



DEPARTMENT OF THE ARMY  
HUNTINGTON DISTRICT, CORPS OF ENGINEERS  
502 EIGHTH STREET  
HUNTINGTON, WEST VIRGINIA 25701-2070

REPLY TO  
ATTENTION OF:

CELRH-EC-CE (Lisa Humphreys)

04 March 2010

MEMORANDUM FOR Commander, US Army Engineer District, Louisville,  
Attn: CELRL-PM-M-E (Michael Saffran)

SUBJECT: Defense Environmental Restoration Program for Formerly Used Defense Sites (DERP-FUDS) - Closeout of TNT Area B, Project No. G05OH001814, Plum Brook Ordnance Works, Erie County, Ohio

1. CELRH has fulfilled the requirements of USACE Engineering Regulation ER 200-3-1, *Environmental Quality - Formerly Used Defense Sites (FUDS) Program Policy*, Section 4-7.4.1 for closeout of TNT Area B project at the former Plum Brook Ordnance Works (PBOW), DERP-FUDS Project No. G05OH001814.
2. TNT Area B Project – Remedial investigations, risk assessments and a Feasibility Study were conducted as well as a Non-Time Critical Removal Action (NTCRA). Completion of the NTCRA showed that no further action was required to protect human health and the environment. The No Further Action Decision Document for TNT Area B was signed 23 September 2009. The Ohio EPA concurrence letter was signed 29 September 2009 and is attached to the Project Closeout Report.
3. Please have the PCO Report signed by Russell Boyd, and return a signed copy to this office and to Ms. Patty Bertsch, CELRD-PDM.
4. Please contact me at (304) 399-5388 or [Richard.L.Meadows@usace.army.mil](mailto:Richard.L.Meadows@usace.army.mil) if you have any questions or require additional information regarding this submittal.

RICHARD L. MEADOWS  
Project Manager

Encl  
as

CF:  
CELRD-PDM (P. Bertsch)

**Project Close-Out Report  
Plum Brook Ordnance Works - G05OH0018  
TNT Area B (TNTB Soils & Sediment) – G05OH001814  
Sandusky, Erie County, Ohio  
04 March 2010**

## **I. INTRODUCTION**

This Final Project Close-Out Report documents that the U.S. Army Corps of Engineers (USACE), Huntington District (CELRH) completed all investigations and response actions for project G05OH001814 titled TNT Area B (TNTB) at the Plum Brook Ordnance Works site in accordance with *U.S. Army Corps of Engineers Engineering Regulation 200-3-1, Section 4-7.4.1.*

## **II. SUMMARY OF SITE CONDITIONS**

### **Background**

The former Plum Brook Ordnance Works is located four (4) miles south of Sandusky, Ohio, near Lake Erie. Nitro-aromatic explosives produced at the site included TNT, DNT, and pentolite; other products produced at the ordnance works included nitric and sulfuric acid. The plant operated for four years from 1941 to 1944, and was decontaminated by the end of 1945. Possession of the property was transferred to the Ordnance Department in 1945, then to the War Assets Department, and finally to the GSA in 1949. NASA acquired the property in 1963 and presently maintains and utilizes 6,453.5 of the original 9,072 acres.

The U.S. Army entered into a contract with Trojan Powder Company for the purpose of manufacturing this ordnance. The official title for the site during this time was the Plum Brook Ordnance Works (PBOW). Groundbreaking to construct the facilities to support the manufacturing of ordnance began on April 15, 1941. Production began on December 16, 1941 and ended on V-J Day (August 15, 1945). During the production period more than one billion pounds of ordnance was manufactured.

PBOW was placed in standby condition from 1945 to 1946. Throughout this time, the Army conducted decontamination and decommissioning (D&D) of many of the buildings and structures associated with the manufacturing of ordnance. Decontamination of TNT lines, acid lines, pentolite lines, and DNT lines were conducted September through December 1945. Typical D&D methods for buildings and structures involved removal and relocation of all explosives to a burning ground where they were burned. Remaining buildings and structures were burned to the ground, when possible. Steam lines, drain lines, etc., were flushed and dismantled. There is no indication in PBOW historical records of where lines were flushed.

It is estimated that 65 percent of the necessary decontamination of PBOW was completed by December 1945. On midnight of December 17, the Ordnance Department became the accountable agency and the U.S. Army Corps of Engineers assumed responsibility for maintenance and custodial duties at the PBOW from January 1 through June 30, 1946. After further decontamination efforts were completed, and the extent of contamination certified, PBOW was transferred to the War Assets Administration in August 1946. From 1946 to 1949 the property was protected and maintained by Matthew-Levio and Sons. In 1949 it was transferred to the General Services Administration (GSA), which maintained oversight of the facility. Ravenna Arsenal conducted further decontamination efforts from 1945 to 1958. NASA accepted the facility in 1963 after Ravenna Arsenal certified that the PBOW had been completely decontaminated and was suitable for unrestricted future use. After acceptance of the PBOW, NASA identified further areas that required decontamination. In 1964, NASA continued site decontamination and the removal of structures.

NASA accepted custody and accountability on PBOW on March 15, 1963, for the purpose of conducting various aerospace research activities. NASA continues to use the site today.

The TNTB manufacturing site consisted of widely scattered buildings of wood frame construction with asbestos and sheet metal coverings. It also included a series of buried and/or overhead flumes and pipes used to transport various liquids associated with the manufacturing process.

After plant operations ceased, the TNTB manufacturing lines were decontaminated by the War Department in late 1945. During decontamination, structures, equipment, and manufacturing debris were either removed and salvaged or removed and burned. After decontamination the property was initially transferred to the Army Ordnance Department to be decontaminated. In 1963, to aid in the property transfer from the U.S. Army to the National Aeronautics and Space Administration (NASA), TNTB was further contaminated.

TNTB currently consists of an area of approximately 55 acres in the south-central portion of PBOW immediately north of West Scheid Road. Significant evidence of former PBOW facilities exists at TNTB in the form of roads, hydrants, above-ground water valves, and ditches; all buildings and structures associated with the manufacturing process have been demolished and removed. Two NASA facilities are present at the site and are currently active for research purposes, the Hypersonic Tunnel Facility (HTF) and Nitrogen Dewar Tanks. The HTF is located in the northwest portion of TNTB and consists of a single building, above and below ground piping and utilities, and paved parking areas. The Nitrogen Dewar Tanks are located in the center of TNTB with aboveground piping and underground utilities leading to the northwest, toward HTF, and to the northeast, off site (Dames & Moore, Inc., 1997).

Nitroaromatic compounds (i.e., explosives) are the major contaminants at TNTB with Polycyclic Aromatic Hydrocarbons (PAHs) and Polychlorinated Biphenyls (PCBs) as secondary contaminants. Nitroaromatic soil contamination was likely due to spills on the surface and leaks from holding areas, flumes and pipelines associated with former manufacturing operations.

### **Remedial Investigation Summary**

A Remedial Investigation (RI) was completed and documented in the *Final TNT Area B Remedial Investigation, Volume 1 – Report of Findings, Final, Former Plum Book Ordnance Works, Sandusky, Ohio*, August 2000. The following section summarizes the RI.

RI activities were conducted separately for TNTB soils (431 samples), surface water (2 samples), and sediment (5 samples) in 1998. Two samples each of surface soil, surface water, and sediment were collected during an initial site investigation in 1993, and 34 soil samples were collected during the 1994 site investigation.

**Soil.** During the RI, TNTB soil was investigated by process line or process type, and the associated building areas are listed below. A summary of the analytical results for the 21 process areas and associated buildings evaluated during the RI is presented in the paragraphs that follow. Samples stated as being collected from a given building (e.g., Building 451) may include not only the former building's footprint, but the general area surrounding the footprint as well. The 21 TNTB areas investigated during the RI include the following:

- DNT process buildings
  - Building 412, DNT sweating and graining building
  - Building 415, DNT nitrating building
- Wastewater settling tanks and associated pipelines

- Building 417, wastewater disposal settling tank
- Wastewater pipelines
- Process line 5
  - Building 451, mono house
  - Building 452, bi-tri house
  - Building 453, fortifier house
  - Building 456, wash house
  - Building 459, acid and fume recovery
  - Northeast nail house
- Process line 6
  - Building 461, mono house
  - Building 462, bi-tri house
  - Building 463, fortifier house
  - Building 466, wash house
  - Building 469, acid and fume recovery
  - Northwest nail house
- Process line 7
  - Building 471, mono house
  - Building 472, bi-tri house
  - Building 473, fortifier house
  - Building 476, wash house
  - Building 479, acid and fume recovery.

**Surface Water and Sediment.** No nitroaromatics or other chemicals interpreted as potentially site-related were detected in any surface water samples associated with TNTB. One nitroaromatic, TNT, was detected in a 1993 sediment sample. No nitroaromatics or other chemicals interpreted as site-related were detected in the RI sediment samples. A lack of nitroaromatics detections in the surface water and RI sediment samples indicates that contaminants associated with TNTB are not appreciably impacting surface water and sediment.

**Groundwater.** Groundwater at TNTB is being evaluated separately and will be addressed in a separate Proposed Plan if necessary. Remediation of contaminated soil at TNTB in any event will also remove potential sources of groundwater contamination.

### **Risk Assessments Summary**

Risk Assessments were completed and documented in the *Final TNT Area B Remedial Investigation, Volume II – Baseline Human Health Risk Assessment and Volume III – Ecological Risk Assessment, Final, Former Plum Book Ordnance Works, Sandusky, Ohio*, August 2000. The results are summarized below.

**Human Health Risks.** A baseline human health risk assessment was conducted at TNTB for soil, surface water and sediment for current and future scenarios including a construction worker, grounds keeper, indoor worker, and resident. There is no land use restriction or land use future plan for TNTB, so risk management decisions were based on unrestricted residential use. The calculated risk and hazard indices for the residential, unrestricted use scenario are as follows:

- The site-related total ILCR ( $1 \times 10^{-3}$ ) from all future resident exposure pathways to surface and subsurface soil exceeded the risk management range. The site-related total HI (244) exceeded the acceptable value of 1. The resident ILCR was associated primarily with 2,4,6-TNT ( $5 \times 10^{-4}$ ), 2,4-DNT ( $3 \times 10^{-4}$ ), 2,6-DNT ( $2 \times 10^{-4}$ ), Aroclor 1260 ( $5 \times 10^{-5}$ ), and benzo(a)pyrene ( $4 \times 10^{-5}$ ). The HI

was associated primarily with TNT (205), 2-ADNT (23), 4-ADNT (11), 2,4-DNT (2), and 2,6-DNT (2).

- The resident ILCR for exposure to sediment ( $1 \times 10^{-6}$ ) was within the risk management range. The resident HI for exposure to sediment (0.2) did not exceed the acceptable criterion of 1.

In summary, predicted levels of exposure to site-related chemicals in surface and subsurface soil did result in unacceptable levels of cancer and non-cancer risk to an on-site resident. These levels resulted in unacceptable non-cancer risks to construction worker, but the cancer risks were at an acceptable level. Both cancer and non-cancer risks to the groundskeeper and indoor worker did not exceed acceptable levels. Similarly, results of the BHHRA were interpreted as indicating that site surface water and sediment did not pose any unacceptable human health risks.

The BHHRA results were used to identify 13 chemicals of concern (COC) for soil. These were chemicals identified as contributing significantly to risk as defined in the BHHRA. The 13 soil COCs were as follows:

- 2-Amino-dinitrotoluene - 2-ADNT
- 4-Amino-dinitrotoluene - 4-ADNT
- 2,4-Dinitrotoluene - 2,4-DNT
- 2,6-Dinitrotoluene - 2,6-DNT
- 2-Nitrotoluene - 2NT
- 2,4,6 -trinitrotoluene - TNT
- Aroclor 1254
- Aroclor 1260
- Benzo(a)pyrene - BaP
- Benzo(a)anthracene - BaA
- Benzo(b)fluoranthene - BaF
- Dibenz(a,h)anthracene - DahA
- Indeno(1,2,3-cd)pyrene - I123cdP

**Ecological Risks.** An ecological risk assessment, composed of a screening-level ecological risk assessment (SLERA) and a predictive baseline ecological risk estimation (BERA), were performed as part of the RI for TNTB (IT, 2000b). The SLERA was composed of two main parts: the ecological site description and the selection of chemicals of potential ecological concern (COPEC). Both of these were part of the problem formulation step of ecological risk assessment. A BERA was conducted for TNTB because the SLERA indicated that the potential for ecological risks could not be characterized as “minimal or nonexistent.”

TNTB is composed of moderate old field, shrub thicket, wet meadow, marshes, and scrub/shrub wetland vegetative communities. Hardwood forested areas are located just outside of TNTB. Mammalian, avian, and herptilian wildlife species have been identified at PBOW. It was determined that the presence of any rare, threatened, or endangered plant species would be unlikely. Two small, intermittent tributaries, which comprise the headwaters at Ransom Brook, are the primary surface water features at the site. During a site visit performed in conjunction with the SLERA, the tributaries were 2 to 3 feet wide and several inches deep; they were judged unlikely to support forage fish due to their shallow depth and intermittent nature.

Among rare, threatened, and endangered animals, only the sedge wren (Ohio endangered) may possibly nest at the site, although its preferred habitats (wet meadows, grassy marshes, old grassy fields) are limited at TNTB. No other rare, threatened, or endangered animals would be expected at TNTB.

The BERA focused on the potential exposure to species or ecological components that were most likely to be affected, given the toxicological and mobility characteristics of the COPECs, and on those COPECs that would most likely produce the greatest effects in the on-site ecosystem.

The risk characterization integrated information on exposure, exposure-effects relationships, and defined or presumed target populations. The result was a determination of the likelihood, severity, and characteristics of adverse effects of COPECs present at a site, based on qualitative and quantitative approaches. The weight-of-evidence risk characterization results, in conjunction with the uncertainties described in the BERA, were summarized by the following statements.

- Impacts to terrestrial plants appear to be insubstantial.
- Terrestrial receptors (especially mice [HQ=4,970], shrews [HQ=18,006], and wrens [HQ=40,308]) are predicted to incur elevated hazards from exposure to 2,4,6-TNT, 4-ADNT, 2-ADNT, and Aroclor 1260 in soil.
- Several surface water COPECs (aluminum, copper, iron lead, manganese, and selenium) and sediment COPECs (2-methylnaphthalene, nickel and zinc) were detected at concentrations greater than the screening criteria. However, the tributaries evaluated at TNTB are intermittent and are very limited, reducing concern for potential impacts to aquatic biota. Also, considerable uncertainties exist associated with toxicity and estimating concentrations in aquatic insects.
- Aquatic macro-receptors (raccoon and duck) are predicted to have elevated HQs from exposure to 2-ADNT and zinc in sediment and aluminum in surface water. Elevated ecological hazards are also predicted for most of the terrestrial receptors based on the iron and aluminum concentrations in surface water, which is assumed to be used as a source for drinking.

### Feasibility Study Summary

The Feasibility Study was completed and documented in the *Final TNT Area B Remedial Investigation, Volume IV – Feasibility Study, Final, Former Plum Book Ordnance Works, Sandusky, Ohio*, dated July 2001.

No chemical specific or location specific ARARs were identified. Action specific ARARs for TCLP and storage and disposal of hazardous waste were identified and summarized in the FS (FS Appendix A) and reprinted in the Proposed Plan (Appendix A). The removal action identified in the FS complied with the action specific ARARs.

The Feasibility Study (FS) was for soils only, the only surface media with COCs. There is a separate FS for TNTB groundwater. The soils FS was used as an EECA for TNTB soils. The remedial goals (RG) for the COCs were defined based on human health unrestricted site use to prevent human exposure via ingestion, dermal and inhalation exposure routes. The RGs were also balanced to ensure the reduction in the potential for adverse ecological effects.

To meet the RGs, 13 former building areas needed 30 excavations to remove chemical concentrations to below RGs. Each former building area needed one or more excavations based on soil sample results from the RI and 30 excavation “hot spot” locations were identified.

## **Non-Time Critical Removal Action Summary**

TNTB had a non-time critical removal action (NTCRA) for contaminated soils as outlined in the FS (IT, 2001) and Action Memorandum (USACE, 2003) that concluded July 2007. The Action Memorandum (USACE, 2003) identified 13 building areas requiring remediation at 30 excavation locations with each having at least one COC at a concentration exceeding its RG. The RGs for the COCs were defined based on human health unrestricted site use to prevent human exposure via ingestion, dermal and inhalation exposure routes. The RGs were also balanced to ensure the reduction in the potential for adverse ecological effects.

There were a total of 13 former building locations consisting of 30 areas to be excavated. During the 1<sup>st</sup> Interim Soil Removal Action (ISRA) which occurred 2002 through 2004, 12 former building locations were excavated for closure with 8 excavated to closure as documented in the *Interim Soil Removal Action Report TNT B Soil Excavation and Ex-Situ Stabilization, PBOW, Sandusky, OH* dated May 2006. During the 2<sup>nd</sup> ISRA which occurred from July 2006 until December 2006, the remaining five former building locations were excavated and contaminated soil removed as documented in the *Interim Soil Removal Action Continuation, Final Report, Sandusky, Ohio* dated July 2007. The actions associated with the excavation, confirmation sampling (nitroaromatics, PAHs and PCBs), treatment and disposal of contaminated soil are described in the Interim Removal Action Final Report (USACE, 2007). A total of 11,811 CY (increased from 2,945 CY) was excavated, treated (when necessary) and disposed of off-site during the removal action to achieve clean closure.

## **Community Relations Activities**

Public participation activities have been satisfied as required in CERCLA Section 113(k), 42 U.S.C. 9613(k), and Section 117, 42 U.S.C. 9617.

A public meeting was held on 16 July 2009 to present the Proposed Plan for TNTB Soils and Sediment. The plan proposed a No Further Action for soil and sediment remedy. A 30-day public comment period began 16 July and ended 15 August 2009. The plan was made available at the meeting, at the Firelands Library (Bowling Green State University, Huron, Ohio) as well as on the PBOW website ([www.lrh.usace.army.mil/projects/current/derp-fuds/pbow/documents](http://www.lrh.usace.army.mil/projects/current/derp-fuds/pbow/documents)). No written comments were received regarding the No Further Action proposal.

## **III. PROTECTIVENESS**

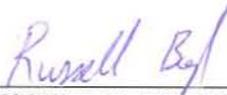
This site meets all the site completion requirements as specified in OSWER Directive 9320.2-09-A-P, *Close Out Procedures for National Priorities List Sites*. Unacceptable risks associated with TNTB soils were addressed by a Non-Time Critical Removal Action (NTCRA) and the risks associated with sediments and surface water were determined to be de minimus. The Decision Document was signed 23 September 2009 and the Ohio EPA concurrence letter signed 29 September 2009 (see attached letter). Ohio EPA provided their concurrence stating that "The NTCRA represents a permanent remedy and is accepted by both the State and community. Therefore Ohio EPA concurs with the No Further Action decision for TNT Area B". Since the NTCRA for the TNT B area has been implemented, the remedy is protective of human health and the environment.

## **IV. FIVE-YEAR REVIEW**

The Decision Document for TNTB Soils and Sediment required that No Further Action be taken to protect human health and the environment; therefore, a five-year review of the remedy for the area is not

required. Groundwater in the vicinity of TNT Area B is being addressed under separate project G05OH001826.

Approved By:

 3/31/2010  
RUSSELL E. BOYD Date  
Chief, Military Branch  
Planning, Programs and Project Management Division

## V. BIBLIOGRAPHY

IT Corporation (IT), 2000a, *Final TNT Area B Remedial Investigation, Volume I – Report of Findings, Final, Former Plum Book Ordnance Works, Sandusky, Ohio*, August.

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IT Corporation (IT), 2001, *Final TNT Area B Remedial Investigation, Volume IV – Feasibility Study, Final, Former Plum Book Ordnance Works, Sandusky, Ohio*, July.

U.S. Army Corps of Engineers (USACE), 2003, *Final Action Memorandum for TNT Area B interim Removal Action at the Plum Brook Ordnance Works, Sandusky, Ohio*, prepared for Huntington District, Huntington, West Virginia, June.

WTI May 2006., *Interim Soil Removal Action Report TNT B Soil Excavation and Ex-Situ Stabilization, PBOW, Sandusky, OH*, prepared for Huntington District, Huntington, West Virginia. May 2006.

U.S. Army Corps of Engineers (USACE) 2007, *Interim Soil Removal Action Continuation, Final Report, Sandusky, Ohio*, prepared for Huntington District, Huntington, West Virginia, July 2007.

*Final Proposed Plan for TNT Area B Soils and Sediments*, July 2009, USACE Huntington District.

*Final Decision Document for TNT Area B Soils and Sediments*, September 2009, USACE Louisville District.



State of Ohio Environmental Protection Agency

Handwritten notes in the top right corner, including the word "minutes" and a signature.

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**September 29, 2009**

Col. Keith A. Landry  
District Engineer  
U.S. Army Engineer District  
Louisville District Corps of Engineers  
P.O. Box 59  
Louisville, KY 40201-0059

Re: Ohio EPA Concurrence on No Further Action Decision Document for Soils and Sediments, TNT Area B, Plum Brook Ordnance Works.

Dear Colonel Landry:

Ohio EPA has reviewed the No Further Action Decision Document for Soils and Sediments, TNT Area B, Plum Brook Ordnance Works. The site is located within The NASA Plumbrook Station, four miles south of Sandusky, Ohio.

Ohio EPA has been involved in the investigation and remediation of this Area of Concern, reviewing and concurring in work plans, analytical data, and investigation Reports for TNT Area B.

The TNT B manufacturing site consisted of an area approximately 55 acres in size and is currently open land with no structures. Nitroaromatic compounds were the major contaminants at TNT Area B, with PAHs and PCBs as secondary contaminants. Nitroaromatic soil contamination was likely due to spills on the surface and leaks from Former holding areas, flumes and pipelines associated with the historical manufacturing Operation.

Unacceptable risks associated with TNT Area B were addressed by a Non-Time Critical Removal Action, documented in USACE reports in 2006 and 2007. The NTCRA represents a permanent remedy which has been reviewed and accepted by both the State and community. Therefore, the Ohio Environmental Protection Agency concurs With the No Further Action decision for TNT Area B.

Ted Strickland, Governor  
Lee Fisher, Lieutenant Governor  
Chris Korleski, Director

Ohio EPA is an Equal Opportunity Employer



Col. Keith A. Landry  
Page 2

If you have any questions regarding this letter, please contact Paul Jayko (DERR, NWDO) at (419) 373-3038.

Sincerely,

A handwritten signature in black ink, appearing to read "Chris Korleski". The signature is fluid and cursive, with the first name "Chris" and last name "Korleski" clearly distinguishable.

Chris Korleski  
Director

AL/csl

pc: File, DERR, NASA-PBOW

ec: Cindy Hafner, Chief, DERR, CO  
Pete Whitehouse, Asst. Chief, DERR, CO  
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