National Aeronautics and
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Evaporation Treatment Unit (ETU) Closure Plan

May 2012

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NASA Johnson Space Center White Sands Test Facility
12600 NASA Road Las Cruces, New Mexico 88012

NASA Johnson Space Center White Sands Test Facility

ETU Closure Plan

May 2012

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Radel Bunker-Farrah Date

Chief, NASA Environmental Office

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List of Acronyms

API	American Petroleum Institute
CP	Corrosion protection
EPA	U.S. Environmental Protection Agency
ETU	Evaporation Treatment Unit
ft	Foot/feet
HWDL	Hazardous waste drain line
in.	Inch(es)
LDR	Land disposal restrictions
NOV	Notice of violation
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
ppm	Parts per million
QA/QC	Quality assurance/quality control
RCRA	Resource Conservation and Recovery Act
SAP	Sampling and analysis plan
SOW	Statement of work
TCI	Tank Consultants, Inc.
TCLP	Toxicity characteristic leaching procedure
WIWPS	WSTF Individual Waste Profile Sheets
WSTF	White Sands Test Facility

1.0 Introduction

The Evaporation Treatment Unit (ETU) is a permitted unit under the NASA/WSTF Resource Conservation and Recovery Act (RCRA) Hazardous Waste Permit (No. NM8800019434). The Hazardous Waste Permit (Permit) (dated November 2009) identified two options for operation of the ETU. Permit Section III.C.4 allowed continued use of the ETU, but required the installation of two angled monitoring wells beneath each ETU tank. Permit Section III.C.3 provided an ETU phase-out option that eliminated all waste discharges to the ETU within three years of the effective date of the Permit and closure of the ETU. On January 6, 2010, NASA notified the New Mexico Environment Department (NMED) of the selection of the option to phase out and close the ETU. Included in the notification was the "NASA White Sands Test Facility (WSTF) Evaporation Treatment Unit Phase Out Plan" (Work Plan). In accordance with Permit Condition III.C.3, the Work Plan included:

- A description of actions to terminate operation of the ETU.
- A schedule for phase out of the ETU.
- A date for receipt of final waste in the ETU.
- A deadline for submittal of an amended closure plan.

The first paragraph of Permit Attachment 11.0, "Closure Plans" states:

> *"The closure plans in this attachment include the steps necessary to clean close the hazardous waste operating units as required by 40 CFR 264.112(b)(1). Copies of the closure plans shall be maintained in the Facility Operating Record. The plans shall be updated as necessary in accordance with 40 CFR 264.112(c)…"*

Section 1.5, 5th paragraph of the Work Plan states:

> *"An Amended Closure Plan will be submitted to NMED for approval by January 17, 2012 (COB)."*

This document is an amended closure plan for the Evaporation Tank Unit (ETU) that provides the procedures for clean closure of the ETU. This closure plan consists of four general activities which are identified below:

- A review of the ETU Operating Record (sections 4.0 and 5.0).
- Closure procedures for the ETU Tank System (section 6.0).
- A structural assessment and visual inspections of the ETU evaporation tanks to verify the integrity of the tank system (section 4.4).
- Soil sampling to demonstrate that a release to the environment from the tank system has not occurred (section 7.7).

The review of the ETU Operating Record as presented in section 4.0 included a review of the waste streams discharged to the ETU. This review was performed to establish a comprehensive list of hazardous wastes (waste codes) and hazardous constituents managed at the ETU. Details of the waste stream review are provided in section 5.0.

All operations per this closure plan will be performed in accordance with WSI 09-SW-0002 "Process Control Utilizing Work Instructions and Work Authorizing Documents" and WSI 09-SW-0001, "Test Preparation Sheet (TPS)". Per Permit section VI.E.2, all records will be maintained in the Facility Operating Record.

2.0 General Closure Information

2.1 Closure Performance Standard

Closure performance standards, under 40 CFR Part 264 and 265 (Interim Status Facilities), Subpart G, Closure and Post-Closure, § 264.111 and § 265.111, respectively, specify the following:

> *"The owner or operator must close the facility in a manner that:*
>
> *(a) Minimizes the need for further maintenance; and*
>
> *(b) Controls, minimizes or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere."*

Based on citations from the U.S. Environmental Protection Agency (EPA) memorandum, closure of the ETU will be complete when:

- All waste in the ETU has been characterized, removed and disposed in accordance with the closure performance standards in Sections 6 and 7 of this closure plan.
- The ETU primary tank liners (liners in direct contact with the waste) have been removed, characterized and disposed in accordance with the closure performance standards in sections 6 and7 of this closure plan.
- All ancillary equipment has been either decontaminated or removed. Removed ancillary equipment will be properly characterized and disposed in accordance with the closure performance standards in sections 6 and 7 of this closure plan. All ancillary equipment that has been successfully decontaminated may either be reused or left in-place.
- A demonstration that soil contamination is not present as a result of ETU operations.
- The ETU closure has been certified by an independent, professional engineer licensed in the state of New Mexico.
- The closure certification has been submitted and approved by NMED.

2.2 Permit Modification Requirement

As specified in the NASA /WSTF RCRA Hazardous Waste Permit attachment 11.0, *Closure Plans*, closure plans shall be updated in accordance with 40 CFR §264.112(c), *Amendment of Plan*. The regulation states that the owner or operator must submit written notification for a permit modification to authorize change in an approved closure plan in accordance with the applicable procedures in parts 124 and 270. Permit modifications at the request of the permittee may be issued under a Class I permit modification as listed in Appendix I with prior administration approval, as referenced in 40 CFR §270.42(2).

2.3 Method of Closure

Closure is a term used to describe the process of removing a RCRA regulated unit from service. Under RCRA the two types of closure are: closure with the waste in place and "clean closure" (removal or decontamination). Clean closure performance standards are as specified per 40 CFR 264.111(a) – (c).

Interpretative guidance is provided by an EPA memorandum from the Acting Director of the Office of Solid Waste, dated March 16, 1998 The 1st page, 3rd paragraph states:

> *"…for clean closure, facility owners/operators must* ***remove all waste from the closing unit and remove or decontaminate all waste residues, contaminated containment system components (emphasis added)****, contaminated soils (including ground water and any other environmental media contaminated by releases from the closing unit), and structures and equipment contaminated with hazardous waste and hazardous waste leachate…."*

The objective of this closure plan is to achieve "clean closure" of the ETU tank system in accordance with 40 CFR 264.110, 40 CFR 264.111, 40 CFR 264.112, 40 CFR 264.113, 40 CFR 264.114, 264.115, and 40 CFR 264.197.

2.4 Closure Schedule

The closure schedule will be as specified by sections 1.4, 1.5 and 1.6 of the Work Plan. A copy of the closure plan and all amendments will be maintained as part of the Facility Operating Record [40 CFR 264.111, 264.112(a), 264.112(b)(1), 264.112(b)(2), 264.112(b)(6)].

2.5 Certification of Closure

Upon completion of closure activities, a closure certification report will be submitted to NMED for review and approval. The submittal will include certification by an independent professional engineer who is registered in the state of New Mexico stating that the ETU has been closed in accordance with the requirements of the closure plan (40 CFR 264.115).

3.0 ETU Tank System Description

. The 200 Area ETU is a tank system used to treat and store hazardous and non-hazardous (non-RCRA regulated) aqueous waste from on-site operations. The unit consists of two above-ground evaporation tanks and ancillary equipment (a piping system and sump to transport waste from the 200 and 800 Areas to the tanks). The ETU tank system also consists of associated equipment such as the ETU unloading pad and ETU unloading pad sump as well as support structures such as the ETU steel work platform and HWDL steel support I-beams. The ETU was operated under interim status authorization, and in accordance with Permits dated February 1993 and November 2009. The unit was approved for use under interim status on October 4, 1988 and was first placed in operation in late 1988.

3.1 ETU Evaporation Tanks

The design of the evaporation tanks is based on the American Petroleum Institute's (API) Standard 650 for "Welded Steel Tanks for Oil Storage." The tanks are constructed from 0.25-inch-thick carbon steel plates that are welded together to form a round flat-bottomed tank. Each tank is 79 ft in diameter and 6 ft in height and provides a maximum capacity of 147,000 gallons with 2 ft of freeboard to prevent overtopping from wave or wind action and additions from storm precipitation. Discharge to the ETU tanks is controlled by manually operated valves. The tanks are equipped with a high level alarm and an automatic telephone dialing system to notify site personnel when the design capacity of the tanks is reached.

The tank foundations were prepared by scarifying and grading the natural ground surface and then adding backfill material to bring the foundations to the proper elevations. To prevent any settling of the tank structures, the soil and backfill soil was compacted to not less than 90% density and the foundation soils were tested at a qualified soils testing laboratory. The circumference of each tank foundation is covered with 2-inch-thick layer of concrete or asphaltic concrete to prevent erosion around the tank foundation.

The steel tank bottoms rest in direct contact with the soil foundation. During the initial installation a cathodic protection system was installed at each tank, each consisting of a series of twenty magnesium sacrificial anodes and two copper-copper sulfate reference electrodes. As part of the 1991 part B submittal, an engineering assessment by a corrosion expert was performed. Based on the soil conditions, soil moisture, soil pH, sulfide levels, structure-to-soil potentials and other corrosion related parameters, the assessment indicated that the sacrificial anode system was not adequate to prevent long term corrosion of the uncoated tank bottoms. Using a conservative estimate, the tanks were recommended for a useful life of 10 years, after which time additional protection would be provided. As required per Permit Attachment IV-5 of the Permit (dated February 1993), an updated assessment report certified by an independent registered engineer was performed by the Corrosion Engineering Division of International Lubrication and Fuel Consultants, Inc. (August 13, 1997) to determine the measures necessary to extend the useful life of the steel tanks. Based on the recommendations of the 1997 corrosion assessment and NMED approval, an impressed current cathodic protection system was installed by Corrosion Service, Inc. in 1998. In accordance with 40 CFR 264.195 (g)(1), the cathodic protection system operation was confirmed within six months of installation and annually thereafter by a corrosion expert as defined by 40 CFR 260.10. An evaluation of the impressed current cathodic protection system was performed by Crown Tech, Inc. (contracted through Tank Consultants, Inc.) as part of the 2005 in-service condition assessment. The results of the ETU corrosion protection system evaluation verified that the ETU impressed current cathodic protection system was designed and operated at a level to provide effective soil side corrosion protection for the two ETU tanks.

The ETU tanks consist of three containment components: a self-supporting quarter-inch carbon steel tank and two inner 30-mil XR-5 brand plastic fabric membrane liners manufactured by Seaman Corporation. The interior surface of the carbon steel tanks is covered with coal tar epoxy (two 6-mil coats). The XR-5 liners and the interior surface of the carbon steel tank are separated from each other and from the steel structure by a drainage netting and a protective fabric liner material. By design, the ETU steel tanks and the primary and secondary XR-5 liners provide primary, secondary and tertiary containment. Leak detection sight glasses that are inspected daily provide leak detection between the primary and secondary liners and between the secondary liner and the steel tank. A nitrogen purge is maintained between the two liners and the secondary liner and steel tanks to minimize condensation.

To support operation of the ETU, the facility is equipped with electrical power, lighting, site water, a nitrogen supply and breathing air. A steel work platform runs between the top of both tanks to allow for sample collection, depth measurements, and visual inspection. A concrete unloading pad and drum pumping station is located between to tanks to support the off-loading of containerized waste from remote facility locations. To prevent deterioration of the tank structures, corrosion-resistant coatings were applied to both the interior and the exterior of the tank structures. Direct exposure of the outer tank structure to the elements is prevented by maintaining a protective coating of paint. For security purposes, the tanks are completely surrounded by a 7-foot-high chain link fence. A net has been installed over the tops of the tanks to provide protection for migratory fowl and other wildlife.

Tank integrity was tested prior to use. All welds were visibly inspected. Per the manufacturer’s instructions, all XR-5 liner seams were vacuum-tested by an authorized installation contractor to verify seam integrity. Prior to the addition of waste, water was added to the tanks to demonstrate the liners did not leak.

During the life of the unit, two written engineering assessments attesting to the structural integrity of the tanks have been performed and certified by a qualified professional engineer (see Section 4.4.).

3.2 ETU Hazardous Waste Drain Lines (HWDL)

The ETU hazardous waste drain lines (HWDL) are a gravity flow piping system designed to convey liquid waste from the 200 and 800 Areas to the evaporation tanks. The HWDL consists of the HWDL sump and four main pipe sections or branches:

- The Evaporation Tank HWDL – HWDL from the HWDL sump to the ETU evaporation tanks.
- The 200 Area HWDL – HWDL section that serves the 200 Area (200 Area to HDWL sump).
- The 800 Area HWDL – HWDL section that serves the 800 Area (800 Area to HWDL sump).
- The 803 HWDL – HWDL section that serves the Bldg. 803 (Bldg. 803 to HWDL sump).

The HWDL was initially installed during fiscal year 1990 and was brought on line during fiscal year 1991. Subsequent construction and upgrading took place during fiscal years 1991, 1992, 1998, and 1999.

All HWDL valves, non-welded flanges or joints and other connections, along with any below ground or buried piping that cannot be visually inspected on a daily basis is equipped with secondary containment. The secondary containment system is specifically designed, installed and operated to prevent the migration of wastes or accumulated liquid out of the system. All HWDL piping was installed according to the manufacturer's instructions. During installation, the primary piping was hydrostatically tested to verify that no leaks existed. During the engineering assessment (as part of the part B submittal information), the secondary containment piping was checked and leak tested with water.

The four main pipe sections consist of a primary drain line surrounded by a secondary containment line. Except for the uppermost portion of the 200 Area HWDL (referred to as the LabCon section), the primary line is a filament wound fiberglass reinforced vinylester pipe with an integral 0.050-inch resin rich reinforced liner (Ameron's Bondstrand Series 5000 pipe). All fittings are of the same construction and material as the pipe. A two-part vinylester thermoset adhesive (Ameron RP 105A) was used to assemble components. The secondary containment line is a filament wound fiberglass reinforced epoxy pipe with an integral epoxy liner (Ameron's Bondstrand series 3000 pipe). The pipe sections were assembled with two-piece compression molded fittings (Dualoy 3000 L clam shell-type fittings) and a two part amine cured epoxy resin adhesive (Ameron SC10).

For the uppermost portion of the 200 Area HWDL (referred to as the LabCon section), the primary line is a centrifugally cast reinforced vinylester pipe with a 55-mil or more 100%-pure resin liner (Fibercast Centricast Plus CL-2030). The pipe sections are assembled with fittings of the same material and a two part vinylester adhesive (Fibercast Weldfast CL 200). The secondary containment line is a centrifugally cast reinforced vinylester pipe with a 30-mil, 100%-pure resin liner (Fibercast Centricast III VE). The secondary pipe sections are assembled with fittings of the same material and a two part vinylester adhesive (Fibercast Weldfast CL 200).

Waste from the 200 and 800 Areas is discharged to the HWDL from a number of locations. Smaller diameter above ground sections of HWDL piping (primarily in buildings and above ground sections in the 800 Area) connect sinks, decon stations, safety showers, cleaning tanks, etc. to the 200 Area, 800 Area, and 803 HWDL sections. The HWDL piping at these locations are assembled from polypropylene pipe with welded fittings (Ryan Herco GSR Fuseal polypropylene pipe with fusion welded fittings). All above ground piping in these areas is inspected daily. For the indoor sections, the buildings serve as secondary containment.

The HWDL sump is located approximately midway along the drain line system where 200 Area, 800 Area and 803 HWDL sections intersect. The HWDL sump is a vertical cylindrical 370-gallon tank with double-wall construction to provide secondary containment. Leak detection is provided by an electronic optical liquid sensor that is located in the bottom of the annular space between the two tank walls (between the primary tank and secondary containment). The tank is positioned below finished grade and within a square-walled, vertically lined concrete pit. At its base, the pit is not lined. The lower portion of the tank is bedded in fine homogeneous sand, which in turn rests on native soil. Construction of the tank is rigid double-walled reinforced resin plastic. Interior dimensions of the inner wall are 48 in. across (horizontal diameter) by 51 in. in height. Outer wall dimensions are 72 in. inside diameter by 62 in. in height. Interior and exterior wall thicknesses are ¼–inch. Six-inch bond pipe legs are installed at the base of the inner tank in order to separate and support the inner tank from collapsing onto the outer tank. All three inlet drain line pipes connect through the top of the tank's cover plate and the one outlet drain line pipe (the Evap. Tank section of the HWDL) connects on the centerline, 9 in. below the top of the tank. The cover plate is bolted to both the inner and outer tanks so that a pressure seal is formed. The wiring for a moisture sensor (electronic optical liquid sensor), an ultrasonic level sensor, and a 4-inch-diameter sample port are all attached to the top of the cover plate. The sampling port rises above the retaining walls to facilitate the access at finished grade.

The Evaporation Tank section of the HWDL transports the waste from the HWDL sump to the evaporation tanks. The up-gradient portion of the HWDL is buried below ground while the lower portion, approximately 127 ft down-gradient from the sump tank, is all above ground to the ETU tanks. The primary and secondary containment piping is the same filament wound fiberglass reinforced piping that serves the 200 and 800 Area branches of the HWDL.

The HWDL leak detection system consists of:

- A sight glass located at the ETU which is inspected daily to provide leak detection for the Evap. Tank HWDL section.
- An electronic optical liquid sensor located in the HWDL sump secondary containment that is wired to an automatic telephone dialing system. The liquid sensor provides leak detection for the 800 Area, 803, and the 200 Area HWDL sections (excluding the uppermost section referred to as the LabCon section).
- Electronic optical liquid sensors at eight locations in the LabCon section secondary containment of the 200 Area HWDL. The liquid sensors are wired to a control box that is inspected daily to provide leak detection for the LabCon section of the 200 Area HWDL.

4.0 Records Review

The closure plan shall include a records review and structural assessment of the ETU upon closure. The following sections 4.1, 4.2, 4.3 and 4.4, provide the information required by the Permit.

4.1 Engineering Certifications and Inspections

As noted in section 3.1, two written engineering assessments have been performed and certified by a qualified professional engineer attesting to the structural integrity of the tanks. In both cases, the ETU tanks were fit for service and no significant structural tank defects were identified.

4.2 Releases, Repairs and Spills

No releases to the environment from the ETU evaporation tanks have occurred. During the life of the tanks, three minor leaks in the primary liner occurred:

- May 7, 1990 (East Tank).
- May 27, 1994 (West Tank).
- June 12, 1996 (West Tank).

In all three cases, less than 50 gallons of waste were removed from the secondary containment. In all cases, the waste was contained by the ETU secondary containment system no liquid was observed in the tertiary containment (between the secondary liner and the steel tank bottom). In all three cases, the minor release from the primary liner was contained and no release to the environment occurred.

No known releases to the environment from the ETU HWDL have occurred. Since installation two leak detection alarm conditions were observed:

- July 13, 1994 (Probe Location # 6).
- February 7, 2011 (Probe Location # 6).

Approximately 2.5 liters of liquid was removed from the secondary containment in 1994 and about two gallons was removed from the secondary containment in 2011. In both cases, all liquids were contained. The liquids were sampled and analyzed and were found to be essentially water.

Details of the events (except for the 1990 leak detection and February 7, 2011 alarm conditions) were previously summarized as part of NASA's submittal (dated November 4, 2004) in response to NMED's Request for Additional Information (dated September 14, 2004). Comment #'s 29 and 30 provide a summary of the 1994 and 1996 leak detection and alarm conditions.

4.3 Notices of Violation and Resolutions

Since operation began under interim status in late 1988, a total of 13 Notices of Violation (NOVs) were associated with the ETU tank system. No NOVs were related to system integrity, leaks, spills or releases to the environment.

Seven NOVs were issued from 1990 through 2004. All NOVs were addressed in an expeditious manner. Of the seven NOVs, five were related to minor tank system inspection discrepancies. One potential NOV was associated with the operation of the ETU and land disposal restrictions (LDR). The issue was referred to EPA Region 6 and resolved. The only other NOV was associated with the requirement for an independent professional engineer certification for a tank system. Per a previous submittal, NASA had contracted an independent professional engineer to assess the system. NASA provided an explanation in their response and the issue was quickly resolved.

The other six NOVs occurred from 2004 through 2006. Of the six NOVs, four were associated with discrepant or inadequate waste characterization. As a matter of enforcement discretion, NMED decided not to pursue three of the NOVs. The other NOV (failure to perform adequate hazardous waste determination for ETU waste) was resolved per a Settlement Agreement and Stipulated Final Order dated February 28, 2007. The remaining two NOVs were related to NASA's failure to maintain an operating log for the waste discharged to the HWDL and NASA's exceedance of the annually permitted discharge of F001/F002 waste to the ETU. The NOVs were resolved per the Settlement Agreement and Stipulated Final Order dated February 28, 2007.

Since 2006, no NOVs associated with the ETU have occurred. During the life of the unit, no NOVs were related to system integrity, leaks, spills or releases to the environment. The majority of the NOVs were due to inadequate waste characterization and minor inspection discrepancies.

4.4 Structural Assessment

During the life of the ETU, two written engineering assessments, certified by a qualified professional engineer attesting to the structural integrity of the tanks have been performed:

- Geoscience Consultants, Ltd., March 26, 1991, as part of the part B submittal information.
- An in-service condition assessment by Tank Consultants, Inc. June 21, 2005 in response to Comment # 39, New Mexico Environment Department (NMED) Notice of Deficiency (NOD), Part 2 dated October 19, 2004.

Comment # 39, NMED (NOD) states:

> *"…NASA must evaluate the condition of the steel structure of both ETU tanks by visual inspection, for soundness and corrosion holes, of the interior and exterior (or thickness of the structure instead of exterior) of the tanks' structures. NASA must assess the impressed current protection system not only by inspection using the reference cells under the tank but also by portable Cu/CuS04 electrodes around the entire perimeter and area of both tanks. The testing must be conducted by a qualified corrosion protection (CP) tester and the results submitted to NMED."*

In response, NASA proposed to establish the integrity and the fitness-for-service of the ETU steel tanks by an external in-service inspection performed by an authorized API inspector. NASA's proposal consisted of:

- An external tank inspection per applicable API 653 guidance.
- An evaluation of the impressed current cathodic protection system by a corrosion expert as defined by 40 CFR 260.10 or API equivalent.
- An evaluation of the annular ring (the outer 18- to 20-inch perimeter of the tank bottom) by long range ultrasonic or equivalent method to detect defects such as corrosion cells in the annular ring.
- A review of the results of the external inspection, inspection test data and historical tank information by qualified personnel. Qualified personnel will provide statements with respect to:
    - The current condition of the tanks and whether or not the tanks are recommended for continued service.
    - The design and operation of the impressed current cathodic protection system.
    - If the tanks are fit for continued service, qualified personnel shall provide a risk-based inspection interval derived from applicable guidance as provided by API 653 or equivalent industry standard.
- As requested by NMED, photographs of the soil side of the tank bottoms were taken.

In June 2005, NASA procured the services of Tank Consultants, Inc. (TCI) to perform an in-service condition assessment of the two ETU tanks. The results of the TCI inspection established that the ETU tanks are fit for continued service. A summary of the TCI report is as follows:

- Per sections I and II of the TCI report, no significant discrepancies with respect to API 653 external inspection criteria were observed.

- Per section III of the TCI report, the impressed current cathodic protection system installed in 1998 was sufficiently designed to provide long term (25 plus years) effective soil side corrosion protection.

- Although the sacrificial anode system installed in 1988 did not provide complete soil side corrosion protection, the structural integrity of the tanks was believed to be not compromised during the period from 1988 to 1998.

- The annual cathodic protection surveys show that the test tank-to-soil cathodic protection potentials meet all industry standards for effective corrosion protection.

- Per section IV of the TCI report, the long range ultrasonic testing of the tank annular ring indicated that the overall condition of the tank floors were found to be in sound condition with no signs of detected corrosion. No indication associated with pitting corrosion or wall thinning was found.

- Per section V of the TCI report, the risk based inspection evaluation states as follows,

  "The double liner leak detection system in these tanks makes the likelihood of failure from internal damage mechanisms very low. The main concern for these tanks is soil side corrosion of the tank floors. The improvements to the cathodic protection system made in 1998 should have significantly reduced the potential for damage (emphasis added)."

To supplement the 2005 in-service condition assessment, the following inspections will be performed:

- The ETU primary and secondary XR-5 liners will be visually inspected by a qualified installation contractor according to the manufactures recommendations during closure activities. All seams and the general condition of the liner material will be evaluated. The qualified installation contractor will provide a written statement attesting to results of the inspection and the condition of the liners.

- Visual inspection of the interior of the ETU steel tanks. The seams and general condition of the interior of the tank will be inspected by a qualified weld inspector or tank inspector. The qualified inspector will provide a written statement attesting to the results of the inspection and the condition of the steel tank. If a hole, crack or gap or stained area indicating significant corrosion is present, NASA will extend soil sample borings at the failure location(s).

- Visual inspection of the ETU tank bottom's soil-side surface for the sample locations as identified per section 7.0. If the steel tanks are reused, a square section of the ETU tank bottom will be cut out as required support soil sampling. These pieces will be visually inspected for evidence of excessive corrosion or other potential failures. Otherwise, the complete soil side of the tank bottom will be inspected during removal. The inspection will be documented with photographs and drawings as necessary.

- Visual inspection of all HWDL removed from the tank system. During removal, the pipe and connections, and fittings (primary piping for above ground sections and secondary containment piping for underground sections) will be inspected for evidence of leaks. The inspection will be documented with photographs and drawings as necessary.

- Visual inspection of the HWDL scheduled for possible reuse at all sample locations as identified per section 7.0. During soil sampling, fittings and connections will be visually inspected for evidence of leaks. The inspection will be documented with photographs and drawings as necessary.

- Visual inspection of the sump. The sump will be internally and externally inspected for evidence of leaks. The inspection will be documented with photographs, video and drawings as necessary.

- Visual inspection of the unloading pad. If a hole, crack or gap or other evidence of failure is identified, NASA will further investigate by sampling the soil at the failure location(s). The inspection will be documented with photographs and drawings as necessary.

All operations per this section will be performed in accordance with WSI 09-SW-0002 “Process Control Utilizing Work Instructions and Work Authorizing Documents” and WSI 09-SW-0001, “Test Preparation Sheet (TPS)”.

5.0 ETU Waste

5.1 Maximum Waste Inventory

The ETU waste treatment process is volume reduction or the concentration of aqueous wastes by evaporation. Historically, the unit received aggregated or comingled aqueous wastes that, at the point of generation, existed as pure compounds, and aqueous mixtures of aerospace propellants, solvents, chemicals or metal solutions. During the life of the unit, about 275,000 gallons of waste were treated per year (based on an annual evaporation rate of 60 in. per year). During the period from 1988 through 2012, approximately 6,600,000 gallons of waste was treated at the unit. Under extreme circumstances, the maximum waste inventory in the tanks would be 300,800 gallons [40 CFR 264.112(b)(3)].

5.2 Waste Description – Hazardous Waste (Waste Codes) and Hazardous Constituents

The ETU received aggregated or comingled wastes that, at the point of generation, existed as pure compounds, and aqueous mixtures of aerospace propellants, solvents, chemicals or heavy metals. All waste streams discharged to the ETU were documented per WSTF Individual Waste Profile Sheets (WIWPS).

Throughout operation, all waste streams discharged to the ETU were documented per appropriate WIWPS. The WIWPS were reviewed or updated annually to document changes in the management, quantity or composition. WSTF has performed a records review and updated the current and historic profiles for waste discharged to the ETU over its operating history. Through this process, as documented by the “ETU Phase Out Waste Characterization and Disposal Plan,” a comprehensive list of hazardous waste (waste codes) and hazardous constituents for the ETU was established.

During the over 20 year operation of the ETU, hundreds of individual waste streams were discharged to the ETU. With a few exceptions, the waste streams can be segregated into the following general categories:

- Alcohol (primarily isopropyl alcohol) – D001 High TOC Ignitable Liquids.
- DOT Oxidizers (primarily laboratory quantities of oxidizers such as hydrogen peroxide) – D001.
- Corrosive Waste (acidic and basic or caustic waste) – D002.
- Reactive Waste (laboratory quantities from a few one-time disposal events) – D003.

- Inorganic and Organic Metal Bearing Waste – D004 through D011.
- Organic Toxic Characteristic Waste Water (waste water generated from process using petroleum derived products) – D018, D035.
- F001/F002 Waste Water (primarily IDW containing low ppm concentrations of F001/F002 constituents).
- F003 Spent Solvents (methanol and acetone used in Clean Room and laboratory rinsing or drying operations).
- Fuel Propellant Waste (typically waste water containing less than 330 ppm and liter quantities or less of neat fuel) – P068, U098, U099, U133.
- Oxidizer Waste Water (wastewater generated from ADGAS treatment of oxidizer propellant waste) – P078.
- Non-Hazardous Waste Water (non-RCRA-regulated wastewater).

Numerous hazardous waste streams, each with specific treatment standards, were discharged to the ETU. An exemption to the LDR regulations is provided under 40 CFR 268.1(c) and 40 CFR Part 148.1. Deep well injection facilities with a "no-migration" petition are exempt from the land disposal prohibitions. Under 40 CFR 268.1(c) and 40 CFR Part 148.1, the owner/operator of a deep well injection facility can petition the administrator for an exemption to the land disposal prohibitions if the owner/operator can demonstrate that there will be no migration of hazardous constituents from the disposal unit or injection zone for as long as the waste remains hazardous. In accordance with the regulations, the ETU liquid waste will be shipped off-site to a Class 1 Hazardous deep well injection facility for disposal.

5.3 ETU Waste Treatment Residue

The ETU waste consists of two phases, an upper or light phase and a bottom or dense phase. Typically, the regulations require that multiple phases be characterized separately. As a result, characterization of the ETU bottom or dense phase is required. The following provides the general information with respect to the regulatory status of the ETU bottom phase.

The ETU treatment process is volume reduction by evaporation. The bottom or dense phase is essentially an accumulation of sand and soil during treatment. As stated in NASA's NOD Response to NMED on May 6, 2004, comment # 31:

"…It has been observed that the dense phase in the evaporation tanks is primarily made up of sand and soil deposited in the tanks from high winds…"

The bottom or dense phase is essentially an accumulation of sand and soil during treatment. During the treatment process windborne particulate (sand and soil) accumulated in the tanks. The windborne sand and soil are residues from treatment. Under RCRA, residues from treatment are a "newly generated waste." The "point-of-generation" is where treatment residue is removed from the treatment process.

The waste discharged to the ETU consisted of listed hazardous waste, characteristic hazardous waste and solid waste (non-RCRA-regulated). From the "derived-from" rule, treatment residues from listed hazardous wastes (non-ICR) remain listed hazardous wastes. The ETU listed hazardous waste codes (non-ICR) are carried through to the treatment residue (windborne sand and soil), unless a "no longer contained" determination is obtained.

For characteristic hazardous waste, the "derived-from" rule states that, if the treatment residue exhibits any characteristic it remains hazardous waste. The specific characteristic waste codes are applicable only if the ETU treatment residue exhibits the specific characteristic of a hazardous waste. If the treatment residue does not exhibit any characteristics, the characteristic waste codes are not applicable.

The LDR status of the treatment residue can be assumed to be similar to that of contaminated soil. Interpretative guidance is provided by correspondence from the EPA Acting Director, Office of Solid Waste dated August 21, 1998. The 1st page, 3rd paragraph states:

"…Note that if contaminated soil from manufacturing gas plant sites does not exhibit a characteristic of a hazardous waste or contain listed hazardous waste when first generated (i.e., when first removed from the land), then the soil is not subject to any RCRA requirements, including the land disposal restrictions…."

Based on the above guidance, if at the "point-of-generation", the ETU treatment residue no longer contains any listed waste and does not exhibit any characteristics of a hazardous waste, the treatment residue (windborne sand and soil) would not be subject to LDR treatment standards.

NASA will ship the waste off site to a RCRA subtitle C or D landfill. If a "no longer contained-in" determination is not approved or the waste exhibits a characteristic, the treatment residue would be managed as an "as-generated" waste with the point of generation being when the residue is removed from the tanks. NASA will subsequently manage the waste in accordance with 40 CFR 262.34 and the waste will be treated to meet the 40 CFR Part 268 Subpart D Treatment Standards prior to land disposal.

6.0 Closure Procedures for the ETU Tank System

In accordance with 40 CFR 264.112 (e), the option to initiate ETU waste removal and ETU ancillary equipment removal or decontamination activities prior to notification of closure per 40 CFR 264.112 (d)(1) may be exercised with an approved closure plan.

40 CFR 264.112 (e) states:

> *"Nothing in this section shall preclude the owner or operation from removing hazardous wastes and decontaminating or dismantling equipment in accordance with the approved partial or final closure plan at any time before or after notification of partial or final closure."*

Many of the inspection items per subsection 4.4, "Structural Assessment and Visual Inspections" will be addressed during the performance of operations per this section. The removal of systems and equipment known to have not come in contact with hazardous waste are not addressed per this closure plan. The ETU support systems and equipment such as the nitrogen supply system, facility water supply, breathing air supply, alarm system/system wiring, etc. may be removed at any time as long as operations of the ETU and ETU closure are not compromised [264.112 (b)(3)].

The general ETU waste removal and the removal or decontamination of ancillary equipment activities are listed below and provide a general sequence of events.

- ETU sludge removal, dewatering, characterization and disposal.
- Decontamination and/or removal of 800 Area and Bldg 803 above ground HWDL.
- Decontamination and/or removal of 200 Area Photo Lab/Chemistry Lab (Wet Lab) aboveground HWDL.

- Decontamination and/or removal of 200 Area Metallurgy Lab/Environmental Lab aboveground HWDL.
- Decontamination and/or removal of 200 Area Chemistry Lab (Oxidizer Lab, Fuel Lab, Propellant Vapor Lab) aboveground HWDL.
- Decontamination and/or removal of the Clean Room Lift Station and associated above ground HWDL.
- Decontamination and/or removal of the 200 Area underground HWDL.
- Decontamination and/or removal of the HWDL Primary Sump.
- Removal of the ETU Evaporation Tank section of the HWDL.
- ETU waste removal and disposal.
- ETU evaporation tank primary liner cleaning and primary/secondary liner removal.
- ETU steel tank decontamination.
- Unloading pad and steel support structures decontamination and removal.

As site conditions dictate, the sequence of events (or activities) per this section may be changed without an amendment to the closure plan as long as the sequence changes do not jeopardize clean closure of the unit. In the event that decontamination is not successful based on the analysis of the third rinse, NASA will repeat the decontamination steps necessary to achieve the applicable decontamination limit.

6.1 ETU Treatment Residue Phase Separation, Characterization and Disposal

The ETU waste consists of two phases, an upper or light phase and a bottom or dense phase as described in section 5.0. The ETU waste will require filtering or phase separation to separate the solid phase (sand and soil) from the liquid waste. The filtering or phase separation process can be performed either on-site or at the deep well injection facility. Deep well injection is applicable to liquid waste. With an approved closure plan, NASA may exercise either option at any time during ETU closure.

The phase separation process is a pretreatment process that is required by the off-site disposal facility to support disposal by deep well injection. This section outlines the procedures for the on-site phase separation. The removal of liquid waste and the option to remove the liquid and solid material without phase separation is discussed in section 6.1.1.

The ETU treatment residue or bottom phase consists of windborne sand and silt. Prior to and during the process, the waste will be continuously agitated or mixed with centrifugal pumps to create a mixture or slurry of suspended solids. The bottoms of the both ETU tanks slope downward towards the work platform. The circulation pumps will discharge at the high end of the tanks and be adjusted to push the solid material towards the low point of the tanks. The slurry of suspended solids will be pumped to a phase separation unit (a vacuum filtration unit, a hydrocyclone/vibratory screen unit or equivalent) where the solid material will be separated from the liquid waste. The filtered liquid will be either recirculated back to the tank or transferred directly to the other evaporation tank. The liquid waste may be transferred back and forth between the two tanks as required to facilitate solids removal. The solid material will be stored in containers in accordance with 40 CFR 262.34(a)(i) or NMAC Title 20, Chapter 9 prior to off-site disposal.

Under RCRA, residues from treatment are a “newly generated waste.” The point of generation is where treatment residue is removed from the treatment process. The waste characterization will be based on sampling and analysis of either the filtered ETU solid material removed from the tank or from sampling and analysis of the ETU bottom phase prior to phase separation. From the “derived-from” rule, treatment residues from listed hazardous wastes (non-ICR) remain listed hazardous wastes. The ETU listed hazardous waste codes (non-ICR) are carried through to the treatment residue (windborne sand and soil), unless a “no longer contained-in” determination is obtained. For characteristic hazardous waste, the “derived-from” rule states that, if the treatment residue exhibits any characteristic it remains hazardous waste. The specific characteristic waste codes are applicable only if the ETU treatment residue exhibits the characteristic of a hazardous waste.

The ETU treatment residue (media) or bottom phase will be sampled and analyzed. Based on the successful demonstration of a “no longer contained-in” determination as provided in section 7.4 of the Sampling and Analysis Plan of this closure plan, the media will be shipped off site for disposal at a RCRA Subtitle D landfill. In the advent that a “no longer contained-in” determination is not attainable, NASA will manage the media in accordance with 40 CFR Part 261, incorporating 40 CFR part 262.34 and dispose of the media in accordance with 40 CFR Part 268.

All operations per this section will be performed in accordance with WSI 09-SW-0002 “Process Control Utilizing Work Instructions and Work Authorizing Documents” and WSI 09-SW-0001, “Test Preparation Sheet (TPS).”

6.1.1 ETU Waste Removal

The ETU waste removal process involves the handling of large quantities of wastewater and rinsewater used in the transfer operation. Per the regulations the waste may be removed at anytime with an approved closure plan. As site conditions dictate, NASA may transfer all the ETU waste to one tank and inactivate the empty tank, and decontaminate the liner per section 6.4 in preparation for inspection as described in section 4.4. This section outlines the procedures for removal of the waste from the ETU tanks.

Prior to and during the first stages of the transfer or waste removal operation centrifugal pumps will be used to circulate or mix the waste to facilitate the removal of solid material (sand and silt) in the tanks. Pumps or the off-site vendor’s tank trailer vacuum system will be used to transfer the waste to the other evaporation tank or to the tank trailer. The bottoms of the both ETU tanks slope downward towards the work platform. The circulation pumps will discharge at the high end of the tanks and adjusted to push the solid material towards the low point of the tanks. To support solids removal, a fire hose(s) may be required to push the solid material to the low end of the tank.

The general procedures for ETU waste removal with phase separation and ETU waste removal without phase separation are basically the same. The only difference is that during waste removal without phase separation more water from fire hose(s) will be required to push the solid material to the low end of the tanks, and more residual solid material will remain in the tanks after liquid ETU waste is removed. The residual solid material will have to be physically moved by personnel inside the tanks with shovels and buckets.

All operations per this section will be performed in accordance with WSI 09-SW-0002 “Process Control Utilizing Work Instructions and Work Authorizing Documents” and WSI 09-SW-0001, “Test Preparation Sheet (TPS).”

6.2 HWDL Decontamination

Following the general sequence of events described in section 6.0, decontamination of the HWDL follows the removal of the ETU tank sludge. All HWDL primary pipes will be decontaminated using the following procedures:

- Pressure washed with hot water and detergent (Alconox or equivalent).
- Cleaned or scrubbed with pull through “pipe pigs” (rotary brush or other mechanical-type cleaning equipment).
- Pressure rinsed with water.
- Sampled and analyzed to verify the decontamination process is complete in accordance with section 6.2.1 of this closure plan.

The pressure washing system consists of a pressure washer, high pressure hose, and high pressure rotary jet nozzles specifically designed for pipe and drain cleaning applications. The pressure washer nozzle (rotary jet nozzle) will be inserted into the primary HWDL and run the entire length of the piping. Due to the nozzle design, the entire inner surface of the pipe will be rinsed with high pressure water.

Complete sections or runs of the HWDL starting with the upstream branches of the HWDL will be pressure washed. The rinsate will be discharged to the downstream HWDL to the ETU. All work areas with the potential for contamination due to spills during the decontamination process will either be on concrete or covered with polyethylene sheeting (6 mil minimum). Smaller sections or branches (fittings or connections) of HWDL pipe may be either pressured washed in place or removed and pressure washed at the ETU unloading pad. All rinsate will be collected, managed and disposed of as hazardous waste. During the decontamination process, the work areas located at the ends of the pipe sections will either be located on concrete or over polyethylene sheeting (6 mil minimum). Appropriate containers will be provided at both ends of the pipe as required to collect residual liquids.

The primary containment pipe will be pressure washed as described above. During the initial installation of the HWDL, water was used to performance test and integrity test the HWDL secondary containment piping. No releases from the HWDL primary piping to the secondary containment piping have occurred. Any residual liquid will be collected, managed and disposed of as non-hazardous waste. In the event evidence (free liquids, staining, corrosion, etc.) of a release from the primary containment line is encountered during disassembly, the secondary containment portion of the HWDL will be decontaminated using the steps provided above. The rinsate will be sampled and analyzed to meet applicable decontamination verification levels. Rinsing of the secondary containment pipe and sampling and analysis are not required. The pipe will be cut into sections as required to support transportation and disposal. During the removal process the work areas located at the ends of the pipe sections shall either be located on concrete or over polyethylene sheeting (6 mil minimum). Appropriate containers will be provided at both ends of the pipe as required to collect residual liquids.

All operations per this section will be performed in accordance with WSI 09-SW-0002. “Process Control Utilizing Work Instructions and Work Authorizing Documents” and WSI 09-SW-0001, “Test Preparation Sheet (TPS).”

6.2.1 HWDL Decontamination Verification

The HWDL decontamination will be successful when the criterion established in section 7.5.1 of the Sampling and Analysis Plan of this closure plan are met. In the advent that a “no longer contained-in” demonstration is unattainable, NASA will manage the primary containment piping in accordance with 40 CFR Part 261, incorporating 40 CFR Part 262.34, and will dispose of the primary containment piping in accordance with 40 CFR Part 268.

6.3 HWDL Primary Sump Decontamination

The waste in the HWDL primary sump will be removed from the sump with a vacuum trailer or pumped into containers with a diaphragm pump and transported and managed in accordance with 40 CFR Part 262.34. The primary sump will then be decontaminated using the following procedure:

- Pressure washed with hot water and detergent (Alconox or equivalent).
- Subsequent to the removal of the residual cleaning solution, the tanks will receive a final rinse (3rd rinse) and this rinsate will be removed from the sump.
- A sample from the 3rd rinse will be sampled and analyzed to verify the decontamination process is complete in accordance with section 6.3.1 of this closure plan.

All rinsate meeting the description of a listed hazardous waste or that exhibits the characteristic of a hazardous waste will be managed in accordance with 40 CFR 262.34. All work areas with the potential for contamination due to spills during the decontamination process will be covered with polyethylene sheeting (6 mil minimum) prior to commencement of decontamination activities.

To facilitate soil sampling beneath the secondary containment sump, the primary sump will be removed subsequent to the decontamination verification per section 6.3.1 and a successful “no longer contained-in” demonstration per section 7.5.2.

Based on historical records maintained as part of the operating record, a discharge to the secondary containment sump has never occurred. Pending completion of soil sampling beneath secondary containment sump and analytical confirmation that a release to the environment has not occurred, any damage incurred to the secondary containment sump will be repaired. The sump will be considered cleaned closed, left in place, and potentially used in the future for non-hazardous waste management activities.

All operations per this section will be performed in accordance with WSI 09-SW-0002 “Process Control Utilizing Work Instructions and Work Authorizing Documents” and WSI 09-SW-0001, “Test Preparation Sheet (TPS).”

6.3.1 HWDL Primary Sump Decontamination Verification

The HWDL Primary Sump decontamination will be successful when the criterion established in section 7.5.2 of the Sampling and Analysis Plan of this closure plan are met. In the event that a “no longer contained-in” demonstration is unattainable, NASA will manage the primary containment piping in accordance with 40 CFR Part 261, incorporating 40 CFR Part 262.34 and will dispose of the primary containment piping in accordance with 40 CFR Part 268.

6.4 ETU Primary Liner Final Cleaning

After all ETU waste liquids and residue have been removed, the liners will be decontaminated using the following procedure:

- Rinsed with a fire hose and the rinsate will be removed.
- The primary liner will then be cleaned with detergent (Alconox or equivalent), scrubbed with soft bristle brooms, rinsed with water, and the rinsate will be removed.

- Subsequent to the removal of the residual cleaning solution, the liners will receive a final rinse (3rd rinse) and this rinsate will be removed from the tanks.

All rinsate will be managed as a hazardous waste in accordance with 40 CFR Part 262.34. Subsequent to the final rinse, in accordance with section 4.4, the liners will be inspected.

6.4.1 ETU Primary Liner Management

Pending completion of the liner final cleaning, liner inspection as performed in accordance with section 4.4 of this closure plan, and sampling and analysis of the liners as performed per section 7.6, the liners will be disposed as a non-hazardous, solid waste. According to 40 CFR Subpart J, 264.197(a), tank system closure and post closure, contaminated containment system components such as liners must be removed or decontaminated and managed as a hazardous waste unless 40 CFR Part 261.3(d) applies.

Samples from each of the primary liners will be collected to create composite samples for each liner. Based on historical records, there have been no releases (leaks) from the primary liner to secondary liner since 1998. The sampling and analysis performed for the primarily liner is representative (worst case scenario) for the felt liner and the secondary containment liner. A successful "no longer contained-in" demonstration will meet the criteria specified in section 7.5 of the Sampling and Analysis Plan of this closure plan.

In the event that 40 CFR Part 261.3(d), does not apply, NASA will manage the liners in accordance with 40 CFR Part 261, incorporating 40 CFR part 262.34 and disposed of the waste in accordance with 40 CFR Part 268.

6.5 ETU Unloading Pad Decontamination

The interior of the ETU unloading pad will be decontaminated by being pressure washed three times with water either prior to or after the inspection per section 4.4. NASA will use analysis of final (3rd) rinse water as decontamination verification per section 7.4.3 of the Sampling and Analysis Plan of this closure plan.

All washwater, rinsate, PPE and other spent materials will be collected, managed as a hazardous waste in accordance with 40 CFR Part 261, incorporating 40 CFR part 262.34 and disposed of the waste in accordance with 40 CFR Part 268.

6.6 ETU Steel Support Structures Management

The steel work platform and other metal support structures are materials that do not facilitate the transfer or storage of hazardous waste in the ETU Tank System. As a best management practice, NASA will thoroughly rinse all support structures, and the rinsate will be collected and managed as a non-hazardous solid waste.

6.7 ETU Steel Tank Decontamination or Removal

Based on historical records, there have been no apparent releases (leaks) from the secondary liners to the steel tanks. Pending the inspection of the liners performed per section 4.4, if is determined that the secondary liner was compromised, a release could have occurred, and if the tanks are left in place, NASA will decontaminate the ETU steel tanks.

To decontaminate the tanks, the interior of ETU steel tanks will be pressure washed with detergent (Alconox or equivalent), scrubbed with soft bristle brooms and pressure rinsed three times with water either prior to or after the inspection per section 4.4. NASA will use analysis of final (3rd) rinsewater from the tanks as decontamination verification. Successful decontamination will meet the same criteria as used for the HWDL Decontamination Verification (section 7.5.1).

If NASA opts to manage the steel tanks as scrap metal, no decontamination or verification sampling and analysis is required. The steel tanks will be cut into sections as required to support handling, transportation and management as scrap metal.

All operations per this section will be performed in accordance with WSI 09-SW-0002 "Process Control Utilizing Work Instructions and Work Authorizing Documents" and WSI 09-SW-0001, "Test Preparation Sheet (TPS)."

7.0 Sampling and Analysis Plan

This SAP describes the procedures and criteria that will be used to collect and analyze samples during clean closure of the Evaporation Treatment Unit (ETU). The ETU tank system consists of two 147,000 gallon capacity open-top tanks and associated ancillary equipment (HWDL and HWDL sump), Closure activities include:

- A review of the ETU Operating Record.
- ETU waste removal and decontamination or removal of ancillary equipment.
- A structural assessment and visual inspections of the ETU evaporation tanks to verify the integrity of the tanks system.
- Soil sampling to demonstrate that a release to the environment from the tank system has not occurred.

All operations per this sampling and analysis plan will be performed in accordance with WSI 09-SW-0002, "Process Control Utilizing Work Instructions and Work Authorizing Documents" and WSI 09-SW-0001, "Test Preparation Sheet (TPS)." Per Permit section VI.E.2, all records will be maintained in the Facility Operating Record.

7.1 Objective

The objective of the SAP is to address specific closure sampling and analysis requirements associated with the ETU closure, and describe the sampling, analysis, and quality assurance/quality control (QA/QC) methods that will be used to demonstrate clean closure. The analytical results will be used to demonstrate that decontamination activities meet closure performance standards and that no releases from the ETU to the environment have occurred.

7.2 Sample Collection Procedures

Sampling procedures and equipment will be in accordance with the NASA/WSTF Hazardous Waste Operating Permit, Attachment 12, section 6.5.2. Sampling procedures and equipment will be selected in accordance with 40 CFR 261, Appendix I, Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods EPA (SW-846), the RCRA Waste Sampling Draft Technical Guidance EPA 530-D-02-002, the Standard Guide for Selection of Sampling Equipment for Waste and Contaminated Media Data Collection Activities (ASTM 6232).

7.3 Personal Protective Equipment

At a minimum, samplers will don face shield, goggles, chemical resistant gloves (nytex or butyl rubber), and safety-toed boots. In accordance with 29 CFR 1910.132 Subpart I, NASA WSTF JHA# EN-007, “Sampling Operations (Air, Noise, etc.),” and NASA WSTF JHA# HW-024, “Evaporation Tank Unit Sampling” shall be provided as a reference for the proper safety procedures for sampling.

7.4 ETU Treatment Residue (Sand/Soil) “No Longer Contained-In” Demonstration

Upon completion of the phase separation, the filter media (sand and soil) will not contain free liquids (SW-846 9095B). The media, a solid matrix, will be analyzed for total constituents as opposed to EPA Method 1311 (total characteristic leaching procedure; TCLP), using SW-846 Method 8260C for volatiles, SW-846 Method 8270D for semi-volatiles, hydrazines by HPLC (NASA/WSTF), and SW-846 Method 6010B/7470A for RCRA metals. EPA Method 1311, section 1.2 of the TCLP does allow for a total constituent analysis in lieu of the TCLP extraction. If a waste is 100% solid, as defined by the TCLP method, then the results of the total constituent analysis may be divided by twenty to convert the total results into the maximum leachable concentration. A successful demonstration of a “no longer contained-in” will meet the following criteria:

- This determination addresses characteristic hazardous waste and underlying hazardous constituents, which are known to have been managed in the ETU The determination will be based on no detections of the hazardous constituents above the 40 CFR Part 268.40 or 268.48 regulatory limits. Therefore, the media when discarded as a solid waste does not exhibit the characteristic of a hazardous waste per 40 CFR Part 261 Subpart C, does not contain underlying hazardous constituents as defined §268.2(i)), in excess of 40 CFR Part 268.48 regulatory limits.
- For listed waste codes P078 and U134, the wastes meet the 40 CFR Part 268.40 Technology Based Standards (ADGAS and NEUTR, respectively).With respect to listed hazardous waste managed in the ETU that have a treatment based technology standard (P068, U098, U099, U133), the determination that the media “no-longer contained-in” listed hazardous waste (P068, U098, U099, and U133) will be based on no detections of the hazardous constituents above the laboratories reporting limits. Therefore, the media when discarded as a solid waste does not contain hazardous waste and does not meet the listing description of a listed hazardous waste per 40 CFR Part 261 Subpart D.
- The determination that the media “no longer contained-in” F001, F002, F003, F007, and P082 listed hazardous waste will be based on no detections of the hazardous constituents above the 40 CFR Part 268.40 concentration based treatment standards. With respect to F001, F002, F003, and F007 listed hazardous waste, the determination will be based on no detections of constituents of concern above the 40 CFR Part 268.40 concentration based treatment standard. For P082 (N-Nitrosodimethylamine), the determination that the media no longer contains hazardous waste will be based on no detections of the hazardous constituent above the above the 40 CFR Part 268.40 concentration based treatment standard. Therefore, the media when discarded as a solid waste does not contain hazardous waste and does not meet the listing description of a listed hazardous waste per 40 CFR Part 261 Subpart D.

7.5 Decontamination Verification Sampling

The sampling and analysis plan shall describe the verification sampling process to ensure that all equipment and structures scheduled for decontamination are successfully decontaminated. The equipment and structures scheduled for decontamination are the ETU tank liners, HWDL, HWDL sump, ETU unloading pad, and ETU unloading pad sump. The following sections provide the decontamination criteria for the respective equipment and structures.

All operations per this section will be performed in accordance with WSI 09-SW-0002 “Process Control Utilizing Work Instructions and Work Authorizing Documents” and WSI 09-SW-0001, “Test Preparation Sheet (TPS).” The procedures for Decontamination Verification Sampling and Analysis are provided in Attachment 23.

7.5.1 HWDL Decontamination Verification

All primary HWDL sections that are scheduled for decontamination include the 200 Area HWDL, 800 Area HWDL and 803 HWDL. NASA will use analysis of final (3rd) rinsewater from the HWDL primary containment piping as the decontamination verification. Samples of the rinsate will be analyzed for total constituents using SW-846 Method 8260C for volatiles, SW-846 Method 8270D for semi-volatiles, hydrazines by HPLC (NASA/WSTF), and SW-846 Method 6010B/7470A for RCRA metals. A successful demonstration of a “no longer contained-in” will meet the following criteria:

- This determination addresses characteristic hazardous waste and underlying hazardous constituents, which are known to have been managed in the ETU Tank System. The determination will be based on no detections of the hazardous constituents above the 40 CFR Part 268.40 or 268.48 regulatory limits in the final (3rd) rinse water. Therefore, the primary containment piping after decontamination does not exhibit the characteristic of a hazardous waste per 40 CFR Part 261 Subpart C, does not contain underlying hazardous constituents as defined by §268.2(i), in excess of 40 CFR Part 268.48 regulatory limits.
- For listed waste codes P078 and U134, the wastes meet the 40 CFR Part 268.40 Technology Based Standards (ADGAS and NEUTR, respectively).With respect to listed hazardous waste managed in the ETU Tank System that have a treatment based technology standard (P068, U098, U099, U133), the determination that the primary containment piping “no longer contained-in” listed hazardous waste (P068, U098, U099, and U133) will be based on no detections in the final (3rd) rinse water above the laboratories reporting limits. Therefore, after successful decontamination the primary containment piping does not contain hazardous waste and does not meet the listing description of a listed hazardous waste per 40 CFR Part 261 Subpart D.
- The determination that the primary containment piping “no longer contained-in” F001, F002, F003, F007, and P082 listed hazardous waste will be based on no detections of the hazardous constituents above the 40 CFR Part 268.40 concentration based treatment standards. With respect to F001, F002, F003, and F007 listed hazardous waste, the determination will be based on no detections of constituents of concern above the 40 CFR Part 268.40 concentration based treatment standard in final (3rd) rinse water. For P082 (N-Nitrosodimethylamine), the determination that the primary containment piping “no longer contained-in” listed hazardous waste will be based on no detections in the final (3rd) rinse water above the laboratories reporting limits. Therefore, after successful decontamination the primary containment piping does not contain hazardous waste and does not meet the listing description of a listed hazardous waste per 40 CFR Part 261 Subpart D.

The sample parameters, analytical methods, preservation methods and holding times are provided in section 7.12 of this Sampling and Analysis Plan.

In the event that a “no longer contained-in” demonstration is unattainable, NASA will manage the primary sump in accordance with 40 CFR Part 261, incorporating 40 CFR Part 262.34 and dispose of the primary sump in accordance with 40 CFR Part 268.

7.5.2 HWDL Primary Sump Decontamination Verification

NASA will use analysis of final (3rd) rinse water from the HWDL primary sump as the decontamination verification. Samples of the rinsate will be analyzed for total constituents using SW-846 Method 8260C for volatiles, SW-846 Method 8270D for semi-volatiles, hydrazines by HPLC (NASA/WSTF), and SW-846 Method 6010B/7470A for RCRA metals. A successful “no longer contained-in” demonstration will meet the criteria outlined in section 7.5.1 of the Sampling and Analysis Plan of this closure plan.

In the event that a “no longer contained-in” demonstration is unattainable, NASA will manage the primary sump in accordance with 40 CFR Part 261, incorporating 40 CFR Part 262.34 and dispose of the primary sump in accordance with 40 CFR Part 268.

7.5.3 ETU Unloading Pad Decontamination Verification

NASA will use analysis of final (3rd) rinse water from the ETU Unloading Pad as the decontamination verification. Samples of the rinsate will be analyzed for total constituents using SW-846 Method 8260C for volatiles, SW-846 Method 8270D for semi-volatiles, hydrazines by HPLC (NASA/WSTF), and SW-846 Method 6010B/7470A for RCRA metals. A successful “no longer contained-in” demonstration will meet the criteria outlined in section 7.5.1 of the Sampling and Analysis Plan of this closure plan.

In the event that a “no longer contained-in” demonstration is unattainable, NASA will manage the ETU Unloading Pad in accordance with 40 CFR Part 261, incorporating 40 CFR Part 262.34 and dispose of the primary sump in accordance with 40 CFR Part 268.

7.5.4 ETU Unloading Pad Sump Decontamination Verification

NASA will use analysis of final (3rd) rinse water from the ETU Unloading Pad Sump as the decontamination verification. Samples of the rinsate will be analyzed for total constituents using SW-846 Method 8260C for volatiles, SW-846 Method 8270D for semi-volatiles, hydrazines by HPLC (NASA/WSTF), and SW-846 Method 6010B/7470A for RCRA metals. A successful “no longer contained-in” demonstration will meet the criteria outlined in section 7.5.1 of the Sampling and Analysis Plan of this closure plan.

In the event that a “no longer contained-in” demonstration is unattainable, NASA will manage the ETU Unloading Pad Sump in accordance with 40 CFR Part 261, incorporating 40 CFR Part 262.34 and dispose of the primary sump in accordance with 40 CFR Part 268.

7.6 ETU Primary Liner “No Longer Contained-In” Determination

The liners are a solid matrix and will be analyzed for total constituents as opposed to EPA Method 1311 (TCLP), using SW-846 Method 8260C for volatiles, SW-846 Method 8270D for semi-volatiles, hydrazines by HPLC (NASA/WSTF), and SW-846 Method 6010B/7470A for RCRA metals. EPA Method 1311, section 1.2 of the TCLP does allow for a total constituent analysis in lieu of the TCLP extraction. If a waste is 100% solid, as defined by the TCLP method, then the results of the total constituent analysis may be divided by twenty to convert the total results into the maximum leachable concentration. A successful “no longer contained-in” demonstration will meet the following criteria:

- This determination addresses characteristic hazardous waste and underlying hazardous constituents, which are known to have been managed in the ETU. The determination will be based on detections of the hazardous constituents that do not exceed the 40 CFR Part 268.40 or 268.48 regulatory limits. Therefore, the liners (primary, felt, and secondary) when discarded as a solid waste do not exhibit the characteristics of a hazardous waste per 40 CFR Part 261 Subpart C and do not contain underlying hazardous constituents as defined by §268.2(i), in excess of 40 CFR Part 268.48 regulatory limits.
- For listed waste codes P078 and U134, the wastes meet the 40 CFR Part 268.40 Technology Based Standards (ADGAS and NEUTR, respectively).With respect to listed hazardous waste managed in the ETU that has a treatment based technology standard (P068, U098, U099, U133), the determination that the liners "no longer contained-in" listed hazardous waste (P068, U098, U099, and U133) will be based on detections of the hazardous constituents that do not exceed the laboratories reporting limits. Therefore, the liners when discarded as a solid waste do not contain hazardous waste and do not meet the listing description of a listed hazardous waste per 40 CFR Part 261 Subpart D.
- The determination that the liners "no longer contained-in" F001, F002, F003, F007, and P082 listed hazardous waste, will be based on detections of the hazardous constituents that do not exceed the 40 CFR Part 268.40 concentration based treatment standards. With respect to F001, F002, F003, and F007 listed hazardous waste, the determination will be based on detections of constituents of concern that do not exceed the 40 CFR Part 268.40 concentration based treatment standard. For P082 (N-Nitrosodimethylamine), the determination that the media "no longer contained-in" hazardous waste will be based on detections of the hazardous constituent that do not exceed the 40 CFR Part 268.40 concentration based treatment standards. Therefore, the liners when discarded as a solid waste do not contain hazardous waste and do not meet the listing description of a listed hazardous waste per 40 CFR Part 261 Subpart D.

7.7 Soil Sampling

Based on historical records, there have been no apparent releases (leaks) from the ETU tank system to the environment. Soil sampling will be performed to confirm that a release to the environment from the ETU tank system has not occurred. The soil, as a solid matrix, will be analyzed for total constituents as opposed to EPA Method 1311 (TCLP), using SW-846 Method 8260C for volatiles, SW-846 Method 8270D for semi-volatiles, hydrazines by HPLC, and SW-846 Method 6010B/7470A for RCRA metals. EPA Method 1311, section 1.2 of the TCLP does allow for a total constituent analysis in lieu of the TCLP extraction. If a waste is 100% solid, as defined by the TCLP method, then the results of the total constituent analysis may be divided by twenty to convert the total results into the maximum leachable concentration. Successful demonstration/verification that the soil has not been contaminated will meet the following criteria:

- This determination addresses characteristic hazardous waste and underlying hazardous constituents, which are known to have been managed in the ETU tank system. The determination will be based on detections of the hazardous constituents that do not exceed the 40 CFR Part 268.40 or 268.48 regulatory limits. For RCRA metals, which are naturally occurring at WSTF, specifically arsenic and barium, the determination that soil has not come in contact with hazardous waste will be based on NMED Residential SSLs for total RCRA metals.
- P078 and U134 wastes managed in the ETU tanks system meet the 40 CFR Part 268.40 Technology Based Standards (ADGAS and NEUTR, respectively).With respect to listed hazardous waste managed in the ETU tanks system that have a treatment based technology standard (P068, U098, U099, and U133), the determination that the soil has not come in contact

with hazardous waste will be based on detections of the hazardous constituents that do not exceed the laboratories reporting limits.

- The determination that the soil has not come in contact with F001, F002, F003, F007, and P082 listed hazardous waste, will be based on detections of the hazardous constituents that do not exceed the 40 CFR Part 268.40 concentration based treatment standards. With respect to F001, F002, F003, and F007 listed hazardous waste, the determination will be based on detections of constituents of concern that do not exceed the 40 CFR Part 268.40 concentration based treatment standard. For P082 (N-Nitrosodimethylamine), the determination that the soil has not come in contact with hazardous waste will be based on detections of the hazardous constituent that do not exceed the 40 CFR Part 268.40 concentration based treatment standard.

If it is determined that the soil has come in contact with hazardous waste, NASA will manage the contaminated soil in accordance with 40 CFR part 264.197(b).

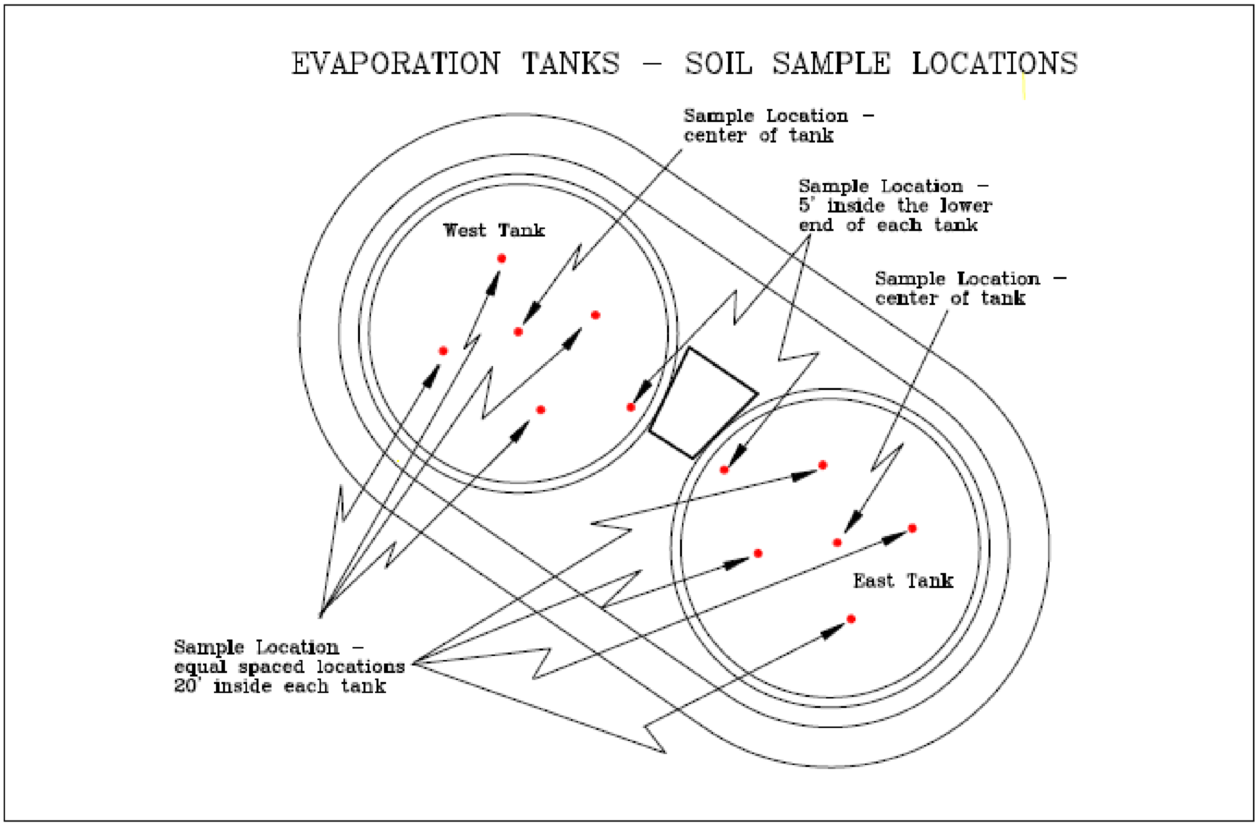
All operations per this section will be performed in accordance with WSI 09-SW-0002 "Process Control Utilizing Work Instructions and Work Authorizing Documents" and WSI 09-SW-0001, "Test Preparation Sheet (TPS)."

7.7.1 ETU Evaporation Tank Soil Sampling – Locations, Depths and Rationale for Selection

Both ETU tanks are constructed with an approximately 1% slope toward the work platform. Due to the slope of the tank bottoms, the liquid would gradually migrate to the lower end of the tanks. A release to the environment would have to pass through a failure in the primary liner, migrate downward, pass through a failure in the secondary liner, migrate downward, pass through a failure in the steel tank structure and remain undetected by the primary and secondary leak detection systems. The secondary liner and steel tank structure would have a higher probability of exposure to liquid waste at the lower areas of the tanks. The sample locations include: one at the center of the tanks, four equal spaced locations about 20 ft from the edge of the tanks, and one additional location at the lower end of the tanks (about 5 ft inside the tanks).

Soil samples will be collected and analyzed to demonstrate that a release from the ETU evaporation tanks did not occur. The evaporation tank soil sampling locations are presented in Figure 1 below.

Figure 1 ETU Soil Sampling Locations



Liquid has never been detected between the secondary liner and the steel tank structure. The secondary containment liner will be visually inspected by a qualified installation contractor during the condition assessment per section 4.4. The interior of the steel tank will also be visually inspected. If no evidence of failure is found in the interior of the steel tank, soil samples will be taken at approximately 1 ft and 2 ft depths at five equally spaced locations 20 ft inside each tank. Sample locations 5 ft inside the lower end of each tank will extend to a depth of at least 10 feet. In the event visible evidence of contamination or excess moisture is present at a depth of 10 feet, the boring depths will be extended 10 ft below the depth(s) of visible contamination or excess moisture and a sample will be taken. If a hole, crack or other evidence of failure is identified in the steel tank, NASA will advance the soil borings to a depth of 10 ft at the location of the failure. Soil samples will be collected using a sterile single use or decontaminated spade, scoop, auger, trowel, or other equipment as specified in the approved methods per section 7.2.

7.7.2 ETU HWDL Sump Soil Sampling – Locations, Depths and Rationale for Selection

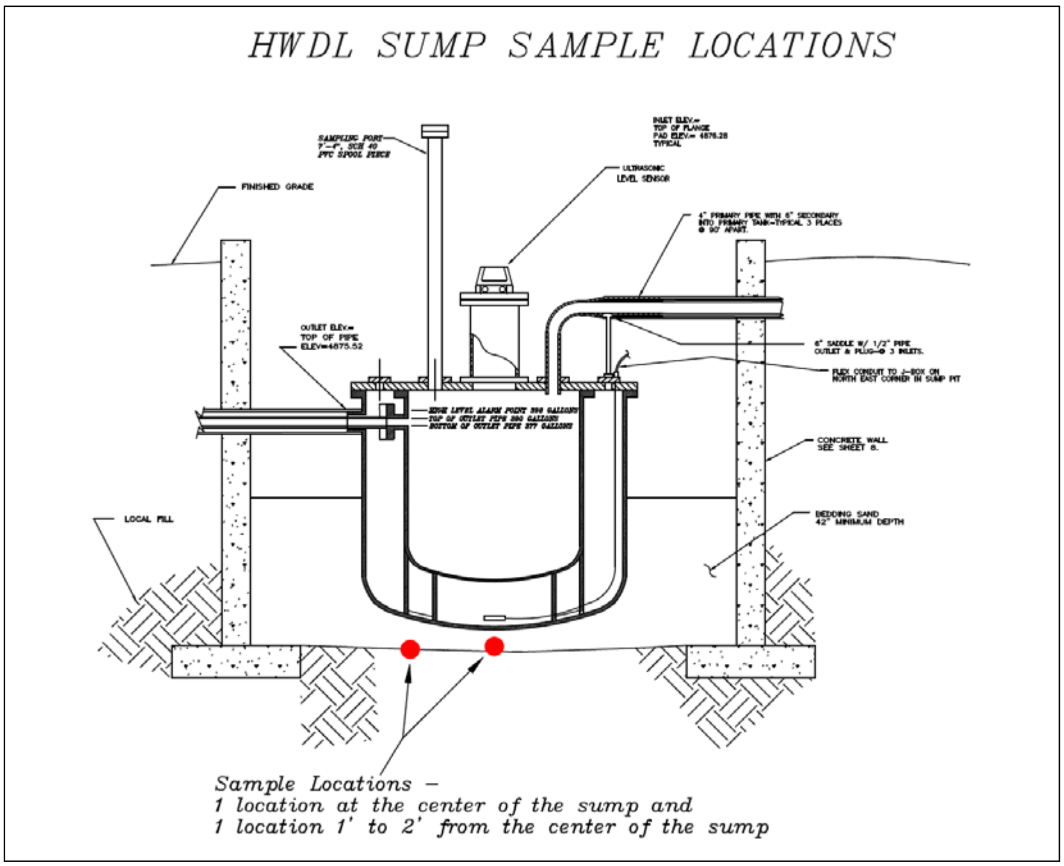
The sample locations include one at the center of the sump and one location 1 – 2 ft from the center of the sump. A release to the environment would pass through a failure in the primary tank, remain undetected by the leak detection system, and pass through a failure in the secondary containment. An alarm condition indicating a release from the primary sump tank to the sump secondary containment has never been observed. Since installation, no repairs to the primary or secondary sump tanks have been performed.

The HWDL sump was installed according to standard industry practice. Immediately under and around the sump secondary containment, the sump is bedded in sand. The sand bedding rests on local backfill material. The materials were assumed to be clean during the installation. The sump tanks have been operational over the life of the HWDL and have never been repaired. A release or leak from the sump secondary containment would still be still leaking and would easily be detected from samples from the first 2 ft beneath the sump, the bedding sand and local backfill.

A release from the primary containment to the secondary containment has never been detected. Upon removal, the HWDL sump will be visually inspected per section 4.4. Soil samples will be taken from the pipe bedding sand (0 – 6 in. below the secondary containment) and local backfill material (1 – 2 ft below the secondary containment). In the event that a release from the primary or secondary containment portion of the sump is observed, NASA will extend the boring depths to 10 feet below the depth(s) of the visible contamination or excess moisture. The samples will be collected using a sterile or decontaminated spade, scoop, auger, trowel, or other equipment as specified in the approved methods per section 7.2.

Soil samples will be collected and analyzed to demonstrate that a release from the ETU HWDL sump did not occur. The ETU HWDL sump soil sampling locations are presented in Figure 2 below.

Figure 2 ETU HWDL Sump Soil Sampling Locations



7.7.3 ETU HWDL Soil Sampling – Locations, Depths and Rationale for Selection

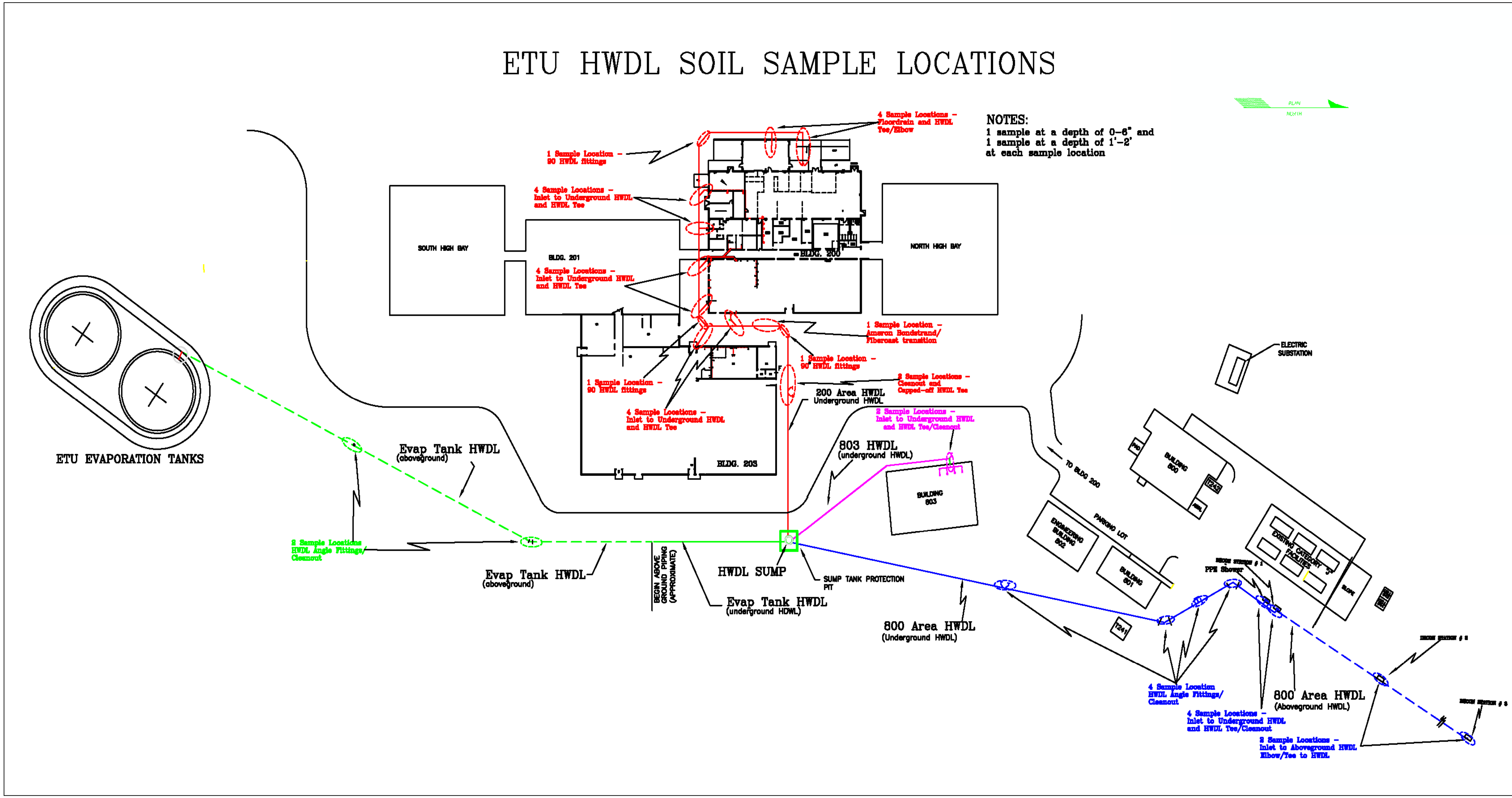
Soil samples will be collected and analyzed to demonstrate that a release from the ETU HWDL did not occur. The ETU HWDL soil sampling locations are presented in Figure 3. During the initial installation the HWDL primary piping was hydrostatically leak tested. The secondary containment was performance tested and leak tested with water. The underground HWDL is fabricated from fiberglass or plastic materials, therefore failures due to corrosion are not an issue. The primary mode of failure would be due to stresses in the piping system that would create cracks in the pipe system joints. Typically, the locations most susceptible to stress are connections such as tees, elbows, and cleanouts. These locations are also more difficult to install than straight sections of pipe. The sample locations are at each tee, elbow, and cleanout.

A release to the environment would pass through a failure in the primary containment pipe, remain undetected by the leak detection system, and pass through a failure in the secondary containment piping. The HWDL was installed according to standard industry practice. Immediately under and around the HWDL secondary containment, the pipe is bedded in sand. The sand bedding rests on local backfill material. The materials were assumed to be clean during the installation. The HWDL has been continuously operational and has never been repaired. A release or leak from the secondary containment would still be leaking and could easily be detected from samples from the first 2 ft beneath the pipe, the bedding sand and local backfill.

The HWDL was installed according to industry standards. Soil samples will be collected from at about 30 locations. Soil samples from above ground piping sections will be taken at approximately 1 ft and 2 ft depths. Underground sections of the HWDL are bedded in sand to a depth of 6 inches below the secondary containment piping. Soil samples will be taken from the pipe bedding sand (0 – 6 in. below the secondary containment) and local backfill material (1 – 2 ft below the secondary containment). In the event that a release from the primary or secondary containment portion of the HWDL is observed, NASA will extend the boring depths to 10 feet below the depth(s) of the visible contamination or excess moisture. The samples will be collected using a sterile or decontaminated spade, scoop, auger, trowel, or other equipment as specified in the approved methods per section 7.2. Direct push or powered auger equipment may be used as needed to advance to the target depth.

Figure 3 HWDL Soil Sampling Locations (not to scale)

(SEE NEXT PAGE)


ETU HWDL SOIL SAMPLE LOCATIONS
NOTES:
1 sample at a depth of 0-6" and
1 sample at a depth of 1'-2'
at each sample location
ETU EVAPORATION TANKS
Evap Tank HWDL (aboveground)
Evap Tank HWDL (underground HDWL)
HWDL SUMP
SUMP TANK PROTECTION PIT
BEGIN ABOVE GROUND PIPING (APPROXIMATE)
200 Area HWDL Underground HWDL
803 HWDL (underground HWDL)
800 Area HWDL (Underground HWDL)
800 Area HWDL (Aboveground HWDL)
SOUTH HIGH BAY
NORTH HIGH BAY
BLDG. 200
BLDG. 201
BLDG. 203
BUILDING 803
ELECTRIC SUBSTATION
TO BLDG 200
PARKING LOT
PPE Shower
4 Sample Locations - Floordrain and HWDL Tee/Elbow
1 Sample Location - 90 HWDL fittings
4 Sample Locations - Inlet to Underground HWDL and HWDL Tee
1 Sample Location - Ameron Bondstrand/Fiberoast transition
2 Sample Locations - Cleanout and Capped-off HWDL Tee
2 Sample Locations - Inlet to Underground HWDL and HWDL Tee/Cleanout
2 Sample Locations HWDL Angle Fittings/Cleanout
4 Sample Location HWDL Angle Fittings/Cleanout
4 Sample Locations - Inlet to Underground HWDL and HWDL Tee/Cleanout
2 Sample Locations - Inlet to Aboveground HWDL Elbow/Tee to HWDL

7.8 Cleaning of Sampling Equipment

When applicable, sampling operations will be performed per the procedures and requirements outlined in Permit Attachment 12, "Waste Analysis Plan" of the NASA/WSTF Hazardous Waste Operating Permit. Reusable sampling equipment will be cleaned and rinsed with deionized water prior to use. Sampling equipment rinsate blanks will be collected and analyzed only if reusable sampling equipment is used. Reusable decontamination equipment, including protective clothing and tools, used during closure activities will be scraped as necessary to remove residue and cleaned with a hot water pressure washer or detergent (Alconox or equivalent)/water solution. Sampling equipment will be cleaned prior to each use with a wash solution, rinsed several times with deionized water, and air-dried to prevent cross contamination of samples. A disposable sampler is considered clean if still in a factory-sealed wrapper. Residue, disposable decontamination equipment, reusable decontamination equipment that cannot be decontaminated, and rinsate from decontamination will be containerized and managed as hazardous waste.

7.9 Selection of Analytical Laboratories

When applicable, sampling operations will be performed per the procedures and requirements outlined in Permit Attachment 12, "Waste Analysis Plan" of the NASA/WSTF Hazardous Waste Operating Permit. Off-site analytical laboratories used by WSTF must be contracted in accordance with federal acquisition regulations. As a part of the procurement process, NASA provides candidate laboratories with a statement of work (SOW) for the work to be contracted. Any successful bidder must adequately address the requirements of the SOW, prior to award of the contract. The following provides typical elements contained within analytical statements of work:

- The laboratory is required to provide a copy of the laboratory quality assurance plan.
- The laboratory must indicate what laboratory-specific standard operating procedures will be used and provide them if requested.
- NASA specifies the analytical method(s) to be used.
- NASA identifies the approximate number of samples to be submitted for each method.
- NASA identifies the sample matrix or matrices.
- NASA estimates the approximate time period of sample submission.
- NASA provides required quantitation and method detection limits.
- The laboratory must provide current laboratory quantitation and detection limits for specified methods and matrices and if unavailable for specific analytes, the laboratory must estimate the time required to establish these limits.
- The laboratory must provide the procedures and frequencies for establishing method detection and quantitation limits.
- The laboratory must provide an analyte list (if different from list specified in method).
- NASA identifies any additional analytes required for specific analyses.
- Data package requirements are specified by NASA.
- NASA requires that the laboratory report data below the quantitation limit, but above the method detection limit.

- The laboratory is required to specify sample container and preservation requirements (if they are different than EPA guidance, the discrepancy is discussed with the laboratory).
- NASA specifies laboratory turn-around time requirements.
- NASA evaluated proposals from laboratories based on technical merit and certification from recognized industry programs (e.g. NELAP, National Environmental Laboratory Accreditation Program).

7.10 Sample Control

When applicable, sampling operations will be performed per the procedures and requirements outlined in Permit Attachment 12, "Waste Analysis Plan" of the NASA/WSTF Hazardous Waste Operating Permit. Strict chain of custody controls are utilized for all samples collected at WSTF. Each sample is recorded on a designated chain of custody form or work order that includes chain of custody data. Chain of custody forms are used to track possession of samples from the time of collection through sample analysis and the reporting of analytical results to NASA by on-site and offsite laboratories. Chain of custody forms provide legal documentation of possession throughout the entire sampling and analysis process. Each form will contain the following information as applicable to on-site and off-site laboratories:

- Sample shipment information.
- Unique sample number of each sample.
- Sample type/matrix.
- Sample collection location.
- Number of containers for each sample.
- Required chemical analyses.
- Date of sample shipment.
- Signature(s) with date(s) and time(s) of all personnel involved in sample custody.

A chain of custody form is completed for each shipment of samples and is included in the ice chest during shipment or delivery to the analytical laboratory. A copy of the form is retained at WSTF with the shipping documentation. The original chain of custody accompanies the samples to the analytical laboratory, and is eventually returned with the analytical report from the laboratory to become a part of the permanent sampling and analytical records maintained at WSTF.

7.11 Sample Logbook

All pertinent information on the sampling effort must be recorded in a bound logbook. Information must be recorded in ink and any cross-outs must be made with a single line and the change initialed and dated by the author. The sample logbook will include the following information:

a. the sample location;

b. suspected composition;

c. sample identification number;

d. volume/mass of sample taken;

e. purpose of sampling;

f. description of sample point and sampling methodology;

g. date and time of collection;

h. name of the sample collector;

i. sample destination and how it will be transported;

j. observations;

k. name(s) of personnel responsible for the observations

l. sample analytical method.

7.12 Sample Handling, Preservation, and Storage

Samples will be collected and containerized in appropriate pre-cleaned sample containers. The requirements in SW-846 (EPA, 1986) for sample containers, preservation techniques, and holding times are presented in Table 1 below. Samples that require cooling to 4° Celsius will be placed in a cooler with ice or "blue ice" or in a refrigerator immediately upon collection.

When applicable, sampling operations will be performed per the procedures and requirements outlined in Permit Attachment 12, "Waste Analysis Plan" of the NASA/WSTF Hazardous Waste Operating Permit.

The sample preservation and storage protocols recommended by Chapters Two, Three, and Four of SW-846 will be used for most samples collected. If more appropriate, guidance from the Standard Guide for Sampling Waste and Soil for Volatile Organic Compounds (ASTM D 4547-98) or other EPA-recommended guidance may be utilized for the preservation of waste samples.

Table 1 ETU Analysis, Containers, Preservation Methods and Holding Times

Analysis	Method	Sample Media	Container	Preservation	Holding Times
Volatile Organics	EPA Method 8260B	Decontamination solution (3rd rinsate)	2-42 ml VOA vials	HCl to pH <2 or as directed by the analytical laboratory, Cool 4^o C	14 days
		Soil	500 ml glass Jar	Cool 4^o C	14 days
Hydrazines	HPLC	Decontamination solution (3rd rinsate)	1-42 ml VOA vials	HCl to pH <2 or as directed by the analytical laboratory, Cool 4^o C	7 days
		Soil	500 ml glass Jar	Cool 4^o C	7 days
Semi-volatile Organics	EPA Method 8270	Decontamination solution (3rd rinsate)	2- 1 L amber glass bottles	Cool 4^o C	14 days
		Soil	500 ml glass Jar	Cool 4^o C	14 days
TCLP Metals	EPA Method 6010B/ 7470a	Decontamination solution (3rd rinsate)	1- 1 L poly bottle	HNO_3 to pH <2 or as directed by the analytical laboratory, Cool 4^o C	180 days (except 28 days for mercury)
		Soil	500 ml glass Jar	Cool 4^o C	180 days (except 28 days for mercury)