ATTACHMENT 21
ETU AND FTU DRAWINGS AND SUMMARY DESCRIPTION

21.1 EVAPORATION TREATMENT UNIT

The 200 Area Evaporation Treatment Unit consists of two 147,000 gallons capacity steel tanks, a four-inch drain line, and a 370 gallons in-line sump tank. Hazardous waste is conveyed to the tanks either through a gravity flow drainline system from nearby generators in the 200 and 800 Areas, or by truck from other remote generation points in the Facility. Hazardous waste brought in from remote locations is conveyed to the unit at the drum pumping station that is located between the two evaporation tanks.

21.1.1 Summary Description

21.1.1.a Tanks

The two evaporation tanks are 79 feet in diameter (horizontally), with open tops. They rise six feet three inches above the final surface grade. The tanks consist of three containment components: a self supporting quarter inch carbon steel structure in the outermost position; and two inner, 30-mil PVC membranes that are separated from each other and from the steel structure by "Geotextile" material. The leak detection systems are installed between the membranes and the secondary membrane and the steel structure.

Dimensions were selected for each tank to provide a maximum capacity of 147,000 gallons in addition to including a two feet freeboard. The designed freeboard is intended to prevent overtopping from wave or wind action and additions from storm precipitation. All valves in the tank unit are manually operated. Flow to either evaporation tank can be shutoff entirely for the purpose of maintenance or an emergency.

The foundation for the tanks consists of the area's natural soil and backfill soil, which was compacted to prevent any settling of the tank structures. 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. A steel work platform runs between the top of both tanks to allow for sample collection, depth measurements, and visual inspection. For security purposes, the tanks are completely surrounded by a seven-foot high chain link fence. A plan view of the tanks is provided in Fig. 21.3 of the Permit Application.

For the protection of migratory fowl and other wildlife, a net has been installed over the tops of the tanks and a chain fence surrounds the entire periphery of the unit. A warning light and an automatic telephone dialing system are in place to notify facility personnel when the active tank has reached design capacity. When the capacity is reached, a manually operated valve is regulated to switch the drain line waste transfers to the then inactive tank or entirely shut-off the drainage to either tank. In the event the drain line system must be prevented from receiving waste, each location which accepts waste to the drain line will be fitted with a "DO NOT OPERATE" tag. To further ensure that personnel are informed that no waste is to be introduced to the Hazardous Waste Drain Line (HWDL) an announcement will be made over the 200 and 800 Area intercom system informing all personnel that the drain line is inoperable.

The HWDL system is not equipped with bypass systems. In the event that a leak is detected or an obstruction prevents waste from flowing in the drain line, the drain line will be taken out of service until the problem is rectified. Because the ETU tanks are open top, no pressure controls are necessary.

21.1.1.b External Corrosion Protection

The ETU was approved for use under RCRA Interim status in October 1988 and remained under interim status until the Part B permit was approved in 1993. Because the steel tank bottoms came in direct contact with the underlying soil, a corrosion protection system was installed at the time of construction. During the Engineering Assessment of the ETU in 1990 to satisfy requirements of 40 CFR 264.192(a), an evaluation of the cathodic protection system was performed and the system was found to be inadequate. At the time of this evaluation the recommended useful life of the tanks was estimated to be ten years, after which time additional protection would have to be provided.

In 1997, another evaluation (see Appendix 21-B of the Permit Application) was performed to investigate if an impressed current cathodic protection system could be utilized to extend the life of the ETU. It was found that an impressed current cathodic protection system would adequately protect the steel structural components of the tanks and extend the useful life of the ETU.

A permit modification requesting permission to install an impressed cathodic protection system and extend the useful life of the ETU's steel structural components by 25 years was approved by NMED in November 1997 (see Appendix 21-C of the Permit Application). An impressed cathodic protection system was installed at the ETU in 1998.

Currently, NASA is utilizing an impressed current corrosion protection system. The system was designed and installed by a professional corrosion specialist. A report containing factors affecting the potential for corrosion, a determination of adequate corrosion prevention and a description of system components, as required by § 264.192(a)(3)(i-ii) is located in Appendix 21-D of the Permit Application. The corrosion protection system is inspected on a monthly basis by contractor Environmental Department personnel, and on an annual basis by a corrosion expert to ensure that the system is functioning properly.

21.1.1.c HWDL Sump

The drain line sump tank is situated approximately midway along the drain line system where three inlet lines intersect with the one outlet line. Secondary containment is provided by the double wall with the necessary storage capacity in between and a moisture sensor at the bottom of the secondary containment tank. The holding capacity of the primary tank is about 370 gallons.

The entire vertical cylindrical 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 forty-eight inches (48 in) across (horizontal diameter) by fifty-one inches (51 in) in height. Those of the outer wall are seventy-two inches (72 in) inside diameter by sixty-two inches (62 in) in height. Interior and exterior wall thicknesses are one-quarter (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 connects on the centerline, nine inches 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. Besides the inlet pipes, the wiring for a moisture sensor, an ultrasonic level sensor, and a four inches (4 in) diameter sample port are all attached to the top of the cover plate. The sampling port rises seven feet (7 ft) above the cover plate, and high enough above the retaining walls to facilitate the access at finished grade.

21.1.1.d Drain Line Piping

The drain line pipes are specifically designed for conveying liquid hazardous waste from the 200 and 800 Areas, and the LABCON area buildings to the ETU tanks. Initial installation of the drain line was during 1990, and it was first use in 1991. Subsequent construction and upgrading took place in 1991, 1992, 1998, and 1999.

All segments of the drain line that are underground consist of a primary drainline and a secondary containment line. Sections of the primary drainline installed in 1990 constructed of Amerson's Bondstrand series 5000 pipe. This is a filament wound fiberglass reinforced vinyl ester pipe with five hundredth inch integral reinforced liner. Sections installed in 1991 are constructed of Fibercast's Centricast Plus CL-2030 pipe. This is a centrifugally cast reinforced vinyl ester pipe with a 55-mil pure resin liner. A two-part vinyl ester thermoset adhesive was used to assemble the components.

Sections of the secondary containment line installed in 1990 are constructed of Amerson's Bondstrand Series 300 pipe. This is a filament wound, fiberglass reinforced, epoxy pipe with an integral epoxy liner. Sections of the secondary containment line installed in 1991 are constructed of Fibercast's Centricast III VE. This is a centrifugally cast, reinforced vinyl ester pipe with a 30-mil, 100 percent pure resin liner. The fittings are manufactured and assembled in the same manner as the primary line.

The upgradient portion of the primary drain line pipe are buried below ground while the lower portion, approximately 127 feet down gradient from the sump tank, is all above ground to the ETU tanks.

21.1.2 As-Built Drawings and Photographs

The following photographs and construction diagrams are provided in the Appendix to this Attachment:

- Figure 21.3 ETU Plan View Diagram
- Figure 21.4 200/800 Area Piping Diagram
- Figure 21.5 ETU Pump Station Diagram
- Figure 21.8 ETU HWDL Sump Diagram

21.1.3 Operating Procedures

The ETU, located in the 200 Area, receives hazardous waste from nearby generators in the 200 and 800 Area, or by truck from remote generation points at the facility. Those waste streams generated in the 200 and 800 Areas are conveyed to the ETU tanks through a four inch gravity flow drain line used exclusively for hazardous waste. For the remote transfers, waste is brought to a "drum pump station", located between the two evaporation tanks. Waste is then mechanically pumped from drum type containers or from tanker trucks, directly into one of the evaporation tanks.

Hazardous waste generated throughout the facility primarily consists of acidic and alkaline wastewater generated during aerospace part cleaning, and dilute concentrations of rocket fuels (hydrazine). Smaller quantities of waste are generated from laboratory testing, photographic and battery processing. All waste streams are water soluble and intentionally diluted with water to help promote chemical compatibility.

The tanks were built to receive various dilute wastes from the Chemistry Laboratory (waste from various analyses), the Photography Laboratory (photographic development chemicals), the Component Services Department (acids, bases, and detergents), groundwater monitoring activities (purge water), propulsion testing (decontamination water), and the Hazardous Fluid Test Area (dilute hydrazine fuel waste). As required by site procedures, all waste proposed for treatment in the tanks must be evaluated by the contractor Environmental Department prior to entering the tanks to ensure that the wastes are compatible with the contents of the tanks and with the tanks liner.

Treatment in the waste in the ETU tanks is primarily evaporation and volatilization, but other processes also occur. The average annual rate of evaporation ranges between 89 -112 inches per year (http://www.wrcc.dri.edu). Other treatment processes include but are not limited to chemical, biological and solar induced reactions.

An internal policy was established stating when a dense phase, similar in chemical composition to the a contrasting lighter phase, develops in either tank for a continual period of three months and sustaining a minimum thickness of 12 inches, then all but 3 inches of the dense phase will be removed. Total waste removal will not be attempted under the above conditions in order to protect the primary liner from tears and abrasions potentially caused from the removal operations. Liquid waste removal took place once after treatment operations began in 1990, and this resulted from the need to evacuate one of the tanks in order to complete repair from a minor leak detected in the primary liner.

21.1.4 Waste Removal

Hazardous waste removed from the evaporation tanks for off-site shipment will be pumped into tanker trucks. It is possible that some of these trucks may be too large to allow for their hose lines and connections to be protected from spills or leaks over the drum pump station's concrete pad and its containment. In such case, all components of tanker trucks that have potential to cause leaks or spills will be protected by chemical resistant plastic sheeting secured to the ground and protected from being torn or punctured. The plastic sheeting will be set down so that any spill or leak will drain toward the concrete sump. If this cannot be accomplished, another method of collecting spills or leaks will be implemented.

21.2 FUEL TREATMENT UNIT

21.2.1 Summary Description

The FTU is a tank system that stores WSTF-generated fuel waste prior to off-site disposal or safe transfer to the ETU. The system was initially designed to chlorine oxidize the waste fuels. The system's design included the material compatibility with the fuels, oxidizer, pH controller, sodium hydroxide, and reaction products. The reaction products were then transferred to the ETU. However, the chlorination treatment portion of the system never operated correctly during pre-startup testing and has never been used. The FTU, under current permit modification, accumulates and stores fuel waste until off-site disposal or safe transfer to the ETU because it has become more economical to do so. The original written assessment, that has been reviewed and certified by an independent, qualified, registered professional engineer as to the structural integrity and suitability for handling hazardous waste as required by 40 CFR 264.191 and 40 CFR 264.192, is included in Permit Attachment 15. All of the system materials are compatible with the aqueous fuel waste, as demonstrated over the eight years of operation.

The storage tanks are above ground, raised pedestal, commercial, chemically inert, glass-lined, vertical, cylindrical, carbon steel tanks produced to American Society of Mechanical Engineers Code Rules, Section VIII, Division 1. The capacity of each tank is 4,000 gallons. The tanks' maximum dimensions are a height of 12.3 feet and a diameter of 8.4 feet. The tanks have their own stands and piping connections. No penetrations or modifications have been done to the tanks. The tanks were selected from the above Code production based on the initial design use of chlorine oxidation for the destruction of the fuels with sodium hydroxide pH control, and the chemically inert glass-lining compatibility with both the reactants and products.

The content of the tanks is aqueous hydrazine(s) waste generated from WSTF facility operations. This waste is not a characteristic waste. The individual constituents of the waste are hydrazine (HZ), methyl hydrazine (MMH), 1,1-unsymmetrical dimethylhydrazine (UDMH), and 1,2-symmetrical dimethylhydrazine (SDMH).

The site selected for the FTU had previously been occupied by a non-RCRA storage and transfer unit for chemical oxidizer. Selection of the site was based upon its convenient proximity to the facility's largest generators of fuel waste and the presence of existing electrical power and water supply from the previous operation. In order to accommodate the new unit's design, working areas made of concrete had to be extended and peripheral grading reconstructed.

Waste hydrazine fuels and aqueous mixtures are generally basic, with the pH approximately 7 to 8. The slightly basic waste is compatible with the glass lining of the tank, which has a corrosion rate of less than 0.002 inches per year under 50% sodium hydroxide conditions. The volatile organic content of the aqueous fuel waste varies by individual fuel concentration.

The waste is stored under ambient temperature and pressure conditions. The maximum storage temperature will be less than 140°F, and therefore below the boiling point of any of the pure components of the waste or of any less than 10% aqueous mixtures of the wastes. The compatibility of the stored wastes with the tanks and ancillary equipment construction materials has been demonstrated for the eight years of permitted process operation.

The facility tanks receive fuel wastes ranging in concentration from dilute aqueous mixtures to neat compounds. The tanks are fed from waste vessels transported by vehicle from point of generation to the unit, i.e., there is no waste feed piping exterior to the unit. The wastes can be the pure compounds, or mixtures of the pure compounds, or aqueous mixtures of methylhydrazine, 1-1, dimethylhydrazine, 1-2, dimethylhydrazine, and/or hydrazine. These wastes are generated at WSTF and held in storage until a disposable amount is accumulated. The waste is then either shipped off-site to a permitted disposal facility or mixed with water to 330 ppmw or less and transferred to the ETU for treatment.

The facility receives waste generated from several processes at WSTF. WSTF is a research and test facility and, as a result, the fuel concentration of the feed stream will vary from trace amounts to neat fuel depending on the generating process. The volume of waste generated also varies with testing frequency. Currently, WSTF generates a total of about 10,000 to 12,000 gallons of waste per year with an average fuel concentration of 1.5%. Dilute waste fuel mixtures are generated from rinse water used to decontaminate parts at decontamination stations in the 200, 300, 400, and 800 Areas. This waste usually contains low levels of fuel, typically below 1 percent fuel.

Residual fuel that remains in fuel supply lines and test equipment is another source of waste fuel in the 200, 300, 400, and 800 Areas. In the 300 and 400 Areas, this fuel is removed from the fuel supply lines with aspirators. The aspirators use water to collect fuel liquid and vapor that is removed from the lines. In the 800 Area, the residual fuel is removed by purging the system with nitrogen and collecting the fuel liquid and vapor in a barrel of water. The fuel concentration of these waste streams is about 5 to 15 percent.

Concentrated waste fuel mixtures are also generated from operations at WSTF. WSTF receives fuel in 55-gallon drums from the manufacturer. Usually, there is about one gallon of neat fuel left in each drum that cannot be transferred to the fuel supply system or test equipment. This waste fuel must be removed before returning the drum. Fuel sampling practices also generate concentrated waste fuel mixtures. After the fuel samples are analyzed, the excess fuel from the sampling container and any off-specification fuel must be stored and disposed.

To protect the 45 psig maximum attainable working pressure tanks, +30/-10 psig rupture discs are installed at the top of the tanks, approximately 15 feet above the containment.

21.2.2 As-Built Drawings and Photographs

- Figure 22.1 **FTU Civil Construction Diagram**
- Figure 22.2 **FTU Process Piping Diagram**
- Figure 22.3 **FTU Supplemental Construction Diagram**

21.2.3 Operating Procedures

Waste fuel from throughout WSTF, after sampling and analysis, is transported to the unloading pad at the FTU and transferred by pump to the facility storage tank(s). All waste fuel transfers to the storage tank(s) are tracked and a written record is maintained. This record includes the fluid level in the storage tank(s), the name of the waste, its WIWPS number, its origin, volume, fuel concentration, and the date of the transfer. For informational purposes, the operational job instruction (WJI ENV-007) for transport, transfer, and storage activities at the FTU is included as Appendix 22-B of the Permit Application. The waste fuel feed is blended with other waste fuel mixtures or with water to reduce the fuel concentration in the storage tank(s) to below 10 percent. Prior to off-site disposal or transfer to the ETU, the contents of the storage tank(s) are sampled and analyzed to ensure that the fuel concentration has been reduced to the waste profile level for off-site disposal or transfer to the ETU.

When a storage tank has a disposable amount of waste, it is sampled and analyzed to verify that the fuel concentration is below the concentration of the waste characterization for the receiving disposal facility or the acceptance limit of for the ETU. If the waste concentration is greater than the limits, the waste is mixed with water until in meets the treatment/disposal criteria. The waste is off-loaded from the unit to the transport vehicle generally by the vacuum pump of the transporter. The waste may also be off-loaded to the transport vehicle by the Crane pump.

The tanks are vented to atmosphere. However, the tank(s) vent stack emissions are scrubbed through redundant activated carbon filters for volatile organic entrapment. The point of vapor release, after scrubbing, is at the top of the tanks, thereby negating any confined area of vapor discharge.

The facility operates on an eight-hour workday, as scheduled, and the facility is monitored every working day. Based on the current fuel generation at WSTF, it is estimated that the facility will be operated about 400 hours per year.

All of the Unit's feed system operations are directed and performed by personnel qualified as "Hazardous Waste Handlers" (see Permit Attachment 10). The personnel must also be qualified for fully encapsulated suits and airlines since all open loop and new equipment/configuration activities require this level of personnel protective equipment. The fluid level in the storage tank(s) is monitored every working day to monitor for leaks and to assure sufficient ullage is available to prevent overfilling the tank(s) during any addition process. The waste is transferred to the storage tank(s) by pumps. Wastes from drums, aspirators, and decontamination processes are pumped into the storage tank(s) by a pneumatic, double Teflon diaphragm pump. Circulation, tank transfer, and tanker on-load and off-load pumping processes use electrical Crane centrifugal pumps designed to transfer up to neat propellant. The pumps are raised within the secondary containment to allow for inspections for leaks, corrosion, and deterioration. The Crane pumps have electrical safety cutoff switches located both at the pump location on the pad and in the control room.

21.2.4 Rationale for Treatment

The calculation and rationale for 10 percent dilution of fuels, all carbon filters design and calculations are provided in the Appendices 22-A and 22-C of the Permit Application.