

**CORRECTIVE ACTION UNIT
EVALUATION FOR NITROGLYCERIN
AREA UNITS
(SSAs 11, 12, and MU 5)**

**RFAAP, Radford Virginia
RCRA Corrective Action Permit Number VA 1210020730**

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1.0 EXECUTIVE SUMMARY

As defined in the February 23, 2010 meeting between representatives of Radford Army Ammunition Plant (RFAAP) and US EPA Region III, specific Site Screening Areas (SSAs) would be grouped either programmatically or geographically to more effectively evaluate the criteria for their inclusion in the upcoming renewal of RCRA Corrective Action Permit VA 1210020730. The Units discussed herein are SSAs that:

- Serve as pretreatment facilities in the Nitroglycerin Area of the RFAAP Facility (SSAs 11 and 12),
- Miscellaneous Unit (MU) that includes the area where an explosion occurred in 1993,

All of the Units are located within an active production area of the RFAAP Facility.

The tanks at SSA 11 and SSA 12 have met the definition of a RCRA tank since installation. In addition, according to 40 CFR Part 261.4, SSA 11 and SSA 12 are excluded from RCRA Corrective Action because the areas are regulated as waste water treatment units under VPDES. Additionally, there have been no documented releases from these areas.

Structural material and surface soil in and around the 1993 explosion site (MU 5) was removed from the site during clean-up procedures, and was replaced with clean fill material. All energetic were consumed during the explosion. No indication of a release of hazardous materials at the MU has been documented.

Accordingly, as described below, it is appropriate to remove these units from further consideration under the Facility RCRA Corrective Action Permit.

2.0 INTRODUCTION AND BACKGROUND

In accordance with the RCRA Corrective Action Permit VA 1210020730, the scope of this investigation has been determined by the RFAAP and the US EPA (the parties). See Part II – *Specific Facility Conditions* – Section D.7 below. The language in bold provides the regulatory basis for the scope of this investigation:

“D- 7. Attachment A contains a list of thirty-one (31) identified Site Screening Areas (SSAs) which may pose a threat, or potential threat to human health and the environment. The Permittee shall submit to the EPA and the VDEQ SSP Work Plan(s) which shall outline the activities necessary to determine if there have been releases of hazardous substances,

*solid wastes, pollutants, contaminants, hazardous wastes, or hazardous constituents to the environment from the SSAs. **The scope of the SSPs shall be determined by the Parties.** The SSP Work Plan(s) shall include a proposed Deadline or Milestone for the submittal of an SSP Report(s)....”*

Each of the Units described in this report are located within a Nitroglycerin (NG) Area. The RFAAP Facility has 2 NG Areas. **Figure 1** (see **Attachment 1**) shows the locations of the Units. The Nitroglycerin Area Number 1 (NG-1) was constructed in the 1940's and was updated in the late 1970's to manufacture nitroglycerin. NG-1 was modernized in the 1980's to manufacture nitroglycerin and other liquid explosives. NG-1 has manufactured both diethylene glycol dinitrate (DEGDN), a nitrate ester used in propellants and other propulsion systems and nitroglycerin. NG-1 is currently listed as active but idle. NG Area 2 manufactures nitroglycerin. The NG 1 pretreatment plant (SSA 11) was used to remove nitrate esters from wastewater produced in the manufacture of DEGDN and NG. The NG 2 pretreatment plant (SSA 12) is used as a pretreatment facility for wastewater produced in the manufacture of nitroglycerin. In 2001, studies were conducted to show residual NG concentrations in the wastewater were minimal and could be treated by the Biological Wastewater Treatment Plant (Bioplant) without the requirement to pretreat the wastewater. Modifications to the operation were accomplished in 2001 and 2002 to bypass the pretreatment facility and allow the direct discharge of NG acidic wastewater to the Bioplant. SSA 12 currently acts as a pumping station for wastewater that is treated at the Bioplant. The 1987 RCRA Facility Assessment noted there were no visible signs of releases at the Units described in this report. No other observations were made or documentation produced that indicated spills or releases have occurred at these Units.

Current land use for SSA 11 and 12, and MU 5, is defined as industrial/commercial. It is not reasonable to assume that the NG area will ever be utilized for residential purposes.

3.0 UNIT DESCRIPTION AND EVALUATION

3.1 SSA 11: NITROGLYCERIN 1 PRETREATMENT PLANT

The NG-1 Area Wastewater Pretreatment Plant is an active but idle site consisting of the following 9 subunits:

- ❖ Unit 11a; NG Acidic Wastewater (Sluice) Gutter: An above ground wastewater gutter system constructed to convey NG or DEGDN wastewater to the Lift Station Storage Tank inside Bldg. 906-6 (Unit 11b). The gutter system is lined with stainless steel and is covered with fiberglass.
- ❖ Unit 11b; Lift Station Storage Tank (inside Bldg. 906-6): A 1,200 gallon open-top, stainless steel storage tank, located below grade within a concrete dike inside the building, constructed to receive effluent from the Unit 11a wastewater gutter.

- ❖ Unit 11c; Nitroglycerin Acidic Wastewater Feed and Equalization Tanks: Wastewater from Unit 11b is pumped to any one of three aboveground, closed top acidic water storage feed tanks. Two of the tanks have a capacity of 25,000 gallons, and the other has a capacity of 20,000 gallons. All tanks are steam jacketed to control the temperature of the wastewater. The tanks do not have secondary containment, and are located north of Building 3622.
- ❖ Unit 11d; Batch Reaction Tanks: Acidic wastewater from Unit 11c is pumped to any one of three stainless steel aboveground batch reaction tanks located within Building 3622. Two of the tanks are closed top, and the other is open top. Sodium hydroxide or sodium hydrosulfide is added to the wastewater in these tanks to raise the pH.
- ❖ Unit 11e; Lime Mix Tanks: Four above ground, closed top stainless steel tanks located within Building 3622, formerly used to add and mix lime slurry with the acidic wastewater.
- ❖ Unit 11f; Wastewater Neutralization Tank, Fiberglass Overflow Tank, and Sulfuric Acid Storage Tank: Wastewater (pH >11) from Bldg. 3622, is transferred to a 250 gallon open top stainless steel tank located outside of Building 3622 to be neutralized using 92% sulfuric acid. Unit also consists of a 2,100 gallon sulfuric acid storage tank which feeds the neutralization tank. Also a part of Unit 11f is an open-top fiberglass wastewater overflow tank, which was designed to catch any overflow from the neutralization tank and provide additional residence time for pH stabilization when continuous neutralization of wastewater was conducted. Continuous neutralization processing was later abandoned, reverting to batch neutralization. (1987 RFA incorrectly states the neutralization tank is a 2,100 gallon SST tank, and omits reference to the sulfuric acid storage tank.)
- ❖ Unit 11g; Lime Slurry Wastewater Clarifiers: Two concrete below-grade clarifiers located outside of Building 3622, constructed to settle out lime solids from the wastewater, when the former lime slurry pH adjustment process was used.
- ❖ Unit 11h; Sludge Concentrator and Holding Tank: An open top, 10,000 gallon stainless steel tank located adjacent to Unit 11g used to store lime sludge from the clarifiers.
- ❖ Unit 11i; Sludge Hopper: Lime sludge from Unit 11h is pumped to the hopper, to be dumped into trucks for waste disposal.

Wastewater pretreatment originally used lime slurry to raise the pH of the wastewater above 11 before being neutralized to 9 with sulfuric acid. Units 11e, 11g, 11h, and 11i, are associated with this operation, and were permanently closed and made inactive in 1982-1983, when the sodium hydroxide/sodium hydrosulfide pH adjustment process was added.

Historical Information of Site

1979–Present: The Nitroglycerin Area No. 1 Wastewater Pretreatment Plant (Bldg. 3622) was constructed in 1979-1980 to pre-treat up to 0.11 million gallons per day of acidic nitroglycerin (NG) and diethylene glycol dinitrate (DEGDN) laden wastewater. Acidic NG and DEGDN

wastewater generated in the NG-1 production area is pretreated to decrease residual levels of nitrate esters present in the wastewater before being discharged to the Biological Wastewater Treatment Plant (Bioplant). During the pretreatment process, the pH of the wastewater is raised to >11 using sodium hydroxide or sodium hydrosulfide to destroy the nitrate esters. Earlier operations used lime slurry to raise the wastewater pH. Afterwards, the pH is lowered to approximately 9 using sulfuric acid, and then discharged to the Bioplant for further treatment. The NG-1 Area is in active status; however, is currently idle, as NG is normally manufactured in the NG-2 Area, and DEGDN production has been sporadic. The pretreatment plant is located approximately 300 feet northwest of the NG-1 Area.

Spill / Cleanup Records of Site

Plant wastewater utilities, NG Area, and Environmental personnel were consulted to determine if any spills or cleanup actions have occurred at the site. Utilities personnel reported no records of spills, releases, or cleanup actions, from this facility during its years of operation. Environmental noted two small sulfuric acid spills occurred in 1995 and 1996. Both spills were onto the ground outside the building, and were neutralized and cleaned up as required. The 1987 A. T. Kearney RFA noted there were no visible signs of releases. No other observations were made or documentation produced that indicated spills or releases have occurred at this site.

Historical Studies and Investigations Conducted at SSA-11

- ❖ RCRA Facility Assessment of Radford Army Ammunition Plant; 1987; Prepared by A. T. Kearney for the Environmental Protection Agency; Section IV, pages 39-41

Migration Pathways Analysis

- ❖ Soil and Groundwater: The stainless steel tanks that were part of the treatment process at SSA 12 are seamless and have no evidence of degradation. The unit is in good repair and exhibits no loss of integrity. The integrity of the stainless steel tanks prohibit the infiltration of water contained in the unit to soil and groundwater.
- ❖ Surface Water: Currently regulated under the VPDES permit at Outfall 004.

Basis for Removal from the RCRA Corrective Action Permit

During the operational history of the NG-1 Area the Wastewater Pretreatment Plant and its subunits were excluded from RCRA regulation under 40 CFR Part 261.4, as it was regulated under a VPDES wastewater treatment unit under the Clean Water Act. Currently, it is considered to be part of the collection system for the industrial wastewater treatment system. In the event

hazardous wastewater or treatment chemicals escaped the plant or its subunits, the waste would have been regulated by RCRA.

During the operational history of the unit two small sulfuric acid spills (less than Reportable Quantity of 1,000 pounds) that occurred onto the ground outside the building in 1995 and 1996 were immediately neutralized and cleaned up as required. Aside from these two spills, there is no documentation or indication that reportable spills of listed hazardous substances/wastes to the environment have occurred at this facility. Additionally in its current operational status there are no RCRA wastes being processed through the unit. Therefore, this SSA should be removed from the RCRA Corrective Action Permit.

3.2 SSA 12: NITROGLYCERIN 2 PRETREATMENT PLANT

Currently, the NG-2 pretreatment plant is not actively treating waste. It is functioning as a pump station for flow to the industrial wastewater treatment system. When the NG-2 Area Wastewater Pretreatment Plant was an active pretreatment unit, the following 12 subunits were part of the process train:

- ❖ Unit 12a; Lime Mix Tanks: Four above ground stainless steel tanks located inside of Building 9410, which were formerly used to mix lime slurry with NG acidic wastewater. Lime was added to the wastewater to raise the pH to >11 to destroy the residual nitrate esters in the water. The lime addition system was placed in standby status in the early 1980's and replaced by a sodium hydroxide/sodium hydrosulfide pH adjustment system. Wastewater from the mix tanks was then pumped to the flocculation tanks, Unit 12c. (No photo available. Tanks were removed)
- ❖ Unit 12b; Indoor Wastewater Equalization Tanks (formerly referred to as Indoor Batch Reaction Tanks in the 1987 RFA): During the time when lime slurry was used to raise the pH, acidic wastewater from Unit 12c (Flocculation Tanks) was pumped to any one of two (2) 20,000 gallon stainless steel indoor wastewater equalization tanks (formerly called batch reaction tanks), or two identical tanks that were previously located outside of Building 9410. The two outdoor tanks were removed in the early 1980's. During lime pH adjustment operations from 1977 to the early 1980's, lime slurry was added to these tanks to raise the pH to >11. Similarly, when sodium hydroxide/sodium hydrosulfide operations began in the early 1980's, these indoor tanks were used to mix the caustic solutions with the acidic wastewater to obtain the required pH and destroy the nitrate esters. Wastewater from these equalization tanks flows to the flash in-line mixers (Unit 12e) where sulfuric acid is added to neutralize the wastewater.
- ❖ Unit 12c; Flocculation Tanks: Wastewater from the lime mix tanks was pumped to two 110 gallon stainless steel open top tanks. Flocculants were added to the wastewater to remove residual solids in the wastewater, before being drained to the indoor wastewater

equalization tanks (Unit 12b). These tanks were taken out of service when the lime slurry system was placed in standby status.

- ❖ Unit 12d; Outdoor Wastewater Equalization Tanks (formerly referred to as Outdoor Batch Reaction Tanks in A.T. Kearney RFA): Acidic wastewater from Unit 12c (Flocculation Tanks) was formerly pumped to any one of two indoor 20,000 gallon stainless steel aboveground equalization tanks (formerly called indoor batch reaction tanks) located outside of Building 9410, or two identical tanks located inside of 9410. The two outdoor tanks no longer exist at this facility. During lime pH adjustment operations from 1977 to the early 1980's, lime slurry was added to these equalization tanks to raise the pH to >11.
- ❖ Unit 12e; Flash In-Line Mix Tanks: Two flash mixers installed in two below grade mixing tanks inside of Building 9410, to mix sulfuric acid with the wastewater before being pumped into the wastewater denitration tanks (Unit 12j).
- ❖ Unit 12f; Lime Silo: An outdoor lime silo and conveyor system used to transfer powdered lime to the former lime mix tanks (Unit 12a). The silo has been inactive since the lime slurry pH adjustment system was placed in standby service.
- ❖ Unit 12g; Sodium Hydroxide Storage Tank: A 5,000 gallon closed top stainless steel storage tank located adjacent to Building 9410. The tank is located within a concrete dike and is inside of an enclosed building. The tank stores 50% sodium hydroxide, which is used to adjust the pH of the wastewater to >11 in the equalization tanks (Unit 12b).
- ❖ Unit 12h; Sulfuric Acid Storage Tank: A 2,300 gallon closed top, insulated stainless steel storage tank located outside of Building 9410. The tank is located within a concrete dike and contains 93% sulfuric acid, which is used to neutralize the pH >11 wastewater to approximately 9 in the flash in-line mix tanks (Unit 12e).
- ❖ Unit 12i; Caustic Mix and Feed Tanks: Two insulated 50 gallon stainless steel tanks located inside of Building 9410, used to mix and feed sodium hydroxide or sodium hydrosulfide solutions into the wastewater equalization tanks (Unit 12b) to raise the pH to >11.
- ❖ Unit 12j; Wastewater Denitration Tanks: Two open top 10,000 gallon stainless steel NG wastewater storage tanks located inside of Building 9410, used to accept wastewater which has been pH adjusted with sulfuric acid. Wastewater from the denitration tanks flows to the clarifiers (Unit 12k).
- ❖ Unit 12k; Clarifiers: Wastewater from Unit 12j flows into two closed top steel clarifier tanks to settle out residual solids from the wastewater. The sludge is pumped to the sludge tanks (Unit 12l).
- ❖ Unit 12l; Sludge Tanks: Sludge which has been separated from the clarifier tanks is collected in two sludge tanks, and is pumped to the sludge hopper to be unloaded into tanker trucks for off-site shipment.

Historical Information of Site

1977–2002: The Nitroglycerin (NG) Area No. 2 Wastewater Pretreatment Plant (Bldg. 9410) began operations in 1977 to pre-treat up to 0.15 million gallons per day of wastewater. Wastewater generated in the NG-2 production area is pretreated (denitrated) to decrease residual levels of nitrate esters present in the wastewater before being discharged to the Biological Wastewater Treatment Plant (Bioplant). During the pretreatment process, the pH of the wastewater is raised to >11 using sodium hydroxide or sodium hydrosulfide to destroy the nitrate esters. Earlier operations used lime slurry to raise the wastewater pH. Afterwards, the pH is lowered to approximately 9 using sulfuric acid, then discharged to the Bioplant for further treatment. The NG-2 Area is in active status and manufactures NG. In 2001, studies were conducted to show residual NG concentrations in the wastewater were minimal and could be treated by the Bioplant without the requirement to pretreat the wastewater. Modifications to the operation were accomplished in 2001 and 2002 to bypass the pretreatment facility and allow the direct discharge of NG acidic wastewater to the Bioplant. The pretreatment plant is located approximately 400 feet southwest of the NG-2 processing operations.

Spill / Cleanup Records of Site

Plant wastewater utilities, NG Area, and Environmental personnel were consulted to determine if any spills or cleanup actions have occurred at the site. Utilities personnel reported no records of spills, releases, or cleanup actions, from this facility during its years of operation. NG Area and Environmental personnel reported a 50 gallon 93% sulfuric acid spill occurred in July 1999; however, the spill was completely contained within the concrete dike as designed. No release to the environment was noted. The 1987 RFA noted there were no visible signs of releases. No other observations were made or documentation produced that indicated spills or releases have occurred at this site.

Historical Studies and Investigations Conducted at SSA-12

- ❖ RCRA Facility Assessment of Radford Army Ammunition Plant; 1987; Prepared by A. T. Kearney for the Environmental Protection Agency; Section IV, pages 42-43

Migration Pathways Analysis

- ❖ **Soil and Groundwater:** The stainless steel tanks that were part of the treatment process at SSA 12 are seamless and have no evidence of degradation. The unit is in good repair and exhibits no loss of integrity. The integrity of the stainless steel tanks prohibit the infiltration of water contained in the unit to soil and groundwater.
- ❖ **Surface Water:** Building 9410 is located in a depressed area. There is no migration pathway from the unit to surface water (See **Figure 2**).

Basis for Removal from the RCRA Corrective Action Permit

During its operational history the NG-2 Area Wastewater Pretreatment Plant and its subunits are excluded from RCRA regulation under 40 CFR Part 261.4, as it is regulated as a VPDES wastewater treatment unit under the Clean Water Act. In the event hazardous wastewater or treatment chemicals escaped the plant or its subunits, the waste would have been regulated by RCRA.

This SSA should be removed from the RCRA Corrective Action Permit because there is no documentation or indication that a reportable quantity of listed hazardous substances/wastes has been released to the environment at this facility.

3.3 MU 5: NITROGLYCERIN AREA

The focus of this MU is the site of the 1993 explosion. Review of a February 16, 1993 Accident Report indicated that the energetic materials were consumed in the explosion. A June 30, 1993 Hazards Analysis Study was performed in support of the NG-2 Building 9482 Storehouse explosion. An engineering action was performed to remove all debris and soil surrounding the explosion site. The explosion site was backfilled and reseeded to stabilize the soil and support a vegetative cover (see **Photos 1 and 2**). Additionally, the Nitroglycerin Area is an active area.

Migration Pathways Analysis

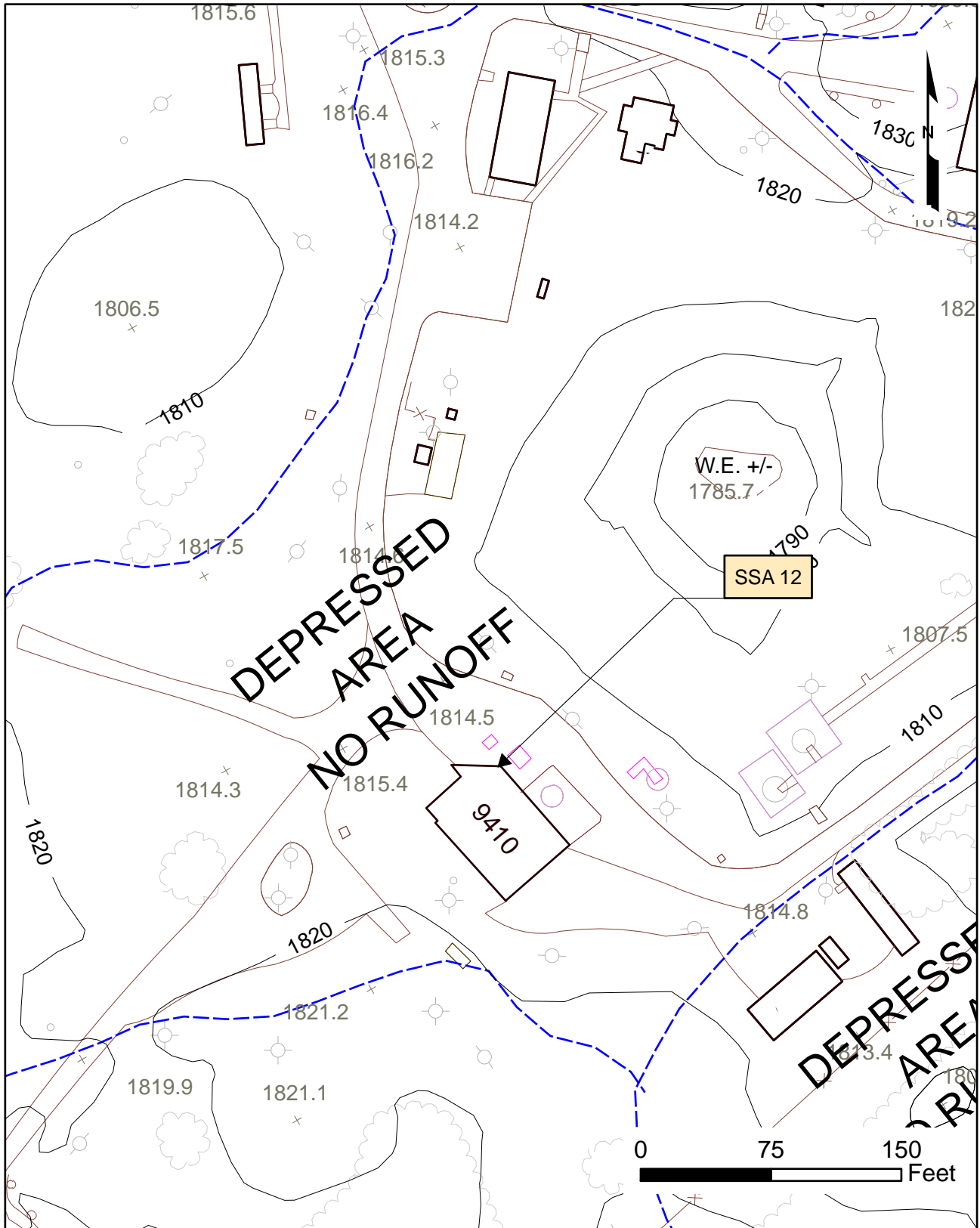
- ❖ Soil, Groundwater and Surface Water: Structural material and surface soil in and around the 1993 explosion site was removed from the site during clean-up procedures, and was replaced with clean fill material. There is no migration pathway from the unit to soil, surface water or groundwater (See **Photo Number 1 and 2**).

Basis for Removal from the RCRA Corrective Action Permit

No indication of a release of hazardous materials at the MU has been documented. Additionally, the NG area is an active area.

ATTACHMENT 1
FIGURES





ATTACHMENT 2
PHOTOGRAPHS



Photo 1. MU 5 – Location of 1993 Explosion, Nitroglycerin Area.



Photo 2. MU 5 – Location of 1993 Explosion, Nitroglycerin Area..