EEE Consulting, Inc.
Environmental, Engineering and Educational Solutions

April 8, 2015

Matt Alberts, Environmental Engineer
BAE SYSTEMS, Ordnance Systems Inc.
Radford Army Ammunition Plant
4050 Peppers Ferry Road
Radford, Virginia 24141

Re: RCRA Waste Tank System Assessment
Tank 1A, 1 B and the Makeup Water Tank
Radford Facilities Army Ammunition Plant (RFAAP)
Hazardous Waste Incinerator Complex
Radford, Virginia
EEE Consulting Project Number 15-711

Dear Mr. Alberts:

EEE Consulting, Inc. (EEE) respectfully submits this engineering and compliance assessment of the existing tank system comprised of Tank 1A, Tank 1B and the Makeup Water Tank associated with the Hazardous Waste Incinerator Process. Tank 1A is a process slurry tank that contains hazardous wastewater. It is open topped, 6.5 feet in diameter and has a volume of approximately 1,900 gallons with a maximum operational volume of approximately 1,520 gallons. Tank 1 B is identical to Tank 1A. The Makeup water Tank is open topped, 6.0 feet in diameter and has an approximate volume of 1,500 gallons. All the tanks and piping are located within the limits of the basement of the incinerator Grinder building (Bldg. 442). These above ground storage tank systems have been evaluated to demonstrate compliance with the Virginia Department of Environmental Quality RCRA Hazardous Waste Regulations (9 VAC 265.191 and 195). This written assessment presents the status of compliance with the regulatory requirements.

The documents that were reviewed included:

1. Tank Assessment Report (API 653), RFAAP, Tanks 1A, 1B and Makeup water, Superior Services, January, 2015
2. Daily Inspection Records,
3. Tank Level Records,
4. Waste Profiles,
5. Drawings:
    a. 044200-25767-T160-00: Grinder Building Slurry Tank, November 15, 1974
    b. 044200-23998-F357-00: Waste Propellant Incinerator Facility Hopper For Handling of Liquid Explosives Waste to the Slurry Tank, Details, November 1, 1978

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Additionally, an onsite inspection of the tanks and tank system ancillary equipment piping was performed on January 29, 2015.

RESULTS OF INSPECTION AND DOCUMENT REVIEW

A copy of the applicable regulations (9 VAC 265.190 through 265.201 – also referred to as Subpart J) is appended to this assessment report as **Appendix A,** and pertinent sections are referred to by reference throughout this assessment.

Section 265.191 Assessment of an existing tank system's integrity

EEE evaluated the ancillary equipment for the Tank Systems from the point of generation at the grinder assembly to the makeup water concrete vault located outside of Building 442 on January 29, 2015. EEE observed that the piping was welded throughout the run and was in good condition without evidence of distress or leaks. A non-specific repair (use of a pipe bonding agent or "pipe putty") was noted on the bottom drain line of Tank 1B. The repair was determined by Superior Services to not constitute a tank integrity exception. A repair that meets the tank system specifications was recommended by Superior Services (See **Appendix B** for Superior's Report).

Secondary containment of the Tank systems and the associated ancillary piping is provided by the basement enclosure. The Basement is approximately 18-feet x 27-feet in size (approximately 3,600 gallons per foot of height). As the basement is serviced by concrete stairs in an enclosed stairwell, the effective height of the containment is 8-feet (approximately 28,000 gallons). The floor is comprised of concrete and wall joints are adequately sealed. The basement has an integral sump with a float switch operated pump. The pump is active and was tested during the site visit. While full secondary containment is not specifically required for welded piping that is inspected daily, a release from the piping on the ground floor of Building 442 would flow into the basement and associated sump.

EPA defines ancillary equipment (40 CFR 260.10) as "any device including but not limited to such devices as piping, fittings, flanges, valves and pumps, that is used to distribute, meter or control the flow of hazardous waste from its point of generation to a storage or treatment tanks(s), between hazardous waste storage and treatment tanks to a point of disposal onsite, or to a point of shipment for disposal off-site".

Section	Compliant?	Basis/Documentation
265.191 (a)	N/A	Tank systems have adequate secondary containment meeting the requirements of 265.193
265.191 (b) (1)	Yes	Superior Services API 653 Tank Assessment Report, January 2015
265.191 (b) (2)	Yes	Waste Profile Data
265.191 (b) (3)	N/A	The tank systems are not in contact with the soil; therefore, corrosion protection is not applicable
265.191 (b) (4)	Yes	The date of Tank construction is unknown, although shop drawings indicate a likely installation date of 1977
265.191 (b) (5)	Yes	Tank Ultrasonic Tests - Superior Services API 653 Tank Assessment Report, January 2015 (Tables 1, 2 and 3)
265.191 (c)	N/A	Installation and operational data indicate that the Tank systems stored materials that were considered hazardous prior to July 14, 1986.

N/A = Not Applicable

Section 265.192 Design and installation of new tank systems or components

Technically, this section pertains to new tanks only, although regulatory enforcement guidance defines "new tank systems" as reinstalled and replacement tank systems or components. As data indicate that components of the system have been replaced, it was determined that Section 265.192 is applicable.

Section	Compliant?	Basis/Documentation
265.192 (a) (1)	Yes	Superior Services API 653 Tank Assessment Report, January 2015
265.192 (a) (2)	Yes	Waste Profile
265.192 (a) (3)	N/A	The tank systems are not in contact with the soil, therefore corrosion protection is not applicable
265.192 (a) (4)	N/A	The tank systems and all components are located above ground
265.192 (a) (5)	Yes	Superior Services API 653 Tank Assessment Report, January 2015 (see section pertaining to tank inspection observations)
265.192 (b) (1-6)	Yes	Superior Services API 653 Tank Assessment Report, January 2015 (see section pertaining to tank inspection observations)
265.192 (c)	N/A	The tank systems and all components are located above ground
265.192 (d)	N/A	Tanks are open topped, therefore not pressure tested.
265.192 (e)	Yes	Piping is all secure
265.192 (f)	N/A	The tank systems are not in contact with the soil; therefore, corrosion protection is not applicable
265.192 (g)	Yes	Records are properly maintained by facility at time of inspection

N/A = Not Applicable

265.193 Containment and detection of releases

Section	Compliant?	Basis/Documentation
265.193 (b) (1)	Yes	Concrete lined containment in good condition
265.193 (b) (2)	Yes	Containment is equipped with level activated sump for collection of liquids
265.193 (c) (1)	Yes	Concrete lined containment in good condition
265.193 (c) (2)	Yes	Superior Services API 653 Tank Assessment Report, January 2015 (see section pertaining to tank inspection observations)
265.193 (c) (3)	Yes	Containment is equipped with level activated sump for collection of liquids and all tanks are digitally monitored for level
265.193 (c) (4)	Yes	Containment is equipped with level activated sump for collection of liquids
265.193 (d) (1-4)	Yes	Concrete lined containment dike in good condition
265.193 (e) (1)	Yes	Field measurement of basement indicates 3,600 gallons of containment per foot of height, with a max height of 8 feet (approx.. 28,000 gallons). Required volume is 5,300 gallons.
265.193 (e) (2-3)	N/A	Tanks are located in concrete secondary containment
265.193 (f) (1)	Yes	Ancillary piping runs are within the limits of the containment
265.193 (f) (2-4)	Yes	All appurtenance and ancillary equipment are within the limits of the containment
265.193 (g-h)	N/A	Facility is not currently seeking a variance
265.193 (i) (1-4)	Yes	Tank Ultrasonic Test – Superior Services API 653 Tank Assessment Report, January 2015 (Tables 1, 2 and 3)

N/A = Not Applicable

265.194 General operating requirements.

Section	Compliant?	Basis/Documentation
265.194 (a -c)	Yes	Tank system has adequate secondary containment meeting the requirements of 265.193. Spill prevention controls, overfill protection and sufficient freeboard in the containment dike are all present and maintained.

N/A = Not Applicable

265.195 Inspections

Section	Compliant?	Basis/Documentation
265.195 (a)	Yes	Daily inspections ongoing
265.195 (b) (1-3)	Yes	Daily inspections ongoing
265.195 (c)	Yes	Documentation maintained and procedures are integrated into training
265.195 (d)	N/A	Facility is not a Performance Track member
265.195 (e)	Yes	Daily inspections ongoing
265.195 (f)	Yes	The tank system is not in contact with the soil, therefore cathodic protection is not applicable
265.195 (g))	Yes	Records are properly maintained by facility at time of inspection

N/A = Not Applicable

Sections 265.196 and 265.197 are not germane to this assessment.

265.198 Special Requirements for ignitable or reactive wastes

Section	Compliant?	Basis/Documentation
265.198 (a) (1-3)	Yes	Waste is mixed with water prior to grinding to render it non-reactive or ignitable
265.195 (b)	Yes	The incinerator compound is managed to meet protective distances

Sections 265.199 through 265.201 are not germane to this assessment.

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

In general, the 3 hazardous waste tanks (Tank 1A, 1B and the make-up water tank) are compliant with the applicable section of Part 265, Subpart J of the Resource Conservation Recovery Act (RCRA) regulations. The tank and associated overfill protection, spill prevention controls and secondary containment structure have documented structural integrity and operational functionality.

The ancillary equipment, specifically the overhead piping that convey liquids from the grinder assembly to the waste tanks and containment structure, are currently compliant. The piping is inspected daily and the ultrasonic testing indicates full integrity.

Please call me or Chris Lalli at (540) 953-0170 if you have any questions about this assessment.

Sincerely,
EEE Consulting, Inc.

Andrew E. Kassoff, P.E., P.G., LEED AP
President

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

Engineer: Andrew E. Kassoff, PE, PG

Signature:

Registration Number: 43711
State Registered: Virginia
Firm: EEE Consulting, Inc.

COMMONWEALTH OF VIRGINIA
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4-8-2015
PROFESSIONAL ENGINEER
SEAL

APPENDIX A
SUBPART J REGULATIONS

Subpart J—Tank SystemsSource:51 FR 25479, July 14, 1986, unless otherwise noted.§

265.190 Applicability. The requirements of this subpart apply to owners and operators of facilities that use tank systems for storing or treating hazardous waste except as otherwise provided in paragraphs (a), (b), and (c) of this section or in § 265.1 of this part.

(a) Tank systems that are used to store or treat hazardous waste which contains no free liquids and are situated inside a building with an impermeable floor are exempted from the requirements in § 265.193. To demonstrate the absence or presence of free liquids in the stored/treated waste, the following test must be used: Method 9095B (Paint Filter Liquids Test) as described in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," EPA Publication SW-846, as incorporated by reference in § 260.11 of this chapter.

(b) Tank systems, including sumps, as defined in § 260.10, that serve as part of a secondary containment system to collect or contain releases of hazardous wastes are exempted from the requirements in § 265.193(a).

(c) Tanks, sumps, and other collection devices used in conjunction with drip pads, as defined in § 260.10 of this chapter and regulated under 40 CFR part 265 subpart W, must meet the requirements of this subpart.

§ 265.191 Assessment of existing tank system's integrity.

a) For each existing tank system that does not have secondary containment meeting the requirements of § 265.193, the owner or operator must determine that the tank system is not leaking or is unfit for use. Except as provided in paragraph (c) of this section, the owner or operator must obtain and keep on file at the facility a written assessment reviewed and certified by a qualified Professional Engineer in accordance with § 270.11(d) of this chapter, that attests to the tank system's integrity by January 12, 1988.

(b) This assessment must determine that the tank system is adequately designed and has sufficient structural strength and compatibility with the waste(s) to be stored or treated to ensure that it will not collapse, rupture, or fail. At a minimum, this assessment must consider the following:

(1) Design standard(s), if available, according to which the tank and ancillary equipment were constructed;

(2) Hazardous characteristics of the waste(s) that have been or will be handled;

(3) Existing corrosion protection measures;

(4) Documented age of the tank system, if available, (otherwise, an estimate of the age); and

(5) Results of a leak test, internal inspection, or other tank integrity examination such that:

(i) For non-enterable underground tanks, this assessment must consist of a leak test that is capable of taking into account the effects of temperature variations, tank end deflection, vapor pockets, and high water table effects,

(ii) For other than non-enterable underground tanks and for ancillary equipment, this assessment must be either a leak test, as described above, or an internal inspection and/or other tank integrity examination certified by a qualified Professional Engineer in accordance with § 270.11(d) of this chapter that addresses cracks, leaks, corrosion, and erosion. [**Note:** The practices described in the American Petroleum Institute (API) Publication, Guide for Inspection of Refinery Equipment, Chapter XIII, "Atmospheric and Low-Pressure Storage Tanks," 4th edition, 1981, may be used, where applicable, as guidelines in conducting the integrity examination of an other than non-enterable underground tank system.]

c) Tank systems that store or treat materials that become hazardous wastes subsequent to July 14, 1986 must conduct this assessment within 12 months after the date that the waste becomes a hazardous waste.(d) If, as a result of the assessment conducted in accordance with paragraph (a) of this section, a tank system is found to be leaking or unfit for use, the owner or operator must comply with the requirements of § 265.196.

§ 265.192 Design and installation of new tank systems or components.

(a) Owners or operators of new tank systems or components must ensure that the foundation, structural support, seams, connections, and pressure controls (if applicable) are adequately designed and that the tank system has sufficient structural strength, compatibility with the waste(s) to be stored or treated, and corrosion protection so that it will not collapse, rupture, or fail. The owner or operator must obtain a written assessment reviewed and certified by a qualified Professional Engineer in accordance with § 270.11(d) of this chapter attesting that the system has sufficient structural integrity and is acceptable for the storing and treating of hazardous waste. This assessment must include the following information:

(1) Design standard(s) according to which the tank(s) and ancillary equipment is or will be constructed.

(2) Hazardous characteristics of the waste(s) to be handled.

(3) For new tank systems or components in which the external shell of a metal tank or any external metal component of the tank system is or will be in contact with the soil or with water, a determination by a corrosion expert of:

(i) Factors affecting the potential for corrosion, including but not limited to:

(A) Soil moisture content;
(B) Soil pH;
(C) Soil sulfides level;
(D) Soil resistivity;
(E) Structure to soil potential;
(F) Influence of nearby underground metal structures (e.g., piping);
(G) Stray electric current; and,
(H) Existing corrosion-protection measures (e.g., coating, cathodic protection), and

(ii) The type and degree of external corrosion protection that are needed to ensure the integrity of the tank system during the use of the tank system or component, consisting of one or more of the following:

A) Corrosion-resistant materials of construction such as special alloys or fiberglass-reinforced plastic;

(B) Corrosion-resistant coating (such as epoxy or fiberglass) with cathodic protection (e.g., impressed current or sacrificial anodes); and

(C) Electrical isolation devices such as insulating joints and flanges. Note:The practices described in the National Association of Corrosion Engineers (NACE) standard, “Recommended Practice (RP-02-85)—Control of External Corrosion on Metallic Buried, Partially Buried, or Submerged Liquid Storage Systems,” and the American Petroleum Institute (API) Publication 1632, “Cathodic Protection of Underground Petroleum Storage Tanks and Piping Systems,” may be used, where applicable, as guidelines in providing corrosion protection for tank systems.

(4) For underground tank system components that are likely to be affected by vehicular traffic, a determination of design or operational measures that will protect the tank system against potential damage; and

(5) Design considerations to ensure that:

(i) Tank foundations will maintain the load of a full tank;

(ii) Tank systems will be anchored to prevent flotation or dislodgement where the tank system is placed in a saturated zone, or is located within a seismic fault zone; and

(iii) Tank systems will withstand the effects of frost heave.

(b) The owner or operator of a new tank system must ensure that proper handling procedures are adhered to in order to prevent damage to the system during installation. Prior to covering, enclosing, or placing a new tank system or component in use, an independent, qualified installation inspector or a qualified Professional Engineer, either of whom is trained and experienced in the proper installation of tank systems, must inspect the system or component for the presence of any of the following items:

(1) Weld breaks;
(2) Punctures;
(3) Scrapes of protective coatings;
(4) Cracks;
(5) Corrosion;
(6) Other structural damage or inadequate construction or installation. All discrepancies must be remedied before the tank system is covered, enclosed, or placed in use.

(c) New tank systems or components and piping that are placed underground and that are backfilled must be provided with a backfill material that is a noncorrosive, porous, homogeneous substance and that is carefully installed so that the backfill is placed completely around the tank and compacted to ensure that the tank and piping are fully and uniformly supported.

(d) All new tanks and ancillary equipment must be tested for tightness prior to being covered, enclosed or placed in use. If a tank system is found not to be tight, all repairs necessary to remedy the leak(s) in the system must be performed prior to the tank system being covered, enclosed, or placed in use.

(e) Ancillary equipment must be supported and protected against physical damage and excessive stress due to settlement, vibration, expansion or contraction. Note:The piping system installation procedures described in American Petroleum Institute (API) Publication 1615 (November 1979), "Installation of Underground Petroleum Storage Systems," or ANSI Standard B31.3, "Petroleum Refinery System," may be used, where applicable, as guidelines for proper installation of piping systems.

(f) The owner or operator must provide the type and degree of corrosion protection necessary, based on the information provided under paragraph (a)(3) of this section, to ensure the integrity of the tank system during use of the tank system. The installation of a corrosion protection system that is field fabricated must be supervised by an independent corrosion expert to ensure proper installation.

(g) The owner or operator must obtain and keep on file at the facility written statements by those persons required to certify the design of the tank system and supervise the installation of the tank system in accordance with the requirements of paragraphs (b) through (f) of this section to attest that the tank system was properly designed and installed and that repairs, pursuant to paragraphs (b) and (d) of this section were performed. These written statements must also include the certification statement as required in § 270.11(d) of this chapter.

§ 265.193 Containment and detection of releases.

(a) In order to prevent the release of hazardous waste or hazardous constituents to the environment, secondary containment that meets the requirements of this section must be provided (except as provided in paragraphs (f) and (g) of this section):

(1) For all new and existing tank systems or components, prior to their being put into service.

(2) For tank systems that store or treat materials that become hazardous wastes, within 2 years of the hazardous waste listing, or when the tank system has reached 15 years of age, whichever comes later.

(b) Secondary containment systems must be:

(1) Designed, installed, and operated to prevent any migration of wastes or accumulated liquid out of the system to the soil, ground water, or surface water at any time during the use of the tank system; and

(2) Capable of detecting and collecting releases and accumulated liquids until the collected material is removed.

(c) To meet the requirements of paragraph (b) of this section, secondary containment systems must be at a minimum:

(1) Constructed of or lined with materials that are compatible with the waste(s) to be placed in the tank system and must have sufficient strength and thickness to prevent failure due to pressure gradients (including static head and external hydrological forces), physical contact with the waste to which they are exposed, climatic conditions, the stress of installation, and the stress of daily operation (including stresses from nearby vehicular traffic);

(2) Placed on a foundation or base capable of providing support to the secondary containment system and resistance to pressure gradients above and below the system and capable of preventing failure due to settlement, compression, or uplift;

(3) Provided with a leak detection system that is designed and operated so that it will detect the failure of either the primary and secondary containment structure or any release of hazardous waste or accumulated liquid in the secondary containment system within 24 hours, or at the earliest practicable time if the existing detection technology or site conditions will not allow detection of a release within 24 hours;

(4) Sloped or otherwise designed or operated to drain and remove liquids resulting from leaks, spills, or precipitation. Spilled or leaked waste and accumulated precipitation must be removed from the secondary containment system within 24 hours, or in as timely a manner as is possible to prevent harm to human health or the environment, if removal of the released waste or accumulated precipitation cannot be accomplished within 24 hours.

Note If the collected material is a hazardous waste under part 261 of this chapter, it is subject to management as a hazardous waste in accordance with all applicable requirements of parts 262 through 265 of this chapter. If the collected material is discharged through a point source to waters of the United States, it is subject to the requirements of sections 301, 304, and 402 of the Clean Water Act, as amended. If discharged to Publicly Owned Treatment Works (POTWs), it is subject to the requirements of section 307 of the Clear Water Act, as amended. If the collected material is released to the environment, it may be subject to the reporting requirements of 40 CFR part 302.

(d) Secondary containment for tanks must include one or more of the following devices:
(1) A liner (external to the tank);
(2) A vault;
(3) A double-walled tank; or
(4) An equivalent device as approved by the Regional Administrator.

(e) In addition to the requirements -of paragraphs (b), (c), and (d) of this -section, secondary containment -systems must satisfy the following requirements:
(1) External liner systems must be:
(i) Designed or operated to contain 100 percent of the capacity of the largest tank within its boundary;
(ii) Designed or operated to prevent run-on or infiltration of precipitation into the secondary containment system unless the collection system has sufficient excess capacity to contain run-on or infiltration. Such additional capacity must be sufficient to contain precipitation from a 25-year, 24-hour rainfall event;
(iii) Free of cracks or gaps; and
(iv) Designed and installed to completely surround the tank and to cover all surrounding earth likely to come into contact with the waste if released from the tank(s) (i.e., capable of preventing lateral as well as vertical migration of the waste).

(2) Vault systems must be:
(i) Designed or operated to contain 100 percent of the capacity of the largest tank within its boundary;
(ii) Designed or operated to prevent run-on or infiltration of precipitation into the secondary containment system unless the collection system has sufficient excess capacity to contain run-

on or infiltration. Such additional capacity must be sufficient to contain precipitation from a 25-year, 24-hour rainfall event;

(iii) Constructed with chemical-resistant water stops in place at all joints (if any);

(iv) Provided with an impermeable interior coating or lining that is compatible with the stored waste and that will prevent migration of waste into the concrete;

(v) Provided with a means to protect against the formation of and ignition of vapors within the vault, if the waste being stored or treated:

(A) Meets the definition of ignitable waste under § 261.21 of this chapter, or

(B) Meets the definition of reactive waste under § 261.23 of this chapter and may form an ignitable or explosive vapor; and

(vi) Provided with an exterior moisture barrier or be otherwise designed or operated to prevent migration of moisture into the vault if the vault is subject to hydraulic pressure.

(3) Double-walled tanks must be:

(i) Designed as an integral structure (i.e., an inner tank within an outer shell) so that any release from the inner tank is contained by the outer shell;

(ii) Protected, if constructed of metal, from both corrosion of the primary tank interior and the external surface of the outer shell; and

(iii) Provided with a built-in, continuous leak detection system capable of detecting a release within 24 hours or at the earliest practicable time, if the owner or operator can demonstrate to the Regional Administrator, and the Regional Administrator concurs, that the existing leak detection technology or site conditions will not allow detection of a release within 24 hours. Note:The provisions outlined in the Steel Tank Institute's (STI) "Standard for Dual Wall Underground Steel Storage Tank" may be used as guidelines for aspects of the design of underground steel double-walled tanks.

(f) Ancillary equipment must be provided with full secondary containment (e.g., trench, jacketing, double-walled piping) that meets the requirements of paragraphs (b) and (c) of this section except for:

(1) Aboveground piping (exclusive of flanges, joints, valves, and connections) that are visually inspected for leaks on a daily basis;

(2) Welded flanges, welded joints, and welded connections that are visually inspected for leaks on a daily basis;

(3) Sealless or magnetic coupling pumps and sealless valves, that are visually inspected for leaks on a daily basis; and

(4) Pressurized aboveground piping systems with automatic shut-off devices (e.g., excess flow check valves, flow metering shutdown devices, loss of pressure actuated shut-off devices) that are visually inspected for leaks on a daily basis.

(g) The owner or operator may obtain a variance from the requirements of this Section if the Regional Administrator finds, as a result of a demonstration by the owner or operator, either: that alternative design and operating practices, together with location characteristics, will prevent the migration of hazardous waste or hazardous constituents into the ground water *or* surface water at least as effectively as secondary containment during the active life of the tank system *or* that in the event of a release that does migrate to ground water or surface water, no substantial present or potential hazard will be posed to human health or the environment. New underground tank systems may not, per a demonstration in accordance with paragraph (g)(2) of this section, be exempted from the secondary containment requirements of this section. Application for a variance as allowed in paragraph (g) of this section does not waive compliance with the requirements of this subpart for new tank systems.

(1) In deciding whether to grant a variance based on a demonstration of equivalent protection of ground water and surface water, the Regional Administrator will consider:

(i) The nature and quantity of the waste;

(ii) The proposed alternate design and operation;

(iii) The hydrogeologic setting of the facility, including the thickness of soils between the tank system and ground water; and

(iv) All other factors that would influence the quality and mobility of the hazardous constituents and the potential for them to migrate to ground water or surface water.

(2) In deciding whether to grant a variance, based on a demonstration of no substantial present or potential hazard, the Regional Administrator will consider:

(i) The potential adverse effects on ground water, surface water, and land quality taking into account:

(A) The physical and chemical characteristics of the waste in the tank system, including its potential for -migration,

B) The hydrogeological characteristics of the facility and surrounding land,

(C) The potential for health risks caused by human exposure to waste constituents,

(D) The potential for damage to wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents, and

(E) The persistence and permanence of the potential adverse effects;

(ii) The potential adverse effects of a release on ground-water quality, taking into account:

(A) The quantity and quality of ground water and the direction of ground-water flow,

(B) The proximity and withdrawal rates of water in the area,

(C) The current and future uses of ground water in the area, and

(D) The existing quality of ground water, including other sources of contamination and their cumulative impact on the ground-water quality;

(iii) The potential adverse effects of a release on surface water quality, taking into account:

(A) The quantity and quality of ground water and the direction of ground-water flow,

(B) The patterns of rainfall in the -region,

(C) The proximity of the tank system to surface waters,

(D) The current and future uses of surface waters in the area and any water quality standards established for those surface waters, and

(E) The existing quality of surface water, including other sources of contamination and the cumulative impact on surface-water quality; and

(iv) The potential adverse effects of a release on the land surrounding the tank system, taking into account:

(A) The patterns of rainfall in the region, and

(B) The current and future uses of the surrounding land.

(3) The owner or operator of a tank system, for which a variance from secondary containment had been granted in accordance with the requirements of paragraph (g)(1) of this section, at which a release of hazardous waste has occurred from the primary tank system but has not migrated beyond the zone of engineering control (as established in the variance), must:

(i) Comply with the requirements of § 265.196, except paragraph (d); and

(ii) Decontaminate or remove contaminated soil to the extent necessary to:

(A) Enable the tank system, for which the variance was granted, to resume operation with the capability for the detection of and response to releases at least equivalent to the capability it had prior to the release, and

(B) Prevent the migration of hazardous waste or hazardous constituents to ground water or surface water; and(iii) If contaminated soil cannot be removed or decontaminated in accordance with paragraph (g)(3)(ii) of this section, comply with the requirements of § 265.197(b);(4) The owner or operator of a tank system, for which a variance from secondary containment had been granted in accordance with the requirements of paragraph (g)(1) of this section, at which a release of hazardous waste has occurred from the primary tank system and has migrated beyond the zone of engineering control (as established in the variance), must:

(i) Comply with the requirements of § 265.196(a), (b), (c), and (d); and

(ii) Prevent the migration of hazardous waste or hazardous constituents to ground water or surface water, if possible, and decontaminate or remove contaminated soil. If contaminated soil cannot be decontaminated or removed, or if ground water has been contaminated, the owner or operator must comply with the requirements of § 265.197(b);

(iii) If repairing, replacing, or re-in-stalling the tank system, provide secondary containment in accordance with the requirements of paragraphs (a) through (f) of this section or reapply for a variance from secondary containment and meet the requirements for new tank systems in § 265.192 if the tank system is replaced. The owner or operator must comply with these requirements even if contaminated soil can be decontaminated or removed, and ground water or surface water has not been contaminated.

(h) The following procedures must be followed in order to request a variance from secondary containment:

(1) The Regional Administrator must be notified in writing by the owner or operator that he intends to conduct and submit a demonstration for a variance from secondary containment as allowed in paragraph (g) of this section according to the following schedule:

(i) For existing tank systems, at least 24 months prior to the date that secondary containment must be provided in accordance with paragraph (a) of this section; and

(ii) For new tank systems, at least 30 days prior to entering into a contract for installation of the tank system.

(2) As part of the notification, the owner or operator must also submit to the Regional Administrator a description of the steps necessary to conduct the demonstration and a timetable for completing each of the steps. The demonstration must address each of the factors listed in paragraph (g)(1) or paragraph (g)(2) of this section.

(3) The demonstration for a variance must be completed and submitted to the Regional Administrator within 180 days after notifying the Regional Administrator of intent to conduct the demonstration.

(4) The Regional Administrator will inform the public, through a newspaper notice, of the availability of the demonstration for a variance. The notice shall be placed in a daily or weekly major local newspaper of general circulation and shall provide at least 30 days from the date of the notice for the public to review and comment on the demonstration for a variance. The Regional Administrator also will hold a public hearing, in response to a request or at his own discretion, whenever such a hearing might clarify one or more issues concerning the demonstration for a variance. Public notice of the hearing will be given at least 30 days prior to the date of the hearing and may be given at the same time as notice of the opportunity for the public to review and comment on the demonstration. These two notices may be combined.

(5) The Regional Administrator will approve or disapprove the request for a variance within 90 days of receipt of the demonstration from the owner or operator and will notify in writing the owner or operator and each person who submitted written comments or requested notice of the variance decision. If the demonstration for a variance is incomplete or does not include sufficient information, the 90-day time period will begin when the Regional Administrator receives a complete demonstration, including all information necessary to make a final determination. If the public comment period in paragraph (h)(4) of this section is extended, the 90-day time period will be similarly extended.

(i) All tank systems, until such time as secondary containment meeting the requirements of this section is provided, must comply with the following:

(1) For non-enterable underground tanks, a leak test that meets the requirements of § 265.191(b)(5) must be conducted at least annually;

(2) For other than non-enterable underground tanks, and for all ancillary equipment, the owner or operator must either conduct a leak test as in paragraph (i)(1) of this section or an internal inspection or other tank integrity examination by a qualified Professional Engineer that addresses cracks, leaks, and corrosion or erosion at least annually. The owner or operator must remove the stored waste from the tank, if necessary, to allow the condition of all internal tank surfaces to be assessed. Note:The practices described in the American Petroleum Institute (API) Publication Guide for Inspection of Refining Equipment, Chapter XIII, “Atmospheric and Low Pressure Storage Tanks,” 4th edition, 1981, may be used, when applicable, as guidelines for assessing the overall condition of the tank system.

(3) The owner or operator must maintain on file at the facility a record of the results of the assessments conducted in accordance with paragraphs (i)(1) through (i)(3) of this section.

(4) If a tank system or component is found to be leaking or unfit-for-use as a result of the leak test or assessment in paragraphs (i)(1) through (i)(3) of this section, the owner or operator must comply with the requirements of § 265.196.

§ 265.194 General operating requirements.

(a) Hazardous wastes or treatment reagents must not be placed in a tank system if they could cause the tank, its ancillary equipment, or the secondary containment system to rupture, leak, corrode, or otherwise fail.

(b) The owner or operator must use appropriate controls and practices to prevent spills and overflows from tank or secondary containment systems. These include at a minimum:

(1) Spill prevention controls (e.g., check valves, dry disconnect couplings);

(2) Overfill prevention controls (e.g., level sensing devices, high level alarms, automatic feed cutoff, or bypass to a standby tank); and

(3) Maintenance of sufficient freeboard in uncovered tanks to prevent overtopping by wave or wind action or by precipitation.

(c) The owner or operator must comply with the requirements of § 265.196 -if a leak or spill occurs in the tank -system.

§ 265.195 Inspections.

(a) The owner or operator must inspect, where present, at least once each operating day, data gathered from monitoring and leak detection equipment (e.g., pressure or temperature gauges, monitoring wells) to ensure that the tank system is being operated according to its design.

Note:Section 265.15(c) requires the owner or operator to remedy any deterioration or malfunction he finds. Section 265.196 requires the owner or operator to notify the Regional Administrator within 24 hours of confirming a release. Also, 40 CFR part 302 may require the owner or operator to notify the National Response Center of a release.

(b) Except as noted under the paragraph (c) of this section, the owner or operator must inspect at least once each operating day:

(1) Overfill/spill control equipment (e.g., waste-feed cutoff systems, bypass systems, and drainage systems) to ensure that it is in good working order;

(2) Above ground portions of the tank system, if any, to detect corrosion or releases of waste; and

(3) The construction materials and the area immediately surrounding the externally accessible portion of the tank system, including the secondary containment system (e.g., dikes) to detect erosion or signs of releases of hazardous waste (e.g., wet spots, dead vegetation).

(c) Owners or operators of tank systems that either use leak detection equipment to alert facility personnel to leaks, or implement established workplace practices to ensure leaks are promptly identified, must inspect at least weekly those areas described in paragraphs (b)(1) through (3) of this section. Use of the alternate inspection schedule must be documented in the facility's operating record. This documentation must include a description of the established workplace practices at the facility.

(d) Performance Track member facilities may inspect on a less frequent basis, upon approval by the Director, but must inspect at least once each month. To apply for a less than weekly inspection frequency, the Performance Track member facility must follow the procedures described in § 265.15(b)(5).

(e) Ancillary equipment that is not provided with secondary containment, as described in § 265.193(f)(1) through (4), must be inspected at least once each operating day.

(f) The owner or operator must inspect cathodic protection systems, if present, according to, at a minimum, the following schedule to ensure that they are functioning properly:

(1) The proper operation of the cathodic protection system must be confirmed within six months after initial installation, and annually thereafter; and

(2) All sources of impressed current must be inspected and/or tested, as appropriate, at least bimonthly (i.e., every other month). Note:The practices described in the National

Association of Corrosion Engineers (NACE) standard, “Recommended Practice (RP-02-85)—Control of External Corrosion on Metallic Buried, Partially Buried, or Submerged Liquid Storage Systems,” and the American Petroleum Institute (API) Publication 1632, “Cathodic Protection of Underground Petroleum Storage Tanks and Piping Systems,” may be used, where applicable, as guidelines in maintaining and inspecting cathodic protection systems.

(g) The owner or operator must document in the operating record of the facility an inspection of those items in paragraphs (a) and (b) of this section.

§ 265.196 Response to leaks or spills and disposition of leaking or unfit-for-use tank systems.
A tank system or secondary containment system from which there has been a leak or spill, or which is un-fit for use, must be removed from service immediately, and the owner or operator must satisfy the following -requirements:

(a) *Cessation of use; prevent flow or addition of wastes.* The owner or operator must immediately stop the flow of hazardous waste into the tank system or secondary containment system and inspect the system to determine the cause of the release.

(b) *Removal of waste from tank system or secondary containment system.*

(1) If the release was from the tank system, the owner or operator must, within 24 hours after detection of the leak or, if the owner or operator demonstrates that that is not possible, at the earliest practicable time remove as much of the waste as is necessary to prevent further release of hazardous waste to the environment and to allow inspection and repair of the tank system to be performed.

(2) If the release was to a secondary containment system, all released materials must be removed within 24 hours or in as timely a manner as is possible to prevent harm to human health and the environment.

(c) *Containment of visible releases to the environment.* The owner or operator must immediately conduct a visual inspection of the release and, based upon that inspection:

(1) Prevent further migration of the leak or spill to soils or surface water; and

(2) Remove, and properly dispose of, any visible contamination of the soil or surface water.

(d) *Notifications, reports.*

(1) Any release to the environment, except as provided in paragraph (d)(2) of this section, must be reported to the Regional Administrator within 24 hours of detection. If the release has been reported pursuant to 40 CFR part 302, that report will satisfy this requirement.

(2) A leak or spill of hazardous waste that is:
(i) Less than or equal to a quantity of one (1) pound, and
(ii) Immediately contained and cleaned-up is exempted from the requirements of this paragraph.

(3) Within 30 days of detection of a release to the environment, a report containing the following information must be submitted to the Regional -Administrator:
(i) Likely route of migration of the release;
(ii) Characteristics of the surrounding soil (soil composition, geology, hydrogeology, climate);
(iii) Results of any monitoring or sampling conducted in connection with the release, (if available). If sampling or monitoring data relating to the release are not available within 30 days, these data must be submitted to the Regional Administrator as soon as they become available;
(iv) Proximity to downgradient drinking water, surface water, and population areas; and(v) Description of response actions taken or planned.

(e) *Provision of secondary containment, repair, or closure.*

(1) Unless the owner or operator satisfies the requirements of paragraphs (e) (2) through (4) of this section, the tank system must be closed in accordance with § 265.197.

(2) If the cause of the release was a spill that has not damaged the integrity of the system, the owner/operator may return the system to service as soon as the released waste is removed and repairs, if necessary, are made.

(3) If the cause of the release was -a leak from the primary tank system into the secondary containment system, the system must be repaired -prior to returning the tank system to service.

(4) If the source of the release was a leak to the environment from a component of a tank system without secondary containment, the owner/operator must provide the component of the system from which the leak occurred with secondary containment that satisfies the requirements of § 265.193 before it can be returned to service, unless the source of the leak is an aboveground portion of a tank system. If the source is an aboveground component that can be inspected visually, the component must be repaired and may be returned to service without secondary containment as long as the requirements of paragraph (f) of this section are satisfied. If a component is replaced to comply with the requirements of this subparagraph, that component must satisfy the requirements for new tank systems or components in §§ 265.192 and 265.193. Additionally, if a leak has occurred in any portion of a tank system component that is not readily accessible for visual inspection (e.g., the bottom of an inground or onground tank), the entire component must be provided with secondary containment in accordance with § 265.193 prior to being returned to use.

(f) *Certification of major repairs.* If the owner/operator has repaired a tank system in accordance with paragraph (e) of this section, and the repair has been extensive (e.g., installation of an internal liner; repair of a ruptured primary containment or secondary containment vessel), the tank system must not be returned to service unless the owner/operator has obtained a certification by a qualified Professional Engineer in accordance with § 270.11(d) that the repaired system is capable of handling hazardous wastes without release for the intended life of the system. This certification is to be placed in the operating record and maintained until closure of the facility.

Note:The Regional Administrator may, on the basis of any information received that there is or has been a release of hazardous waste or hazardous constituents into the environment, issue an order under RCRA section 3004(v), 3008(h), or 7003(a) requiring corrective action or such other response as deemed necessary to protect human health or the environment.

Note:See § 265.15(c) for the requirements necessary to remedy a failure. Also, 40 CFR Part 302 requires the owner or operator to notify the National Response Center of a release of any “reportable quantity.”

§ 265.197Closure and post-closure care.

(a) At closure of a tank system, the owner or operator must remove or decontaminate all waste residues, contaminated containment system components (liners, etc.), contaminated soils, and structures and equipment contaminated with waste, and manage them as hazardous waste, unless § 261.3(d) of this Chapter applies. The closure plan, closure activities, cost estimates for closure, and financial responsibility for tank systems must meet all of the requirements specified in subparts G and H of this part.

(b) If the owner or operator demonstrates that not all contaminated soils can be practicably removed or decontaminated as required in paragraph (a) of this section, then the owner or operator must close the tank system and perform post-closure care in accordance with the closure and post-closure care requirements that apply to landfills (§ 265.310). In addition, for the purposes of closure, post-closure, and financial responsibility, such a tank system is then considered to be a landfill, and the owner or operator must meet all of the requirements for landfills specified in subparts G and H of this part.

(c) If an owner or operator has a tank system which does not have secondary containment that meets the requirements of § 265.193(b) through (f) and which is not exempt from the secondary containment requirements in accordance with § 265.193(g), then,

(1) The closure plan for the tank system must include both a plan for complying with paragraph (a) of this section and a contingent plan for complying with paragraph (b) of this section.

(2) A contingent post-closure plan for complying with paragraph (b) of this section must be prepared and submitted as part of the permit application.

(3) The cost estimates calculated for closure and post-closure care must reflect the costs of complying with the contingent closure plan and the contingent post-closure plan, if these costs are greater than the costs of complying with the closure plan prepared for the expected closure under paragraph (a) of this section.

(4) Financial assurance must be based on the cost estimates in paragraph (c)(3) of this section.

(5) For the purposes of the contingent closure and post-closure plans, such a tank system is considered to be a landfill, and the contingent plans must meet all of the closure, post-closure, and financial responsibility requirements for landfills under subparts G and H of this part.

§ 265.198 Special requirements for ignitable or reactive wastes.

(a) Ignitable or reactive waste must not be placed in a tank system, unless:

(1) The waste is treated, rendered, or mixed before or immediately after placement in the tank system so that:
(i) The resulting waste, mixture, or dissolved material no longer meets the definition of ignitable or reactive waste under §§ 261.21 or 261.23 of this chapter; and
(ii) Section 265.17(b) is complied with; or

(2) The waste is stored or treated in such a way that it is protected from any material or conditions that may cause the waste to ignite or react; or

(3) The tank system is used solely for emergencies.

(b) The owner or operator of a facility where ignitable or reactive waste is stored or treated in tanks must comply with the requirements for the maintenance of protective distances between the waste management area and any public ways, streets, alleys, or an adjoining property line that can be built upon as required in Tables 2-1 through 2-6 of the National Fire Protection Association's "Flammable and Combustible Liquids Code," (1977 or 1981), (incorporated by reference, see § 260.11).

§ 265.199 Special requirements for incompatible wastes.

(a) Incompatible wastes, or incompatible waste and materials, must not be placed in the same tank system, unless § 265.17(b) is complied with.

(b) Hazardous waste must not be placed in a tank system that has not been decontaminated and that previously held an incompatible waste or material, unless § 265.17(b) is complied with.

§ 265.200 Waste analysis and trial tests.

In addition to performing the waste analysis required by § 265.13, the owner or operator must, whenever a tank system is to be used to treat chemically or to store a hazardous waste that is substantially different from waste previously treated or stored in that tank system; or treat chemically a hazardous waste with a substantially different process than any previously used in that tank system:

(a) Conduct waste analyses and trial treatment or storage tests (e.g., bench-scale or pilot-plant scale tests); or

(b) Obtain written, documented information on similar waste under similar operating conditions to show that the proposed treatment or storage will meet the requirements of § 265.194(a). Note:Section 265.13 requires the waste analysis plan to include analyses needed to comply with §§ 265.198 and 265.199. Section 265.73 requires the owner or operator to place the results from each waste analysis and trial test, or the documented information, in the operating record of the facility.

§ 265.201 Special requirements for generators of between 100 and 1,000 kg/mo that accumulate hazardous waste in tanks.

(a) The requirements of this section apply to small quantity generators of more than 100 kg but less than 1,000 kg of hazardous waste in a calendar month, that accumulate hazardous waste in tanks for less than 180 days (or 270 days if the generator must ship the waste greater than 200 miles), and do not accumulate over 6,000 kg on-site at any time.

(b) Generators of between 100 and 1,000 kg/mo hazardous waste must comply with the following general operating requirements:

(1) Treatment or storage of hazardous waste in tanks must comply with § 265.17(b).

(2) Hazardous wastes or treatment reagents must not be placed in a tank if they could cause the tank or its inner liner to rupture, leak, corrode, or otherwise fail before the end of its intended life.

(3) Uncovered tanks must be operated to ensure at least 60 centimeters (2 feet) of freeboard, unless the tank is equipped with a containment structure (e.g., dike or trench), a drainage control system, or a diversion structure (e.g., standby tank) with a capacity that equals or exceeds the volume of the top 60 centimeters (2 feet) of the tank.

(4) Where hazardous waste is continuously fed into a tank, the tank must be equipped with a means to stop this inflow (e.g., waste feed cutoff system or by-pass system to a stand-by tank). Note:These systems are intended to be used in the event of a leak or overflow from the tank due to a system failure (e.g., a malfunction in the treatment process, a crack in the tank, etc.).

(c) Except as noted in paragraph (d) of this section, generators who accumulate between 100 and 1,000 kg/mo of hazardous waste in tanks must inspect, where present:

(1) Discharge control equipment (e.g., waste feed cutoff systems, by-pass systems, and drainage systems) at least once each operating day, to ensure that it is in good working order;

(2) Data gathered from monitoring equipment (e.g., pressure and temperature gauges) at least once each operating day to ensure that the tank is being operated according to its design;

(3) The level of waste in the tank at least once each operating day to ensure compliance with § 265.201(b)(3);

(4) The construction materials of the tank at least weekly to detect corrosion or leaking of fixtures or seams; and(5) The construction materials of, and the area immediately surrounding, discharge confinement structures (e.g., dikes) at least weekly to detect erosion or obvious signs of leakage (e.g., wet spots or dead vegetation). Note:As required by § 265.15(c), the owner or operator must remedy any deterioration or malfunction he finds.

(d) Generators who accumulate between 100 and 1,000 kg/mo of hazardous waste in tanks or tank systems that have full secondary containment and that either use leak detection equipment to alert facility personnel to leaks, or implement established workplace practices to ensure leaks are promptly identified, must inspect at least weekly, where applicable, the areas identified in paragraphs (c)(1) through (5) of this section. Use of the alternate inspection schedule must be documented in the facility's operating record. This documentation must include a description of the established workplace practices at the facility.

(e) Performance Track member facilities may inspect on a less frequent basis, upon approval by the Director, but must inspect at least once each month. To apply for a less than weekly inspection frequency, the Performance Track member facility must follow the procedures described in § 265.15(b)(5).(f) Generators of between 100 and 1,000 kg/mo accumulating hazardous waste in tanks must, upon closure of the facility, remove all hazardous waste from tanks, discharge control equipment, and discharge confinement structures. Note:At closure, as throughout the operating period, unless the owner or operator can demonstrate, in accordance with § 261.3(c) or (d) of this chapter, that any solid waste removed from his tank is not a hazardous waste, the owner or operator becomes a generator of hazardous waste and must manage it in accordance with all applicable requirements of parts 262, 263, and 265 of this chapter.

(g) Generators of between 100 and 1,000 kg/mo must comply with the following special requirements for ignitable or reactive waste:(1) Ignitable or reactive waste must not be placed in a tank, unless:

(i) The waste is treated, rendered, or mixed before or immediately after placement in a tank so that

(A) the resulting waste, mixture, or dissolution of material no longer meets the definition of ignitable or reactive waste under § 261.21 or § 261.23 of this chapter, and

(B) § 265.17(b) is complied with; or

(ii) The waste is stored or treated in such a way that it is protected from any material or conditions that may cause the waste to ignite or react; or

(iii) The tank is used solely for emergencies.(2) The owner or operator of a facility which treats or stores ignitable or reactive waste in covered tanks must comply with the buffer zone requirements for tanks contained in Tables 2-1 through 2-6 of the National Fire Protection Association's "Flammable and Combustible Liquids Code," (1977 or 1981) (incorporated by reference, see § 260.11).(h) Generators of between 100 and 1,000 kg/mo must comply with the following special requirements for incompatible wastes:

(1) Incompatible wastes, or incompatible wastes and materials, (see appendix V for examples) must not be placed in the same tank, unless § 265.17(b) is complied with.

(2) Hazardous waste must not be placed in an unwashed tank which previously held an incompatible waste or material, unless § 265.17(b) is complied with.

END OF SUBPART J

APPENDIX B

SUPERIOR SERVICES FEBRUARY 2015
TANK ASSESSMENT REPORT
RADFORD ARMY AMMUNITION PLANT
TANKS 1A, 1B, AND MAKEUP WATER

Prepared for:
Radford Facilities Army Ammunition Plant
Route 114
Radford, Virginia 24143-0002

TANK ASSESSMENT REPORT

RADFORD ARMY AMMUNITION PLANT

TANKS 1A, 1B, AND MAKEUP WATER

Prepared by:
Superior Services
P. O. Box 982
Hendersonville, North Carolina

January 2015 Inspections

February 6, 2015

Radford Facilities Army Ammunition Plant
Route 114
Radford, Virginia 24143-0002

Attention: Mr. Matthew Alberts

Subject: **Tank Assessment Report**
Radford Facilities Army Ammunition Plant
Tanks 1A, 1B, and Makeup Water

Dear Mr. Alberts:

Superior Services (Superior) performed API 653 external inspections of the following tanks: Tank 1A, Tank 1B, and Makeup Water Tank at the Radford Facilities Army Ammunition Plant (RFAAP) located in Radford, Virginia, in January 2015. These inspections were conducted in accordance with API 653, *Tank Inspection, Repair, Alternation, and Reconstruction*, Fourth Edition, Addendum 2, January 2012. This Tank Assessment Report documents the procedures, findings and recommendations of these inspections.

Superior appreciates this opportunity to provide you with these professional services. If you have any questions regarding the report or the project in general, please don't hesitate to give us a call at 828-698-6286.

Sincerely,
Superior Services

Dave Brickley

EXECUTIVE SUMMARY

In accordance with the American Petroleum Institute (API) 653 standard entitled *Tank Inspection, Repair, Alteration, and Reconstruction* Radford Facilities Army Ammunition Plant (RFAAP) is required to conduct periodic integrity testing of hazardous waste tanks at their facility in Radford, Virginia. Superior Services (Superior) performed inspections in January 2015 on the following tanks:

Tank 1A (~1,900 gallon tank): API 653 formal external inspection
Tank 1B (~1,900 gallon tank): API 653 formal external inspection
Makeup Water Tank (1,500 gallon tank): API 653 formal external inspection

As documented in this Tank Assessment Report, Superior has determined that all three of the above listed tanks are suitable for service as hazardous waste storage containers. The following observations and recommendations are presented in the report:

- Tank 1A:
    - tank piping – tank discharge pipe has non-specification repair.

API 653 requires that external inspections be performed in accordance with Section 6 of API 653. API653 Section 6 requires external inspections at least every five years, UT inspections at least every 15 years, and internal inspections at least every 30 years. However, the Resource Conservation and Recovery Act (RCRA) requires annual inspections of hazardous waste tanks. Therefore, the next inspections should occur in 2016.

REPORT CERTIFICATIONS

Superior Services hereby certifies that the inspections conducted on the following tanks meets the integrity testing requirements of the API 653 standard:

Tank 1A	API 653 Formal External Inspection
Tank 1B	API 653 Formal External Inspection
Makeup Water Tank	API 653 Formal External Inspection

Superior Services hereby certifies that the external inspections of the above tanks were conducted in accordance with the American Petroleum Institute (API) standard, *Tank Inspection, Repair, Alteration, and Reconstruction*, Fourth Edition, Addendum 2, January 2012, by a certified API 653 tank inspector.

API Certified Tank Inspector Signature: ______________________

API Certified Tank Inspector Name: Steven L. Shugart

API Certification #: 31235

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1.0 INTRODUCTION

1.1 Statement of Purpose

The American Petroleum Institute (API) standard 653 *Tank Inspection, Repair, Alteration, and Reconstruction* (API 653) covers steel storage tanks built to API 650 *Welded Steel Tanks for Oil Storage* Addendum 3, February 2008 (API 650), and its predecessors. The Radford Facilities Army Ammunition Plant (RFAAP) in Radford, Virginia maintains above ground storage tanks (ASTs) and is subject to API standards for those larger tanks. In accordance with API standards, the RFAAP is required to conduct periodic testing of the tanks at the facility. The purpose of this Tank Assessment Report (TAR) is to document the recently conducted external tank inspections at the RFAAP.

1.2 Background

1.2.1 Site Description

RFAAP operates an ammunition manufacturing plant located on Route 114 northeast of downtown Radford, Virginia. The property is bounded on the north, south, east, and west by residential and agricultural property. RFAAP was established during World War II and produced approximately 600 million pounds of powder during the war years. It was placed in standby status after World War II, but was reactivated to full operating capacity during the Korean and Vietnam Wars. RFAAP manufactures a wide variety of propellants. The propellants are both solvent (single- and multiple-base) and solventless. The facility underwent extensive renovation during the Korean War and further expansion during the 1960s. The present contractor is BAE Systems, Ordnance Systems, Inc.

RFAAP maintains an incineration area with three storage tanks within the basement of the incineration building. Tanks 1A, 1B, and the Makeup Water Tank contain hazardous waste constituents and makeup water. Tank specifications and observations are contained in the Section 3 of this report.

1.2 Report Contents

In addition to the Introduction Section, the remainder of this report contains the following information:

- a description of applicable tank inspection standards and selection;
- inspection observations; and
- suitability for service, recommendations, and the next inspection interval.

2.0 TANK INSPECTION STANDARDS

2.1 Introduction

To meet the tank inspection requirements, RFAAP is committed to testing ASTs for integrity on a regular schedule, as long as the tanks are in service, and whenever material repairs are made. The types and frequencies of integrity tests for ASTs are based upon the type of tank, construction standard, and governing regulations. The period of construction for the tanks in the incineration building area is unknown; the code of construction was most likely API 650 or API 12F. Therefore, API 653 guidelines were followed in conducting the external tank inspections. Superior Services (Superior) has prepared a checklist of applicable items investigated during the tank inspections in January 2015 at the RFAAP. Copies of the relevant checklists are contained in Appendix B of this TAR.

2.2 Shop Built Tanks

Tanks 1A, 1B, and Makeup Water Tank are most likely shop-built aboveground steel tanks. Superior was not able to ascertain the code of construction utilized for tank construction. In accordance with API guidelines, *When design and construction details are not given, and are not available in the as-built standard, details that will provide a level of integrity equal to the level provided by the current edition of the API standard 650 must be used* [API 653; Fourth Edition, Addendum 2; January 2012; page 1-1]. Accordingly, these tanks were inspected using the API standard 653.

Superior conducted external inspection and testing on Tanks 1A, 1B, and the Makeup Water Tank. The external inspections consisted of a visual inspection followed by ultrasonic thickness (UT) testing on each shell and bottom plates. Results are presented in the following two sections of this report.

3.0 TANK INSPECTION OBSERVATIONS

3.1 Introduction

RFAAP contracted with Superior to perform external tank inspections. The tank inspections were conducted by Mr. Steven L. Shugart and Mr. David Brickley in January 2015. Mr. Shugart is a certified API tank inspector (API 653 certified tank system inspector #31235) and Mr. Brickley is a certified Steel Tank Institute inspector. This section of the report presents the tank inspection observations. Tank inspection observations for each tank are presented as follows: tank information; tank observations and issues; and tank design (tank shell and tank bottom).

Superior has prepared external checklists with relevant information regarding each of the inspected tanks; see Tables 1 through 6 in Appendix B. Superior rated each item in each category on a scale of 0 to 3. A rating of 0 means not applicable; a rating of 1 means no exception taken; a rating of 2 means condition requires minor repairs, and is not a tank integrity exception; and a rating of 3 means the condition is adverse to tank integrity and requires immediate repair, or the tank should be removed from service. Most of the listed items had a rating of 0 or 1.

3.2 Tank 1A

3.2.1 Tank Information and Specifications

Tank 1A is about an 1,900-gallon vertical, stainless steel, single-wall, aboveground tank that contains hazardous wastewater. The tank is approximately 6.5 feet in diameter with a 7 foot tall side shell. It is located in the basement of the incineration building in the northern portion of the RFAAP site north of the New River. Figure 1 in Appendix A shows a general site layout drawing which shows the locations of the various tanks at the site. Figure 2 in Appendix A shows the dimensions of the tank shell and bottom, and the locations of the ultrasonic thickness measurement locations. The following list presents some of the tank specifications.

Tank identification	Tank 1A
Location	Inside incineration building basement
Latitude	37^0 10'
Longitude	80^0 32'
Diameter	6.5 feet
Height	7 feet
Product	Hazardous wastewater
Gross capacity	~1,900 gallons
Year built	Unknown
Code of construction	Unknown (suspected code API 650 or API 12F)
Name plate	None present
Manufacturer	Unknown
Bottom construction	Single plate bottom
Type of foundation	Concrete foundation
Cathodic protection	None
Shell construction	Single plate butt-welded, stainless steel panels
Roof access	Steel, or aluminum, ladders; not attached to tank
Roof type	Open top
Safe fill level	~6.5 feet
High level alarm	Unknown
High-high level alarm	Unknown
Maximum fill rate	Unknown
Last external inspection	Unknown
Last internal inspection	Unknown

3.2.2 Tank Observations and Issues

The following observations were noted for this tank:

- tank is most likely shop built;
- no label was observed on the tank shell and the tank manufacturer is unknown;

- information was provided from site personnel on the tank design; the architect-engineer on the project was J. Fruchtbaum Associates, Buffalo, New York; design date is January 1974;
- tank foundation is concrete and the tank rests on four steel supports that sit on concrete piers; the foundation and steel supports do not show any evidence of settlement, exposed rebar, washouts, voids, or leaking;
- tank is single-walled Type 304 stainless steel in good condition; no unusual penetrations or defects were observed in the outer tank shell; there is some staining on the outside shell;
- the tank sits inside the basement of the incinerator building; the dimensions are approximately 18 feet by 27 feet;
- the tank loading pipes, and other pipes associated with this tank, appear well supported and in good condition;
- the following openings were observed in the tank shell: (1) product lines; and (2) other miscellaneous piping;
- tank ladder is made of steel, or aluminum; ladders are not attached to the tank;
- the tank shell consists of two steel plates; each tank plate is approximately 7 feet tall and approximately 10 feet long; tank seams and plate sizes are shown schematically in Appendix A drawings;
- non-destructive UT measurements were made on the tank shell with a Olympus M62-XT gauge (see figures and tables in Appendix B for UT measurements); the range of average thicknesses for the shell panels was 0.260 to 0.261 inches; the thinnest reading was 0.256 inches; design drawings specified 0.250 inch thick panels; and
- thickness measurements were taken on the tank bottom as follows: the average thickness was 0.399 inches and the minimum thickness was 0.363 inches; design drawings specified a 0.375 inch thick bottom plate.

Superior inspected the tank carefully to identify any issues. As described previously, an external checklist was used to rate relevant API 653 tank appurtenances. The checklist is contained in Appendix B of this report. No issues were identified for this tank.

3.2.3 Tank Design Factors

3.2.3.1 Tank Shell Design

As stated in Section 3.2.2, the tank consists of single-wall stainless steel plates which are butt-welded at the vertical and horizontal seams. Photographs in Appendix C show various views of the plates. Superior collected UT readings on the two stainless steel panels of the tank. UT average readings in the tank shell ranged from 0.260 to 0.261 inches. According to the API 653 inspection standard, the minimum acceptable shell thickness for continued service, for tanks with diameters less than 200 feet, is determined by the following formula:

$$t_{min} = \frac{2.6\,(H-1)DG}{SE}$$

where t_{min} = minimum acceptable thickness;
D = nominal diameter;
H = height from bottom of shell course;
G = specific gravity of the contents;
S = maximum allowable stress; and
E = joint efficiency.

Using a nominal diameter of 6.5 feet, a height of 7 feet, a specific gravity of 1.0, a maximum allowable stress of 23,000 lbf/in^2 (see Table 4.1 in API 653), and a joint efficiency of 0.70 (see Table 4.3 in API 653), the minimum acceptable shell thickness for the lower course is 0.006 inches; however, according to API 653, Section 4.3.3.1, the minimum acceptable thickness is 0.10 inches. As stated previously, the tank shell plates ranged in average thickness from 0.260 to 0.261 inches. As shown on figures in Appendix B, none of the readings is below 0.256 inches. Therefore, the measured thickness of the steel plates meets API guidelines.

3.2.3.2 Tank Bottom

The tank bottom is conical and has a 3-inch drain pipe. Photographs in Appendix C show some views of the bottom appurtenances. Superior collected UT measurements on the tank bottom plates. The average range of the UT measurements on the tank bottom plates was 0.399 inches, and the minimum reading was 0.363 inches. In accordance with Section 4.4.7.4, API 653 specifies the following: *the minimum bottom plate thickness in the critical zone of the tank bottom… shall be the smaller of ½ the original bottom plate thickness (not including the original corrosion allowance) or 50 percent of* t_{min} *of the lower shell course … but not less than 0.1 inches.* One-half of the original bottom thickness (i.e., 0.375 inches) is 0.1875 inches. None of the thickness readings approached 0.1875 inches.

3.3 Tank 1B

3.3.1 Tank Information and Specifications

Tank 1B is about an 1,900-gallon vertical, stainless steel, single-wall, aboveground tank that contains hazardous wastewater. The tank is approximately 6.5 feet in diameter with a 7 foot tall side shell. It is located in the basement of the incineration building in the northern portion of the RFAAP site north of the New River. Figure 1 in Appendix A shows a general site layout drawing which shows the locations of the various tanks at the site. Figure 3 in Appendix A shows the dimensions of the tank shell and bottom, and the locations of the ultrasonic thickness measurement locations. The following list presents some of the tank specifications.

Tank identification	Tank 1B
Location	Inside incineration building basement
Latitude	37^0 10'
Longitude	80^0 32'
Diameter	6.5 feet
Height	7 feet
Product	Hazardous wastewater
Gross capacity	~1,900 gallons
Year built	Unknown

Code of construction	Unknown (suspected code API 650 or API 12F)
Name plate	None present
Manufacturer	Unknown
Bottom construction	Single plate bottom
Type of foundation	Concrete foundation
Cathodic protection	None
Shell construction	Single plate butt-welded, stainless steel panels
Roof access	Steel, or aluminum, ladders; not attached to tank
Roof type	Open top
Safe fill level	~6.5 feet
High level alarm	Unknown
High-high level alarm	Unknown
Maximum fill rate	Unknown
Last external inspection	Unknown
Last internal inspection	Unknown

3.2.2 Tank Observations and Issues

The following observations were noted for this tank:

- tank is most likely shop built;
- no label was observed on the tank shell and the tank manufacturer is unknown;
- information was provided from site personnel on the tank design; the architect-engineer on the project was J. Fruchtbaum Associates, Buffalo, New York; design date is January 1974;
- tank foundation is concrete and the tank rests on four steel supports that sit on concrete piers; the foundation and steel supports do not show any evidence of settlement, exposed rebar, washouts, voids, or leaking;
- tank is single-walled Type 304 stainless steel in good condition; no unusual penetrations or defects were observed in the outer tank shell; there is some staining on the outside shell;
- the tank sits inside the basement of the incinerator building; the dimensions are approximately 18 feet by 27 feet;

- the tank loading pipes, and other pipes associated with this tank, appear well supported and in good condition; however, there has been a non-specification repair on the discharge pipe leading to the pumping system;
- the following openings were observed in the tank shell: (1) product lines; and (2) other miscellaneous piping;
- tank ladder is made of steel, or aluminum; ladder is not attached to the tank;
- the tank shell consists of two steel plates; each tank plate is approximately 7 feet tall and approximately 10 feet long; tank seams and plate sizes are shown schematically in Appendix A drawings;
- non-destructive UT measurements were made on the tank shell with a Olympus M62-XT gauge (see figures and tables in Appendix B for UT measurements); the range of average thicknesses for the shell panels was 0.262 to 0.266 inches; the thinnest reading was 0.257 inches; design drawings specified 0.250 inch thick panels; and
- thickness measurements were taken on the tank bottom as follows: the average thickness was 0.392 inches and the minimum thickness was 0.351 inches; design drawings specified a 0.375 inch thick bottom plate.

Superior inspected the tank carefully to identify any issues. As described previously, an external checklist was used to rate relevant API 653 tank appurtenances. The checklist is contained in Appendix B of this report. Only one issue was identified for this tank (i.e., the non-specification repair of the discharge pipe leading to the pumping system).

3.2.3 Tank Design Factors

3.2.3.1 Tank Shell Design

As stated in Section 3.2.2, the tank consists of single-wall stainless steel plates which are butt-welded at the vertical and horizontal seams. Photographs in Appendix C show various views of the plates. Superior collected UT readings on the two stainless steel panels of the tank. UT average readings in the tank shell ranged from 0.262 to 0.266 inches. According to the API 653 inspection standard, the minimum acceptable shell thickness for continued service, for tanks with diameters less than 200 feet, is determined by the following formula:

$$t_{min} = \frac{2.6\,(H-1)DG}{SE}$$

where t_{min} = minimum acceptable thickness;
D = nominal diameter;
H = height from bottom of shell course;
G = specific gravity of the contents;
S = maximum allowable stress; and
E = joint efficiency.

Using a nominal diameter of 6.5 feet, a height of 7 feet, a specific gravity of 1.0, a maximum allowable stress of 23,000 lbf/in^2 (see Table 4.1 in API 653), and a joint efficiency of 0.70 (see Table 4.3 in API 653), the minimum acceptable shell thickness for the lower course is 0.006 inches; however, according to API 653, Section 4.3.3.1, the minimum acceptable thickness is 0.10 inches. As stated previously, the tank shell plates ranged in average thickness from 0.262 to 0.266 inches. As shown on figures in Appendix B, none of the readings is below 0.257 inches. Therefore, the measured thickness of the steel plates meets API guidelines.

3.2.3.2 Tank Bottom

The tank bottom is conical and has a 3-inch drain pipe. Photographs in Appendix C show some views of the bottom appurtenances. Superior collected UT measurements on the tank bottom plates. The average range of the UT measurements on the tank bottom plates was 0.399 inches, and the minimum reading was 0.363 inches. In accordance with Section 4.4.7.4, API 653 specifies the following: *the minimum bottom plate thickness in the critical zone of the tank bottom... shall be the smaller of ½ the original bottom plate thickness (not including the original corrosion allowance) or 50 percent of t_{min} of the lower shell course ... but not less than 0.1 inches.* One-half of the original bottom thickness (i.e., 0.375 inches) is 0.1875 inches. None of the thickness readings approached 0.1875 inches.

3.4 Makeup Water Tank

3.4.1 Tank Information and Specifications

The Makeup Water Tank is about a 1,500-gallon vertical, stainless steel, single-wall, aboveground tank that contains makeup water. The tank is approximately 6.0 feet in diameter with a 7 foot tall side shell. It is located in the basement of the incineration building in the northern portion of the RFAAP site north of the New River. Figure 1 in Appendix A shows a general site layout drawing which shows the locations of the various tanks at the site. Figure 4 in Appendix A shows the dimensions of the tank shell and bottom, and the locations of the ultrasonic thickness measurement locations. The following list presents some of the tank specifications.

Tank identification	Makeup Water Tank
Location	Inside incineration building basement
Latitude	37^0 10’
Longitude	80^0 32’
Diameter	6.0 feet
Height	7 feet
Product	makeup water
Gross capacity	~1,500 gallons
Year built	Unknown
Code of construction	Unknown (suspected code API 650 or API 12F)
Name plate	None present
Manufacturer	Unknown
Bottom construction	Single plate bottom
Type of foundation	Concrete foundation
Cathodic protection	None
Shell construction	Single plate butt-welded, stainless steel panels
Roof access	Steel, or aluminum, ladders; ladders not attached to tank;
Roof type	Open top
Safe fill level	~5.5 feet
High level alarm	Unknown
High-high level alarm	Unknown
Maximum fill rate	Unknown
Last external inspection	Unknown
Last internal inspection	Unknown

3.2.2 Tank Observations and Issues

The following observations were noted for this tank:

- tank is most likely shop built;
- no label was observed on the tank shell and the tank manufacturer is unknown;
- information was provided from site personnel on the other tank designs inside the incinerator building; the architect-engineer on the project was J. Fruchtbaum Associates, Buffalo, New York; design date is January 1974;
- tank foundation is concrete and the tank rests on four steel supports that sit on concrete piers; the foundation and steel supports do not show any evidence of settlement, exposed rebar, washouts, voids, or leaking;
- tank is single-walled Type 304 stainless steel in good condition; no unusual penetrations or defects were observed in the outer tank shell; there is some staining on the outside shell;
- the tank sits inside the basement of the incinerator building; the dimensions are approximately 18 feet by 27 feet;
- the tank loading pipes, and other pipes associated with this tank, appear well supported and in good condition;
- the following openings were observed in the tank shell: (1) product lines; and (2) other miscellaneous piping;
- tank ladder is made of steel, or aluminum;
- the tank shell consists of two steel plates; each tank plate is approximately 7 feet tall and approximately 9.5 feet long; tank seams and plate sizes are shown schematically in Appendix A drawings;
- non-destructive UT measurements were made on the tank shell with a Olympus M62-XT gauge (see figures and tables in Appendix B for UT measurements); the range of average thicknesses for the shell panels was 0.253 to 0.261 inches; the thinnest reading was 0.247 inches; design drawings specified 0.250 inch thick panels; and
- thickness measurements were taken on the tank bottom as follows: the average thickness was 0.394 inches and the minimum thickness was 0.350 inches; design drawings specified a 0.375 inch thick bottom plate.

Superior inspected the tank carefully to identify any issues. As described previously, an external checklist was used to rate relevant API 653 tank appurtenances. The checklist is contained in Appendix B of this report. No issues were identified for this tank.

3.2.3 Tank Design Factors

3.2.3.1 Tank Shell Design

As stated in Section 3.2.2, the tank consists of single-wall stainless steel plates which are butt-welded at the vertical and horizontal seams. Photographs in Appendix C show various views of the plates. Superior collected UT readings on the two stainless steel panels of the tank. UT average readings in the tank shell ranged from 0.253 to 0.261 inches. According to the API 653 inspection standard, the minimum acceptable shell thickness for continued service, for tanks with diameters less than 200 feet, is determined by the following formula:

$$t_{min} = \frac{2.6\,(H-1)DG}{SE}$$

where t_{min} = minimum acceptable thickness;
D = nominal diameter;
H = height from bottom of shell course;
G = specific gravity of the contents;
S = maximum allowable stress; and
E = joint efficiency.

Using a nominal diameter of 6.0 feet, a height of 7 feet, a specific gravity of 1.0, a maximum allowable stress of 23,000 lbf/in^2 (see Table 4.1 in API 653), and a joint efficiency of 0.70 (see Table 4.3 in API 653), the minimum acceptable shell thickness for the lower course is 0.006 inches; however, according to API 653, Section 4.3.3.1, the minimum acceptable thickness is 0.10 inches. As stated previously, the tank shell plates ranged in average thickness from 0.253 to 0.261 inches. As shown on figures in Appendix B, none of the readings is below 0.247 inches. Therefore, the measured thickness of the steel plates meets API guidelines.

3.2.3.2 Tank Bottom

The tank bottom is conical and has a 3-inch drain pipe. Photographs in Appendix C show some views of the bottom appurtenances. Superior collected UT measurements on the tank bottom plates. The average range of the UT measurements on the tank bottom plates was 0.394 inches, and the minimum reading was 0.350 inches. In accordance with Section 4.4.7.4, API 653 specifies the following: *the minimum bottom plate thickness in the critical zone of the tank* *bottom… shall be the smaller of ½ the original bottom plate thickness (not including the original corrosion allowance) or 50 percent of t_{min} of the lower shell course ... but not less than 0.1 inches.* One-half of the original bottom thickness (i.e., 0.375 inches) is 0.1875 inches. None of the thickness readings approached 0.1875 inches.

4.0 SUITABILITY FOR SERVICE, RECOMMENDATIONS & NEXT INSPECTION

4.1 Introduction

Superior performed external tank inspections on Tanks 1A, 1B, and the Makeup Water Tank located at the RFAAP in Radford, Virginia. This section of the Tank Assessment Report documents:

- the suitability for service of each of the tanks;
- recommendations, which must be implemented in order to maintain the suitability for service;
- suggestions, which may be implemented to improve the tank; and
- next inspection interval.

4.2 Suitability for Service

As documented in this Tank Assessment Report, Superior has determined that the above listed tanks are suitable for service as hazardous waste storage containers. One repair is required on the tank piping of Tank 1B. The following observations and recommendations are presented in the report:

- Tank 1B:
  - tank piping – non-specification repair on tank discharge pipe.

4.3 Inspection Interval

API 653 states that periodic tank inspections shall be performed. It requires both external and internal inspections. When the corrosion rate is not known, external and UT inspections are required to be conducted every five years (see Section 6.3.3.2) and every 15 years, respectively. However, RCRA regulations require tank inspections be performed on an annual basis. Therefore, the next external and UT inspections should be performed in 2016.

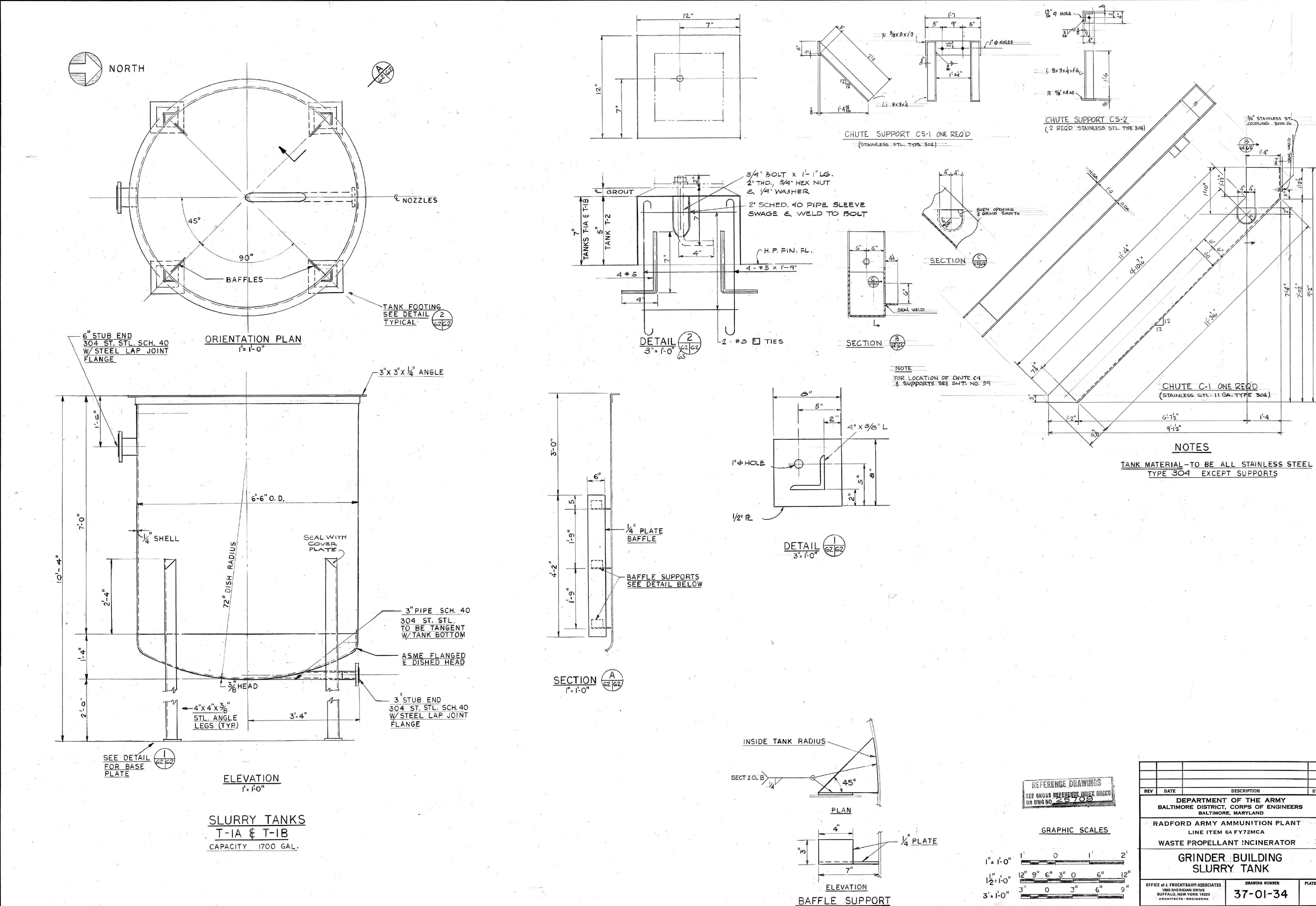
API 653 requires internal inspections every 10 to 30 years, depending upon site conditions. However, in accordance with Section 6.5, *in cases where construction, size, or other aspects allow external access to the tank bottom to determine bottom thickness, an external inspection in* *lieu of an internal inspection is allowed to meet the data requirements……"*. Superior believes that this is the case for Tanks 1A, 1B, and the Makeup Water Tank for the reasons listed below.

- Each of the tanks is elevated, which provided access to the bottoms of the tanks. UT thickness measurements were taken on the tank bottoms. Additionally, each of the tank bottoms was visually inspected; nothing of consequence was noted during the visual or UT inspections.
- Each of the tanks has an open top. Periodically, the tanks can be emptied and visually inspected from the ladders and platforms.

Based on these reasons and based on the more stringent RCRA regulations, annual external and UT inspections should be performed on these three tanks. The next inspections should occur in 2016.

APPENDIX A

FIGURES



NOTES

TANK MATERIAL - TO BE ALL STAINLESS STEEL TYPE 304 EXCEPT SUPPORTS

REV	DATE	DESCRIPTION	BY

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS
BALTIMORE, MARYLAND

RADFORD ARMY AMMUNITION PLANT
LINE ITEM 6A FY72MCA
WASTE PROPELLANT INCINERATOR

GRINDER BUILDING SLURRY TANK

OFFICE of J. FRUCHTBAUM ASSOCIATES, 1965 SHERIDAN DRIVE, BUFFALO, NEW YORK 14223, ARCHITECTS - ENGINEERS

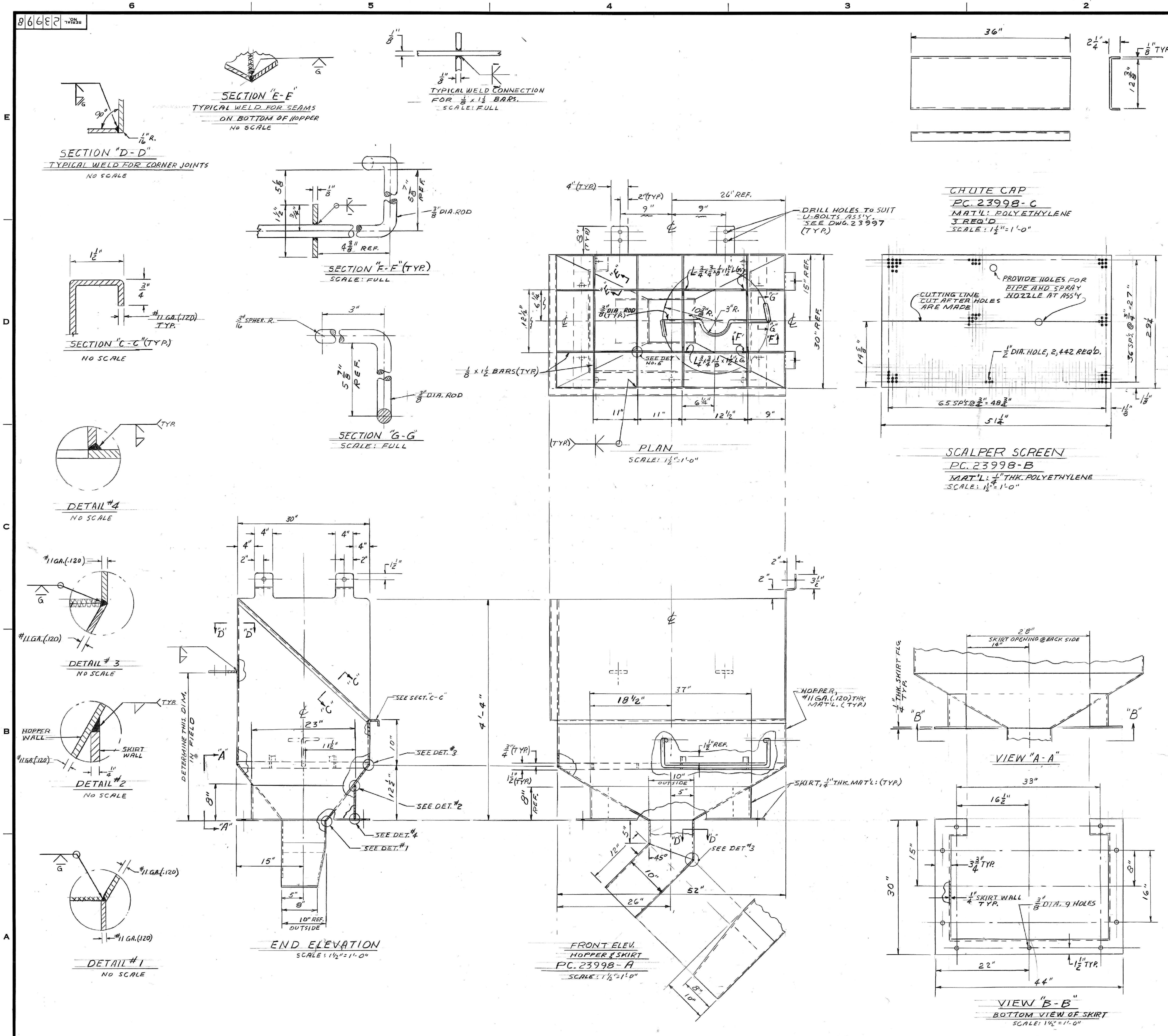
DRAWING NUMBER: 37-01-34

SCALE: AS NOTED DATE: 15 NOV. 1974 SHEET 62 OF

NORFOLK DISTRICT FILE NUMBER RAD 48-1.59

044200 25767 T 160 00

AS BUILT



REVISIONS

DESCRIPTION	DRAFTING DRAWN	DATE	CHECKED	APPROVAL ENG	OPER	SAFETY

GENERAL NOTES:

1. ALL MATERIAL TO BE STAINLESS STEEL 304L, UNLESS OTHERWISE NOTED.
2. ALL WELDING TO BE PER DWG. 11717, SECTION 1 FOR INTERIOR SURFACES & SECTION 2 FOR ALL EXTERIOR SURFACES

TYPE HAZARDOUS CLASS "A" FOR INTERIOR & "B" FOR EXTERIOR

NO.	TITLE
11717	WELD SPECS.
23997	ARRANGEMENT

REFERENCE DRAWINGS

DO NOT SCALE DRAWING

TOLERANCES UNLESS OTHERWISE SPECIFIED
DECIMAL ± ~
FRACTIONAL ± 1/64"
ANGULAR ± 1/2°

RADFORD ARMY AMMUNITION PLANT
U. S. ARMY
RADFORD, VIRGINIA
HERCULES INCORPORATED

BUILDING GRINDER HO. NO. 442
AREA: PILOT "B" DEPT.: PROPELLANT

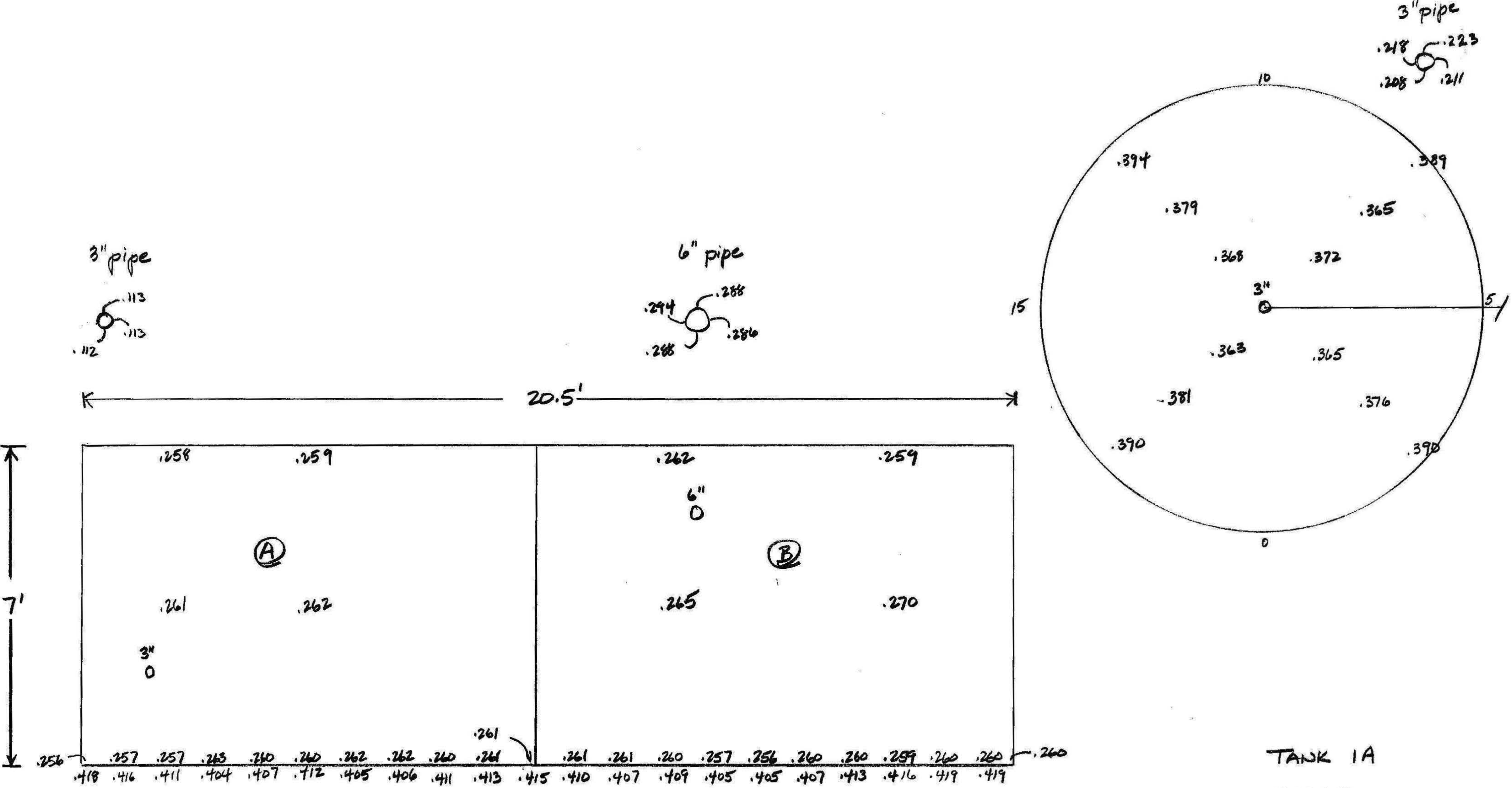
TITLE
WASTE PROPELLANT INCINERATOR FAC.
HOPPER FOR HANDLING OF LIQUID EXPLOSIVE WASTE TO THE SLURRY TANK
DETAILS

APPROVED FOR GENERAL DESIGN AND SPECIFICATIONS
FOR HERCULES INCORPORATED J. I. Bolen 1-9-79 ENGINEERING DEPT. DATE
FOR U. S. GOVERNMENT John C Horvath 1/15/79 DATE
D. M. Day 15 JAN 79

SCALE: AS NOTED DATE: 11-1-78
DRAWN BY: Roseberry CHECKED BY: ECC
APPROVALS
O. B. Caldwell 11-16-78
E.M. SOUCEK 1/3/79 DEPT. SUPT.
R. Harter 1/3/78 SAFETY SUPT.

PROJ: CONTRACT NO. DAAA09-77-C-4007

ACCOUNT NO.	SERIAL NO.	CLASS. CODE	REV.
04420	023998	F357	00

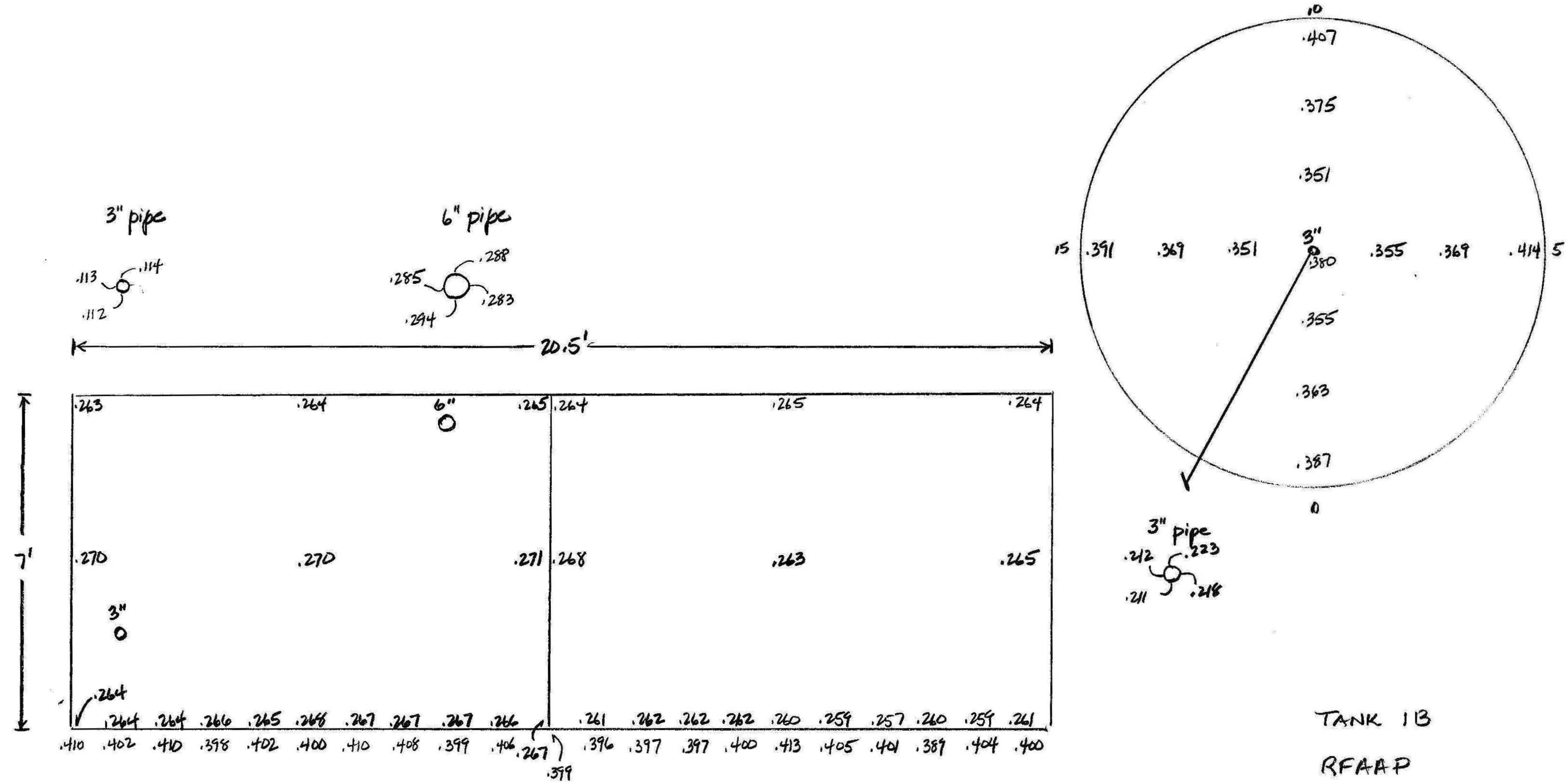


TANK 1A

RFAAP

RADFORD, VA

1" = 2'

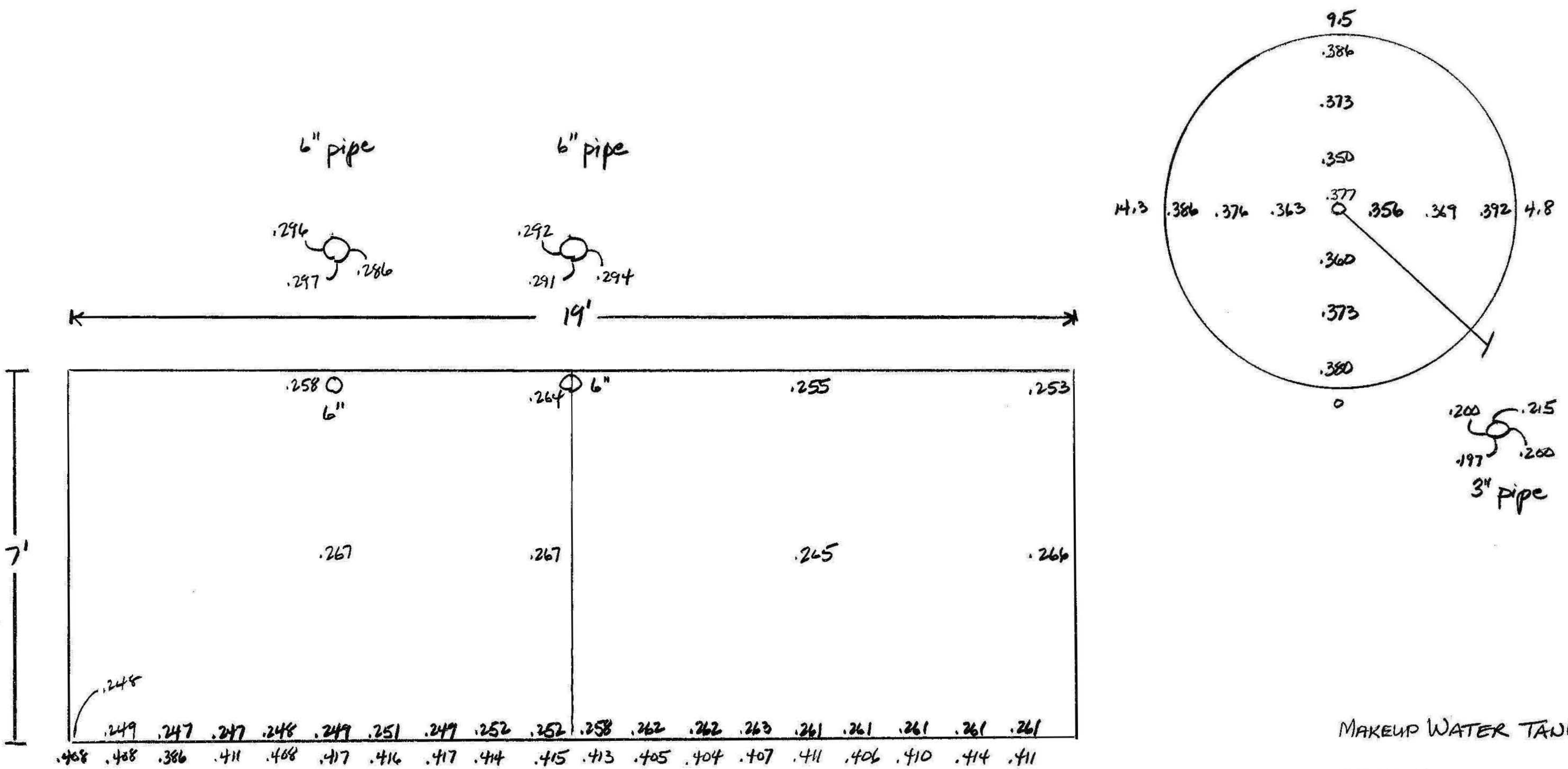


TANK 1B

RFAAP

RADFORD, VA

1" = 2'



MAKEUP WATER TANK

RFAAP

RADFORD, VA

1" = 2'

APPENDIX B

TABLES

TABLE 1
TANK 1A

Tank In-service Inspection Checklist			
Item		**Completed √**	**Comments**
C.1.1	**Foundation**		
	Measure foundation levelness and bottom elevations (see Annex B for extent of measurements).	0	
C.1.1.1	**Concrete Ring**		
	a) Inspect for broken concrete, spalling, and cracks, particularly under backup bars used in welding butt-welded annular rings under the shell.	0	
	b) Inspect drain openings in ring, back of waterdraw basins and top surface of ring for indications of bottom leakage.	0	
	c) Inspect for cavities under foundation and vegetation against bottom of tank.	0	
	d) Check that runoff rainwater from the shell drains away from tank.	0	
	e) Check for settlement around perimeter of tank.	0	
C.1.1.2	**Asphalt**		
	a) Check for settling of tank into asphalt base which would direct runoff rain water under the tank instead of away from it.	0	
	b) Look for areas where leaching of oil has left rock filler exposed, which indicates hydrocarbon leakage.	0	
C.1.1.3	**Oiled Dirt or Sand**		
	Check for settlement into the base which would direct runoff rain water under the tank rather than away from it.	0	
C.1.1.4	**Rock**		
	Presence of crushed rock under the steel bottom usually results in severe underside corrosion. Make a note to do additional bottom plate examination (ultrasonic, hammer testing, or turning of coupons) when the tank is out of service.	0	
C.1.1.5	**Site Drainage**		
	a) Check site for drainage away from the tank and associated piping and manifolds.	0	
	b) Check operating condition of the dike drains.	0	
C.1.1.6	**Housekeeping**		
	Inspect the area for buildup of trash, vegetation, and other inflammables buildup.	1	
C.1.1.7	**Cathodic Protection**		
	Review cathodic protection potential readings.	0	
C.1.2	**Shells**		
C.1.2.1	**External Visual Inspection**		
	a) Visually inspect for paint failures, pitting, and corrosion.	1	
	b) Clean off the bottom angle area and inspect for corrosion and thinning on plate and weld.	0	
	c) Inspect the bottom-to-foundation seal, if any.	0	
C.1.2.2	**Internal (Floating Roof Tank)**		
	Visually inspect for grooving, corrosion, pitting, and coating failures.	0	
C.1.2.3	**Riveted Shell Inspection**		
	a) Inspect external surface for rivet and seam leaks.	0	
	b) Locate leaks by sketch or photo (location will be lost when shell is abrasive cleaned for painting).	0	
	c) Inspect rivets for corrosion loss and wear.	0	
	d) Inspect vertical seams to see if they have been full fillet lap-welded to increase joint efficiency.	0	

TABLE 1
TANK 1A

Tank In-service Inspection Checklist (Continued)			
	Item	Completed √	Comments
	e) If no record exists of vertical riveted seams, dimension and sketch (or photograph) the rivet pattern: number of rows, rivet size, pitch length, and note whether the joint is butt-riveted or lap-riveted.	0	
C.1.2.4	**Wind Girder (Floating Roof Tanks)**		
	a) Inspect wind girder and handrail for corrosion damage (paint failure, pitting, corrosion product buildup), especially where it occurs at tack-welded junction, and for broken welds.	0	
	b) Check support welds to shell for pitting, especially on shell plates.	0	
	c) Note whether supports have reinforcing pads welded to shell.	0	
C.1.3	**Shell Appurtenances**		
C.1.3.1	**Manways and Nozzles**		
	a) Inspect for cracks or signs of leakage on weld joint at nozzles, manways, and reinforcing plates.	/	
	b) Inspect for shell plate dimpling around nozzles, caused by excessive pipe deflection.	/	
	c) Inspect for flange leaks and leaks around bolting.	/	
	d) Inspect sealing of insulation around manways and nozzles.	/	
	e) Check for inadequate manway flange and cover thickness on mixer manways.	0	
C.1.3.2	**Tank Piping Manifolds**		
	a) Inspect manifold piping, flanges, and valves for leaks.	/	
	b) Inspect fire fighting system components.	0	
	c) Check for anchored piping which would be hazardous to the tank shell or bottom connections during earth movement.	/	
	d) Check for adequate thermal pressure relief of piping to the tank.	0	
	e) Check operation of regulators for tanks with purge gas systems.	0	
	f) Check sample connections for leaks and for proper valve operation.	0	
	g) Check for damage and test the accuracy of temperature indicators.	0	
	h) Check welds on shell-mounted davit clips above valves 6 in. and larger.	0	
C.1.3.3	**Autogauge System**		
	a) Inspect autogauge tape guide and lower sheave housing (floating swings) for leaks.	0	
	b) Inspect autogauge head for damage.	0	
	c) Bump the checker on autogauge head for proper movement of tape.	0	
	d) Identify size and construction material of autogauge tape guide (floating roof tanks).	0	
	e) Ask operator if tape tends to hang up during tank roof movement (floating roof tanks).	0	
	f) Compare actual product level to the reading on the autogauge (maximum variation is 2 in.).	0	
	g) On floating roof tanks, when the roof is in the lowest position, check that no more than two ft of tape are exposed at the end of the tape guide.	0	
	h) Inspect condition of board and legibility of board-type autogauges.	0	
	i) Test freedom of movement of marker and float.	0	
C.1.3.4	**Shell-mounted Sample Station**		
	a) Inspect sample lines for function of valves and plugging of lines, including drain or return-to-tank line.	0	
	b) Check circulation pump for leaks and operating problems.	0	

Tank In-service Inspection Checklist (Continued)			
	Item	Completed √	Comments
	c) Test bracing and supports for sample lines and equipment.	0	
C.1.3.5	**Heater (Shell Manway Mounted)**		
	Inspect condensate drain for presence of oil indicating leakage.	0	
C.1.3.6	**Mixer**		
	a) Inspect for proper mounting flange and support.	/	
	b) Inspect for leakage.	0	
	c) Inspect condition of power lines and connections to mixer.	/	
C.1.3.7	**Swing Lines: Winch Operation**		
	a) Nonfloating. Raise, then lower the swing line with the winch, and check for cable tightness to confirm that swing line lowered properly.	0	
	b) Floating. With tank half full or more, lower the swing line, then let out cable and check if swing has pulled cable tight, indicating that the winch is operating properly.	0	
	c) Indicator. Check that the indicator moves in the proper direction: Floating swing line indicators show a lower level as cable is wound up on the winch. Non-floating swing line indicators show the opposite.	0	
C.1.3.8	**Swing Lines: External Guide System**		
	Check for leaks at threaded and flanged joints.	0	
C.1.3.9	**Swing Lines: Identify Ballast Varying Need**		
	Check for significant difference in stock specific gravity.	0	
C.1.3.10	**Swing Lines: Cable Material and Condition**		
	a) For nonstainless steel cable, check for corrosion over entire length.	0	
	b) All cable: check for wear or fraying.	0	
C.1.3.11	**Swing Lines: Product Sample Comparison**		
	Check for water or gravity differences that would indicate a leaking swing joint.	0	
C.1.3.12	**Swing Lines: Target**		
	Target should indicate direction of swing opening (up or down) and height above bottom where suction will be lost with swing on bottom support.	0	
C.1.4	**Roofs**		
C.1.4.1	**Deck Plate Internal Corrosion**		
	For safety, before accessing the roof, check with ultrasonic instrument or lightly use a ball peen hammer to test the deck plate near the edge of the roof for thinning. (Corrosion normally attacks the deck plate at the edge of a fixed roof and at the rafters in the center of the roof first.)	0	
C.1.4.2	**Deck Plate External Corrosion**		
	Visually inspect for paint failure, holes, pitting, and corrosion product on the roof deck.	0	
C.1.4.3	**Roof Deck Drainage**		
	Look for indication of standing water. (Significant sagging of fixed roof deck indicates potential rafter failure. Large standing water areas on a floating roof indicate inadequate drainage design or, if to one side, a nonlevel roof with possible leaking pontoons.)	0	
C.1.4.4	**Level of Floating Roof**		
	At several locations, measure distance from roof rim to a horizontal weld seam above the roof. A variance in the readings indicates a nonlevel roof with possible shell out-of-round, out-of-plumb, leaking pontoons, or hang-up. On small diameter tanks, an unlevel condition can indicate unequal loading at that level.	0	

Tank In-service Inspection Checklist (Continued)			
	Item	Completed √	Comments
C.1.4.5	**Gas Test Internal Floating Roof**		
	Test for explosive gas on top of the internal floating roof. Readings could indicate a leaking roof, leaking seal system, or inadequate ventilation of the area above the internal floating roof.	O	
C.1.4.6	**Roof Insulation**		
	a) Visually inspect for cracks or leaks in the insulation weather coat where runoff rain water could penetrate the insulation.	O	
	b) Inspect for wet insulation under the weather coat.	O	
12	c) Remove small test sections of insulation and check roof plate for corrosion and holes near the edge of the insulated area.	O	
C.1.4.7	**Floating Roof Seal Systems**		
	a) Inspect the condition of the seal, measure and record maximum rim spaces and seal-to-shell gaps around the full roof circumference at the level of inspection. NOTE Inspection of the seal and measurement of the rim spaces and seal-to-shell gaps at more than one level may be necessary to more fully determine if any problems exist at other levels of tank operation).	O	
	b) Measure and record annular space at 30-ft spacing (minimum of four quadrants) around roof and record. Measurements should be taken in directly opposite pairs.	O	
	1) _______ _______ Opposite pair 1. 2) _______ _______ Opposite pair 2.		
	c) Check if seal fabric on primary shoe seals is pulling shoes away from shell (fabric not wide enough).	O	
	d) Inspect fabric for deterioration, holes, tears, and cracks.	O	
	e) Inspect visible metallic parts for corrosion and wear.	O	
	f) Inspect for openings in seals that would permit vapor emissions.	O	
	g) Inspect for protruding bolt or rivet heads against the shell.	O	
	h) Pull both primary and secondary seal systems back all around the shell to check their operation.	O	
	i) Inspect secondary seals for signs of buckling or indications that their angle with the shell is too shallow.	O	
	j) Inspect wedge-type wiper seals for flexibility, resilience, cracks, and tears.	O	
C.1.5	**Roof Appurtenances**		
C.1.5.1	**Sample Hatch**		
	a) Inspect condition and functioning of sample hatch cover.	O	
	b) On tanks governed by Air Quality Monitoring District rules, check for the condition of seal inside hatch cover.	O	
	c) Check for corrosion and plugging on thief and gauge hatch cover.	O	
	d) Where sample hatch is used to reel gauge stock level, check for marker and tab stating hold-off distance.	O	
	e) Check for reinforcing pad where sample hatch pipe penetrates the roof deck.	O	
	f) On floating roof sample hatch and recoil systems, inspect operation of recoil reel and condition of rope.	O	
	g) Test operation of system.	O	
	h) On ultra clean stocks such as JP4, check for presence and condition of protective coating or liner inside sample hatch (preventing rust from pipe getting into sample).	O	

TABLE 3
TANK 1B

Tank In-service Inspection Checklist

	Item	Completed √	Comments
C.1.1	**Foundation**		
	Measure foundation levelness and bottom elevations (see Annex B for extent of measurements).	0	
C.1.1.1	**Concrete Ring**		
	a) Inspect for broken concrete, spalling, and cracks, particularly under backup bars used in welding butt-welded annular rings under the shell.	0	
	b) Inspect drain openings in ring, back of waterdraw basins and top surface of ring for indications of bottom leakage.	0	
	c) Inspect for cavities under foundation and vegetation against bottom of tank.	0	
	d) Check that runoff rainwater from the shell drains away from tank.	0	
	e) Check for settlement around perimeter of tank.	0	
C.1.1.2	**Asphalt**		
	a) Check for settling of tank into asphalt base which would direct runoff rain water under the tank instead of away from it.	0	
	b) Look for areas where leaching of oil has left rock filler exposed, which indicates hydrocarbon leakage.	0	
C.1.1.3	**Oiled Dirt or Sand**		
	Check for settlement into the base which would direct runoff rain water under the tank rather than away from it.	0	
C.1.1.4	**Rock**		
	Presence of crushed rock under the steel bottom usually results in severe underside corrosion. Make a note to do additional bottom plate examination (ultrasonic, hammer testing, or turning of coupons) when the tank is out of service.	0	
C.1.1.5	**Site Drainage**		
	a) Check site for drainage away from the tank and associated piping and manifolds.	0	
	b) Check operating condition of the dike drains.	0	
C.1.1.6	**Housekeeping**		
	Inspect the area for buildup of trash, vegetation, and other inflammables buildup.	1	
C.1.1.7	**Cathodic Protection**		
	Review cathodic protection potential readings.	0	
C.1.2	**Shells**		
C.1.2.1	**External Visual Inspection**		
	a) Visually inspect for paint failures, pitting, and corrosion.	1	
	b) Clean off the bottom angle area and inspect for corrosion and thinning on plate and weld.	0	
	c) Inspect the bottom-to-foundation seal, if any.	0	
C.1.2.2	**Internal (Floating Roof Tank)**		
	Visually inspect for grooving, corrosion, pitting, and coating failures.	0	
C.1.2.3	**Riveted Shell Inspection**		
	a) Inspect external surface for rivet and seam leaks.	0	
	b) Locate leaks by sketch or photo (location will be lost when shell is abrasive cleaned for painting).	0	
	c) Inspect rivets for corrosion loss and wear.	0	
	d) Inspect vertical seams to see if they have been full fillet lap-welded to increase joint efficiency.	0	

Tank In-service Inspection Checklist (Continued)			
	Item	Completed √	Comments
	e) If no record exists of vertical riveted seams, dimension and sketch (or photograph) the rivet pattern: number of rows, rivet size, pitch length, and note whether the joint is butt-riveted or lap-riveted.	0	
C.1.2.4	**Wind Girder (Floating Roof Tanks)**		
	a) Inspect wind girder and handrail for corrosion damage (paint failure, pitting, corrosion product buildup), especially where it occurs at tack-welded junction, and for broken welds.	0	
	b) Check support welds to shell for pitting, especially on shell plates.	0	
	c) Note whether supports have reinforcing pads welded to shell.	0	
C.1.3	**Shell Appurtenances**		
C.1.3.1	**Manways and Nozzles**		
	a) Inspect for cracks or signs of leakage on weld joint at nozzles, manways, and reinforcing plates.	1	
	b) Inspect for shell plate dimpling around nozzles, caused by excessive pipe deflection.	1	
	c) Inspect for flange leaks and leaks around bolting.	1	
	d) Inspect sealing of insulation around manways and nozzles.	1	
	e) Check for inadequate manway flange and cover thickness on mixer manways.	0	
C.1.3.2	**Tank Piping Manifolds**		
	a) Inspect manifold piping, flanges, and valves for leaks.	2	Non-spec repair
	b) Inspect fire fighting system components.	0	
	c) Check for anchored piping which would be hazardous to the tank shell or bottom connections during earth movement.	1	
	d) Check for adequate thermal pressure relief of piping to the tank.	0	
	e) Check operation of regulators for tanks with purge gas systems.	0	
	f) Check sample connections for leaks and for proper valve operation.	0	
	g) Check for damage and test the accuracy of temperature indicators.	0	
	h) Check welds on shell-mounted davit clips above valves 6 in. and larger.	0	
C.1.3.3	**Autogauge System**		
	a) Inspect autogauge tape guide and lower sheave housing (floating swings) for leaks.	0	
	b) Inspect autogauge head for damage.	0	
	c) Bump the checker on autogauge head for proper movement of tape.	0	
	d) Identify size and construction material of autogauge tape guide (floating roof tanks).	0	
	e) Ask operator if tape tends to hang up during tank roof movement (floating roof tanks).	0	
	f) Compare actual product level to the reading on the autogauge (maximum variation is 2 in.).	0	
	g) On floating roof tanks, when the roof is in the lowest position, check that no more than two ft of tape are exposed at the end of the tape guide.	0	
	h) Inspect condition of board and legibility of board-type autogauges.	0	
	i) Test freedom of movement of marker and float.	0	
C.1.3.4	**Shell-mounted Sample Station**		
	a) Inspect sample lines for function of valves and plugging of lines, including drain or return-to-tank line.	0	
	b) Check circulation pump for leaks and operating problems.	0	

Tank In-service Inspection Checklist (Continued)			
	Item	Completed √	Comments
	c) Test bracing and supports for sample lines and equipment.	0	
C.1.3.5	**Heater (Shell Manway Mounted)**		
	Inspect condensate drain for presence of oil indicating leakage.	0	
C.1.3.6	**Mixer**		
	a) Inspect for proper mounting flange and support.	/	
	b) Inspect for leakage.	0	
	c) Inspect condition of power lines and connections to mixer.	/	
C.1.3.7	**Swing Lines: Winch Operation**		
	a) Nonfloating. Raise, then lower the swing line with the winch, and check for cable tightness to confirm that swing line lowered properly.	0	
	b) Floating. With tank half full or more, lower the swing line, then let out cable and check if swing has pulled cable tight, indicating that the winch is operating properly.	0	
	c) Indicator. Check that the indicator moves in the proper direction: Floating swing line indicators show a lower level as cable is wound up on the winch. Non-floating swing line indicators show the opposite.	0	
C.1.3.8	**Swing Lines: External Guide System**		
	Check for leaks at threaded and flanged joints.	0	
C.1.3.9	**Swing Lines: Identify Ballast Varying Need**		
	Check for significant difference in stock specific gravity.	0	
C.1.3.10	**Swing Lines: Cable Material and Condition**		
	a) For nonstainless steel cable, check for corrosion over entire length.	0	
	b) All cable: check for wear or fraying.	0	
C.1.3.11	**Swing Lines: Product Sample Comparison**		
	Check for water or gravity differences that would indicate a leaking swing joint.	0	
C.1.3.12	**Swing Lines: Target**		
	Target should indicate direction of swing opening (up or down) and height above bottom where suction will be lost with swing on bottom support.	0	
C.1.4	**Roofs**		
C.1.4.1	**Deck Plate Internal Corrosion**		
	For safety, before accessing the roof, check with ultrasonic instrument or lightly use a ball peen hammer to test the deck plate near the edge of the roof for thinning. (Corrosion normally attacks the deck plate at the edge of a fixed roof and at the rafters in the center of the roof first.)	0	
C.1.4.2	**Deck Plate External Corrosion**		
	Visually inspect for paint failure, holes, pitting, and corrosion product on the roof deck.	0	
C.1.4.3	**Roof Deck Drainage**		
	Look for indication of standing water. (Significant sagging of fixed roof deck indicates potential rafter failure. Large standing water areas on a floating roof indicate inadequate drainage design or, if to one side, a nonlevel roof with possible leaking pontoons.)	0	
C.1.4.4	**Level of Floating Roof**		
	At several locations, measure distance from roof rim to a horizontal weld seam above the roof. A variance in the readings indicates a nonlevel roof with possible shell out-of-round, out-of-plumb, leaking pontoons, or hang-up. On small diameter tanks, an unlevel condition can indicate unequal loading at that level.	0	

Tank In-service Inspection Checklist (Continued)

Item		Completed √	Comments
C.1.4.5	**Gas Test Internal Floating Roof**		
	Test for explosive gas on top of the internal floating roof. Readings could indicate a leaking roof, leaking seal system, or inadequate ventilation of the area above the internal floating roof.	O	
C.1.4.6	**Roof Insulation**		
	a) Visually inspect for cracks or leaks in the insulation weather coat where runoff rain water could penetrate the insulation.	O	
	b) Inspect for wet insulation under the weather coat.	O	
12	c) Remove small test sections of insulation and check roof plate for corrosion and holes near the edge of the insulated area.	O	
C.1.4.7	**Floating Roof Seal Systems**		
	a) Inspect the condition of the seal, measure and record maximum rim spaces and seal-to-shell gaps around the full roof circumference at the level of inspection. NOTE Inspection of the seal and measurement of the rim spaces and seal-to-shell gaps at more than one level may be necessary to more fully determine if any problems exist at other levels of tank operation).	O	
	b) Measure and record annular space at 30-ft spacing (minimum of four quadrants) around roof and record. Measurements should be taken in directly opposite pairs.	O	
	1) ______ ______ Opposite pair 1. 2) ______ ______ Opposite pair 2.		
	c) Check if seal fabric on primary shoe seals is pulling shoes away from shell (fabric not wide enough).	O	
	d) Inspect fabric for deterioration, holes, tears, and cracks.	O	
	e) Inspect visible metallic parts for corrosion and wear.	O	
	f) Inspect for openings in seals that would permit vapor emissions.	O	
	g) Inspect for protruding bolt or rivet heads against the shell.	O	
	h) Pull both primary and secondary seal systems back all around the shell to check their operation.	O	
	i) Inspect secondary seals for signs of buckling or indications that their angle with the shell is too shallow.	O	
	j) Inspect wedge-type wiper seals for flexibility, resilience, cracks, and tears.	O	
C.1.5	**Roof Appurtenances**		
C.1.5.1	**Sample Hatch**		
	a) Inspect condition and functioning of sample hatch cover.	O	
	b) On tanks governed by Air Quality Monitoring District rules, check for the condition of seal inside hatch cover.	O	
	c) Check for corrosion and plugging on thief and gauge hatch cover.	O	
	d) Where sample hatch is used to reel gauge stock level, check for marker and tab stating hold-off distance.	O	
	e) Check for reinforcing pad where sample hatch pipe penetrates the roof deck.	O	
	f) On floating roof sample hatch and recoil systems, inspect operation of recoil reel and condition of rope.	O	
	g) Test operation of system.	O	
	h) On ultra clean stocks such as JP4, check for presence and condition of protective coating or liner inside sample hatch (preventing rust from pipe getting into sample).	O	

TABLE 5
TANK - MAKEUP WATER

Tank In-service Inspection Checklist			
	Item	**Completed √**	**Comments**
C.1.1	**Foundation**		
	Measure foundation levelness and bottom elevations (see Annex B for extent of measurements).	0	
C.1.1.1	**Concrete Ring**		
	a) Inspect for broken concrete, spalling, and cracks, particularly under backup bars used in welding butt-welded annular rings under the shell.	0	
	b) Inspect drain openings in ring, back of waterdraw basins and top surface of ring for indications of bottom leakage.	0	
	c) Inspect for cavities under foundation and vegetation against bottom of tank.	0	
	d) Check that runoff rainwater from the shell drains away from tank.	0	
	e) Check for settlement around perimeter of tank.	0	
C.1.1.2	**Asphalt**		
	a) Check for settling of tank into asphalt base which would direct runoff rain water under the tank instead of away from it.	0	
	b) Look for areas where leaching of oil has left rock filler exposed, which indicates hydrocarbon leakage.	0	
C.1.1.3	**Oiled Dirt or Sand**		
	Check for settlement into the base which would direct runoff rain water under the tank rather than away from it.	0	
C.1.1.4	**Rock**		
	Presence of crushed rock under the steel bottom usually results in severe underside corrosion. Make a note to do additional bottom plate examination (ultrasonic, hammer testing, or turning of coupons) when the tank is out of service.	0	
C.1.1.5	**Site Drainage**		
	a) Check site for drainage away from the tank and associated piping and manifolds.	0	
	b) Check operating condition of the dike drains.	0	
C.1.1.6	**Housekeeping**		
	Inspect the area for buildup of trash, vegetation, and other inflammables buildup.	1	
C.1.1.7	**Cathodic Protection**		
	Review cathodic protection potential readings.	0	
C.1.2	**Shells**		
C.1.2.1	**External Visual Inspection**		
	a) Visually inspect for paint failures, pitting, and corrosion.	1	
	b) Clean off the bottom angle area and inspect for corrosion and thinning on plate and weld.	0	
	c) Inspect the bottom-to-foundation seal, if any.	0	
C.1.2.2	**Internal (Floating Roof Tank)**		
	Visually inspect for grooving, corrosion, pitting, and coating failures.	0	
C.1.2.3	**Riveted Shell Inspection**		
	a) Inspect external surface for rivet and seam leaks.	0	
	b) Locate leaks by sketch or photo (location will be lost when shell is abrasive cleaned for painting).	0	
	c) Inspect rivets for corrosion loss and wear.	0	
	d) Inspect vertical seams to see if they have been full fillet lap-welded to increase joint efficiency.	0	

Tank In-service Inspection Checklist (Continued)			
	Item	Completed √	Comments
	e) If no record exists of vertical riveted seams, dimension and sketch (or photograph) the rivet pattern: number of rows, rivet size, pitch length, and note whether the joint is butt-riveted or lap-riveted.	0	
C.1.2.4	**Wind Girder (Floating Roof Tanks)**		
	a) Inspect wind girder and handrail for corrosion damage (paint failure, pitting, corrosion product buildup), especially where it occurs at tack-welded junction, and for broken welds.	0	
	b) Check support welds to shell for pitting, especially on shell plates.	0	
	c) Note whether supports have reinforcing pads welded to shell.	0	
C.1.3	**Shell Appurtenances**		
C.1.3.1	**Manways and Nozzles**		
	a) Inspect for cracks or signs of leakage on weld joint at nozzles, manways, and reinforcing plates.	/	
	b) Inspect for shell plate dimpling around nozzles, caused by excessive pipe deflection.	/	
	c) Inspect for flange leaks and leaks around bolting.	/	
	d) Inspect sealing of insulation around manways and nozzles.	/	
	e) Check for inadequate manway flange and cover thickness on mixer manways.	0	
C.1.3.2	**Tank Piping Manifolds**		
	a) Inspect manifold piping, flanges, and valves for leaks.	/	
	b) Inspect fire fighting system components.	0	
	c) Check for anchored piping which would be hazardous to the tank shell or bottom connections during earth movement.	/	
	d) Check for adequate thermal pressure relief of piping to the tank.	0	
	e) Check operation of regulators for tanks with purge gas systems.	0	
	f) Check sample connections for leaks and for proper valve operation.	0	
	g) Check for damage and test the accuracy of temperature indicators.	0	
	h) Check welds on shell-mounted davit clips above valves 6 in. and larger.	0	
C.1.3.3	**Autogauge System**		
	a) Inspect autogauge tape guide and lower sheave housing (floating swings) for leaks.	0	
	b) Inspect autogauge head for damage.	0	
	c) Bump the checker on autogauge head for proper movement of tape.	0	
	d) Identify size and construction material of autogauge tape guide (floating roof tanks).	0	
	e) Ask operator if tape tends to hang up during tank roof movement (floating roof tanks).	0	
	f) Compare actual product level to the reading on the autogauge (maximum variation is 2 in.).	0	
	g) On floating roof tanks, when the roof is in the lowest position, check that no more than two ft of tape are exposed at the end of the tape guide.	0	
	h) Inspect condition of board and legibility of board-type autogauges.	0	
	i) Test freedom of movement of marker and float.	0	
C.1.3.4	**Shell-mounted Sample Station**		
	a) Inspect sample lines for function of valves and plugging of lines, including drain or return-to-tank line.	0	
	b) Check circulation pump for leaks and operating problems.	0	

Tank In-service Inspection Checklist (Continued)

	Item	Completed √	Comments
	c) Test bracing and supports for sample lines and equipment.	0	
C.1.3.5	**Heater (Shell Manway Mounted)**		
	Inspect condensate drain for presence of oil indicating leakage.	0	
C.1.3.6	**Mixer**		
	a) Inspect for proper mounting flange and support.	/	
	b) Inspect for leakage.	0	
	c) Inspect condition of power lines and connections to mixer.	/	
C.1.3.7	**Swing Lines: Winch Operation**		
	a) Nonfloating. Raise, then lower the swing line with the winch, and check for cable tightness to confirm that swing line lowered properly.	0	
	b) Floating. With tank half full or more, lower the swing line, then let out cable and check if swing has pulled cable tight, indicating that the winch is operating properly.	0	
	c) Indicator. Check that the indicator moves in the proper direction: Floating swing line indicators show a lower level as cable is wound up on the winch. Non-floating swing line indicators show the opposite.	0	
C.1.3.8	**Swing Lines: External Guide System**		
	Check for leaks at threaded and flanged joints.	0	
C.1.3.9	**Swing Lines: Identify Ballast Varying Need**		
	Check for significant difference in stock specific gravity.	0	
C.1.3.10	**Swing Lines: Cable Material and Condition**		
	a) For nonstainless steel cable, check for corrosion over entire length.	0	
	b) All cable: check for wear or fraying.	0	
C.1.3.11	**Swing Lines: Product Sample Comparison**		
	Check for water or gravity differences that would indicate a leaking swing joint.	0	
C.1.3.12	**Swing Lines: Target**		
	Target should indicate direction of swing opening (up or down) and height above bottom where suction will be lost with swing on bottom support.	0	
C.1.4	**Roofs**		
C.1.4.1	**Deck Plate Internal Corrosion**		
	For safety, before accessing the roof, check with ultrasonic instrument or lightly use a ball peen hammer to test the deck plate near the edge of the roof for thinning. (Corrosion normally attacks the deck plate at the edge of a fixed roof and at the rafters in the center of the roof first.)	0	
C.1.4.2	**Deck Plate External Corrosion**		
	Visually inspect for paint failure, holes, pitting, and corrosion product on the roof deck.	0	
C.1.4.3	**Roof Deck Drainage**		
	Look for indication of standing water. (Significant sagging of fixed roof deck indicates potential rafter failure. Large standing water areas on a floating roof indicate inadequate drainage design or, if to one side, a nonlevel roof with possible leaking pontoons.)	0	
C.1.4.4	**Level of Floating Roof**		
	At several locations, measure distance from roof rim to a horizontal weld seam above the roof. A variance in the readings indicates a nonlevel roof with possible shell out-of-round, out-of-plumb, leaking pontoons, or hang-up. On small diameter tanks, an unlevel condition can indicate unequal loading at that level.	0	

Tank In-service Inspection Checklist (Continued)			
	Item	**Completed √**	**Comments**
C.1.4.5	**Gas Test Internal Floating Roof**		
	Test for explosive gas on top of the internal floating roof. Readings could indicate a leaking roof, leaking seal system, or inadequate ventilation of the area above the internal floating roof.	O	
C.1.4.6	**Roof Insulation**		
	a) Visually inspect for cracks or leaks in the insulation weather coat where runoff rain water could penetrate the insulation.	O	
	b) Inspect for wet insulation under the weather coat.	O	
12	c) Remove small test sections of insulation and check roof plate for corrosion and holes near the edge of the insulated area.	O	
C.1.4.7	**Floating Roof Seal Systems**		
	a) Inspect the condition of the seal, measure and record maximum rim spaces and seal-to-shell gaps around the full roof circumference at the level of inspection. NOTE Inspection of the seal and measurement of the rim spaces and seal-to-shell gaps at more than one level may be necessary to more fully determine if any problems exist at other levels of tank operation).	O	
	b) Measure and record annular space at 30-ft spacing (minimum of four quadrants) around roof and record. Measurements should be taken in directly opposite pairs.	O	
	1) ______ ______ Opposite pair 1. 2) ______ ______ Opposite pair 2.		
	c) Check if seal fabric on primary shoe seals is pulling shoes away from shell (fabric not wide enough).	O	
	d) Inspect fabric for deterioration, holes, tears, and cracks.	O	
	e) Inspect visible metallic parts for corrosion and wear.	O	
	f) Inspect for openings in seals that would permit vapor emissions.	O	
	g) Inspect for protruding bolt or rivet heads against the shell.	O	
	h) Pull both primary and secondary seal systems back all around the shell to check their operation.	O	
	i) Inspect secondary seals for signs of buckling or indications that their angle with the shell is too shallow.	O	
	j) Inspect wedge-type wiper seals for flexibility, resilience, cracks, and tears.	O	
C.1.5	**Roof Appurtenances**		
C.1.5.1	**Sample Hatch**		
	a) Inspect condition and functioning of sample hatch cover.	O	
	b) On tanks governed by Air Quality Monitoring District rules, check for the condition of seal inside hatch cover.	O	
	c) Check for corrosion and plugging on thief and gauge hatch cover.	O	
	d) Where sample hatch is used to reel gauge stock level, check for marker and tab stating hold-off distance.	O	
	e) Check for reinforcing pad where sample hatch pipe penetrates the roof deck.	O	
	f) On floating roof sample hatch and recoil systems, inspect operation of recoil reel and condition of rope.	O	
	g) Test operation of system.	O	
	h) On ultra clean stocks such as JP4, check for presence and condition of protective coating or liner inside sample hatch (preventing rust from pipe getting into sample).	O	

Superior Testing Services Ultrasonic Thickness Inspection

RFAAP, Radford, Virginia

Table 1 - Tank 1A

	Measurement Location		
	Plate A	Plate B	Bottom
Measured Thickness (inches)	0.256	0.261	0.418
	0.257	0.261	0.416
	0.257	0.260	0.411
	0.263	0.257	0.404
	0.260	0.256	0.407
	0.260	0.260	0.412
	0.262	0.260	0.405
	0.262	0.259	0.406
	0.260	0.260	0.411
	0.261	0.260	0.413
	0.261	0.260	0.415
	0.261	0.265	0.410
	0.262	0.270	0.407
	0.258	0.262	0.409
	0.259	0.259	0.405
			0.405
			0.407
			0.413
			0.416
			0.419
			0.419
			0.390
			0.381
			0.363
			0.372
			0.365
			0.389
			0.394
			0.379
			0.368
			0.365
			0.376
			0.390
Average	**0.260**	**0.261**	**0.399**
Minimum	**0.256**	**0.256**	**0.363**
Max. Variation	**0.004**	**0.009**	**0.036**
Original thickness [(a)]	0.250	0.250	0.375
Ave. % metal loss	**0.0%**	**0.0%**	**0.0%**
Max. % metal loss	**0.0%**	**0.0%**	**3.2%**

Notes:

(a) Nominal 1/4-inch shell and 3/8-inch floor thickness.

(b) UT meter calibrations: measured 0.200 on 0.200" block; 0.500" on 0.500" thick block

Superior Testing Services Ultrasonic Thickness Inspection

RFAAP, Radford, Virginia

Table 2 - Tank 1B

	Plate A	Plate B	Bottom
	Measurement Location		
Measured Thickness (inches)	0.264	0.261	0.410
	0.264	0.262	0.402
	0.264	0.262	0.410
	0.266	0.262	0.398
	0.265	0.260	0.402
	0.268	0.259	0.400
	0.267	0.257	0.410
	0.267	0.260	0.408
	0.267	0.259	0.399
	0.266	0.261	0.406
	0.267	0.268	0.399
	0.270	0.263	0.396
	0.270	0.265	0.397
	0.271	0.264	0.397
	0.263	0.265	0.400
	0.264	0.264	0.413
	0.265		0.405
			0.401
			0.389
			0.404
			0.400
			0.387
			0.363
			0.355
			0.380
			0.351
			0.375
			0.407
			0.391
			0.369
			0.351
			0.355
			0.369
			0.414
Average	**0.266**	**0.262**	**0.392**
Minimum	**0.263**	**0.257**	**0.351**
Max. Variation	**0.005**	**0.006**	**0.041**
Original thickness [(a)]	0.250	0.250	0.375
Ave. % metal loss	**0.0%**	**0.0%**	**0.0%**
Max. % metal loss	**0.0%**	**0.0%**	**6.4%**

Notes:

(a) Nominal 1/4-inch shell and 3/8-inch floor thickness.

(b) UT meter calibrations: measured 0.200 on 0.200" block; 0.500" on 0.500" thick block

Superior Testing Services Ultrasonic Thickness Inspection

RFAAP, Radford, Virginia

Table 3 - Makeup Water Tank

	Measurement Location		
	Plate A	Plate B	Bottom
Measured Thickness (inches)	0.248	0.258	0.408
	0.249	0.262	0.408
	0.247	0.262	0.386
	0.247	0.263	0.411
	0.248	0.261	0.408
	0.249	0.261	0.417
	0.251	0.261	0.416
	0.249	0.261	0.417
	0.252	0.261	0.414
	0.252	0.265	0.415
	0.267	0.266	0.413
	0.267	0.255	0.405
	0.258	0.253	0.404
	0.264		0.407
			0.411
			0.406
			0.410
			0.414
			0.411
			0.380
			0.373
			0.360
			0.377
			0.350
			0.373
			0.386
			0.386
			0.376
			0.363
			0.356
			0.369
			0.392
Average	**0.253**	**0.261**	**0.394**
Minimum	**0.247**	**0.253**	**0.350**
Max. Variation	**0.014**	**0.008**	**0.044**
Original thickness [(a)]	0.250	0.250	0.375
Ave. % metal loss	**0.0%**	**0.0%**	**0.0%**
Max. % metal loss	**1.2%**	**0.0%**	**6.7%**

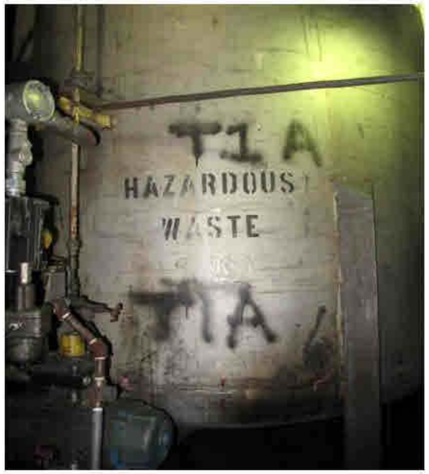
Notes:

(a) Nominal 1/4-inch shell and 3/8-inch floor thickness.

(b) UT meter calibrations: measured 0.200 on 0.200" block; 0.500" on 0.500" thick block

APPENDIX C

PHOTOGRAPHS



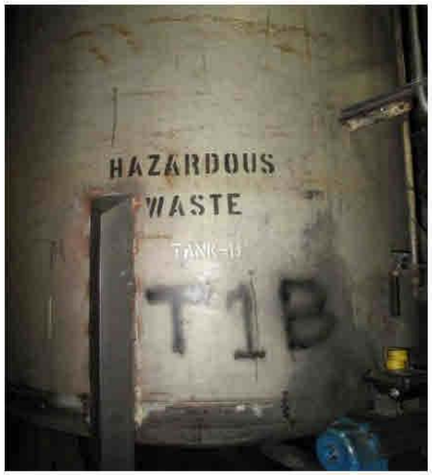
Side view of Tank 1A

Side view of Tank 1A

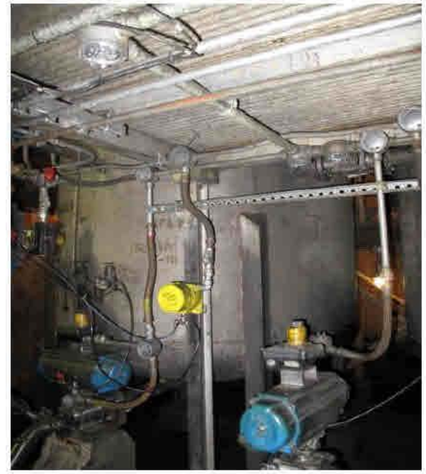
Bottom View of 1A with discharge pipe

Side view of Tank 1A

Appendix D: Photographs



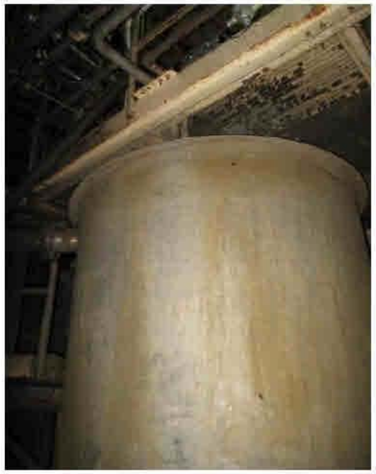
Side view of Tank 1B



Side and bottom view Tank 1B

Side view of Tank 1B

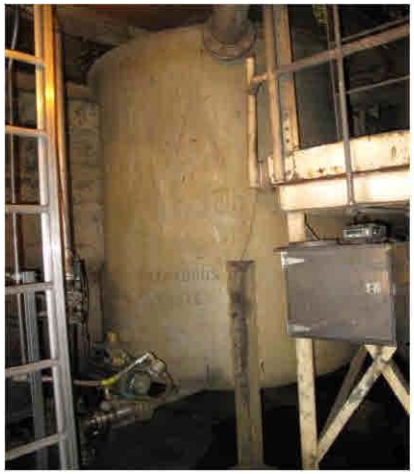
Bottom view tank 1B with non-specification repair



Side view of MAKEUP Water Tank

Side view MAKEUP Water Tank

Side view of MAKEUP WaterTank



Side view of MAKEUP Water Tank

APPENDIX D

INSPECTOR CERTIFICATES

AMERICAN PETROLEUM INSTITUTE
INDIVIDUAL CERTIFICATION PROGRAMS

API Individual Certification Programs

certifies that

Steven L. Shugart

has met the requirements to be a certified

API-653 Aboveground Storage Tanks Inspector

Certification Number *31235*

Original Certification Date *October 31, 2007*

Current Certification Date *October 31, 2013*

Expiration Date *October 31, 2016*

Tina Briskin
Manager, Individual Certification Programs

ICP

2013-045 | 10M | Printed in the USA |

CERTIFICATION

Steel Tank Institute

certifies that

David G. Brickley

has met all of the requirements to become an STI authorized
Level 1 - Aboveground Tank Inspector and a
Level 2 - Aboveground Tank System Inspector
in accordance with the STI Standard SP001

Expiration Date: January 12, 2016 **ID#: AST R10155**

Dana C. Schmidt
Project Engineer
Steel Tank Institute

Steel Tank Institute

Technologies Consulting International, Inc.
Matthews, North Carolina USA

This is to Acknowledge that

Mr. David Brickley

Has successfully completed a ***20 Hours*** *course in*

" Magnetic Flux Leakage & Ultrasonic Thickness Testing Methods"

Above Storage Tank Applications

October 22 & 23, 2012

Instructor

Hussein M Sadek (NDT Level III)
TCI, Inc. Director of Training