864.doc
ND - OH-27	ESP Dust Handling System		NFA approved under TIER-2 - CACWOC concurred on the (DATE) 200900864.doc
ND - OH-A	Slag Pocket Areas		NFA approved under TIER-2 - CACWOC concurred on the (DATE) 200900864.doc
ND - RM-10A	Former Waste Oil Tank		NFA approved under TIER-2 - CACWOC concurred on the (DATE) 200900864.doc
ND - RM-10B	Current Waste Oil Tanker		NFA approved under TIER-2 - CACWOC concurred on the (DATE) 200900864.doc
ND - RM-13	Oil Pond Pickup Unit and Hose		NFA approved under TIER-2 - CACWOC concurred on the (DATE) 200900864.doc
ND - SP-12	Sinter Plant/Open Hearth Sludge Tank		NFA approved under TIER-2 - CACWOC concurred on the (DATE) 200900864.doc
NA - BOP-2	LMF Slag Quench Water Impoundments		NFA approved under TIER-2 - CACWOC concurred on the (DATE) 200900864.doc
1.3 - SI-6	Former Emergency Tar Disposal Pit		NFA approved under TIER-2 - CACWOC concurred on the (DATE) 200900864.doc
1.4 - CP-16	COG Line Disposal Area		NFA approved under TIER-2 - CACWC concurred on the (DATE) 200900864.doc
1.4 - MS-21	COG Line Clean-out Area		NFA approved under TIER-2 - CACWC concurred on the (DATE) 200900864.doc
2.2 - BF-37	Heckett Waste Oil Tank		
3.07 - BF-22	Blast Furnace Evaporation Pond		CACWOC
3.14 - MS-18	Asbestos Storage Area		NFA approved under TIER-2 - CACWOC concurred on the (DATE) 200900864.doc
2.07 - BF-18	Blast Furnace Sludge Surface	6/11/2007	CACWOC - See letter 200700697.doc
2.07 - BF-19	Blast Furnace Sludge Surface	6/11/2007	CACWOC - See letter 200700697.doc

ANDERSON GENEVA/USS
Tier 2 SWMU List

RCRAInfo Name	SWMU Name	C-Action Complete	Status/Comments
2.07 - BF-20	Blast Furnace Sludge Surface	6/11/2007	CACWOC - See letter 200700697.doc
2.07 - BF-21	Blast Furnace Sludge Pile	6/11/2007	CACWOC - See letter 200700697.doc
2.14 - MS-3	Nitrogen Plant Ditch	12/17/2007	Pipe Mill Verification and Cleanup/Management Report TN200701346.doc) submitted C-Action/stabilization measures are complete. Human Health Risk Evaluation Report (TN200701448.doc) demonstrating C-Action complete with controls. SMP finaled and signed by
3.03 - MS-17	Miscellaneous Wastes Near Pipe Mill	12/17/2007	
3.03 - PM-4	Pipe Mill Wastewater Sump Overflow	12/17/2007	
3.03 - PM-5	Pipe Mill Waste Oil Tank	12/17/2007	
3.03 - PM-6	Large Pipe Mill Waste Oil Tank	12/17/2007	
3.03 - PM-7	Wastewater Pump Station and	12/17/2007	
3.03 - PM-8	Trench Pipe from Pioneer Pipe	12/17/2007	
3.05 - MS-14	Powerhouse Baghouse Truck Loading	6/7/2007	CACWOC - See letter 200700670.doc
3.05 - MS-22	Powerhouse Ash Pit and Ash Pile	6/7/2007	CACWOC - See letter 200700670.doc
3.17 - 3.17A	Bead Blast Area**	6/7/2007	CACWOC - See letter 200700677.doc
2.04B - OH-2	Iron Desulfurization Baghouse Tote Box**	5/11/2007	CACWOC - See letter 200700448.doc
2.04B - OH-22	Open Hearth Clarifiers Area	5/11/2007	CACWOC - See letter 200700448.doc
2.04B - OH-23	Open Hearth Clarifiers Area	5/11/2007	CACWOC - See letter 200700448.doc
2.04B - OH-24	Thickener Tank Area**	5/11/2007	CACWOC - See letter 200700448.doc
2.04B - OH-25	Thickener Tank Area**	5/11/2007	CACWOC - See letter 200700448.doc
2.04B - OH-26	Sludge Pipe	5/11/2007	CACWOC - See letter 200700448.doc
2.04B - OH-29	Area Beneath Sludge Pipe**	5/11/2007	CACWOC - See letter 200700448.doc
2.15C - MS-5B	Pipe Mill Sewers	12/17/2007	Pipe Mill Verification and Cleanup/Management Report TN200701346.doc) submitted C-Action/stabilization measures are complete. Human Health Risk Evaluation Report (TN200701448.doc) demonstrating CACWC.
3.02B - CP-2	Coal Mixing Baghouse Discharge Area	5/9/2007	CACWOC - See 200700455.doc
3.3R - 3.3R	New Pipeline from Pioneer Pipe	6/12/2008	See NFA letter TN200800482.doc. Pipeline was never built and therefore moved to tier 2. CACWOC concurred on the (DATE) 200900864.doc
2.12 - SI-5A	Treated Water Cooling Pond and Pipeline	6/23/2008	NFA see letter 200800323.doc.
3.18 - 3.18A	Pipeline to BF Evaporation Pond	12/28/2005	NFA/CACWOC based on Residential $<10^{-6}$ and HQ<1 per UDEQ NFA Letter dated 12/28/05
3.12 - MS-6	Satellite Spent 1,1,1-TCA Collection Area	5/5/2008	CACWOC - See letter TN200800293.doc.
3.06 - MS-7	Satellite Spent 1,1,1-TCA Collection Site	5/5/2008	CACWOC - See letter TN200800293.doc.
3.04 - MS-8	Former Satellite 1,1,1-TCA Collection Site	5/5/2008	CACWOC - See letter TN200800293.doc.
3.12 - MS-9	Former Satellite Spent 1,1,1-TCA Collection Site**	5/5/2008	CACWOC - See letter TN200800293.doc.
3.04 - MS-10	Former Satellite 1,1,1-TCA Collection Site**	5/5/2008	CACWOC - See letter TN200800293.doc.

ANDERSON GENEVA/USS
Tier 2 SWMU List

RCRAInfo Name	SWMU Name	C-Action Complete	Status/Comments
3.04 - MS-11	Central Spent 1,1,1-TCA Collection Site	5/5/2008	CACWOC - See letter TN200800293.doc.
3.04 - MS-25C	New Satellite Storage Area	5/5/2008	CACWOC - See letter TN200800293.doc.
3.15 - MS-25D	New Satellite Storage Area	5/5/2008	CACWOC - See letter TN200800293.doc.
3.15 - MS-25E	New Satellite Storage Area	5/5/2008	CACWOC - See letter TN200800293.doc.
3.15 - MS-25F	New Satellite Storage Area	5/5/2008	CACWOC - See letter TN200800293.doc.
3.15 - MS-25G	New Satellite Storage Area	5/5/2008	CACWOC - See letter TN200800293.doc.
1.01 - MS-25H	New Satellite Storage Area	5/5/2008	CACWOC - See letter TN200800293.doc.
3.15 - MS-25I	New Satellite Storage Area	5/5/2008	CACWOC - See letter TN200800293.doc.
1.05 - BP-12	Sludge Buggy Dump Area 2	9/23/2008	CACWOC - see letter 200800768.doc.
2.10 - BF-33	Former Emergency Slag/Deskulling Pits	8/27/2008	(NFA - see letter 200800515.doc.) Letter 200800570.doc recindes the earlier descision and grants a CACWC. **Letter 200900798.doc combines Bf-33 and BF-34 and grants a CACWOC**
2.10 - BF-34	Former Emergency Slag/Deskulling Pits	10/8/2008	CACWOC - See 200800871.doc
2.09 - OH-30	Open Hearth LUST Area**	2/12/2009	CACWOC - See 200900125.doc
3.04 - MS-20	Waste Oil Collection Tank (Central	2/12/2009	CACWOC - See 200900125.doc
3.04 - MS-26	LUST Area (Central Garage)**	2/12/2009	CACWOC - See 200900125.doc
3.04 - MS-1	Caustic Cleaning Tank (Near Central	2/12/2009	CACWOC - See 200900125.doc
3.08 - OR-1A	Waste Oil Tank (Heavy Duty Garage	2/12/2009	CACWOC - See 200900125.doc
3.04 - OR-1B	Waste Oil Tank (M-2 Garage)	2/12/2009	CACWOC - See 200900125.doc
3.04 - OR-24	Waste Oil Tank and Truck Loading Area	2/12/2009	CACWOC - See 200900125.doc
3.09 - OR-1C	Waste Oil Tank (Caterpillar Garage)	2/12/2009	CACWOC - See 200900125.doc
3.13 - MS-13	Skull Cracker Area	2/12/2009	**CACWC** - See 200900125.doc
2.15B - MS-5A	All Sewers except Pipe Mill Sewers	12/22/2008	VI approval letter 200700519.doc. LROF approved see letter 200801176.doc, with CACWOC.
2.05 - RM-15	LUST Area (Rolling Mills)**	3/30/2009	LROF approved see letter 200900327.doc,
2.05 - RM-E	Former Caustic Wash Tank Area	3/30/2009	LROF approved see letter 200900327.doc,
3.13 - MS-27	Waste Oil Storage Area	5/14/2009	LROF approved, see 200900549.doc, CACWOC.
3.13 - MS-29	Open Hearth Highline (Diesel)	5/14/2009	New SWMU - Notification received on1/23/08. Investigation and interim action 200800205.doc. Interim measures approved see 200800517.doc. Aproval for additional GW investigation, addtion of new monitoring well. LROF approved, see 200900549.doc, subsurf
1.02 - OR-21B	Oil Reclamation Sludge Piles	6/25/2009	Approval of interim action, see 200900094.doc. CACWOC approved 6/25/09
1.02 - OR-22B	Oil Reclamation Sludge Piles	6/25/2009	Approval of interim action, see 200900094.doc. CACWOC approved 6/25/09
2.12 - SI-5C	Treated Water Cooling Pond and Pipeline	6/25/2009	Approval of interim action, see 200900094.doc. CACWOC approved 6/25/09

ANDERSON GENEVA/USS
Tier 2 SWMU List

RCRAInfo Name	SWMU Name	C-Action Complete	Status/Comments
3.02A - CP-14	Hammermill Baghouse No. 3 Discharge Area	7/7/2009	LROF approved see 200900751.doc, CACWOC.
2.16 - SP-13	Sinter Plant and Open Hearth Underground Slurry Pipeline	7/7/2009	LROF approved see 200900751.doc, CACWOC.
2.17 - SP-15	Sinter Plant Collection Sump Area**	7/7/2009	CACWOC - See letter 200900751.doc,
2.04A - OH-3A	Pig Machine Sumps and Drainage Ditch**	7/7/2009	CACWOC - See letter 200900751.doc,
2.04A - OH-3B	Pig Machine Sumps and Drainage Ditch**	7/7/2009	CACWOC - See letter 200900751.doc,
2.04A - OH-3C	Pig Machine Sumps and Drainage Ditch**	7/7/2009	CACWOC - See letter 200900751.doc,
2.03 - BF-13	Blast Furnace Clarifier Area	7/7/2009	CACWOC - See letter 200900751.doc,
2.03 - BF-14	Blast Furnace Clarifier Area	7/7/2009	CACWOC - See letter 200900751.doc,
2.03 - SP-11	Sinter Plant Clarifier Area**	7/7/2009	CACWOC - See letter 200900751.doc,
2.03 - SP-16	Sinter Plant Pond	7/7/2009	CACWOC - See letter 200900751.doc,
1.04 - BP-11	Sludge Buggy Dump Area 1	7/7/2009	**CACWC - See letter 200900751.doc.**
3.16 - BOP-1	Q-BOP Baghouse Dust Bins and Area	7/7/2009	CACWOC - See letter 200900751.doc,
1.04 - MS-19	PCB Collection Site	7/7/2009	NL approval 2008.00019.doc. LROF approved for CACWC see letter 200900755.doc
2.04A - OH-28	Former Ladle Burnout Baghouse Tote		
3.19 - 3.19A	Sulfur Piles		Comments on letter report fo findings see 200800601.doc
2.02 - MS-15	Sanitary Treatment Plant		CACWOC 6/16/09 - see 200900697.doc.
1.02 - OR-3	East Oil Reclamation Ditch	9/21/2009	CACWOC approved, see letter 200900942.doc.
1.02 - OR-4	Primary Oil/Water Separator Pond	9/21/2009	CACWOC approved, see letter 200900942.doc.
1.02 - OR-5	Primary Oil/Water Separator Pond	9/21/2009	CACWOC approved, see letter 200900942.doc.
1.02 - OR-6	Waste Oil Diversion Ditches	9/21/2009	CACWOC approved, see letter 200900942.doc.
1.02 - OR-7	Waste Oil Diversion Ditches	9/21/2009	CACWOC approved, see letter 200900942.doc.
1.02 - OR-8A	Secondary Oil/Water Separator Ponds, and Waste Oil Reclaimer Units	9/21/2009	CACWOC approved, see letter 200900942.doc.
1.02 - OR-8B	Secondary Oil/Water Separator Ponds, and Waste Oil Reclaimer Units	9/21/2009	CACWOC approved, see letter 200900942.doc.
1.02 - OR-9A	Secondary Oil/Water Separator Ponds, and Waste Oil Reclaimer Units	9/21/2009	Approval for interim action 200801048.doc. CACWOC approved, see letter
1.02 - OR-9B	Secondary Oil/Water Separator Ponds, and Waste Oil Reclaimer Units	9/21/2009	Approval for interim action 200801048.doc. CACWOC approved, see letter
1.02 - OR-10	Waste Oil Pipes	9/21/2009	Approval for interim action 200801048.doc. CACWOC approved, see letter 200900942.doc.

ANDERSON GENEVA/USS
Tier 2 SWMU List

RCRAInfo Name	SWMU Name	C-Action Complete	Status/Comments
1.02 - OR-11	Waste Oil Pipes	9/21/2009	CACWOC approved, see letter 200900942.doc.
1.02 - OR-12A	Waste Oil Holding Ponds/Return Ditches**	9/21/2009	Approval for interim action 200801048.doc. CACWOC approved, see letter 200900942.doc.
1.02 - OR-12B	Waste Oil Holding Ponds/Return Ditches**	9/21/2009	Approval for interim action 200801048.doc. CACWOC approved, see letter 200900942.doc.
1.02 - OR-12C	Waste Oil Holding Ponds/Return Ditches**	9/21/2009	Approval for interim action 200801048.doc. CACWOC approved, see letter 200900942.doc.
1.02 - OR-13	Underground Excess Wastewater Pipes	9/21/2009	CACWOC approved, see letter 200900942.doc.
1.02 - OR-14	Underground Excess Wastewater Pipes	9/21/2009	CACWOC approved, see letter 200900942.doc.
1.02 - OR-15A	Auxiliary Oil/Water Separator Ponds**	9/21/2009	CACWOC approved, see letter 200900942.doc.
1.02 - OR-15B	Auxiliary Oil/Water Separator Ponds**	9/21/2009	CACWOC approved, see letter 200900942.doc.
1.02 - OR-16A	Reclaimer Aerators & Wastewater Ditches	9/21/2009	CACWOC approved, see letter 200900942.doc.
1.02 - OR-16B	Reclaimer Aerators & Wastewater Ditches	9/21/2009	CACWOC approved, see letter 200900942.doc.
1.02 - OR-17A	Reclaimer Aerators & Wastewater Ditches	9/21/2009	CACWOC approved, see letter 200900942.doc.
1.02 - OR-17B	Reclaimer Aerators & Wastewater Ditches	9/21/2009	CACWOC approved, see letter 200900942.doc.
1.02 - OR-18A	Secondary Pond Wastewater Ditches and Discharge Pipes	9/21/2009	CACWOC approved, see letter 200900942.doc.
1.02 - OR-18B	Secondary Pond Wastewater Ditches and Discharge Pipes	9/21/2009	CACWOC approved, see letter 200900942.doc.
1.02 - OR-19A	Secondary Pond Wastewater Ditches and Discharge Pipes	9/21/2009	CACWOC approved, see letter 200900942.doc.
1.02 - OR-19B	Secondary Pond Wastewater Ditches and Discharge Pipes	9/21/2009	CACWOC approved, see letter 200900942.doc.
1.02 - OR-20	Weir 8 Wastewater Ditch	9/21/2009	Approval for interim action 200801048.doc. CACWOC approved, see letter 200900942.doc.
1.02 - OR-23	Truck Loading Sump	9/21/2009	Approval for interim action 200801048.doc. CACWOC approved, see letter 200900942.doc.
1.02 - OR-A	Waste Oil Dehydrator Tank Area	9/21/2009	CACWOC approved, see letter 200900942.doc.
1.02 - OR-B	Waste Oil Dehydrator Tank Area	9/21/2009	CACWOC approved, see letter 200900942.doc.
1.02 - OR-C	Reclaimed Oil Storage Tank Area**	9/21/2009	CACWOC approved, see letter 200900942.doc.
1.02 - OR-D	Reclaimed Oil Storage Tank Area**	9/21/2009	CACWOC approved, see letter 200900942.doc.

ANDERSON GENEVA/USS
Tier 2 SWMU List

RCRAInfo Name	SWMU Name	C-Action Complete	Status/Comments
1.02 - OR-E	Reclaimed Oil Storage Tank Area**	9/21/2009	CACWOC approved, see letter 200900942.doc.
1.02 - OR-F	Reclaimed Oil Storage Tank Area**	9/21/2009	CACWOC approved, see letter 200900942.doc.
4.0 - 4.2	Oil Reclamation Area	9/21/2009	CACWC, see letter 200900942.doc. SMP and EC submitted on 8/3/09 and 8/10/09 (see 200902536.pdf and 200902589.pdf). Comments sent on 9/15/09 see 200900944.doc
2.15A - MS-5A	South Area Wastewater Sewers		CACWOC - see 200801176.doc.
2.18 - CP-13A	Coke Oven Gas Drip Leg Areas (area south of 800 N.)**		2/25/09 - AGD proposed to divide this SWMU into two SWMUs. See TN200800682.pdf. Approve division of SWMU see 200900296.doc. CACWOC approved see 200900972
2.19 - BF-38D	Discrete Areas of Tar		Notification of new SWMU received 6/15/09, see 200901943.pdf. LROF (200903222.pdf) submitted on 9/28/09. Approval of CACWOC (200901238.doc).

ANDERSON GENEVA/USS
Groundwater SWMUs

RCRAInfo Name	SWMU Name	C-Action Complete	Status/Comments
GROUNDWATER SWMUs			
4.0 - 4.1	Benzol Plant Area		
4.0 - 4.2	Oil Reclamation Area		
4.0 - 4.3	Tar Pond Area		
4.0 - 4.4	Coke Plant By-products Area		
4.0 - 4.5	Parish Chemical Area Impacts		
4.0 - 4.6	Maintenance Area		
4.0 - 4.7	Pipe Mill Area		
4.0 - 4.8	Nitrogen Plant Area Impacts		
4.0 - 4.9	Rolling Mill Clarifier Area		
4.0 - 4.1	South Quench Tower Sump		
4.0 - 4.11	Front End Oil Tanks South Area		
4.0 - 4.12	Front End Oil Tanks North Area		
4.0 - 4.13	Open Hearth Highline Area		

ATTACHMENT 2

INSPECTION CHECKLIST

A. INSPECTION PLAN

A.1. Structures and Facilities to be inspected

A.1.a Run-On Diversion Ditches: The diversion ditches shall be visually inspected to assure that they can remain operable during storm events as designed. The inspection team shall look for erosion, lack of vegetative cover, and sedimentation.

A.1.b Cover Integrity: The cover shall be examined visually to check for sliding, subsidence, settlement, tension cracking, lack of vegetation, ponding of surface water, and condition of vegetation.

A.1.c Survey Bench Mark Settlement Plates and Monuments: The survey benchmarks, settlement plates, and monuments shall be located and visually inspected for damage or movement. If damage or movement is detected, they shall be repaired or replaced. The settlement plates shall be read in order to detect any settlement of the final cover.

A.1.d Monitoring Wells: Monitoring wells shall be inspected during the regular sampling program.

A.1.e Groundwater Withdrawal Wells: The groundwater withdrawal wells shall be inspected whenever the wells are sampled.

A.2. Frequency of Inspections

A.2.a. Inspections shall be conducted quarterly. Inspections may coincide with sampling of the monitoring wells.

A.2.b The monitoring well inspections and groundwater withdrawal well inspections shall coincide with the monitoring program.

A.2.c The Permittee shall document the inspections on the Observation and Inspection Checklists included in this attachment and maintain copies on site.

B MAINTENANCE PLAN

B.1. Cover Maintenance Activities and Schedule: The surface and slopes of the final cover shall be inspected for damage as outlined in I.A.2 of Attachment 1. Soil shall be replaced as required., based on needs determined from regular inspections. The repair of all surface subsidence, soil erosion problems, or slope damage shall be completed as soon as possible but no later than three days after the problem was first noticed.

B.2. Reseeding Schedule: The cover shall be reseeded as required.

B.3. Fertilizing Schedule: Fertilizer shall be applied as necessary.

B.4. Rodent and Insect Control: During the routine inspections, the cap and final cover shall be carefully scrutinized for animal burrows or insect mounds and repaired as required.

B.5. Erosion Control: The activities for erosion control shall include excavation of sediment deposits, replacement of eroded soil, replacement of eroded slag and other compaction, installing of energy dissipation structure as required and reseeding as applicable. Any repair will be completed as soon as possible but no later than three days after the problem is first observed.

B.6 Maintenance of Groundwater Monitoring System: The Permittee shall inspect and maintain the groundwater monitoring system to meet the rerquirements of Module III.

B.7 Hazard Signs: If it is observed during the periodic inspections that the identification or hazard signs are damaged or in need of maintenance, the damaged portion will be repaired or replaced.

Observation And Inspection Checklist

ITEM	General Condition	Change From Previous Inspection	Action Taken By Inspector
General Condition Of The Site Cap			
Signs of Sloughing or Sliding at out Slopes Signs of Subsidence Evidence of Sheet Erosion Evidence of Gully Erosion Evidence of Boggy Area Extent of Vegetation Cover Condition of Vegetation Cover Changes in Vegetation Evidence of Rodent Damage			
Conditions Of Ditches			
Evidence of Erosion Obstruction of Flow Conditions of Structures and Appurtenances Condition of Vegetative Lining			
Decant Inlet and Pipes			
Clogging at Inlet Clogging at pipes Characteristic of Discharge Signs of Corrosion Signs of Cracking or Crushing Erosion Condition at Inlet Erosion Condition at Discharge			
Concrete Structures			

Cracking Spalling Areas of Seepage Vertical, Horizontal or Tilting Movements			
Instrumentation			
Settlements Monuments and Bench Marks Vent Stacks Monitoring Wells and Pump Wells Hazard Signs			

Discussion

LEGEND REPORTING CODE

General Conditions Column	**Changes Column**	**Action Taken Column**
NA - Not Applicable	NA - Not Applicable	RM - Routine Maintenance
NU - Nothing Unusual	NC - No Changes	ND - Notified Designer
AR - Action Required	I - Improved from Previous Inspection	RC - Repair Completed
D - See Discussion	D - See Discussion	D - See Discussion

Inspector Signature

EXPLANATION OF INSPECTION OBSERVATIONS

GENERAL CONDITION OF THE SITE CAP AT OUT SLOPES

ITEMS INSPECTED	DESCRIPTION OF ITEMS TO BE OBSERVED	CORRECTION METHOD
Signs of Sloughing or Sliding at the Out slopes	Check for bulging along or at the base of the slopes and the formation of vertical displacement and cracking at or along the top of the distressed area. Special care	Repair slide area by replacement with suitable material. Use straw bales as necessary to control erosion
Signs of Subsidence	Check for settlements due to consolidation of soft foundation material. Evidenced by bowl-shaped depressions, possibly impounding water. Care shall be exercised in areas of heavy vegetation to avoid overlooking such areas.	Clear vegetation in the area. Repair low spots by filling to grade with off-site borrow material. Fertilize, seed and mulch as necessary to re-establish vegetation. Use straw bales as necessary to control erosion.
Evidence of Sheet Erosion	Check areas, which lack ground cover. Sheet erosion is evidenced by surficial loss of soil in a somewhat	Regrade as necessary. Fertilize, seed, and mulch to establish vegetation. Use straw bales to control erosion if necessary.
Evidence of Gully	Check areas which lack ground cover. Gully erosion is due to the effects of the concentration of overland flow and results in the creation of narrow and deep channels.	Regrade as necessary. Replace eroded material with suitable off-site borrow. Fertilize, seed, and mulch to establish vegetation. Use straw bales as necessary to further check erosion.

Evidence of Boggy Area	Check for evidence of wet or boggy area. Evidenced by areas where vegetation may be thriving due to moist conditions or ponded water may be present.	Clear vegetation in the area. Repair low spots by filling off-site borrow. Fertilize, seed, and mulch. Use bales as necessary.
Extent, Condition, and Changes in Vegetation Cover	All areas that were seeded shall have a well-developed vegetation cover, which is uniform and continuous. Irregularities such as difference in color. Density, rate of growth, type of growth, or a difference in the character of the vegetation will be noted.	Sample soils to determine nutrient deficiencies. Apply fertilizer amounts as specified by soil analysis, followed by seed and mulch application
Evidence of Rodent Damage	Check for the presence of animal burrows or insect mounds.	Notify local exterminating and pest control company. After application of pesticide or rodenticide, backfill and regrade areas involved. Apply fertilizer, seed, and mulch.

DECANT INLETS AND PIPES

ITEM INSPECTED	**DESCRIPTION OF ITEMS TO BE OBSERVED**	**CORRECTION METHOD**
Spalling	Concrete structures (inlets and walls) shall be inspected for spalling as evidenced by the removal of the concrete matrix at the surface. The remaining surface will be rough, and the aggregate will be exposed	If spalling is severe causing inlet or end wall to not function as desired, then structure replacement is necessary.

Areas of Seepage	Concrete catch basins Inlet 1 and 2. Shall be inspected to verify that the weep holes are free from debris and functioning.	Remove debris from weep hole, and clean as necessary
Vertical, Horizontal or Tilting Movements	Check to verify that vertical and horizontal elements of end walls and inlets are plumb	If movement or tilting is causing the inlet or end wall not to function as designed, then structure replacement is necessary
Clogging	Check for debris or accumulation of other material at the inlets 1. and 2. Check the riser in Ponds 1 and 2 for accumulation of debris. Siltation in the inlets may clog Discharge Pipes 1 and 2.	Remove accumulated debris from all inlets and risers. Clear out catch basins. Unplug pipelines by rodding out or flushing.
Characteristic of Discharge	Evaluate the character and quantity of water flowing into and out of all pipes. If inflow differs from the outflow, it is possible that cracks or open joints are allowing flow to escape or providing additional flow to the pipe	Where open joints or cracks in the pipes are suspected, the pipes should be inspected. Damaged pipes or joints should be excavated and repaired.
Corrosion, Cracking, or Crushing	Check for corrosion, cracking, or crushing at all visible portions of pipes. Settlement above the pipelines may indicate that the pipe has been crushed. Tilted riser pipes in the sedimentation ponds indicate that corrosion may have occurred. Loss of pond	Replace damaged pipe as necessary.

	volume may also indicate corrosion of the riser has occurred.	
Erosion at Inlet and Outlet	Check for erosion at inlet to pipes which can result in solids being carried into the pipelines. Erosion at the discharge of pipes is evidenced by undercutting the discharge point or undercutting the toe of adjacent slopes	Regrade as necessary. Replace eroded material. Fertilize, seed, and mulch as appropriate. Provide energy dissipators at discharge points

CONDITIONS OF DITCHES

ITEM INSPECTED	**DESCRIPTION OF ITEMS TO BE OBSERVED**	**CORRECTION METHOD**
Evidence of Erosion	The banks and beds of all ditches (A,B,C, and D) shall be examined to determine if erosion or siltation has occurred. Erosion is evidenced by sides that are steeper than shown on the plans or by localized irregularities in configuration.	Re-establish proper ditch configuration. Reseed to establish vegetative cover.
Obstruction to Flow	Check for sloughed-in soil, other foreign objects, excessive vegetative growth, or siltation due to erosion.	Remove all obstructions and repair ditch to original configuration. Revegetate as necessary.
Condition of Structures	The condition of all structures and appurtenances that are a part of the ditches should be noted, including culverts, inlets, endwall,	Repair or replace structure. Remove obstructions to inlets and pipes. Regrade and revegetate as necessary.

	risers, etc. Check for accumulation of debris, settlement or movement, cracks, rust, scour, and erosion	
Condition of Vegetative Lining	Check that vegetation covers all ditches, is uniform and continuous. Note differences in vegetation colour, density, type of growth, and character of vegetation	Sample soils in areas of bare spots to determine nutrient requirements. Remove unsuitable materials if necessary. Replace with suitable material and revegetate.

INSTRUMENTATION

ITEM INSPECTED	**DESCRIPTION OF ITEMS TO BE OBSERVED**	**CORRECTION METHOD**
Settlement Monuments and Bench Marks	Inspect settlement monuments and bench marks to see that they are still in existence and in good condition. Obvious tilt of the settlement monument shall be noted.	Relocate and re-establish bench marks and settlement monuments as necessary.
Vent Stacks	Check that the PVC vent stacks are not cracked or damaged and that the pipe is not obstructed.	Repair or replace pipe if damaged. Remove obstructions in pipe as necessary.
Monitoring Wells and Pump Wells	Check that covers and locks are secure and operable.	Repair or replace cover if damaged. Severe damage to a well may necessitate well redrilling.
Hazard Signs	Check to see that the hazard signs are still in existence.	Repair damaged, illegible signs or replace if necessary.

CONCRETE STRUCTURES

ITEM INSPECTED	**DESCRIPTION OF ITEMS TO BE OBSERVED**	**CORRECTION METHOD**
Cracking	Inspect concrete structures (Inlet and end Walls) for cracks. If cracks are noticed on a particular structure, other similar structures shall be checked for evidence of cracks.	If cracking is severe causing inlet or end wall to not function as designed, then structure replacement is necessary.

Attachment 3

- Map with Closed hazardous waste impoundment monitoring wells
- Map with SWMU locations and approximate groundwater plume locations

Aerial Source: AGRC 2009 High Resolution Ortho-Imagery 1 Foot

File: X:\Projects\USS-Geneva\GIS\Hazardous_Waste_Impoundment\Fall_2009\FigCHWI_Sitemap_Fall09.mxd

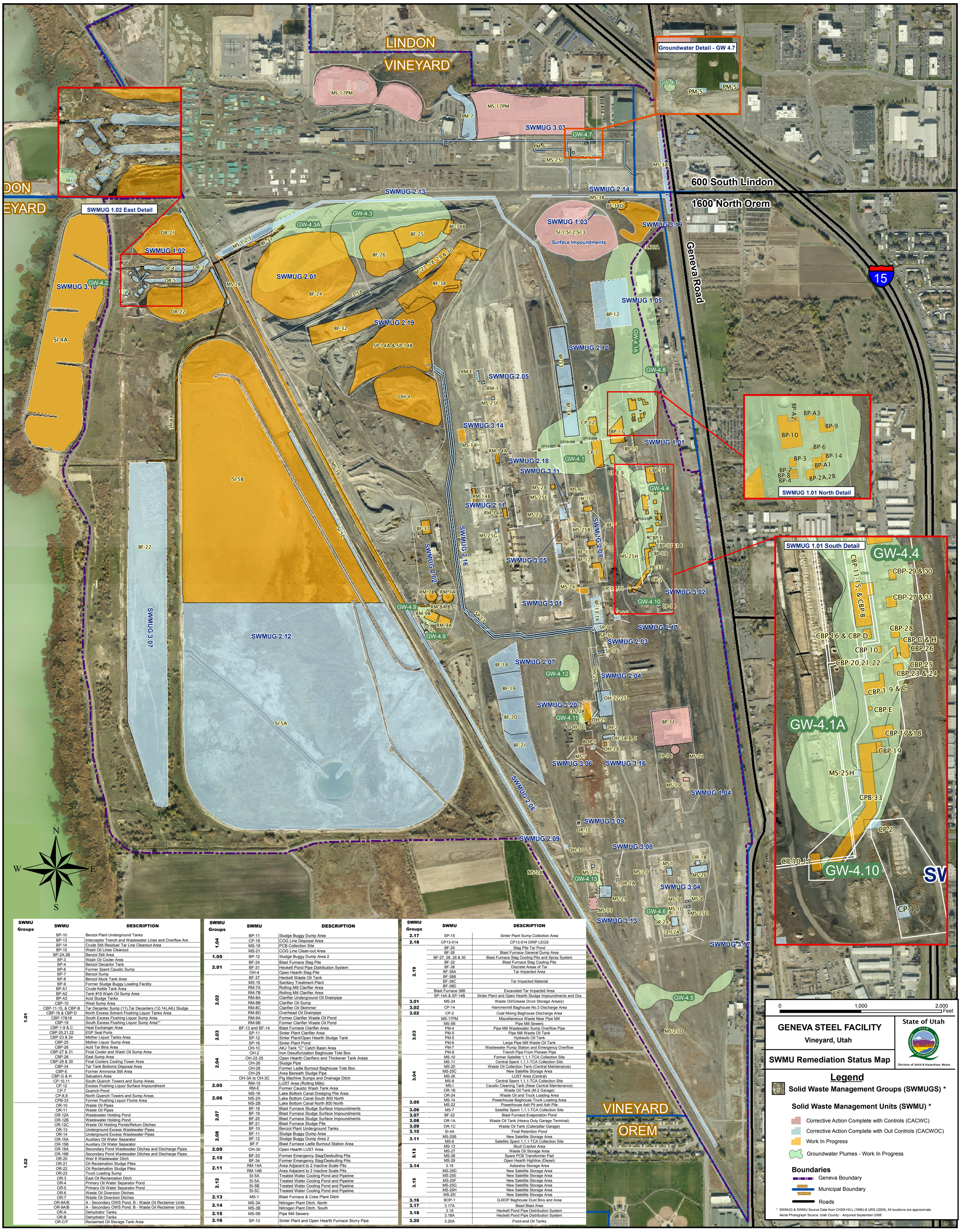
◑	Piezometer	◎	Sump
⬠	UPDES Outfall 005	▬	Trench
◐	Monitoring Well	×—×—×	Fence
◐	Monitoring Well (Sampled during semi-annual groundwater sampling event)		

N
W E
S

50 0 50 100
Feet

Site Map and Monitoring Locations
Hazardous Waste Impoundments
Former Geneva Steel Facility
Vineyard, Utah

URS



SWMU Groups	SWMU	DESCRIPTION
1.01	BP-10	Benzol Plant Underground Tanks
	BP-13	Interceptor Trench and Wastewater Lines and Overflow Are
	BP-14	Crude Still Residue/ Tar Line Cleanout Area
	BP-15	Wash Oil Lines Cleanout
	BP-2A,2B	Benzol Still Area
	BP-3	Wash Oil Cooler Area
	BP-4	Benzol Decantor Tank
	BP-6	Former Spent Caustic Sump
	BP-7	Benzol Sump
	BP-8	Benzol Muck Tank Area
	BP-9	Former Sludge Buggy Loading Facility
	BP-A1	Crude Kettle Tank Area
	BP-A2	Tank #19 Wash Oil Sump Area
	BP-A3	Acid Sludge Tanks
	CBP-10	West Sump Area
	CBP-11-15, & CBP-B	Tar Decanter Sump (11),Tar Decanters (12-14),AKJ Sludge
	CBP-16 & CBP-D	North Excess Solvent Flushing Liquor Tanks Area
	CBP-17&18	South Excess Flushing Liquor Sump Area
	CBP-19	South Excess Flushing Liquor Sump Area**
	CBP-1-9 & C	Heat Exchanger Area
	CBP-20,21,22	ESP Seal Ports
	CBP-23 & 24	Mother Liquor Tanks Area
	CBP-25	Mother Liquor Sump Area
	CBP-26	Acid Tar Bins Area
	CBP-27 & 31	Final Cooler and Wash Oil Sump Area
	CBP-28	East Sump Area
	CBP-29 & 30	Final Coolers Cooling Tower Area
	CBP-34	Tar Tank Bottoms Disposal Area
	CBP-E	Former Ammonia Still Area
	CBP-G & H	Satuators Area
	CP-10,11	South Quench Towers and Sump Areas
	CP-12	Excess Flushing Liquor Surface Impoundment
	CP-7	Quench Pond
	CP-8,9	North Quench Towers and Sump Areas
	CPB-33	Former Flushing Liquor Flume Area
1.02	OR-10	Waste Oil Pipes
	OR-11	Waste Oil Pipes
	OR-12A	Wastewater Holding Pond
	OR-12B	Wastewater Holding Pond
	OR-12C	Waste Oil Holding Ponds/Return Ditches
	OR-13	Underground Excess Wastewater Pipes
	OR-14	Underground Excess Wastewater Pipes
	OR-15A	Auxiliary Oil Water Separator
	OR-15B	Auxiliary Oil Water Separator
	OR-18A	Secondary Pond Wastewater Ditches and Discharge Pipes
	OR-19B	Secondary Pond Wastewater Ditches and Discharge Pipes
	OR-20	Weir 8 Wastewater Ditch
	OR-21	Oil Reclamation Sludge Piles
	OR-22	Oil Reclamation Sludge Piles
	OR-23	Truck Loading Sump
	OR-3	East Oil Reclamation Ditch
	OR-4	Primary Oil Water Separator Pond
	OR-5	Primary Oil Water Separator Pond
	OR-6	Waste Oil Diversion Ditches
	OR-7	Waste Oil Diversion Ditches
	OR-8A/B	A - Secondary OWS Pond, B - Waste Oil Reclaimer Units
	OR-9A/B	A - Secondary OWS Pond, B - Waste Oil Reclaimer Units
	OR-A	Dehydrator Tanks
	OR-B	Dehydrator Tanks
	OR-C/F	Reclaimed Oil Storage Tank Area

SWMU Groups	SWMU	DESCRIPTION
1.04	BP-11	Sludge Buggy Dump Area
	CP-16	COG Line Disposal Area
	MS-19	PCB Collection Site
	MS-21	COG Line Clean-out Area
1.05	BP-12	Sludge Buggy Dump Area 2
2.01	BF-24	Blast Furnace Slag Pile
	BF-31	Heckett Pond Pipe Distribution System
	OH-4	Open Hearth Slag Pile
2.02	BF-37	Heckett Waste Oil Tank
	MS-15	Sanitary Treatment Plant
	RM-7A	Rolling Mill Clarifier Area
	RM-7B	Rolling Mill Clarifier Area
	RM-8A	Clarifier Underground Oil Drainpipe
	RM-8B	Clarifier Oil Sump
	RM-8C	Clarifier Oil Skimmer
	RM-8D	Overhead Oil Drainpipe
	RM-9A	Former Clarifier Waste Oil Pond
	RM-9B	Former Clarifier Waste Oil Pond
2.03	BF-13 and BF-14	Blast Furnace Clarifier Area
	SP-11	Sinter Plant Clarifier Area
	SP-12	Sinter Plant/Open Hearth Sludge Tank
	SP-16	Sinter Plant Pond
2.04	OH-1C	AKJ Tank "C" Catch Basin Area
	OH-2	Iron Desulfurization Baghouse Tote Box
	OH-22-25	Open Hearth Clarifiers and Thickener Tank Areas
	OH-26	Sludge Pipe
	OH-28	Former Ladle Burnout Baghouse Tote Box
	OH-29	Area Beneath Sludge Pipe
	OH-3A to OH-3C	Pig Machine Sumps and Drainage Ditch
2.05	RM-15	LUST Area (Rolling Mills)
	RM-E	Former Caustic Wash Tank Area
2.06	MS-16	Lake Bottom Canal Dredging Pile Area
	MS-2A	Lake Bottom Canal South 800 North
	MS-2B	Lake Bottom Canal North 800 North
2.07	BF-18	Blast Furnace Sludge Surface Impoundments
	BF-19	Blast Furnace Sludge Surface Impoundments
	BF-20	Blast Furnace Sludge Surface Impoundments
	BF-21	Blast Furnace Sludge Pile
2.08	BF-10	Benzol Plant Underground Tanks
	BF-11	Sludge Buggy Dump Area
	BF-12	Sludge Buggy Dump Area 2
	BF-F	Blast Furnace Ladle Burnout Station Area
2.09	OH-30	Open Hearth LUST Area
2.10	BF-33	Former Emergency Slag/Deskulling Pits
	BF-34	Former Emergency Slag/Deskulling Pits
2.11	RM-14A	Area Adjacent to 2 Inactive Scale Pits
	RM-14B	Area Adjacent to 2 Inactive Scale Pits
2.12	SI-5A	Treated Water Cooling Pond and Pipeline
	SI-5A	Treated Water Cooling Pond and Pipeline
	SI-5B	Treated Water Cooling Pond and Pipeline
	SI-5C	Treated Water Cooling Pond and Pipeline
2.13	MS-1	Blast Furnace & Coke Plant Ditch
2.14	MS-3A	Nitrogen Plant Ditch, North
	MS-3B	Nitrogen Plant Ditch, South
2.15	MS-5B	Pipe Mill Sewers
2.16	SP-13	Sinter Plant and Open Hearth Furnace Slurry Pipe

SWMU Groups	SWMU	DESCRIPTION
2.17	SP-15	Sinter Plant Sump Collection Area
2.18	CP13-014	CP13-014 DRIP LEGS
2.19	BF-25	Slag Pile Tar Pond
	BF-26	Blast Furnace General Dump Area
	BF-27, 28, 29 & 30	Blast Furnace Slag Cooling Pits and Spray System
	BF-32	Blast Furnace Slag Cooling Pits
	BF-38	Discrete Areas of Tar
	BF-38A	Tar Impacted Area
	BF-38B	
	BF-38C	Tar Impacted Material
	BF-38D	
	Blast Furnace 38B	Excavated Tar Impacted Area
	SP-14A & SP-14B	Sinter Plant and Open Hearth Sludge Impoundments and Dra
3.01	MS-24	Waste Oil/Grease Drum Storage Area(s)
3.02	CP-14	Hammermill Baghouse No.3 Discharge Area
3.02	CP-2	Coal Mixing Baghouse Discharge Area
3.03	MS-17PM	Miscellaneous Waste Near Pipe Mill
	MS-5B	Pipe Mill Sewers
	PM-4	Pipe Mill Wastewater Sump Overflow Pipe
	PM-5	Pipe Mill Waste Oil Tank
	PM-5	Hydraulic Oil Tank
	PM-6	Large Pipe Mill Waste Oil Tank
	PM-7	Wastewater Pump Station and Emergency Overflow
	PM-8	Trench Pipe From Pioneer Pipe
3.04	MS-10	Former Satellite 1,1,1-TCA Collection Site
	MS-11	Central Spent 1,1,1-TCA Collection Site
	MS-20	Waste Oil Collection Tank (Central Maintenance)
	MS-25C	New Satellite Storage Area
	MS-26	LUST Area (Central)
	MS-8	Central Spent 1,1,1-TCA Collection Site
	MS-I	Caustic Cleaning Tank (Near Central Maintenance)
	OR-1B	Waste Oil Tank (M-2 Garage)
	OR-24	Waste Oil and Truck Loading Area
3.05	MS-14	Powerhouse Baghouse Truck Loading Area
	MS-22	Powerhouse Ash Pit and Ash Pile
3.06	MS-7	Satellite Spent 1,1,1-TCA Collection Site
3.07	BF-22	Blast Furnace Evaporation Pond
3.08	OR-1A	Waste Oil Tank (Heavy Duty Garage Terminal)
3.09	OR-1C	Waste Oil Tank (Caterpillar Garage)
3.10	SI-4A	Final Retention Pond
3.11	MS-25B	New Satellite Storage Area
	MS-6	Satellite Spent 1,1,1-TCA Collection Site
3.13	MS-13	Skull Cracker Area
	MS-27	Waste Oil Storage Area
	MS-28	Spare PCB Transformer Pad
	MS-29	Open Hearth Highline (Diesel)
3.14	3.18	Asbestos Storage Area
3.15	MS-25D	New Satellite Storage Area
	MS-25E	New Satellite Storage Area
	MS-25F	New Satellite Storage Area
	MS-25G	New Satellite Storage Area
	MS-25H	New Satellite Storage Area
	MS-25I	New Satellite Storage Area
3.16	BOP-1	Q-BOP Baghouse Dust Bins and Area
3.17	3.17A	Bead Blast Area
3.18	3.18	Heckett Pond Pipe Distribution System
	3.18A	Heckett Pond Pipe Distribution System
3.20	3.20A	Front-end Oil Tanks

0 1,000 2,000 Feet

GENEVA STEEL FACILITY

Vineyard, Utah

SWMU Remediation Status Map

State of Utah

Division of Solid & Hazardous Waste

Legend

Solid Waste Management Groups (SWMUGS) *

Solid Waste Management Units (SWMU) *

- Corrective Action Complete with Controls (CACWC)
- Corrective Action Complete with Out Controls (CACWOC)
- Work In Progress
- Groundwater Plumes - Work In Progress

Boundaries

- Geneva Boundary
- Municipal Boundary
- Roads

* SWMUG & SWMU Source Data from CH2M HILL (1996) & URS (2009). All locations are approximate.

Aerial Photograph Source: Utah County - Acquired September 2008

ATTACHMENT 4

SAMPLING PROCEDURES TEST METHODS

CHAPTER 1

1.0 SAMPLING QUALITY ASSURANCE AND QUALITY CONTROL

1.1 GENERAL

1.1.1 Level of Experience

All sampling personnel shall be acquainted with the sampling requirements of this program, the associated documentation, field procedures, preservation methods, cleaning and decontamination requirements, health and safety requirements, use of equipment, and any pertinent protocols prepared by Permittee. The team leader shall have at least one year of experience in groundwater sampling.

1.1.2 Manpower

At least two sampling persons shall be present at each sampling.

1.1.3 Duration

Water levels in all wells shall be measured within a 24 - hour period. All wells shall be sampled within a 96 - hour period. Delays beyond this time shall be documented and explained in the report for the monitoring event.

1.1.4 Equipment Constraints

Samples will be obtained with a submersible pump, a peristaltic pump, or a bailer if needed. The pumps shall be equipped with flexible inert tubing. The tubing shall be dedicated for each well if possible. If it is not possible to have dedicated tubing, new clean tubing shall be used for each well. Bailers shall be fluorocarbon resin material (Teflon), polyethylene, poly-vinyl chloride (PVC), or stainless steel with fluorocarbon coated wire, fiberglass, single-strand stainless steel wire, or nylon twine. Polyethylene bailers, PVC bailers, and nylon twine are disposable items used only once; they shall not be decontaminated and re-used at multiple wells. Each bailer shall

be equipped with a ball check valve in the bottom, which forms a watertight seal when raised. Submersible pumps shall be stainless steel in construction and decontaminated properly between each well.

1.1.5 Sample Containers Composition

Sample containers will be of the compositions and volumes indicated in Table 1.

1.1.6 Decontamination, Cleaning, and Storage of Sampling Equipment and Containers

All sampling equipment will be cleaned using the decontamination procedures outline below before each use. To minimize the potential for cross-contamination between wells, all downhole sampling equipment will be decontaminated between wells, according to the procedures outlined below.

Sample equipment will be cleaned and prepared for field use according to the following procedures:

a. Laboratory-grade detergent and potable water wash
b. Potable water rinse
c. Triple deionized water rinse

The sample equipment shall be allowed to air dry to the extent possible. All sampling equipment will be stored in an area where no contamination will occur.

1.1.7 Sample Container Labeling

Sample bottles will be prelabeled to the extent possible before the bottles are shipped to the site. In order to maintain confidentiality, the site will not be identified as a Permittee named facility nor its geographic location listed. Sample labels will include the following information:

a. Sample number as noted in field logbook
b. Sample type; i.e., parameters for analysis
c. Organization collector represents (employer)
d. Name of collector
e. Date and time of collection

1.1.8 Preservatives

All sampling containers shall come from the lab with the appropriate preservatives as shown in Table 1 and shall be shipped from the laboratory with the appropriate preservatives (see Table 1) already added to the appropriate containers.

1.1.9 Preparation and Specifications of Water, Reagents, and Preservatives

The following water quality will be required for dilutions, blanks, and final rinse water:

Analysis	Water Type	Reference
Metals	ASTM Type II	SW846
Organics	Organic Free Water	SW846
pH	Distilled Water	EPA-600/4-79-019
Sulfate, Chloride	Distilled Water	EPA-600/4-79-019
Specific Conductance	Distilled Water	EPA-600/4-79-019
Total Organic Halogen	Reagent Water	SW846 TOX Method 9020
Total Organic Carbon	C02 Free, Double-Distilled Water	EPA-600/4-79-020

1.1.10 Blanks, Duplicates, and Quality Control

Two types of blanks pertain to sampling quality control: the trip blank and the equipment blank. Trips blanks for VOA analysis will be prepared in the lab by filling each sample bottle with distilled water. The blanks will be transported to the site, handled as any other sample, and returned to the lab in the same manner. If there is reason to suspect that certain detected parameters are due to contamination in handling, the suspected contamination can be evaluated by analyzing the trip blank.

One VOA trip blank (consisting of 3 VOA vials) must be prepared for each cooler that contains VOA samples**.** Trip blanks for other parameters are optional.

Note that it is important to prepare trip blanks in a clean atmosphere. VOA blanks are particularly vulnerable to contamination from many sources; for example, electrical tape can cause vinyl chloride contamination, and silicone sealant can cause methylene chloride contamination.

Equipment blanks are collected to test decontamination procedures and are prepared principally when non-dedicated sampling equipment is used (i.e., pumps). This will indicate the effectiveness of the field equipment decontamination. At least one set of equipment blanks will be collected per event. Laboratory-grade distilled water shall be used and the blank shall be collected in the same fashion as the actual sample.

Matrix Spike and Matrix Spike Duplicate (MS/MSD) samples are collected to evaluate the effects of sample matrix on the precision and accuracy of the analytical methods. MS/MSD samples shall be collected immediately after collection of the primary sample in the same manner and using the same types of containers. The MS/MSD samples shall be labeled in a way that indicates which primary sample they are associated with.

Points will be selected for quality control prior to initiation of the sampling program. At the points selected for quality control, either a duplicate (to check analytical precision) or a field blank (to check sampling precision) will be collected. Duplicate and field blank samples will be handled no differently than any other samples. One duplicate will be prepared for every 10 samples.

Field blanks will be collected by pouring laboratory-grade distilled water into the appropriate sample containers located near the well head. Site conditions should be the same as at the time of sample collection. The field blank sample for metals analysis will not be filtered.

Duplicate samples are a check on laboratory precision and, as such, must be identified in the field so that the laboratory is unaware of which sample has been duplicated. It is imperative that the sample numbers selected for the split sample be recorded in the field log book since this will be the only record of the splitting.

Duplicate samples shall be collected by alternately filling the primary and the duplicate sample containers. Both samples are then handled in the same manner as all other samples.

As stated above, a VOA trip blank shall be prepared for each cooler containing samples for volatile organic analysis. At least one equipment blank, one duplicate, one field blank, and one MS/MSD set must be collected for each event.

1.2 GROUNDWATER SAMPLING

1.2.1 Field Instruments Preparation

Prior to shipping to the field, all instruments shall be tested to ensure they are operating correctly. Tests shall include battery checks, calibration with standard reference solutions, and calibration checks against other standard reference solutions. Reference solutions shall bracket the anticipated (probable) range to be encountered.

Recalibration shall be performed in the field as necessary should the calibration range be higher or lower than field conditions.

Instrumentation reference solutions and other pertinent data required for this sampling program are shown in Table 2.

1.2.2 Field Instrumentation Calibration

After shipping to the site and prior to actual sampling, all field instruments shall be calibrated as indicated on Table 2 as follows:

a. pH Meter

The pH meter must be calibrated at least once each day using two different pH buffer solutions. The probe must be rinsed thoroughly between buffer measurements with distilled/deionized water and again after calibration is completed. The buffer solutions used will be recorded in the field logbook. A third pH buffer solution in the expected pH range of the well water samples will be used to check the pH meter standardization. If the reading differs by more than 0.1 pH units, the instrument will be recalibrated. If unacceptable deviations still occur, the operating manual will be consulted for the prescribed action; or an alternate, properly functioning pH probe will be used.

b. Specific Conductivity Meter

The specific conductance/thermistor meter is less likely to exhibit random fluctuations and will only require daily standardization against a known KC1 solution. Thoroughly rinse the probe with distilled/deionized water after immersing in the KC1 standard solution. Note that specific conductance is temperature dependent; and, therefore, the meter readings must be adjusted to reflect the temperature of the standard solution

c. Temperature Measurement

Probe temperature readings must also be checked daily. This is accomplished by taking a temperature reading using the probe and comparing with temperature measurements made using a mercury thermometer. If the temperature probe is not properly calibrated, the probe will be brought into calibration according to the manufacturer's recommendations as specified in the operation/maintenance manuals provided with the unit.

d. Total Water Quality Meter

If a water quality meter is used (measuring pH, temperature, dissolved oxygen, conductivity, turbidity, and salinity in one unit) calibration shall be performed daily during sampling by submersing the unit in a container of the appropriate auto-calibration solution. All reading shall be recorded in the log book and checked against the standard value for the solution (given on the solution container). If the readings deviate more than the given tolerance (see calibration solution container), recalibrate the unit. If unacceptable deviations still occur, the operating manual will be consulted for the prescribed action; or an alternate, properly functioning water quality meter will be used.

1.2.3 Sequence of Well Sampling

The wells shall be sampled in the following order. *MW-19, MW-17D, MW14D, MW-1, MW-10, MW-12, MW-8, MW-22, MW-24, MW-23, MW-21, MW-13, MW-9, and MW-5.*

1.2.4 Field Log Book

The field logbook is a bound, consecutively paginated notebook used to record field data measurements and observations. It serves as the permanent record of all events occurring during the sampling event.

Entries into the logbook must be made in waterproof ink. Information during each event will vary according to site-specific facilities procedures and conditions but will, at a minimum, contain the following details:

a. Sampling date and time

b. Sampling locations and identification numbers

c. Purpose of sampling

d. Names of field crew present at the site

e. Brief description of weather conditions including temperature reading, wind direction and strength, and precipitation

f. Identification of well and initial groundwater level measurement, and total depth of well

g. PID readings, odors, and other readings pertaining to air quality

h. Time well was purged, well evacuation details prior to sampling (to include purge volume), sample collection procedure, and well sampling sequence.

i. Final field water quality measurements including:

1) pH

2) Specific Conductance

3) Water Temperature

j. Types of sample containers used and sample identification numbers, parameters to be measured, sampling remarks/observations, identification of blanks, duplicates, etc.

k. Sample numbers and identification of duplicate samples, sample distribution and transporter, collection of quality assurance/control samples.

Each page must be initialed by the individual keeping the logbook. Upon returning to the office, a copy of the field log entries will be provided for the project files.

1.2.5 Vapor Detection at the Well Head

Prior to removing any well water or taking any level measurements, the air space within the protective casing will be monitored by a photoionization detector (PID). The humidity of the well may interfere with the operation of the PID in which case the probe may be held beside the well head for vapor detection.

All readings must be noted in the field logbook. In the event of readings above background, the sampling team will move upwind until the vapors have cleared.

1.2.6 Water Level Measuring and Detection/Sampling of Immiscible Layers

Based on the past 8 years of groundwater sampling, floating or submerged immiscible layers are not expected. However, while not expected, floating or submerged immiscible layers may exist. Should this occur, the sampling plan shall be revised to allow for sampling the floating and submerged layers and for evaluating volatile organic acids, acid extractables, and base neutrals.

Prior to evacuation of the wells, the following procedures should be implemented:

a. Remove locking and protective caps

b. Sample the air in the well head for organic vapors using a PID; record measurement, and allow the vapors to clear prior to recording water levels

c. Determine from top of casing the static groundwater level using a water level meter as well as the total well depth. Record to the nearest 0.01 feet. The probe, which contacts the water surface, must be rinsed three times with distilled water between each well.

d. Lower a dual-interface probe into the well, or product gauging paste applied to a water level probe, to determine the existence of any immiscible layers(s), light and/or dense.

e. If immiscible layer(s) are detected, sample the layer with a peristaltic pump or a top filling fluorocarbon resin bailer.

f. Evacuate the well as required.

1.2.7 Well Volume Calculations

The firm performing the sampling will obtain the elevation of the reference mark on the PVC casing or the top of casing from Permitee prior to sampling.

As discussed in Section 1.2.6, groundwater elevation shall be measured by a water level meter accurate to within 0.01 feet. Measurements are taken with respect to the depth below the reference mark located on the well casing or the top of casing and recorded in the field logbook. By subtracting the depth to water surface from the depth of the well and referring to Table 3, the sampling team will calculate the volume of water contained in the well.

Note that any reporting of water level measurements must be with respect to mean sea level in units of feet.

1.2.8 Well Evacuation

Wells shall be evacuated until the pH, specific conductance, and temperature readings have stabilized (10 percent). At a minimum, indicator parameters will be measured at least 5 times. At least three well volumes will be evacuated as determined in Section 1.2.7, unless the well is purged dry. If the well recharges slowly (i.e., time for evacuation of one well volume is greater than 30 minutes and the well is almost dry) only one evacuation is necessary. Samples may then be taken after the well has sufficiently recharged.

All dedicated sample equipment shall not be allowed to contact the ground. The dedicated tubing will be coiled on to a clean plastic sheet and not allowed to contact the ground.

To prevent degassing of volatiles from the water, the peristaltic or submersible pump must be operated so as to not exceed a maximum flow rate of 100 ml/minute during sample collection. The maximum flow rate during purging shall not exceed 2,000 ml/minute. If a bailer is used it will not be allowed to drop into the well. The check valve (s) must be periodically observed as ongoing experience indicates, for fouling may result in reduced delivery capacity or in aeration of the sample.

The PID will be used to monitor the atmosphere in the immediate vicinity of the well head while purging and sampling operations occur. Readings above background will result in immediate evacuation of the well head until the vapors have dispersed.

The presence of floating or submerged layers must be noted in the field log book as well as pertinent observations such as color, clarity, odor, etc.

Activities, which may contribute to contamination during sampling, such as decontamination activities, are strictly prohibited in the immediate sampling area.

1.2.9 Sequence of Sample Withdrawal

Samples will be collected and containerized in order of the volatilization sensitivity of the parameters. The order of collection will be:

a. Volatile organics *

b. Semi-volatile organic acids*

c. Total organic halogens*

d. Total organic carbon*

e. Acid extractable and base neutral compounds**

f. Total metals

g. Dissolved metals

h. Phenol

i. Cyanide

j. Sulfate

k. Nitrate

* Sample vials will be filled so there are no air spaces
** Bottles will be filled so there is minimal air space. Caps shall be secured snugly but not tightly to prevent backing off of the caps and introduction of air.

Samples will be collected in a controlled manner with a minimum of agitation. Sample containers will be filled in accordance with the requirements shown in Table 1. The pH and specific conductance also will be measured at the lab.

1.2.10 Sample Filtration

Samples for dissolved metals must be field filtered through sterile-packaged 0.45-micron filters prior to adding to sample container. Filters will be glass, polyethylene, or equivalent inert material and the type and brand will be noted in the field logbook.

1.2.11 Sample Storage

All sample containers must be immediately put on ice and maintained at a maximum temperature of 4^0C until the samples are analyzed. Sample storage times in the field will be kept to a minimum and samples will be submitted to the laboratory on a daily basis.

1.3 SAMPLE DOCUMENTATION

1.3.1 Sample Custody Seals

Sample Cooler seals will be placed on every cooler in order to detect unauthorized tampering of samples following sample collection up to the time of analysis. Laboratory supplied seals will be used for this purpose. The seal will include the following information:

a. Collector's name and signature
b. Date and time of signature

The seal must be attached in such a way that it is necessary to break it in order to open the container. Seals must be affixed before the samples leave the custody of sampling personnel. Seals of electrical tape or glue or sealant are unacceptable.

1.3.2 Chain of Custody

Sample custody forms must be completed at the time of sampling in accordance with the requirements of SW-846 (See Figure 1). The specific analysis for each sample must be provided on the form. A detailed list of required analysis may be attached to the form if required. The following chain of custody procedure must be implemented by the field team leader to assure sample integrity.

Samples will be under custody of the sampling team leader. The samples will be considered in custody when:

a. They are in his/her possession;
b. They are in view after being in possession;
c. They are locked up or sealed securely to prevent tampering; or
d. They are in a designated secure area.

The original of the sample custody form must accompany the samples at all times after collection. A copy of the sample custody form will be held by the sampling team leader.

When samples are transferred in possession, the individuals relinquishing and receiving will sign, date, and note the time and sample or sampling chest condition on the form.

All persons handling the samples must sign for delivery and for receipt. A carbon copy will be retained by the sampling team leader and will be given to the project manager for the project file after the sampling crew returns to the office. When the laboratory completes the analyses, this original is to be returned by the laboratory to the project manager for the project files.

1.3.3 Sample Delivery

After the samples have been collected, it will be the responsibility of the sampling team leader to arrange for delivery of the shipping containers to the laboratory and to assure that the proper chain of custody is documented. The field team leader or designee must either overnight mail or deliver the samples to the laboratory as soon as possible after returning from the sampling trip. If overnight mail is used it is imperative that the sample containers be packaged properly in order to prevent breakage and to maintain a maximum temperature of $4^{o}C$. Also the laboratory should be contacted to ensure that someone will be at the laboratory to receive the samples and make sure they are checked in and stored properly.

Upon transfer of sample custody, the shipping containers will be examined to certify that they have not been disturbed. This observation, the deliverer's and receiver's signatures, and dates and times of custody transfer must be noted on the chain of custody form. The original and duplicate chain of custody forms must accompany these samples and be signed by the laboratory. The chain of custody form will remain with the samples and the completed form will be returned by the laboratory along with the results of the sample analyses for placement in project files.

1.3.4 Documentation and Document Routing

Upon returning to the office, the sampling team leader must:

a. Provide a copy of the field log pages for the project file. The field log book must be stored in a secure area for safekeeping.

b. Place the copy of the custody form in the project files. When received from the laboratory, the original custody form must also be placed in the project files.

1.3.6 Data Deliverables and Evaluation

For analyses associated with the Hazardous Waste Surface Impoundments, the laboratory will provide a data package that includes QC data but not raw data. Data deliverables for RCRA activities conducted as part of the VIWP implementation will be presented in the Notification Letter and consistent with the methodology defined in the VIWP. The laboratory Practical Quantitation Limits (PQL=s) will serve as the detection limit for parameters analyzed.

Data received from the laboratory will be reviewed by a chemist and a data validation report prepared describing the validation process and presenting the validated data. Validated data will be used for submittals to the UDEQ where data quality is a requisite for decision making and the validation report submitted along with the laboratory results. Data used as a screening tool may not be subject to validation.

CHAPTER 2

2.0 LABORATORY QUALITY ASSURANCE/QUALITY CONTROL PLAN

2.1 GENERAL

2.1.1 Laboratory

The laboratory(s) invited to perform the analyses outlined in Table 1 will submit a Quality Assurance/Quality Control (QA/QC) plan to Permitee. No analytical work will be performed until the QA/QC plan has been reviewed and approved by Permitee.

The laboratory will follow EPA guidelines and meet EPA requirements as outlined in:

a. SW-846, "Test Methods for Evaluating Solid Waste Physical/Chemical Methods, 11 Third Edition (November 1986); Final Update I, July 1992; Final

Update IIA, August 1993; Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, June 1997.

b. EPA-600/4-79-020, "Methods for Chemical Analysis of Water and Wastes," revised March 1983.

c. EPA-600/4-79-019, "Handbook for Analytical Quality Control in Water and Wastewater Laboratories," 1979.

d. QAMS - 005/80, "Interim Guidelines and Specifications for Preparing Quality Assurance Plans," 1980.

e. 40 CFR 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act."

2.1.2 Laboratory Certifications

Laboratories performing analytical work to support groundwater monitoring under Section V of this Permit are required to be certified by the Utah Department of Health, Division of Laboratories (a Acertified Laboratory***@).*** Ten percent (10%) of any analyses performed under a screening program by a non-certified laboratory (such as a close-support field laboratory) shall be sent to a Certified Laboratory as a quality-control measure. Any determination of No Further Action under Permit Conditions must be supported by at least one verification analysis performed by a Certified Laboratory. In addition to the Utah Certification, a Certified Laboratory shall have one of the following certifications or approvals:

a. EPA Public Drinking Water Supply Certification
b. EPA Contract Laboratory Program
c. U.S. Army **Environmental *Center*** Contract Laboratory Program.

2.1.3 Laboratory Administration

The laboratories performing analytical work will be required to include the following information on their QA/QC plan:

a. Laboratory organization and chain of command including whom will be Permitee's contact person in the laboratory, the sample custodian, supervisors, and analysts, identifying-specific persons via flow chart or other method.

b. Description of each position, its requirements including experience, certifications, and degrees.

c. Seminars and training programs to which laboratory employees are sent including safety and right-to-know training.

d. Resumes of all personnel to be involved in the analytical program.

2.1.4 Analytical Methods

Where possible, analytical methods will be in accordance with the methods specified in:

a. SW-846, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," Third Edition (November 1986); Final Update I, July 1992; Final Update IIA, August 1993; Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, June 1997.

b. EPA-600/4-79-020, "Methods for Chemical Analysis of Water and Wastes," March 1983 Revision.

c. 40 CFR 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act: Final Rule and Interim Final Rule and Proposed Rule," October 26, 1984.

In cases where this is not possible, a reference method will be given from the best available source.

Table 1 summarizes analytical requirements.

2.1.5 Water Quality

The following water quality will be required for dilutions, blanks and final rinse water, and in analytical procedures.

Analysis	Water Type	Reference

Metals	ASTM Type II	SW846
Organics	Organic Free Water	SW846
pH	Distilled Water	EPA-600/4-79-019
Specific Conductance	Distilled Water	EPA-600/4-79-019
Total Organic Halogen	Reagent Water	SW846 TOX Method 9020
Total Organic Carbon	C02 Free, Double-Distilled Water	EPA-600/4-79-020

2.1.6 Solvent, Reagent, and Reference Quality

All solvents and reagents shall be American Chemical Society (ACS) Certified Grade and will conform to specifications set by the Committee on Analytical Reagents of the ACS where such specifications exist (ASTM Volume 11.02, page 64).

All standards will be ACS reference grade standards or will be prepared from ACS analytical reagent grade chemicals using ACS approved methods. For calibration purposes, standards will be purchased or prepared to bracket the anticipated range for each analyte.

2.1.7 Laboratory Quality Assurance Program Plan

The Permittee will maintain the Quality Assurance Program Plan and Analytical Support Plan for each of the laboratories used for environmental sampling at the facility. The QA/QC plan will contain Standard Operating Procedures (SOPs) for all activities that could directly or indirectly influence the data quality plus SOPs for all analyses and instrumentation that will be used in the program. SOPs will include corrective action procedures for improperly functioning equipment, data of unacceptable quality, samples of questionable integrity and discovery of sample contamination. Quality assurance goals for analytical parameters by test method will be identified.

2.1.8 Quality Control for Analytical Performance

Quality control for analytical performance will be performed on a daily basis for each parameter. Quality control will be performed to assess both accuracy and precision by establishing upper and lower control limits using EPA accepted procedures.

SAMPLING AND PRESERVATION PROCEDURES FOR DETECTION MONITORING[a] (Cont.)

References: Test Methods for Evaluating Solid Waste – Physical/Chemical Methods, Final Update III, June 1997 (SW-846)
Methods for Chemical Analysis of Water and Wastes (EPA-600/4-79-020, March 1983.
Standard Methods for the Examination of Water and Wastewater, 18th edition, 1992

[b] CONTAINER TYPES: G = Glass
P = Plastic (polyethylene)
T = Fluorocarbons resins (PTFE, Teflon®, FEP, PFA, etc.)

[c] Based on the requirements for detection monitoring (265.93), the owner/operator must collect a sufficient volume of groundwater to allow for the analysis of four separate replicates.

[d] Shipping containers (cooling chest with ice or ice pack) should be certified as to the 4°C temperature at the time of sample placement into these containers. Preservation of samples required that the temperature of collected samples must be adjusted to the 4°C immediately after collection. Shipping coolers must be at 4°C and maintained at 4°C upon placement of sample and during shipment. Temperature blanks are to be placed into the shipping chest to document shipping temperature. Chain of Custody forms will have shipping/receiving and in-transit (maximum/minimum) temperatures for recording data and verification.

[e] Do not allow any head space in the container.

[f] Use ascorbic acid only in the presence of oxidizing agents.

ATTACHMENT 5
STATISTICAL ANALYSIS OF GROUNDWATER MONITORING DATA

1.0 INTRODUCTION

As part of the post-closure permit for the Hazardous Waste Impoundments (HWI) at the Geneva Steel site in Vineyard, Utah, the Utah Department of Environmental Quality, Division of Solid and Hazardous Waste (UDEQ/DSHW) requires post-closure monitoring of groundwater the uppermost aquifer beneath the HWI. The requirement includes statistical evaluation of groundwater monitoring data collected from wells within and adjacent to the HWI. This document, *Attachment 5, Statistical Analysis of Groundwater Monitoring Data,* describes the statistical methods used to evaluate the groundwater data.

Modules III and IV of the post-closure permit require a monitoring program to detect the release to groundwater of hazardous constituents from the HWI and to ensure compliance with the groundwater protection standards referenced in the permit. The 13 monitoring wells listed in Exhibit 1 and shown graphically in Exhibit 2 constitute the network of monitoring wells specified in Modules III and IV of the permit. Exhibit 1 also indicates whether a well is a background or compliance well, and the depth group to which each monitoring well is assigned; the segregation into groups by depths is necessary for proper application of the statistical analysis methodology described below. Note that some wells belong to more than one group because of the length of the screened interval in the wells. Sampling of the well network is performed in accordance with the schedule specified in Table 1 of Attachment 6 of the permit, and to all other requirements of the permit. Statistical analysis of the groundwater monitoring data is performed after each sampling event.

Exhibit 3 graphically depicts the statistical methodology used to evaluate the data collected from the HWI monitoring network. The methodology is consistent with the requirements outlined in R315-8-6, *Standards for Owners and Operators of Hazardous Waste Facilities, Groundwater Protection* of the Utah Administrative Rules. It includes computation of the descriptive statistics for each measured groundwater constituent for each monitoring well, time series plots for selected constituents, evaluation of whether the data for a constituent can be considered to be a sample drawn from a normal distribution, and hypothesis testing procedures (analysis of variance, the *t*-test, the Kruskal Wallis test and the Wilcoxon Rank-Sum test) used to compare data from compliance wells to data from background wells. The remainder of *Attachment 5* describes the methodology in more detail, beginning with a discussion of how nondetect samples are treated. Brief explanations of hypothesis testing and parametric and nonparametric statistical procedures follow. The decision logic depicted in Exhibit 3 is then thoroughly described, particularly the application of the various hypothesis testing procedures.

In addition to monitoring of groundwater in the uppermost aquifer beneath the HWI, as specified in Modules III and IV of the post-closure permit, Module V of the permit requires perimeter groundwater monitoring for the entire Geneva Steel site. The network of perimeter monitoring wells and piezometers comprises the locations listed in Exhibit 4 and depicted graphically in Exhibit 5. Included in Exhibits 5 and 6 are sentry wells located interior to the site that will be evaluated using by the same statistical methods used to evaluate the perimeter wells. The statistical analysis methodology applied to the groundwater data derived from the perimeter monitoring network and the sentry wells is summarized in Exhibit 6.

Defining background groundwater concentrations for the constituents detected in the perimeter and sentry locations is problematic because many of the wells located on the eastern property boundary, and thus upgradient in terms of the horizontal component of the hydraulic gradient, show elevated levels of some groundwater constituents. For example, dissolved arsenic was measured at a concentration of 310 micrograms per liter (µg/L) in a groundwater sample taken from PZ-01D, near the northeastern corner of the site, during December 2004. This is only slightly below the concentration of 320 µg/L measured in a sample taken from MW-109M, on the western boundary of the site, during the same sample event. The difficulty in defining background is due to two primary factors: (1) naturally-occurring spatial variability in groundwater chemistry, and (2) the presence of industrial facilities to the east, and upgradient, of the Geneva Steel site. Because of the difficulty defining in background conditions, an intrawell approach will be used to evaluate groundwater data derived from the perimeter and sentry locations. In an intrawell approach the only data used in the statistical evaluation of a well are from the well itself. The intrawell analysis includes computation of the descriptive statistics for each measured groundwater constituent for each monitoring well, time series plots for selected constituents, calculation of the lower confidence limit (LCL) for the median based on the seven most recent measurements and comparison of the median with the site-specific screening level (SSSL) for the constituent, time series plots of median derived from the seven most recent samples, and estimates of trend based on the entire historical record for the constituent in the well. Note that the analyte list for the monitoring and sentry locations is considerably longer than for the HWI monitoring wells because it consists of the groundwater monitoring list in 40 CFR 264 Appendix IX.

Compared to the HWI wells, the perimeter and sentry locations have a short historical sampling record, which limits the number of statistical procedures that can be applied to the data. Future modification of the methods applied to data acquired from the perimeter and sentry locations may be warranted as new data become available and understanding of groundwater chemistry improves.

2.0 NONDETECTS

Many of the dissolved groundwater constituents sampled at the HWI often occur at a level below the laboratory method detection limit (MDL) for the constituent. The data for the constituent are therefore censored, because the true concentration of the constituent cannot be estimated due to laboratory limitations. For example, toluene has been measured above the laboratory detection limit in only five of the 25 samples taken from MW-21 between April 1990 and October 2003, and during the same period toluene has never been measured above the detection limit in MW-22, MW-23, and MW-24. A common practice employed in the statistical analyses of censored groundwater data is substitution, i.e., to replace nondetects with an arbitrary numerical value, typically one-half the detection limit reported by the laboratory.

This approach is increasingly recognized as inappropriate, particularly when a large (> 15%) fraction of the measurements are below the detection limit, because it introduces bias in the calculation of sample statistics and the estimation of population parameters, distorts the sample histogram by introducing a spike (or spikes, in the case of multiple detection limits) at one-half the MDL, and negatively affects the results of parametric hypothesis testing (EPA, 1992; Helsel and Hirsch, 2002; Helsel, 2005). Two steps are taken to mitigate the effects of nondetects on the estimation of population parameters and hypothesis testing. First, population parameters such as the mean and standard deviation are estimated using techniques that account for nondetects without resorting to substitution (Helsel, 2005). These techniques include the Kaplan-Meier and maximum likelihood methods (Helsel, 2005). Second, nonparametric methods are preferred when making comparisons between upgradient and downgradient wells. Nonparametric methods do not require an assumption about a true underlying data distribution (which can be difficult to infer with censored data), using instead the relative positions (ranks) of the data rather than the reported numerical values (Conover, 1999).

3.0 HYPOTHESIS TESTING

The comparison between background and compliance wells relies on statistical hypothesis testing, a method of inferring from sampled data whether or not a given statement about one or more populations is true (Conover, 1999). Testing is performed using two hypotheses, the null hypothesis H_0 and the alternative hypothesis H_A. In groundwater monitoring, the two hypotheses take the following general form for a particular dissolved constituent:

H_0: There is no difference in concentration between the background and compliance wells

H_A: The compliance wells have higher concentrations than the background wells

The relative likelihood of the two hypotheses is evaluated using an appropriate test statistic computed from the sampled data. The value of the test statistic is an indicator of whether to accept or reject the null hypothesis (Ostle and Mensing, 1975). Following the example above, one possible test statistic is the difference between the median of the concentration measurements from the compliance well(s) and the median of the measurements from the background well(s). If the difference is small, it would seem reasonable to accept the null hypothesis and conclude that there is no difference between the background and compliance wells. Conversely, if the median computed from the compliance well(s) is much larger than the median for the background well(s), it would be reasonable to reject the null hypothesis in favor of the alternative, and conclude that groundwater samples from the compliance wells might be affected by site contaminants.

Probability provides the means to quantify the concepts of "small," "large," and "reasonable," and also to specify the risk of error. Occurrence probabilities for possible values of the chosen test statistic are determined either by computation or from tables. If the null hypothesis is true, and there is in fact no difference in concentration between the background and compliance wells, then in the example above the probability is small that a large difference in median concentrations will occur. There is always a risk, however, that a large difference in observed medians is a random occurrence, due to the use of sampled data rather than to actual (and unknown) differences in the underlying populations, in which case the null hypothesis is erroneously rejected. This type of error, falsely rejecting the null hypothesis when it is true, is called *Type I* error (also called a *false positive*). By design, the probability of Type I error, denoted by α, is made small, commonly 0.05 or 0.01. Thus, when the computed value of the test statistic has an occurrence probability of less than α, H_0 is rejected. The probability α is also called the significance level of the test, and the quantity 1- α is called the confidence level of the test.

A second type of error, failing to reject the null hypothesis when it is false, is called *Type II* error; the probability of committing a Type II error is denoted by β. Unlike α, β is not specified, but depends on the true (and unknown) value of the test statistic as determined from the true (unknown) underlying populations. In the example above, if the true background and compliance medians differ, but by only a small amount, the probability β will be high; if the true difference in medians is large, however, then the probability β will be small.

4.0 PARAMETRIC vs. NONPARAMETRIC METHODS

Parametric statistical methods assume that the sample data come from population with a known distribution (Conover, 1999). The most common assumption is that the sample data are drawn from a normal distribution, or a closely related distribution such as the lognormal. Verification of this assumption requires accepting the null hypothesis of goodness-of-fit tests such as the Shapiro Wilk *W* test or D'Agostino test (Gilbert, 1987). As noted in Section 2.0, however, the presence of nondetects distorts the sample distribution, negatively affecting the reliability of conclusions inferred from these tests (Helsel, 2005).

Nonparametric methods, also known as distribution-free methods, require no assumptions about the population probability distribution (Conover, 1999). These procedures use data ranks or sample quantiles, and therefore take advantage of the information conveyed by nondetects in the form of population proportions. Nonparametric methods are often equally effective to parametric methods, and in some cases are superior, particularly with positively-skewed data and in the presence of data outliers, common situations encountered in environmental investigations (Conover, 1999). Substitution of numeric values for the nondetects is not necessary and there is no need to transform sample data by taking logarithms or powers of the data in order to apply nonparametric methods.

5.0 STATISTICAL ANALYSIS METHODOLOGY, HWI MONITORING WELLS

The analytical results for past data obtained from the HWI wells have been reported using at least two distinct reporting protocols. Data from the earliest sampling events were reported using laboratory reporting limits (RLs), whereas data from subsequent events were reported using MDLs. Unfortunately, some of the RLs in the early data are often an order of magnitude or more greater than either actual sample values or the MDLs. This discrepancy severely limits the utility of the early data because the high RLs provide information of negligible beneficial value. For example, the RL in 1999 for arsenic in MW-10 (a shallow background well) was 100 µg/L, whereas in subsequent events, measured concentrations were less than 11 µg/L. Clearly, little valuable statistical information can be derived from RLs that are greater than the estimated range of concentrations. In these cases, data reported as less than excessively high RLs are excluded from statistical computations.

The majority of the statistical computations will be performed using the commercial NCSS® software package available from Number Crunching Statistical Systems (NCSS [Hintze, 2004]). NCSS® is a comprehensive statistical software that includes nearly all of the techniques described in this document, including the Kaplan-Meier method. MDL (Helsel, 2005) is an additional program that may be used that computes descriptive statistics for a sample in the presence of nondetects.

Statistical methods can only be applied when an adequate number of data are available. This is true both theoretically (larger sample sizes yield more reliable statistics) and practically (numerical algorithms perform poorly when sample sizes are small). Accordingly, the parametric statistical analysis will be limited to those constituents and locations for which (1) at least five samples are available, and (2) with a proportion of nondetects of no more than 50%. Non-parametric analysis will be performed on all data sets.

5.1 DESCRIPTIVE STATISTICS AND TIME SERIES PLOTS

The initial step in the methodology presented in Exhibit 3 is the calculation of the descriptive statistics and the construction of time series plots for selected constituents in each well. The wells and constituents are listed in Table 1 of Attachment 6 of the HWI post-closure permit.

For each constituent in a given well, the descriptive statistics are computed using the entire available historical record of measurements except data omitted based on excessively high RLs or MDLs. The descriptive statistics computed for each constituent fall into two groups. The first group comprises the sample median, quartiles, interquartile range, minimum, maximum, absolute range, and the total number of samples and proportion of nondetects; the second group comprises the sample mean and the standard deviation. The reason for dividing the sample statistics into two groups stems from the impact of nondetects on the computation of the statistics. Nondetects do not affect the first group of sample statistics, provided that the statistics are reported in a way that preserves the information carried by the nondetects. For example, in the simple case where the entire data sample for a constituent in a well consists of nondetects, each of the statistics (except for the number of samples and proportion of nondetects) in the first group would be equal to <MDL, where MDL is the method detection limit for the constituent and, for the sake of illustration, is assumed constant throughout the historical record of measurements. In a somewhat less obvious example suppose the 25th and 75th percentiles of a data set are, respectively, <MDL and $c_{0.75}$; then the interquartile range (*IQR)* would be reported as <($c_{0.75}$-MDL). The key point is that no substitution is necessary for nondetects when computing the descriptive statistics of the type in the first group. In contrast, calculation of the sample statistics in the second group requires an approach to account for data that occur below the MDL. Either the Kaplan-Meier method (Helsel, 2005) or the maximum likelihood method (Helsel, 2005) will be employed to compute the sample mean and standard deviation in the presence of nondetects.

Time series plots of the historical record for a constituent in a well permit visual evaluation of temporal trends in measured concentrations. Each plot will display the permitted concentration limit (PCL)

specified in the post-closure permit, if a PCL exists. Differing symbols will be used to distinguish between detections and nondetects. Nondetects will be assigned a value of zero solely for the purpose of constructing the plots. Time series plots will be generated only for those constituents and locations for which (1) have at least five samples available, and (2) with a proportion of nondetects of no more than 50%.

5.2 PROPORTION OF NONDETECTS

In addition to the descriptive statistics, the proportion of nondetects for each constituent in each compliance well will be computed. Because of practical considerations, a data sample set must have a proportion of nondetects of less than 50% for additional data analysis.

5.3 GOODNESS-OF-FIT TESTING FOR NORMALITY

Each constituent in a well will be tested for normality using the Shapiro-Wilk *W* goodness-of-fit test (Gilbert, 1987; EPA, 1992). The *W* test will be performed to evaluate whether the data set can be considered to be a sample drawn from a normally distributed population, and thus to determine whether parametric or nonparametric methodologies are appropriate in subsequent comparisons between compliance and background wells. In order to perform the test, nondetects will be dropped from the sample set. Unfortunately, this compromise for dealing nondetects is deemed a necessary practical tradeoff in order to accomplish goodness-of-fit testing. If a suitable technique for performing goodness-of-fit testing in the presence of nondetects is identified it will be proposed to UDEQ/DSHW. As noted in Section 2.0, when a large proportion of the data are nondetects, such as often occurs with data from the HWI wells, goodness-of-fit testing becomes problematic when data substitution is used. Thus, experience with data from HWI wells indicates that although normality may be inferred for a constituent in a particular well, it cannot be inferred for the constituent in all wells within a well group. This observation holds whether the *W* test is performed using the raw data or the logarithm of the data. The equivocal results of goodness-of-fit testing, largely a consequence of the typically high proportion of nondetects, reinforce the selection of nonparametric methods for interwell comparisons.

The results of the goodness-of-fit testing for normality will be used to determine whether parametric or non-parametric methods are used to compare concentrations in compliance wells with background.

5.4 COMPARISONS WITH BACKGROUND

The method used to compare the concentrations of a groundwater constituent measured in samples from compliance wells against concentrations measured in samples from a background well (or wells) depends on the number of compliance wells involved in the comparison and whether the data sample is consistent with the characteristics of a normal distribution. When multiple compliance wells are compared to background (either a single well or the pooled result from multiple wells), either parametric analysis of variance (ANOVA) methods or the non-parametric Kruskal-Wallis test is used. When a single compliance well is compared to a single background well, either the parametric *t*-test for means (a special case of the ANOVA method) or the Wilcoxon Rank-Sum test is used. These well-established methods are described in EPA (1992) and Conover (1999). Conover (1999) provides the better and more comprehensive description of the non-parametric methods, including exhaustive examples and a readable discussion of theory.

5.4.1 PARAMETRIC METHODS

Data analyzed using the parametric methods described below must satisfy the requirements that (1) each of the data samples can be considered as a sample drawn from a normal distribution; and (2) the (unknown) variance of each of the underlying normal distributions is equal (Ostle and Mensing, 1975). Thus to evaluate whether a particular constituent in the compliance wells is elevated with respect to background, the sample data from *all* wells must be a sample from some normal distribution, and the underlying normal distributions must *all* have the same variance. Parametric methods will be used if both of these requirements are satisfied.

It is unlikely, however, the *W* tests for normality will indicate that all well-specific samples for a constituent are consistent with a normal population, particularly when the proportion of nondetects in a well is high. It is also unlikely the sample variance computed from the data from each well will indicate that population variances are equal. (The modified Levene test of variance was used to evaluate the hypothesis of equal variance in NCSS [Hintze, 2004].) Accordingly, the comparisons between compliance and background wells will probably be performed using non-parametric methods. Nonetheless, discussion of the parametric methods is included for completeness.

5.4.1.1 ANALYSIS OF VARIANCE (ANOVA)

One-way ANOVA is a parametric method for comparing constituent concentrations in multiple compliance wells to background (either a single well or the pooled result from multiple background wells). The test assumes that (1) all samples are random samples from their respective normal population, (2) the variance of the normal populations are identical, and (3) in addition to independence within each

sample, there is mutual independence among the various samples. The test will be performed at the α = 0.01 significance level. The null and alternative hypotheses are:

H_0: The means of each of the underlying normal populations are identical

H_A: Not all of the means are equal

Thus, rejecting the null hypothesis suggests that at least one well exhibits higher constituent concentrations than in other wells. Failing to reject indicates no difference between compliance wells and background. Note that rejecting H_0 is not evidence of contamination. For example, all concentrations in a well may be below the PCL, but at a level that is slightly elevated in comparison to other wells. Moreover, the test makes no distinction between background and compliance wells; they are compared as a group, so elevated concentrations in the background well may lead to rejecting H_0. Finally, the result applies to the group of wells tested, not to an individual well. In the event of rejection, evaluation of individual wells is necessary, including comparison to the constituent PCL, time series plots, prediction intervals, and evaluation of the hydrogeological setting of the well. Clear explanations of the computational details for the one-way ANOVA method test are presented in EPA (1992) and Ostle and Mensing (1975).

5.4.1.2 *t*-TEST

The two-sample *t*-test is a parametric test for comparing the means of two samples (Ostle and Mensing, 1975). The test is used to compare a single well against background. The test assumes that (1) both samples are random samples from normal populations, (2) the variances of the underlying populations are identical and (3) in addition to independence within each sample, there is mutual independence among the various samples. The test will be performed at the α = 0.01 significance level. The null and alternative hypotheses are:

H_0: Both underlying populations have the same mean

H_A: The mean of the compliance well population is higher than that of the background population

The alternative hypothesis above is for an upper-tailed test, and is one of three statements of H_A that are possible with the test (see Ostle and Mensing, 1975). Rejecting the null hypothesis suggests that the downgradient well exhibits higher constituent concentrations than the background well. Failing to reject indicates no difference between the compliance well and background. Rejecting H_0 is not evidence of contamination, since all concentrations in a well may be below the PCL, but at a level that is slightly elevated in comparison to the background well. In the event of rejection, evaluation of the compliance

well is necessary, including comparison to the constituent PCL, time series plots, prediction intervals, and evaluation of the hydrogeological setting of the well. Clear explanations of the computational details for the *t*-test are presented in EPA (1992) and Ostle and Mensing (1975).

5.4.2 NON-PARAMETRIC METHODS

Non-parametric methods are more applicable to the HWI because of the very small likelihood that the data sets used in the evaluations will all meet the requirements for parametric testing discussed above.

5.4.2.1 KRUSKAL-WALLIS TEST

The Kruskal-Wallis test is a nonparametric counterpart to the parametric ANOVA method, and is used to compare constituent concentrations in multiple compliance wells to background (either a single well or the pooled result from multiple background wells). The test assumes that (1) all samples are random samples from their respective populations, and (2) in addition to independence within each sample, there is mutual independence among the various samples. The test will be performed at the $\alpha = 0.01$ significance level. The null and alternative hypotheses are:

H_0: The population distribution functions for each sample are identical

H_A: At least one of the populations tends to yield larger observations than at least one of the other populations

H_A is sometimes recast to state that the populations do not have equal means. Thus, rejecting the null hypothesis suggests that at least one well exhibits higher constituent concentrations than in other wells. Failing to reject indicates no difference between compliance wells and background. Note that rejecting H_0 is not evidence of contamination. For example, all concentrations in a well may be below the PCL, but at a level that is slightly elevated in comparison to other wells. Moreover, the test makes no distinction between background and compliance wells; they are compared as a group, so elevated concentrations in the background well may lead to rejecting H_0. Finally, the result applies to the group of wells tested, not to an individual well. In the event of rejection, evaluation of individual wells is necessary, including comparison to the constituent PCL, time series plots, prediction intervals, and evaluation of the hydrogeological setting of the well. Clear explanations of the computational details for the Kruskal-Wallis test are presented in EPA (1992) and Conover (1999).

5.4.2.2 WILCOXON RANK-SUM TEST

Also known as the Mann-Whitney test, the Wilcoxon Rank-Sum test is a nonparametric counterpart to the parametric two-sample *t*-test for comparison of means (Conover, 1999). The test is used to compare a single well against background. The test assumes that (1) both samples are random samples from their

respective populations, and (2) in addition to independence within each sample, there is mutual independence among the various samples. The test will be performed at the $\alpha = 0.01$ significance level. The null and alternative hypotheses are:

H_0: The population distribution functions for each sample are identical

H_A: The expected value from one population is greater than the expected from the other population

The alternative hypothesis above is for an upper-tailed test, and is one of three statements of H_A that are possible with the test (see Conover, 1999). Rejecting the null hypothesis suggests that the downgradient well exhibits higher constituent concentrations than the background well. Failing to reject indicates no difference between the compliance well and background. Rejecting H_0 is not evidence of contamination, since all concentrations in a well may be below the PCL, but at a level that is slightly elevated in comparison to the background well. In the event of rejection, evaluation of the compliance well is necessary, including comparison to the constituent PCL, time series plots, prediction intervals, and evaluation of the hydrogeological setting of the well. Clear explanations of the computational details for the Wilcoxon Rank-Sum test are presented in EPA (1992) and Conover (1999). (Note: Conover (1999) denotes the test as the Mann-Whitney test.)

5.5 PREDICTION INTERVALS (INTRAWELL HISTORY COMPARISON)

Additional evaluation is warranted when either of the Kruskal-Wallis or Wilcoxon Rank-Sum tests suggests that a constituent concentration may be elevated in a compliance well. The first step in the evaluation is to compare recently measured concentrations against the historical record of concentrations in the well. The historical record is divided into a background period, consisting of a specified number of past measurements, and the prediction period, consisting of the measurements more recent than the period. In this sense, the prediction limit is not a bound on actual future concentrations, but a hypothetical bound on concentrations measured after some fixed time in the past. As few as one sample (the most recently measured concentration) can constitute the prediction period. This intrawell comparison is accomplished by estimating the nonparametric upper prediction limit (EPA, 1992), which is simply the maximum value of the measurements in the background period.

The prediction limit has confidence probability 1-α that the next future sample or samples will be below the prediction limit. The confidence 1-α depends on the number of samples for the constituent used for the prediction period, denoted by n, and the number of future samples k: $(1-\alpha) = n/(n+k)$, or $\alpha = 1 - n/(n+k)$. Thus, the significance level α is not specified, but is computed. Given a fixed number

of available samples $n+k$, the only way to decrease α is to decrease the number of predicted samples and increase the number of background samples. For example, if $n+k = 24$ and $k = 8$, then $\alpha = 0.33$, an excessively high false positive rate. Decreasing k to one yields $\alpha = 0.04$. When intrawell prediction limit calculations are warranted, k will be set equal to one. Note that in the future the significance level α will continually decrease as the number of sampling events increase.

Exceedance of the intrawell prediction limit suggests the potential of groundwater contamination due to past activities at the site. As discussed in the next section, however, elevated constituent concentrations in a well may be due to hydrogeological conditions, which must be considered before concluding that groundwater contamination has occurred.

5.6 HYDROGEOLOGICAL SETTING

The Geneva Steel site is located on the eastern shoreline of Utah Lake, which exerts major hydrogeological influence on subsurface flow at the site because it is a regional groundwater sink. Groundwater mainly derived from precipitation in the Wasatch Mountains, located approximately 8 miles east of the Geneva Steel site, ultimately discharges to Utah Lake. As a result, the local hydraulic gradient at the site yields groundwater flow that is generally directed upward and to the west. In addition, groundwater originating in the mountains carries with it dissolved constituents due to mineralization in the mountains, modified by the subsurface geochemical conditions encountered as the groundwater moves from the mountains to the lake.

In this setting, the deep HWI monitoring wells can be considered to provide background information for some of the groundwater constituents measured in samples from the shallower wells. Arsenic, for example, is ubiquitous in the deep monitoring wells as a group, generally occurring at concentrations four to ten times the PCL and above the concentrations measured in shallow wells. Based on review of time series plots, this pattern appears to be temporally persistent. It is unlikely that the elevated levels of arsenic in the deep monitoring wells are due to site impacts because the upward component of flow would tend to prevent dissolved contaminants from migrating downward. Thus, any evaluation of arsenic in groundwater at the site should consider the spatial distribution of arsenic in the subsurface before concluding that contamination has occurred in deep compliance wells.

The example of arsenic described above is only one example of how natural conditions can affect the distribution of dissolved constituents in groundwater. Other natural hydrogeological circumstances, unanticipated and not explored here, may also affect groundwater chemistry at the HWI, and should be evaluated before concluding that groundwater contamination has occurred due to the HWI.

6.0 ANALYSIS METHODOLOGY, PERIMETER AND SENTRY MONITORING LOCATIONS

In contrast to the HWI monitoring wells, the perimeter monitoring locations are intended to monitor groundwater quality at the facility boundary. The sentry wells are intended to delineate impacts to groundwater quality due to a specific solid waste management unit (SWMU) or group of SWMUs (SWMUG). The risk-based SSSLs will be used with both the perimeter and sentry wells as a benchmark to identify potentially compromised groundwater quality.

Fewer sampling events are available for the perimeter and sentry locations compared with the HWI monitoring network. This is the main reason for using different statistical procedures to evaluate data from the perimeter and sentry locations. When sufficient data become available in the future (approximately 15 total sampling events), review of the statistical methods is warranted. At that time, the same general procedures used to evaluate data from the HWI network may be applicable to data from the perimeter and sentry locations.

Similar to the HWI wells, the analytical results for past data obtained from the perimeter and sentry wells have been reported using at least two distinct reporting protocols for the perimeter monitoring locations. Data from the earliest sampling events were reported using laboratory RLs, whereas data from subsequent events were reported using MDLs. Unfortunately, the RLs of the early data are often several orders of magnitude greater than either actual sample values or the MDLs. This discrepancy severely limits the utility of the early data because the high RLs provide information of negligible beneficial value. For example, the RL in 1997 for 1,2-dichloroethane in MW-100S (a perimeter well) was 5,000 µg/L, whereas in subsequent events, measured concentrations were on the order of 1 µg/L or less or below a MDL of 0.26 µg/L. Clearly, little valuable statistical information can be derived from RLs that are greater than the estimated range of concentrations. A similar situation occurs when the MDL applied to early sampling events are greater than reported values from subsequent events. In these cases, data reported as less than excessively high RLs or MDLs are excluded from statistical computations.

The majority of the statistical computations will be performed using the commercial NCSS® software package available from NCSS (Hintze, 2004). NCSS® is comprehensive statistical software that includes nearly all of the techniques described in this document, including the Kaplan-Meier method. Two additional programs may be used: Trend Version 2.01, documented in Gilbert (1987) performs the Mann-Kendall test for trend and Sen's estimate of slope; and MDL (Helsel, 2005) computes descriptive statistics for a sample in the presence of nondetects.

Statistical methods can only be applied when an adequate number of data are available. This is true both theoretically (larger sample sizes yield more reliable statistics) and practically (numerical algorithms perform poorly when sample sizes are small). Accordingly, the parametric statistical analysis will be limited to those constituents and locations for which (1) at least five samples are available, and (2) with a proportion of nondetects of no more than 50%. Non-parametric analysis will be performed on all data sets.

6.1 DESCRIPTIVE STATISTICS AND TIME SERIES PLOTS

Descriptive statistics and time series plots will be generated as described in section 5.1. Exceedance of the respective SSSL by any constituent will be noted.

6.2 PROPORTION OF NON-DETECTS

In addition to the descriptive statistics, the proportion of nondetects for each constituent in each compliance well will be computed. Because of practical considerations, a data sample set must have a proportion of nondetects of less than 50% for additional data analysis.

6.3 EVALUATE DATA TRENDS (MANN-KENDALL METHOD)

The Mann-Kendall test is a non-parametric method that can be used for evaluating whether the data exhibit a temporal trend. It is particularly appropriate for use in the PGMP because irregularly spaced data and nondetects can be accommodated (Gilbert, 1987). The test assumes sample independence. The test will be performed at the $\alpha = 0.05$ significance level. The null and alternative hypotheses are:

H_0: The data do not exhibit a trend

H_A: The data exhibit an upward trend

The alternative hypothesis above is for an upper-tailed test, and is one of three statements of H_A that are possible with the test (see Gilbert, 1987). Rejecting the null hypothesis suggests a trend of increasing concentration for the constituent in the well. Gilbert (1987) and Gibbons (1994) provide discussion and examples of the Mann-Kendall test, including the necessary probability tables for the test statistic. As much of the historical record of data as possible will be used to evaluate the presence of an upward trend (see discussions regarding RLs in Section 6.0).

6.4 LOWER CONFIDENCE LIMIT FOR THE MEDIAN

This approach is analogous to using the four most recent samples to compute the lower confidence limit for the mean and using the computed lower limit to infer exceedance of some stipulated groundwater standard. The lower confidence limit for the median is used in lieu of the more common lower confidence limit for the mean because of the typically high proportion of nondetects that occur in groundwater samples from the Geneva Steel site and because a reasonably low probability α of Type I error can be achieved with seven samples. In addition, the median is a better measure of central tendency than the mean for positively-skewed data (Ostle and Mensing, 1975), such as often occurs with groundwater monitoring data.

The lower one-sided confidence limit for the median will be used to determine exceedance of the SSSL for each constituent in each well and will be computed using the seven most recent samples. When seven samples are not available, the maximum possible odd number of samples will be used; for example, if six data are available, the five most recent data will be used. When seven data are available, the lower limit for the 94% confidence interval ($\alpha = 0.06$) for the median is given by the second of the ordered data, i.e., the next to the smallest (minimum) of the data (Conover, 1999). Note that the size of the confidence interval is fixed for a given number of data, and decreases when fewer samples are used in the calculation. When fewer than seven data are available, Conover (1999) provides a table (Table A.3 – Binomial Distribution) for evaluating the size confidence interval (in each case, the second of the ordered data will be used as the LCL). Exceedance of the SSSL by the lower confidence limit for the median is statistical evidence that the constituent is above its SSSL in groundwater, indicating degradation in groundwater quality with respect to the constituent in question.

6.5 TIME SERIES PLOTS OF THE MEDIAN

As a complement to time series plots of the actual data, a time series plot will be generated of the median computed using the seven most recent data. The plot will also display the LCL for the median, computed as described in Section 6.4, and the SSSL for the constituent. The purpose of the plot is to provide the means to visually evaluate the trend; a persistent increase in the value of the computed median suggests that increasing concentrations of the constituent from upgradient sources are reaching the well. These plots will not be generated until the third round of applying the data analysis described above because the plots will not begin to have any value until at least three data are posted to the plot.

7.0 REFERENCES

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Gilbert, R.O., 1987. *Statistical Methods for Environmental Pollution Monitoring.* John Wiley and Sons, New York.

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Hintze, J., 2004. Number Crunching Statistical Systems (NCSS). Kaysville, Utah. www.NCSS.com.

Ostle, B. and R.W. Mensing, 1975. *Statistics in Research.* The Iowa State University Press, Ames, IA.

U.S. Environmental Protection Agency (EPA), 1992. *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Addendum to Interim Final Guidance.* U.S. EPA, Washington, D.C.

Exhibit 1. Hazardous Waste Impoundment Groundwater Monitoring Wells

Shallow Wells		Intermediate Wells		Deep Wells	
Well ID	**Type**	**Well ID**	**Type**	**Well ID**	**Type**
MW-10	Background	MW-1	Background	MW-19D	Background
MW-12	Compliance	MW-5	Compliance	MW-14D	Compliance
MW-21	Compliance	MW-8	Compliance	MW-17D	Compliance
MW-22	Compliance	MW-9	Compliance		
MW-23	Compliance	MW-13	Compliance		
MW-24	Compliance	MW-21	Compliance		
		MW-22	Compliance		
		MW-23	Compliance		
		MW-24	Compliance		

Exhibit 2. Hazardous Waste Impoundment Groundwater Monitoring Wells Site Map

Exhibit 3 Statistical Evaluation Flowchart for the Hazardous Waste Impoundment Wells

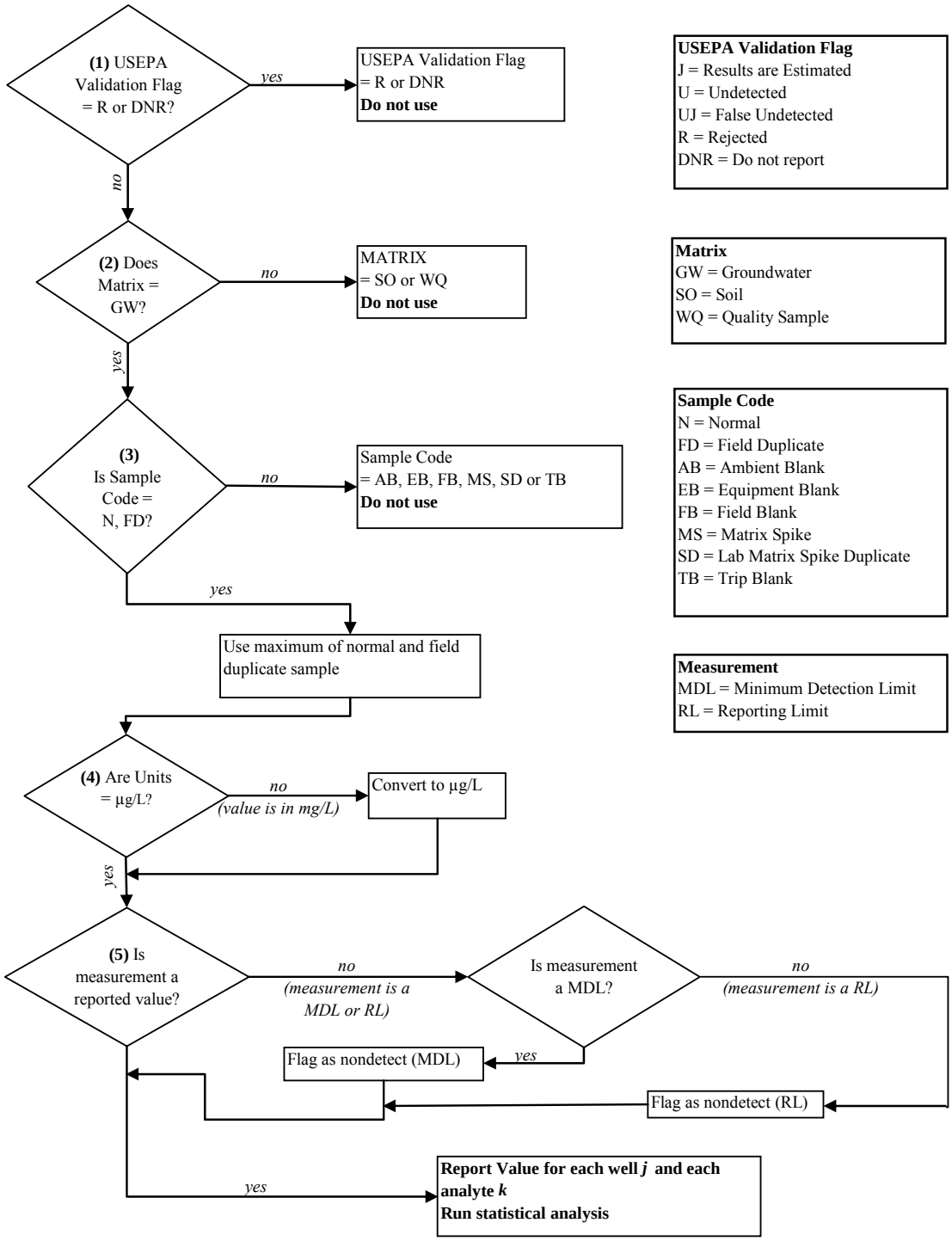

Exhibit 3 (continued)
Statistical Evaluation Flowchart for the Hazardous Waste Impoundment Wells

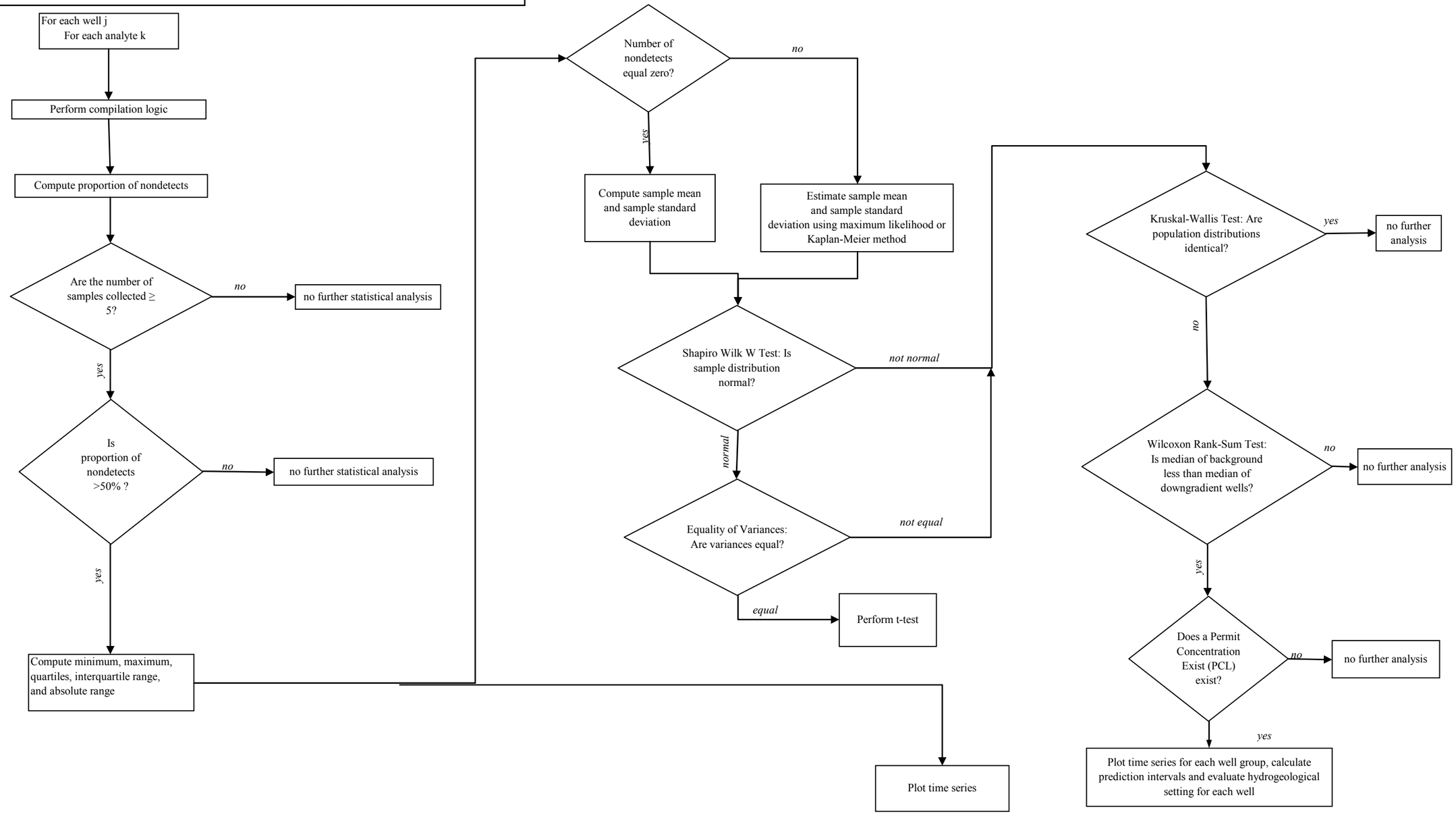

Exhibit 4. Perimeter and Sentry Groundwater Monitoring Locations

Perimeter-In Wells		
Well ID		
MW-100S	MW-116S	PZ-03M
MW-101S	MW-117S	PZ-03SR
MW-102S	MW-118S	PZ-04D
MW-103S	MW-119S	PZ-04M
MW-104M	MW-120S	PZ-04S
MW-104S	MW-121S	PZ-05S
MW-105S	MW-122S	PZ-06S
MW-106M	MW-123S	PZ-07D
MW-106S	MW-124S	PZ-07S
MW-107S	MW-125S	PZ-08D
MW-108S	MW-126S	PZ-08M
MW-109M	MW-127S	PZ-08S
MW-109S	MW-128S	PZ-09D
MW-110S	MW-129S	PZ-09M
MW-111S	MW-130S	PZ-09S
MW-112M	PZ-01D	PZ-11S
MW-112S	PZ-01M	PZ-12S
MW-113S	PZ-01S	PZ-13D
MW-113M	PZ-02D	PZ-13M
MW-114M	PZ-02M	PZ-13S
MW-114S	PZ-02S	PZL-16
MW-115S	PZ-03D	PZL-16

PZ-10S, on previous lists, has been destroyed
PZL-18, on previous lists, cannot be located
MW-112M and MW-112S were abandoned after the 2006 sampling event
MW-113M was added beginning with the 2006 sampling event

Exhibit 5. Perimeter and Sentry Groundwater Monitoring Locations

Exhibit 6 Statistical Evaluation Flowchart for the Perimeter and Sentry Wells

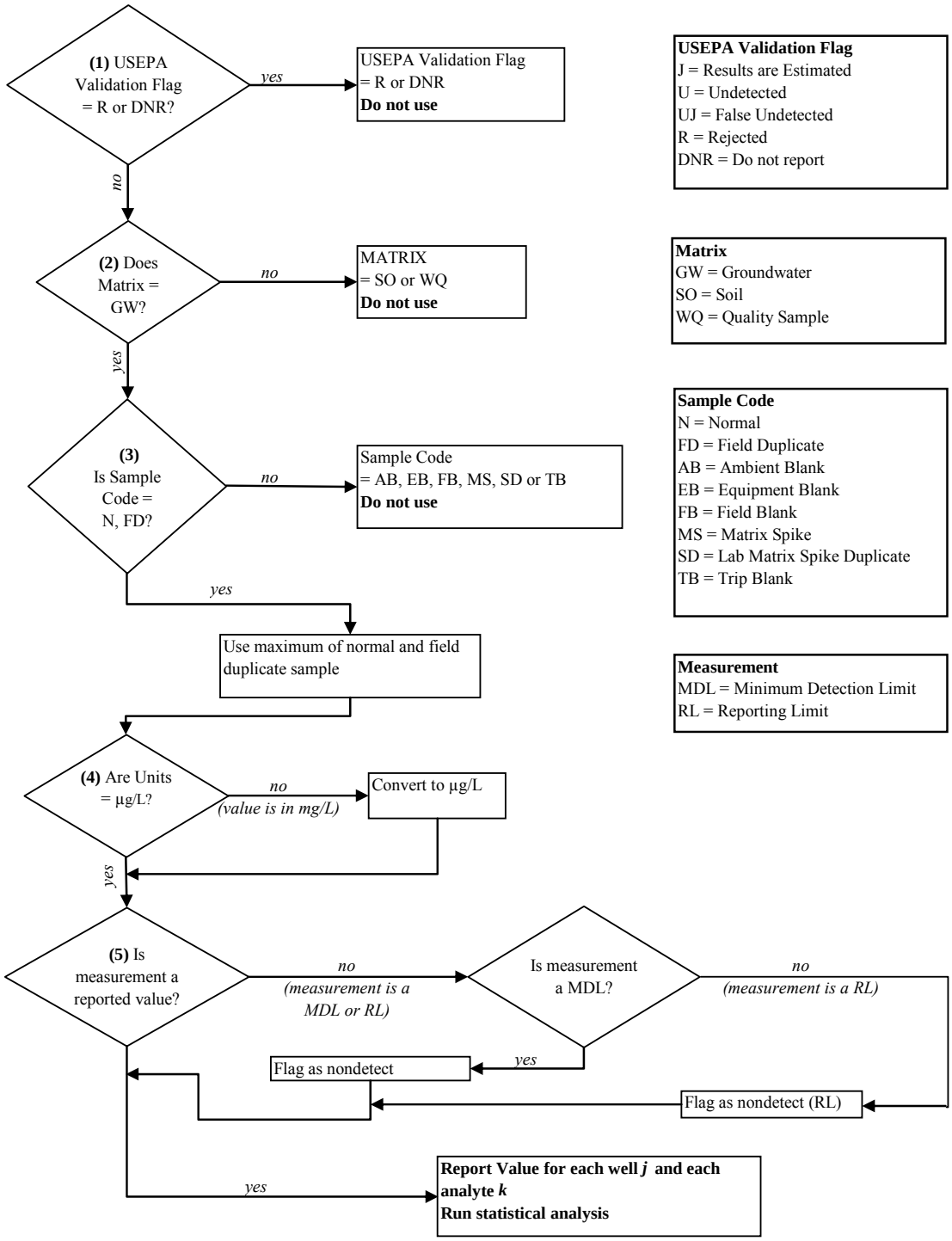

Exhibit 6 (continued) Statistical Evaluation Flowchart for the Perimeter and Sentry Wells

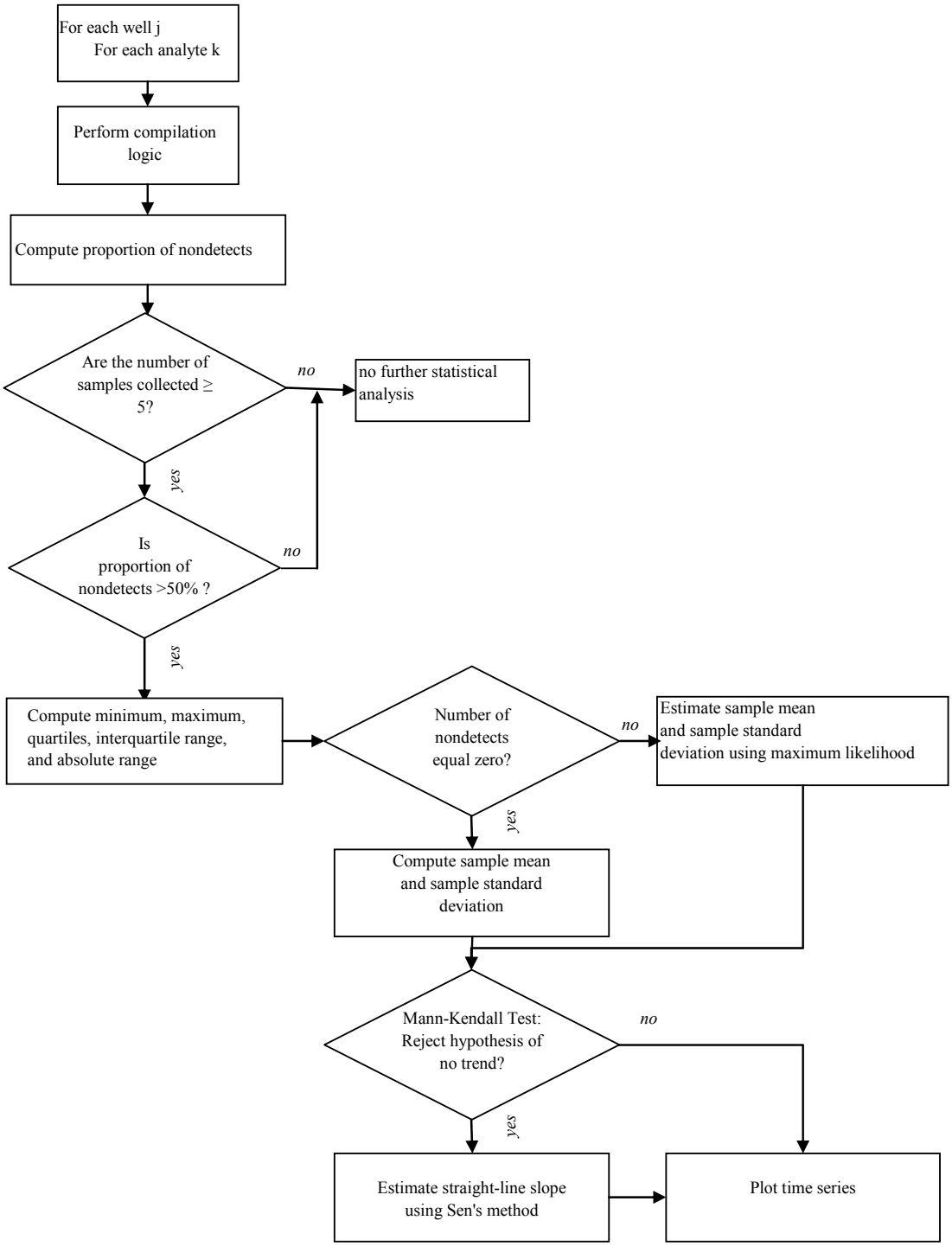

TABLE 1
Hazardous Waste Impoundment
Monitoring Well Sampling Requirements

			Shallow Aquifer Monitoring Wells					Deep Aquifer Monitoring Wells		Non-compliance Monitoring Wells						
		Concen-	Upgradient	Downgradient Compliance Wells				Upgradient	Downgradient Compliance	Shallow Aquifer						Deep Aquifer
Compound	Method	tration	MW-1	MW-21	MW-22	MW-23	MW-24	MW-19	MW-17D	MW-5	MW-8	MW-9	MW-10	MW-12	MW-13	MW-14D
LONG LIST VOLATILES		µg/l														
acetone	8260B	*100	A	A	A	A	A	A	A	A						
acetonitrile	8260B	*100	A	A	A	A	A	A	A	A						
benzene	8260B	5	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
1,1-dichloroethane	8260B		A	A	A	A	A	A	A	A						
1,1-dichloroethylene	8260B		A	A	A	A	A	A	A	A						
1,4-dioxane	8260B		A	A	A	A	A	A	A	A						
ethylbenzene	8260B	5	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
isobutyl alcohol	8260B		A	A	A	A	A	A	A	A						
toluene	8260B	5	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
xylenes	8260B	5	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
LONG LIST SEMI-VOLATILES																
2,4-dimethylphenol	8270C	10	SA	SA						SA						
2-picoline	8270C	10	SA	SA						SA						
4,4'-DDD	8081A		A	A						A						
4,4'-DDE	8081A		A	A						A						
acenaphthene	8270C	200	A	A						A						
acenaphthylene	8270C	10	SA	SA						SA						
acetophenone	8270C	10	A	A						A						
aniline	8270C	100	A	A						A						
beta-BHC	8081A	0.05	A	A						A						
naphthalene	8270C	10	SA	SA						SA						
o-cresol (2-methylphenol)	8270C	10	SA	SA						SA						
p-cresol (4 methylphenol)	8270C	10	SA	SA						SA						
phenol	8270C	10	SA	SA						SA						
pyridine	8270C	10	SA	SA						SA						
LONG LIST METALS																
antimony	6010B	300	A	A	A	A	A	A	A	A	A					
arsenic	6010B	50	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
barium	6010B	1000	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
beryllium	6010B	3	A	A	A	A	A	A	A	A	A					
chromium	6010B	50	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
cobalt	6010B	70	A	A	A	A	A	A	A	A	A					
lead	6010B	50	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
nickel	6010B	50	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
thallium	6010B	*400	A	A	A	A	A	A	A	A	A					
vanadium	6010B	*80	A	A	A	A	A	A	A	A	A					
zinc	6010B	20	A	A	A	A	A	A	A	A	A					
GENERAL PARAMETERS																
cyanide	335.2	40	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
nitrate	353.4	NR	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
sulfate	375.2	NR	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
pH	150.1	NR	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
specific conductance	Field	NR	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
Total Organic Carbon (TOC)	Field	NR	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
Total Organic Halogens (TOX)	9020	NR	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA

NR = None Required

A = Annually SA = Semi-annual