Attachment X

Site-Specific Sampling and Analysis Plan
Remedial Investigations and Feasibility Studies
TNT Area A and TNT Area C

Former Plum Brook Ordnance Works
Sandusky, Ohio

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IT Project Numbers 807111 and 807112
Control Copy No.__7__

Revision 0

July 2000

(This SSAP must be used in conjunction with the PBOW SAP, 1996)

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DISCIPLINE SIGN-OFF REVIEW

Client Name: U.S. Army Engineer District, Nashville; CELRN-ED-R-M

Project Description: RI / FS / DD, TNT Area A & C, Former Plum Brook Ordnance Works, Sandusky, OH

Contract Number: DACA62-00-D-0002 Delivery Orders: 0004 0003

Project Numbers: 807112 807111 Task / Phase Number: 0200000

Document Type	Identify specific section or segment covered by this checkprint	Document Origin
☐ Technical / Cost Proposal		☐ Originator Developed
☐ RFP		☒ Edited Standard
☐ Contract / Subcontract		☐ Client Furnished
☒ SAP, SSAP, CDAP, or QAPP	SSAP, RI/FS/DD, TNT Areas A and C, Rev. 1, July 2000	
☒ SHP or SSHP	SSHP, RI/FS/DD, TNT Areas A and C, Rev. 1, July 2000	**Document Status**
☐ _____ Report		☐ Preliminary
☐ Risk Assessment / Evaluation		☐ Internal Draft
☐ Specifications & Plans		☐ Draft
☐ Design Calculations		☐ Draft Final
☐ Tables		☒ Final
☐ Drawings / Figures		☐ Other: _____
☐ Other: _____		

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List of Acronyms

ASTM	American Society for Testing and Materials
bgs	below ground surface
D&M	Dames and Moore
DNT	dinitrotoluene
DQO	data quality objective
EPA	U.S. Environmental Protection Agency
HPLC	high performance liquid chromatography
IDW	investigation-derived waste
IT	IT Corporation
mg/kg	milligrams per kilogram
MK	Morrison-Knudsen Ferguson Corporation
NASA	National Aeronautic and Space Administration
PBOW	Plum Brook Ordnance Works
PCB	polychlorinated biphenyl
QA	quality assurance
QC	quality control
QAPP	quality assurance project plan
RBC	risk-based concentration
RBSC	risk-based screening concentration
RI	remedial investigation
SAP	sampling and analysis plan
SSAP	site-specific sampling and analysis plan
SVOC	semivolatile organic compound
TAL	target analyte list
TCL	target compound list
TNT	trinitrotoluene
TNTA	TNT Area A
TNTC	TNT Area C
USACE	U.S. Army Corps of Engineers
VOC	volatile organic compound

1.0 Project Description

The U.S. Army is conducting studies of environmental impact at previously owned U.S. Department of Defense properties. The former Plum Brook Ordnance Works (PBOW) is located in Sandusky, Erie County, Ohio (Figure 1-1). It is being investigated under the Defense Environmental Restoration Program (DERP) for Formerly Used Defense Sites (FUDS) and is being managed and technically overseen by the Nashville District of the U.S. Army Corps of Engineers (USACE). This 9,000-acre facility was used for the manufacture of explosives during World War II. The site is currently owned by the National Aeronautics and Space Administration (NASA) and operated as the Plum Brook Station of the NASA Glenn Research Center based in Cleveland, Ohio.

As an attachment to the PBOW site-wide sampling and analysis plan (SAP) (IT Corporation [IT], 1996a), this site-specific sampling and analysis plan (SSAP) has been prepared for the field work to be carried out in support of the remedial investigations (RI) at Trinitrotoluene Area A (TNTA) and TNTC. This SSAP must be used in conjunction with the SAP and the quality assurance project plan (QAPP) (IT, 1996b) to ensure that work performed at the subject site will be of the quality required to satisfy the overall and site-specific project objectives. A site-specific safety and health plan has also been prepared separately for this investigation and must be used in conjunction with the site-wide safety and health plan (IT, 1996c).

1.1 Site History

The PBOW site, built in early 1941, manufactured 2,4,6-trinitrotoluene (TNT), dinitrotoluene (DNT), and pentolite. Production of explosives began in December 1941 and continued until 1945. After the plant was shut down, decontamination of TNT, acid, pentolite, and DNT processing lines began; decontamination was completed during the last quarter of 1945. The property was initially transferred to the Ordnance Department, then to the War Assets Administration after it was certified by the U.S. Army to be decontaminated. In 1949, PBOW was transferred to the General Services Administration. NASA acquired PBOW in 1963 and is presently utilizing the site.

1.2 Summary of Existing Site Data

1.2.1 TNTA Area

The former TNTA is located in the northeastern part of PBOW and occupies approximately 114 acres of land with Columbus Avenue bisecting the site as shown in Figure 1-2. NASA constructed its administration building on the east side of Columbus Avenue in the central portion of former TNT Area A. The NASA Administration Building and associated parking areas cover two of the former TNT process buildings (Buildings 121 and 122) at TNTA. TNTA was used during World War II as a manufacturing facility for TNT and DNT. During PBOW operations, TNTA contained four TNT lines consisting of five buildings each and two DNT lines each consisting of one building (Figure 1-3). Wastewater from TNTA was routed to the Pentolite Road Red Water Ponds through underground flumes and sewer lines. Significant previous remediation activities have been performed in TNT Area A. Very little above ground evidence of the former PBOW structures and features, other than abandoned railroad tracts, ditches, and aboveground water valves remain in the area. According to the records review report (Dames and Moore [D&M], 1995), TNTA was decontaminated along with two other TNT areas in 1955 and again in 1966. The decontamination at TNTA was reported as very thorough. Significant subsurface contamination including underground flumes and sewer lines, were removed: however, some underground flumes previously deemed uncontaminated still remain. Approximately 16,000 pounds of TNT was removed from Area A. Previous environmental investigations in this area included a 1993 site inspection by Morrison-Knudsen Ferguson Corporation (MK) (MK, 1994) and a 1994 TNT Areas site investigation by D&M (D&M, 1997). The MK inspection of the TNTA site included one soil sample, one co-located sample pair of surface water and sediment, and three groundwater samples. No explosive residues were detected in any of these samples.

A total of 36 soil samples were collected from 28 borings within the TNTA site during the 1994 D&M investigation (Table 1-1 and Figure 1-3). Boring locations were placed in and around former buildings that were associated with the TNT production lines. In addition, 1 soil boring was installed in a ditch north of Maintenance Road. A wide range of nitroaromatic compounds was detected, including concentrations of TNT at up to 580 mg/kg (near Wastewater Settling Tanks) and 53 mg/kg (near Fortifier House). One boring (TNTA-S22-0.0/2.0) near Mono House exhibited 2,4-DNT and 2,6-DNT concentrations of 45 mg/kg and 47 mg/kg, respectively.

IT conducted a site-wide groundwater investigation at PBOW in 1996 (IT, 1997) and again in 1997 (IT, 1998). Both investigations included collection of groundwater samples from wells in TNTA. There are seven existing monitoring wells in TNTA, five overburden wells (MK-MW22, 23, 24 and PB-TNTA-MW10, 11) and two bedrock wells (PB-BED-MW17, 18). MK-MW24 is located on the south perimeter of TNTA, hydraulically upgradient of the site, and PB-BED-MW17 and MK-MW23 are located on the north perimeter of TNTA downgradient of the site. PB-BED-MW18 is located along the east perimeter of TNTA, hydraulically cross-gradient of the site. Three wells, PB-TNTA-MW10, 11 and MW-MK22 are all located within the TNTA Area. Of the overburden wells, only MK-M22 had explosive concentrations exceeding the risk-based concentration (RBC) levels: 4-amino-2, 6-DNT was detected exceeding the RBC for the 1997 and 1998 sampling events. All the overburden wells had groundwater samples with concentrations of dissolved manganese exceeding the respective screening level. In addition, one groundwater sample from MK-MW23, a downgradient well, had a concentration of bis (2-ethylhexyl) phthalate exceeding the respective RBC. In PB-BED-MW18, the groundwater sample from this well exhibited concentrations of 1,3-dinitrobenzene and nitrobenzene exceeding the screening levels. PB-BED-MW-17 and 18 had detected concentrations of the volatile organic compounds (VOCs), benzene, and the dissolved metal barium exceeding their respective RBCs.

1.2.2 TNTC Area

The former TNTC, located in the southwestern portion of PBOW, occupies approximately 119 acres of land as shown in Figure 1-2. NASA currently uses some of the existing structures in the area for storage purposes. TNTC was used during World War II as a manufacturing facility for TNT and DNT. During PBOW operations, TNTC contained five TNT lines consisting of five buildings each (Figure 1-4). Wastewater from TNTC was routed to the West Area Red Water Ponds through underground flumes and sewer lines. Presently, the area is largely overgrown with trees and brush; however, some of the roads, building foundations, and remnants of utilities from former TNT operations are still recognizable. According to the records review report (D&M, 1995), TNTC was decontaminated along with two other TNT areas in 1955 and again in 1966. However, the decontamination at TNTC was reportedly not as thorough as that in TNT A and significant subsurface contamination associated with underground flumes and sewer lines is probably still present. Previous environmental investigations in this area included a 1993 site inspection by MK (MK, 1994) and a 1994 TNT Areas site investigation by D&M (D&M, 1997). The MK inspection of the TNTC site included two surface soil samples, and one collocated sample pair of surface water and sediment. Organic compounds were not detected in the surface

water sample or the collocated sediment sample. Toluene was detected in both surface soil samples at concentrations below the quantitation limit.

A total of 30 soil samples were collected from 26 borings within the TNTC site during the 1994 D&M investigation (Table 1-1 and Figure 1-4). Boring locations were placed in and around former buildings that were associated with the TNT production lines. A wide range of nitroaromatic compounds were detected, including TNT at concentrations up to 2.7 mg/kg (near Wash House) and 2,4-DNT up to 8.7 mg/kg (also near Wash House).

IT conducted a site-wide groundwater investigation at PBOW in 1996 (IT, 1997) and again in 1997 (IT, 1998); both investigations included collection of groundwater samples from six overburden monitoring wells (IT-MW09, MK-MW12, PB-TNTC-MW03, PB-TNTC-MW04, PB-TNTC-MW05 AND PB-TNTC-MW06) in TNTC. Chlorobenzene was detected in IT-MW09 below its risk-based concentration (RBC) in 1997. In 1998 benzene and toluene were detected in IT-MW09 at concentrations below RBCs. The SVOC bis (2-ethylhexyl) phthalate was detected above the RBC in MK-MW12 and PB-TNTC-MW06 in 1997. Explosives were not detected in either sampling event.

Manganese was detected in five wells at dissolved phase concentrations above the RBSC in 1997. Iron and nickel exceeded the RBSC in the dissolved phase in PB-TNTC-MW06 and PB-TNTC-MW03 respectively. In 1998, only manganese was found to exceed the RBC in the dissolved phase.

1.3 Site-Wide Hydrogeology

Two hydrolithologic units are known to exist at PBOW. The overburden unit, composed of glacial outwash materials, has a thickness ranging from a few feet in the south to more than 40 feet in some locations in the north. The water producing capacity of the overburden materials is strongly controlled by seasonal changes and the overburden water-bearing zone is therefore not considered to be a source of water. The bedrock unit consists of Devonian limestone and shale that dip to the southeast at approximately 35 feet per mile. Based on previously collected data, the overburden thickness within the TNT Areas is generally less than 10 feet at TNTA and less than 15 feet at TNTC.

In general, groundwater flows in a northerly direction, towards Lake Erie, in both the unconsolidated overburden material and consolidated bedrock. However, on the western side of the

installation groundwater in the overburden water-bearing zone flows to the northwest while groundwater in the bedrock aquifer flows to the northeast. The groundwater flow regime in the overburden unit shows a strong seasonal variation (IT, 1999).

2.0 Scope of Work and Objectives

2.1 Scope of Work

As specified in separate scopes of work (USACE, 2000), the RI activities at TNTA and TNTC will consist of preparation of site-specific addenda to the site-wide SAP, and safety and health plan; completion of field activities, including installation of soil borings and collection of soil samples from selected locations for chemical analysis; evaluation of analytical results; report preparation; and a geographic information system deliverable.

2.2 Objectives

The primary objective of the RI is to determine the extent of chemical(s) of potential concern in soils at TNTA and TNTC. Specific objectives of the RI are summarized as follows:

- Define site physical features and characteristics
- Determine the nature and extent of source areas
- Determine whether contaminant distribution is consistent with Department of Defense activities
- Collect data for use in baseline human health and ecological risk assessments of TNT Area A and TNT Area C.

Sufficient surface and subsurface soil data will be collected so that a feasibility study can be conducted for both TNTA and TNTC to select the most effective remediation technology. Additionally, the collected data will be used to conduct human health and ecological risk assessments for each site.

2.3 QAPP Review

The site-wide QAPP (IT, 1996) referenced throughout this work plan has been reviewed to ensure that it remains accurate. During this review, numerous changes have occurred since its publication that affect this field program. The specific discrepancies in the QAPP and the required modifications are shown in the comment response log attached to this SSAP. All modifications required to the QAPP are reflected in this SSAP.

2.4 Site-Specific Data Quality Objectives

2.4.1 Overview

The data quality objectives (DQO) process followed during the planning stages of the RI evaluated data requirements needed to support the decision-making process and selected the best action to satisfy these requirements. Incorporated components of the DQO process, described in the U.S. Environmental Protection Agency (EPA) publication 9355.9-01 *Data Quality Objectives Process for Superfund* (EPA, 1993), are discussed in detail in Section 3.3 of the SAP. Determining factors for procedures necessary to satisfy investigative objectives and to establish the basis of future actions at PBOW are presented in Figure 3-2 of the SAP (IT, 1996a).

2.4.2 Data Users and Available Data

A site-specific conceptual model developed using existing data, helped to identify data gaps. During the project planning process effective methodologies for filling the data gaps were designed and reviewed by the data users with the most efficient data collection design being implemented. The SSAP records the rationale for the design, including the location, number, and type of sampling necessary to fill the data gaps and to satisfy the DQOs. The SSAP, along with companion documents, provides the regulatory agencies with sufficient detail so that they can conclude whether the investigative effort is adequate to satisfy the study objectives.

2.4.3 Conceptual Site Model

Four factors considered in defining the conceptual model for the RI are:

- Potential contaminant sources
- Migration pathways
- Potential receptors
- Contaminants of concern.

A source of contamination at PBOW is past TNT manufacturing activities, including the production and storage of raw materials. Sources at the proposed areas of investigation result from TNT and DNT production and associated activities. The migration pathways for potential contaminants include groundwater, soil, sediment, and surface water runoff to creeks. Likely receptors at PBOW are limited to aquatic organisms in creeks and wildlife. Exposure of humans to potential contaminants under current land use at PBOW is unlikely since the site is a secure NASA research station. Potential receptors near the facility include off-site water users. Chemicals of potential concern based on past use of the site should primarily be nitroaromatic

explosives, but may also include VOCs, semivolatile organic compounds (SVOC), metals, pesticides/polychlorinated biphenyls (PCB), and cyanide.

2.4.4 Decision-Making Process, Data Uses, and Needs

The decision-making process, presented in detail in Section 3.3.3 of the SAP (IT, 1996a), consists of a seven-step process that will be followed during the RI (IT, 1996a). Data uses and needs are summarized in Table 2-1. Figure 2-1 presents the order in which samples will be collected and organized.

2.4.5 Risk Evaluation

Confirmation of contamination during the RI will be based upon a comparison of detected contaminants in confirmation soil samples from this investigation to the most current preliminary remediation goals (RBCs) developed by EPA Region 9. EPA definitive data will be used to determine whether the established guidance criteria are exceeded in the soil. Definitive data will be adequate for confirming the presence of the soil contamination and for supporting a risk assessment and feasibility study, if necessary. Analytical results from the groundwater samples collected during this investigation will be compared to Region 9 PRGs.

2.4.6 Data Quality, Types, and Quantities

Surface and subsurface soil, groundwater, surface water, and sediment samples will be collected and analyzed to meet the objectives of the RI. QA/quality control (QC) samples will be collected for all sample types as described in Section 3.3 of this SSAP. All samples, except the screening samples, will be analyzed by EPA-approved methods and will comply with EPA definitive data requirements. In addition to meeting the quality needs of the RI, data analyzed at this level of quality are appropriate for all phases of the characterization and risk assessment. All soil screening samples will be analyzed using a high performance liquid chromatography (HPLC) screening method. The data will be used to determine the nature and extent of the nitroaromatic contamination.

2.4.7 Precision, Accuracy, and Completeness

Laboratory requirements of precision, accuracy, and completeness for confirmation samples generated during the RI are provided in Chapter 12.0 of the QAPP (IT, 1996b).

3.0 Field Activities

Field activities associated with the RI at TNTA and C will include surface and subsurface soil sampling, groundwater sampling, explosives screening analyses, confirmation analysis for selected soil samples, land surveying, and investigation-derived waste (IDW) management.

3.1 Investigative Approach

The RI approach to the TNTA and TNTC areas will be consistent with work conducted at TNT B (IT, 1999). This approach involves an iterative sampling scheme using screening analysis for nitroaromatic explosives using HPLC. The HPLC screening method is based on the definitive SW-846 method 8330. The screening method uses a shorter extraction time and does not include second column confirmation. The HPLC screening method will provide more valuable field data than traditional (i.e., colorimetric) screening methods by allowing lower detection limits and the detection of multiple compounds. The colorimetric method is prone to interference by other nitroaromatic and nitroamine compounds. Such compounds will be detected and quantified using the HPLC screening method.

A maximum of 360 screening surface soil, 40 screening subsurface soil, 20 fixed-base laboratory surface soil, and 20 fixed-base laboratory subsurface soil confirmation samples are proposed at each of the sites (Tables 3-1 and 3-2). All field screening samples will be analyzed using the screening level SW-846 8330 method for nitroaromatics. The confirmation samples will be analyzed by definitive EPA methods for nitroaromatic compounds, VOCs, SVOCs, PCBs and metals. Soil sample locations will be selected to provide adequate coverage of areas with the potential to be contaminated based on past site usage, previous analytical results at the site (D&M, 1997), and to cover suspected source areas identified during investigations at PBOW TNT B (IT, 1999) and other similar TNT production facilities (e.g., West Virginia Ordnance Works and Volunteer Army Ammunition Plant). The locations selected will be further guided by EPA Region 9 PRGs (Table 3-3). Figures 3-1 and 3-2 present the design of the initial soil sampling locations.

Screening data will be reviewed in an iterative manner to determine if there are discernable patterns of soil contamination and to place subsequent delineation samples. It is anticipated that at least three phases of surface and subsurface soil delineation will be required (Figure 2-1). To accomplish this, initial sampling locations will be selected based on the historical use of the site

and findings from the TNT B investigation. Following the initial Phase I round of surface soil sampling, delineation samples will be collected in Phase II to determine the lateral extent of contamination. Approximately 40 surface soil samples per site will be reserved for Phase III sampling to provide additional delineation of surface soil contamination detected in Phase II. If these are not required for delineation, they will be used to sample miscellaneous areas such as drains, ditches, and low lying areas that may accumulate surface run off. Phase III sampling will consist of subsurface soil sampling using screening level analysis to delineate the vertical extent of contamination based on results of surface soil screening. Selection of the locations for subsurface sampling will be based on the highest concentrations of nitroaromatics detected in the surface soil samples. However, to best use the limited number of borings available, only one boring per building will be completed to determine the vertical extent of contamination. If available, borings will be completed at the monohouse and bi/tri-houses even if no surface soil contamination was evident in field screening data. This approach is based on findings of the TNT B investigation that found subsurface contamination at these buildings but no associated surface soil contamination.

Selection of alternate or delineation samples will be completed in consultation with the USACE-Nashville District. Data from this soil sampling effort are expected to provide estimates of concentrations of contaminants in soil and volumes of contaminated soil for use in the subsequent feasibility study.

3.2 Soil Sampling Locations

3.2.1 TNT Area A

3.2.1.1 Surface Soil Placement

Twenty buildings are associated with four TNT production lines, including two nitrating buildings, two DNT sweating and graining houses, two nail houses, and a wastewater settling tank which were shared by the production lines. The wastewater settling tank area is located in the northern part of the site that is connected to the production lines via underground red water sewers. Seven of these buildings and the settling tanks were sampled during the 1994 D&M investigation. Explosives were detected in some of the samples at concentrations above PRGs (Table 3-4 and Figure 3-1). Surface soil screening samples will be collected in and around each building area (including the settling tank area). It is anticipated that at least 222 surface soil samples will be collected during the initial Phase I surface soil sampling. In May 2000, historical

photos were studied that were stored at PBOW. The approximate locations of the former drowning and acid storage tanks at the TNTA were determined from these photos. Based on these new data, additional sample locations were added as shown on the revised Figure 3-1. Historical data will be used where appropriate; however, some of the historical samples were calculated from depths (i.e., > 1 foot) and thus, a surface soil sample is required at the same location. If open drains are encountered, one or more of the surface soil samples may be collected from the drains provided that there is reasonable justification to suspect the presence of contaminants (i.e., receiving run-off from a known source area). Sample identification for surface soil sampling is presented in Table 3-5. Based on the surface soil screening results, twenty surface soil fixed-based confirmation samples will also be collected.

3.2.1.2 Subsurface Soil Placement

Based on the surface soil field screening results at TNTA, 20 contaminated areas that exceed Region 9 PRGs will be further evaluated by collecting subsurface samples using a direct-push technology. This approach will better utilize the limited number of samples available. If it is determined that there are less than 20 hot spots, the remainder of those subsurface screening samples will be collected at selected locations determined to have the greatest likelihood of contamination. Based on the findings from the TNTB investigation, the mono, bi-tri and fortifier houses have the greatest probability of subsurface contamination.

Subsurface soil samples will be collected from two intervals between 2 to 10 feet below ground surface (bgs). In each of these boreholes, soil samples from the 4 to 6 and 8 to 10 feet intervals will be collected; however, sampling will terminate at bedrock if it is encountered above 10 feet bgs. In addition, the actual sampling depths may vary based on visual evidence of contamination. A complete lithologic description will be performed for each borehole. Based on the results of the initial screening subsurface sampling, a maximum of twenty subsurface soil confirmation samples will also be collected. Sample identification for subsurface soil screening samples is presented in Table 3-5.

3.2.1.3 Shallow Groundwater Sampling

Based on the analytical results from the confirmation soil samples, ten shallow (overburden) groundwater samples will also be collected. If bedrock is encountered at less than 5 feet bgs and the borehole is dry, the borehole will be abandoned. The groundwater sample locations will be placed at the confirmation sample locations which display the highest detections for PBOW related contaminants. The groundwater sampling points will not be developed or purged. Groundwater

samples collected will be analyzed at a fixed-based laboratory for VOCs, SVOCs, nitroaromatic compounds, and target analyte list (TAL) metals (Table 3-1).). Selected groundwater samples will be filtered in the field using a 0.45 micron filter to determine the relationship between total and dissolved metals. It is anticipated that three groundwater samples will require filtration; however, the exact number of groundwater samples to be filtered is contingent upon OEPA approval. Sample identification for groundwater sampling is presented in Table 3-6. Based on results from the site-wide groundwater monitoring report (IT, 1997), the overburden thickness ranges from less than 5 feet in the south central portion of the site to 16 feet in the northeast portion of the site as shown in Figure 3-7 of the 1997 report.

3.2.1.4 Surface Water and Sediment Sampling

Ten surface water samples and ten collocated sediment samples will be collected at locations in Lindsley Ditch to the north and east of TNT Area A, including any source seeps if present (Table 3-7). Specific sampling locations will be selected based on the site walk over during the kick-off meeting.

3.2.2 TNT Area C

3.2.2.1 Surface Soil Placement

Twenty-eight buildings are associated with five TNT production lines, and a wastewater settling tank area, located in the northern part of the site, that is connected to the production lines via underground red water sewers. Three of these buildings and the settling tanks were sampled during the 1994 D&M investigation. Explosives were detected in some of the samples of concentrations exceeding Region 9 PRGs (Table 3-8 and Figure 3-2). These features are shown on Figure 1-4. Surface soil screening samples incorporating historical sampling locations where appropriate will be collected in and around each building area (including the settling tank area). It is anticipated that at least 255 surface soil samples will be collected during the initial Phase I surface soil sampling. If open drains are encountered, one or more of the surface soil samples may be collected from the drains if there is reasonable justification to suspect the presence of contaminants (i.e., receiving run-off from a known source area). Sample identification for surface soil sampling is presented in Table 3-9. Based on the initial field screening results, twenty surface soil fixed-base confirmation samples will also be collected.

3.2.2.2 Subsurface Soil Placement

Based on the surface soil field screening results at TNTC, 20 contaminated areas that exceed Region 9 PRGs will be further evaluated by collecting subsurface samples using direct-push technology. This approach will better utilize the limited number of samples available. If it is determined that there are less than 20 hot spots, the remainder of those subsurface screening samples will be collected at selected locations determined to have the greatest likelihood of contamination. Based on findings from the TNTB investigation, the mono, bi-tri, and fortifier houses have the greatest probability for having subsurface soil contamination.

Subsurface soil samples will be collected from 2 intervals between 2 to 10 feet bgs. In each of these boreholes, soil samples from the 4 to 6 and 8 to 10 feet intervals will be collected unless there is visual evidence of contamination. However, sampling will terminate at bedrock if it is encountered above 10 feet bgs. A complete lithologic description will be performed for each borehole. Based on the results of the initial screening subsurface sampling, a maximum of 20 subsurface soil confirmation samples will also be collected. Sample identification for subsurface soil screening samples is presented in Table 3-9.

3.2.2.3 Shallow Groundwater Sampling

Based on the analytical results from the confirmation soil samples, ten shallow (overburden) groundwater samples will also be collected. If bedrock is encountered at less than 5 feet bgs and the borehole is dry, the borehole will be abandoned. The groundwater sample locations will be placed at the confirmation sample locations which display the highest detections for PBOW related contaminants. The groundwater sampling points will not be developed or purged. Groundwater samples collected will be analyzed at a fixed based laboratory for VOCs, SVOCs, nitroaromatic compounds, and TAL metals (Table 3-2). Selected groundwater samples will be filtered in the field using a 0.45 micron filter to determine the relationship between total and dissolved metals. It is anticipated that three groundwater samples will require filtration; however, the exact number of groundwater samples to be filtered is contingent upon OEPA approval.

Before it is analyzed for nitroaromatic compounds and TAL metals. Sample identification for groundwater sampling is presented in Table 3-10. Based on the results of the groundwater investigation (IT, 1997), the overburden thickness ranges from less than 5 feet in the southeast portion of TNTC to over 15 feet in the northwest portion of the site.

3.2.2.4 Surface Water and Sediment Sampling

IT will collect a total of 15 surface water samples (if there is sufficient water) and collocated sediment samples from streams and ponds in association with the TNT Area C investigations (Table 3-11). This may include source seeps in TNT Area C, if any are present and off-site locations along Plum Brook if there is sufficient flow. As previously stated, specific locations will be selected based on the site walk over during the kick-off meeting.

3.3 Sampling Methodology and Procedures

The following sampling methods and operational procedures have been developed to ensure that the data acquired through field sampling will meet the data quality objectives stated in Section 3.3. All soil samples collected by IT field personnel will be documented through the use of Sample Collection Logs and Analysis Request/Chain of Custody Record forms (Figure 6-2 of the SAP [IT, 1996a]) following field custody procedures specified in Section 5.1 of the QAPP (IT, 1996b). Any changes from the work plans will be recorded in chronological order in the variance log shown in Figure 9-1 of the SAP (IT, 1996a).

The confirmation samples will be of definitive data quality to be used in risk assessments of TNTA and TNTC. Confirmation sample locations will be selected based on the screening results and will consist of both surface and subsurface samples. Confirmation samples will be collected to confirm either a positive detection or a nondetect from screening samples. Therefore, up to five confirmation samples shall be selected from screening locations exhibiting non-detect in screening analyses. Confirmation samples will be collected following the same procedures as for screening samples. The selection of boring locations for confirmation samples will be determined in consultation with the USACE-Nashville District on-site representative.

3.3.1 Surface Soil Sampling

3.3.1.1 Screening Sampling

At each screening surface sample location for screening analysis, four to six soil samples will be collected with a stainless-steel trowel between 0 and 1 foot from a 1-foot square placed over the sample location. Each of these four to six samples of soil will be homogenized in a 1-gallon plastic bag (baggie). The composited soil will be placed into a 4-ounce glass sample jar. The sample will be placed on ice in a sample cooler until the sample is delivered to field laboratory personnel for nitroaromatic analysis.

3.3.1.2 Confirmation Sampling

Surface soil samples collected for confirmation analysis at the fixed base laboratory will be sampled by two methods, one for the soil to be analyzed for VOCs and a second for the soil to be analyzed for the remainder of the analyses (nitroaromatics, SVOCs, metals, and PCBs). The samples will be collected no deeper than 1 foot deep. The soils collected for VOC analyses will be sampled using three EnCore™ samplers and collected from undisturbed soil. Surface debris will be removed prior to sampling. Each EnCore™ sampler will be filled using the T-handle and plunger then capped (as per the manufacturer's instructions included with each sampler). The sampler is then individually labeled with the sample number and sealed in an outer foil ziplock bag that is provided by the manufacturer. The completed sample label will be affixed to the outside of the bag for shipment to the laboratory. All bagged samples will be placed in a cooler on ice and chilled to 4 degrees Celsius upon collection, then prepared for same-day laboratory shipment. All VOC samples collected using the EnCore™ sampler must be received by the laboratory and extracted within 48 hours. With this restriction, no soil VOC samples can be collected on Saturday or Sunday. At the request of the laboratory, an additional quantity of soil will be collected using a stainless steel, acetate sleeve lined drive sampler. The drive sampler will be hammered to depth, then the sleeve will be removed, capped, and placed in a sample cooler. The purpose of this additional sample is to insure that the laboratory has sufficient volume of soil for the analysis in the event that the sample has to be re-run. No VOC samples will be placed in a plastic bag and mixed. The soil to be analyzed for the remaining analyses will be sampled with a stainless-steel hand auger, trowel, or similar device, between 0 and 1 foot from the four corners and at the center of a 1-foot square placed over the sample location. Each of these four to six aliquots of soil will be homogenized in a stainless-steel bowl, then transferred to the appropriate sample jars. Each confirmation sample will have an associated screening sample.

3.3.2. Subsurface Soil Sampling

3.3.2.1 Screening Sampling

At each field screen subsurface sample location, an approximately 1.5-inch diameter, stainless steel, acetate-lined sampling core will be hydraulically hammered to the required depth. The drive point will then be retracted and the soil sampler will be driven forward, filling the liner with soil. If the sample is to be submitted for screening analysis, all of the sample will be placed into a 1-gallon plastic bag (baggie) and homogenized. Soil from the plastic bag will be transferred to a 4-ounce glass amber jar for nitroaromatic analysis.

3.3.2.2 Confirmation Sampling

If the soil sample is for confirmation analysis, a portion of the liner will be cut to expose the soil and three EnCore™ samplers will be used (as described in the surface soil section) to collect the volatile organic analyte portion of the sample. This portion of the sample will be placed on ice in a cooler as soon as it is collected. At the request of the laboratory, an additional quantity of soil will be collected by cutting off a portion of the liner adjacent to the sampled interval, and covering the ends with vinyl end caps with a square piece of 2-inch wide Teflon™ tape in between them. The purpose of this additional sample is to insure that the laboratory has a sufficient volume of soil for the analysis in the event that the sample has to be re-analyzed. The remainder of the soil in the liner will be placed into a stainless-steel bowl, homogenized, and transferred to appropriate sample jars, then placed on ice. To obtain a sufficient volume to fill all the appropriate sample jars, it may be necessary to collect additional soil. If another boring is necessary, it will be immediately adjacent to the original location to the same depth as the first sample.

All subsurface soil samples will be visually inspected and logged on the hazardous, toxic, and radiologic waste drilling log (Figure 4-11 of the SAP) by an IT field geologist using the Unified Soil Classification System. Upon completion of the boring, the hole will be backfilled with either soil cuttings from the hole or granulated bentonite.

3.3.3 Shallow Groundwater Sampling

Shallow groundwater samples will be collected (provided there is sufficient water) using either hydropunch sampling or by placing temporary piezometers in the borings created during subsurface soil sampling. Hydropunch sampling is the preferred method for collection of the groundwater sample; however, under low yield conditions, a temporary piezometer may be required. Temporary piezometers will be installed inside 3-inch drive rod. The piezometers will be constructed of two-inch diameter PVC with a 15 foot screen (0.010 slot). A surface seal will be competed using bentonite to prevent surface water from entering the borehole. The temporary piezometer will be allowed to sit a minimum of 24 hours before being sampled to allow for settling of particles disturbed during the installation process, as well as allowing time for the water column to reach its static level. Before a groundwater sample is collected, the static water level will be measured and recorded for potential use in refining groundwater flow interpretations. The groundwater level will be measured below top of either the hydropunch casing or piezometer, and then the hydropunch casing/piezometer height will be measured above ground surface. Each

location will be staked and the location surveyed for horizontal and vertical data. Each groundwater sample will be collected using a peristaltic pump and PTFE tubing, an inertial pump, or stainless steel bailer. In anticipation of these sample points being low yield the groundwater for field parameter measurements (temperature, pH, dissolved oxygen, redox, turbidity, and conductivity) will be collected after the laboratory samples. This field testing will use an appropriate device and method according to EPA 600/4-79-020: Method for Chemical Analysis of Water and Wastes. The groundwater sampling equipment that contacts the water will be dedicated, or cleaned between each use, to prevent cross-contamination.

3.3.4 Surface Water and Sediment Sampling

3.3.4.1 Surface Water Sampling

The equipment required for surface water sampling includes a stainless-steel pitcher, a 100-foot measuring tape, proper sampling containers, and any required health and safety devices.

The following procedure will be followed for the collection of surface water samples:

- Refer to the health and safety plan before proceeding with sampling.
- Surface water shall be collected first, prior to any sediment sampling. If possible, sampling will occur when flowing water is present.
- Surface water sampling shall occur from downstream to upstream with VOCs being collected first followed by SVOCs, explosives, and other required samples.
- Two persons will perform the sampling. One person will carefully adopt an optimal sampling position and remain in that position until all sampling at that locality is completed in order to minimize the agitation of the sediment and water. The other person will be positioned within arms length of the sampler on dry ground, to aid in field measurements, filling of sample bottles, and to fill out sample collection log.
- At each sampling location, a decontaminated stainless-steel pitcher will be triple rinsed with water from the creek. Alternatively, the samples bottles may be directly immersed in the surface water body, unless split samples are required. At end of sampling, field parameters including oxygen-reduction potential, pH, specific conductance, temperature, and dissolved oxygen will be measured and recorded in sample collection log.

- Surface water sample locations will be flagged and shown in the collection log for use during land survey.

- For seeps, the construction of temporary collection boxes may be required.

3.3.4.2 Sediment Sampling

The equipment required for sediment sampling includes an Ekman dredge, hand auger or similar device, stainless-steel bowls, wood stakes, hammer, a 100-foot tape, proper sample container, and required health and safety device.

The following procedure will be followed for the collection of surface water samples:

- Refer to the health and safety plan before proceeding with sampling.

- The collection of sediment samples shall be conducted using a decontaminated Ekman dredge, hand auger or similar device. In flowing water, the sample shall be taken at the location upstream of the sampler.

- Sediment sampling should occur in areas of low flow with sediment consisting of fine sand or smaller grain size.

- Fill the sample containers with sediment from the bowl, packing the VOC samples as soon as possible. Samples collected for VOC analysis will be placed in the container with no headspace. Sample containers will be labeled and placed on ice in a cooler. When all required samples are collected, the sampling location will be staked and flagged for use in land survey.

3.4 Boring Abandonment

Upon completion of soil sampling, soil borings will be abandoned by backfilling with soils removed during sampling or granulated bentonite. Any remaining space will be grouted to the surface. The type of grout to be used will be bentonite-cement slurry grout with approximately 5 percent bentonite powder and 95 percent Type 1 portland cement, mixed with 5 to 6 gallons of clean water. The IT field geologist will check the abandoned boring after 24 hours for any grout settlement or depression and add more grout if necessary. Due to the shallow boring depth, use of a tremie pipe is optional. In the event groundwater is encountered, the boring will be backfilled above the groundwater-bearing zone with bentonite prior to grouting to the surface.

3.5 Land Surveying

Prior to commencing screening soil sampling activities, IT will secure the services of an Ohio-registered professional land surveyor to locate former process buildings based on historical site data; the locations of these buildings will be staked. This approach will provide reference points for the screening samples to define the approximate locations of these soil samples.

Following completion of confirmation soil sampling, groundwater sampling, and surface water/sediment sampling activities, the professional land surveyor will determine the coordinates and elevations of confirmation soil borings and surface water/sediment samples. The horizontal coordinates will be to the closest 0.1 foot and referenced to the State Plane Coordinate System. Vertical coordinates (ground elevation and well riser, if applicable) will be to the nearest 0.01 foot and referenced to the 1929 National Geodetic Vertical Datum. If the 1929 Datum is not readily available, the existing local vertical datum will be used. All survey data will be tabulated. Loop closure for survey accuracy shall be within the horizontal and vertical limits given above. Once sample survey information is available, it will be entered on the boring logs (Figure 4-11 of the SAP).

Critical reference points, landmarks, and sample locations will be plotted on appropriate map figures with a scale large enough to show their locations relative to other structures at the site.

Locations of screening samples will be determined based on tape measuring distances from former process line foundations, and other known site features, to each sample point.

4.0 Sample Analysis and Decontamination Procedures

4.1 Sample Number System

The confirmation sample numbering system to be used during this investigation for fixed-base samples will conform to the USACE-Nashville District's numbering convention. Specifically, each sample will be assigned a unique sample identification number that describes where the sample was collected. Each number consists of a group of letters and numbers, separated by hyphens. The numbering system to be used for the RI is described as follows:

Project Code	Year	Sample Type[a]	Site Identification	Boring Number	Sample Number	Sample Depth (ft)
PBOW	2000	XX	TNTA or TNTC	XXXXX	XXXXXX	XX-XX

[a]Sample types:

ER – Equipment rinsate sample
FB – Field blank
FD – Field duplicate sample
FS – Field split sample
MD – Matrix spike duplicate sample
MS – Matrix spike sample
SS – Surface soil sample
SB – Subsurface soil sample
SD – Sediment sample
SW – Surface water sample
GW – Shallow groundwater sample.

PBOW-00-SO-TNTA-SO001-AB0001-04-06 signifies that this soil sample was collected from a depth of 4 to 6 feet at soil location SO001 in TNTA with a sample number of AB0001. The sample identification number will be recorded by the IT field geologist in the field activity daily log, boring log, and sample collection log as shown respectively in Figures 4-1, 4-11, and 4-16 of the SAP (IT, 1996a).

The soil screening sample numbering system will also conform to USACE-Nashville District's numbering convention.

4.2 Analytical Program

The analytical program has been designed to acquire sufficient and defensible data to determine the extent of contamination in the investigated areas that has been impacted by nitroaromatic

compounds. Table 4-1 summarizes the analytical parameters required and associated laboratory methods to be used during this investigation.

Surface and subsurface soil samples will be screened for nitroaromatic constituents. The analysis will be performed in an off-site laboratory using SW-846 Method 8330. Tables 3-5-and 3-9 present the screening sample identifications for tracking purpose.

Confirmation soil samples will be analyzed by an off-site contract laboratory for nitroaromatics, target compound list (TCL) VOCs, TCL SVOCs, Target Analyte List (TAL) metals, and PCBs. Laboratory QC procedures and data quality requirements are specified in and referenced to appropriate sections of the QAPP (IT, 1996b). Confirmation sample locations will be selected based on the screening results and will consist of both surface and subsurface samples.

In addition to soil samples, groundwater, surface water and sediment samples will be analyzed for nitroaromatics, TCL VOCs, TCL SVOCs, TAL metals, and PCBs by an off-site contract laboratory.

4.3 Decontamination Procedures

Decontamination requirements and procedures are specified in detail in Chapter 5.0 of the SAP (IT, 1996a) and will be followed during the current investigations at TNTA and C. IT field coordinator must contact Plum Brook Station for access to a potable water source for decontamination use. The following summarizes decontamination procedures for equipment before site entry, between borings, and before site departure:

Nonsampling equipment (augers, drill rod, etc that does not contact analytical samples):

- Steam-rinse with potable water, or wash and scrub using a brush with nonphosphate detergent, and then rinse with potable water.

Field screening sample:

- Deionized water/low phosphate detergent wash
- Deionized water rinse (American Society for Testing and Materials [ASTM] Type II)
- Isopropyl alcohol rinse

- Air dry
- Wrap in aluminum foil.

Confirmation samples:

- Wash and scrub using a brush with nonphosphate detergent.
- Rinse with potable water.
- Rinse with ASTM Type II water.
- Rinse with isopropanol.
- Final rinse with ASTM Type II water; the volume of water used will be at least five times greater than the volume of isopropanol used.
- Air dry.
- Wrap in aluminum foil.

5.0 Sample Preservation, Packing, and Shipping

Sample containers and caps will be new, certified as precleaned containers from I-CHEM, made of materials recommended by the EPA in Title 40, Code of Federal Regulations, Part 136 and SW-846 (3rd Edition). Sample containers and preservatives/preservation methods are summarized in Table 5-1. Sample containers will be supplied and shipped to the job site by the designated primary laboratory.

Each sample container will be bagged before placement in the cooler. Sample holding times will be calculated from the date the sample is collected, not the date that it is received by the laboratory.

Samples for chemical analysis will be placed in coolers as soon as possible after collection and will be packed so as to minimize the possibility of container breakage by using Vermiculite, styrofoam peanuts or bubble wrap to fill void spaces in the cooler. Samples will be cooled to a temperature of approximately 4 degrees Celsius and maintained at that temperature by means of double-bagged ice until the cooler is received at the laboratory. Coolers will be shipped to the laboratory by a next-day-delivery service. Notification of shipment, including air bill number, will be telephoned or faxed to the laboratory the day of sample collection. If this is not possible, the laboratory will be notified the following morning.

Completed analytical request/chain of custody records will be secured and included with each shipment of coolers to:

GPL Laboratories
Attention: Bill Lock
202 Perry Parkway
Gaithersburg, Maryland 20877
Telephone: (301) 926-6802.

U.S. Army Corps of Engineers
Chemistry and Materials Quality Assurance Laboratory
Attention: Douglas Taggert
420 South 18th Street
Omaha, Nebraska 68102-2586
Telephone: (402) 444-4300.

6.0 Investigation-Derived Waste Management Plan

Anticipated IDW during field activities includes decontamination fluid and disposable personal protective equipment. Detailed procedures of IDW management is provided in Chapter 8.0 of the SAP (IT, 1996a). The following is a brief summary of the procedures for handling IDW.

6.1 Soil, Groundwater, Surface Water, and Sediment

Residual surface soil, subsurface soil and sediment will be used as backfill at the point of origin. Therefore, no IDW will be generated during these sampling activities. For surface water sampling, samples will be collected directly into sample containers and no excess water will be generated that will require disposal. It is anticipated that approximately one liter of groundwater will be generated at each hydropunch/temporary piezometer sampling location. IDW drums will be labeled to indicate project name, date collected, and contents and stored on pallets in the staging area located east of the Building 9201 on Pentolite Road.

6.2 Decontamination Fluid

Limited quantities of decontamination fluid, including wash water, nonphosphate soapy water, and final rinse water will be kept in plastic tubs during the decontamination process, and will be placed in 55-gallon drums upon completion of field sampling. Decontamination fluid containing small quantities of solvents such as isopropanol will be collected in metal pans for evaporation. IDW drums will be labeled to indicate project name, date collected, and contents and stored on pallets in the staging area located east of the Building 9201 on Pentolite Road.

6.3 Sampling Equipment and PPE

Limited quantities of PPE and sampling equipment, including tyvek suits, latex/nitrile gloves, plastic, and disposable tubing used for groundwater sampling, will be generated during sampling. All sampling equipment and PPE will be double bagged and disposed of in onsite dumpsters. If any of the sampling equipment and PPE appears to be grossly contaminated, it will be decontaminated prior to disposal.

7.0 References

U.S. Army Corps of Engineers (USACE), Nashville District, 2000, ***Scope of Work, Remedial Investigation, Feasibility Study, and Decision Document TNT Area A, Former Plum Brook Ordnance Works (PBOW)***, January 4.

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IT Corporation (IT), 1999, *Summary Report*, ***Site-Wide Groundwater Monitoring (1997-1998), Former Plum Brook Ordnance Works, Sandusky, Ohio***, February.

Dames and Moore (D&M), 1997, ***TNT Areas Site Investigation, Final Report, Plum Brook Ordnance Works, Sandusky, Ohio***, prepared for U.S. Army Corps of Engineers, Nashville District/Huntington District, April.

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IT Corporation (IT), 1998, ***Second Quarterly Groundwater Level Measurements and First Semi-Annual Groundwater Sampling Event, Former Plum Brook Ordnance Works, Sandusky, Ohio***, May.

IT Corporation (IT), 1997, ***Site-Wide Groundwater Investigation, Former Plum Brook Ordnance Works, Sandusky, Ohio***, September.

IT Corporation (IT), 1996a, ***Site-Wide Sampling and Analysis Plan, Plum Brook Ordnance Works, Sandusky, Ohio.***

IT Corporation (IT), 1996b, ***Quality Assurance Project Plan, Plum Brook Ordnance Works, Sandusky, Ohio.***

IT Corporation (IT), 1996c, ***Site-Wide Safety and Health Plan, Plum Brook Ordnance Works, Sandusky, Ohio.***

Morrison-Knudsen Ferguson Corporation (MK), 1994, ***Site Inspection Report, Plum Brook Station, Sandusky, Ohio***, Volume 1, January.

U.S. Army Corps of Engineers (USACE), Nashville District, 1998, ***Scope of Work, Remedial Investigation and Feasibility Study, TNT Area B, Former Plum Brook Ordnance Works (PBOW)***, April 10 (Revised May 5).

U.S. Environmental Protection Agency (EPA), 1993, ***Data Quality Objectives Process for Superfund***, EPA/J40/G-93/071, Publication 9377.9.01, September.

TABLES

Table 2-1

Summary of Data Quality Objectives
Remedial Investigation at TNT Area A and C
Former Plum Brook Ordnance Works
Sandusky, Ohio

Potential Data Users	Available Data	Conceptual Model	Media of Concern	Data Uses and Objectives	Data Types	Analytical Level	Data Quantity
EPA OEPA DOD USACE NASA IT Corporation Other Contractors Possible Future Land Users	Previous environmental investigation of limited scale detected soil contamination	Contaminant Source Burning TNT product on site Migration Pathways Soil, sediment, surface water, and groundwater Potential receptors Wildlife, human Potential Contaminants of Concern VOCs, SVOCs, metals, PCBs, and nitroaromatic explosives	Soils	Determine the existence and nature of soil contamination Determine environmental risks and the necessity of further actions	Soils Metals Explosives VOCs SVOCs PCBs	Field screen Definitive confirmatory samples	360 40 + QA

OEPA - Ohio Environmental Protection Agency.
DOD - U.S. Department of Defense.
EPA - U.S. Environmental Protection Agency.
NASA - National Aeronautics and Space Administration.

VOC - Volatile organic compound.
SVOC - Semivolatile organic compound.
PCB - Polychlorinated biphenyl.

Table 3-1

Summary of Environmental Samples and QA/QC Samples to be Collected
Remedial Investigation at TNT Area A
Former Plum Brook Ordnance Works, Sandusky, Ohio

Sample Type	Required Analysis	Sample Quantity	QA/QC Samples[a]	
			Contract Laboratory (QC)	USACE Laboratory (QA)
Soil Screening	Nitroaromatics	360 (surface soil) 40 (subsurface soil)	--	--
Soil Confirmation[a] (20 surface/20subsurface)	Nitroaromatics	40	4	4
	TCL VOCs	40	4	4
	TCL SVOCs	40	4	4
	TAL Metals	40	4	4
	PCBs	40	4	4
Groundwater	Nitroaromatics	10	1	1
	TCL VOCs	10	1	1
	TCL SVOCs	10	1	1
	TAL Metals	10	1	1
	PCBs	10	1	1
Surface Water	Nitroaromatics	10	1	1
	TCL VOCs	10	1	1
	TCL SVOCs	10	1	1
	TAL Metals	10	1	1
	PCBs	10	1	1
Sediment	Nitroaromatics	10	1	1
	TCL VOCs	10	1	1
	TCL SVOCs	10	1	1
	TAL Metals	10	1	1
	PCBs	10	1	1

[a] Ten percent of the total number of the confirmation soil samples and surface water/sediment samples will be collected for QA and QC analysis.

PCB - Polychlorinated biphenyl.
QA/QC - Quality assurance/quality control.
TAL - Target analyte list.
TCL - Target compound list.
USACE - U.S. Army Corps of Engineers.

Table 3-2

Summary of Environmental Samples and QA/QC Samples to be Collected
Remedial Investigation at TNT Area C
Former Plum Brook Ordnance Works, Sandusky, Ohio

Sample Type	Required Analysis	Sample Quantity	QA/QC Samples[a]	
			Contract Laboratory (QC)	USACE Laboratory (QA)
Soil Screening	Nitroaromatics	360 (surface soil) 40 (subsurface soil)	--	--
Soil Confirmation[a] (20 surface/20subsurface)	Nitroaromatics	40	4	4
	TCL VOCs	40	4	4
	TCL SVOCs	40	4	4
	TAL Metals	40	4	4
	PCBs	40	4	4
Groundwater	Nitroaromatics	10	1	1
	TCL VOCs	10	1	1
	TCL SVOCs	10	1	1
	TAL Metals	10	1	1
	PCBs	10	1	1
Surface Water	Nitroaromatics	15	2	2
	TCL VOCs	15	2	2
	TCL SVOCs	15	2	2
	TAL Metals	15	2	2
	PCBs	15	2	2
Sediment	Nitroaromatics	15	2	2
	TCL VOCs	15	2	2
	TCL SVOCs	15	2	2
	TAL Metals	15	2	2
	PCBs	15	2	2

[a] Ten percent of the total number of the confirmation soil samples and surface water/sediment samples will be collected for QA and QC analysis.

PCB - Polychlorinated biphenyl.
QA/QC - Quality assurance/quality control.
TAL - Target analyte list.
TCL - Target compound list.
USACE - U.S. Army Corps of Engineers.

Table 3-3

Summary of Explosives Preliminary Remediation Goals
Remedial Investigation at TNT Areas A and C
Former Plum Brook Ordnance Works, Sandusky, Ohio

Compound	Preliminary Remediation Goals[a]	
	Residential (mg/kg)	Industrial (mg/kg)
1,3-Dintrobenzene	6.1E+00	8.8E+02
Nitrobenzene	2.0E+01	1.1E+02
2,4-Dinitrotoluene	1.2E+02	1.8E+03
2,6-Dinitrotoluene	6.1E+01	8.8E+02
1,3,5-Trinitrobenzene	1.8E+03	2.6E+04
2,4,6-Trinitrotoluene	1.6E+01	8.2E+01
2-Amino-4,6-Dinitrotoluene	NA	NA
4-Amino-2,6-Dinitrotoluene	NA	NA

[a] From EPA Region 9, Preliminary Remediation Goals for Planning Purposes, 2000.
mg/kg - Milligrams per kilogram.
NA - Not applicable.

Table 3-4

Major TNT Production Buildings at TNT Area A
Former Plum Brook Ordnance Works, Sandusky, Ohio

Former Building Name	Building Number	Building Sampled*	Previous Data*
Mono House	111,121,131,141	141	TNT, 2,4-DNT, 2,6-DNT
Fortifier House	113,123,133,143	143	TNT, 2,4-DNT, 2,6-DNT
Bi-Tri House	112,122,132,142	142	TNT, 2,4-DNT, 2,6-DNT, 2-A-DNT, 4-A-DNT
Wash House	116,126,136,146	136,146	TNT, 2-A-DNT
Nail House	128,148	--	Not sampled
Recovery House	119,129,139,149	--	Not sampled
DNT Nitrator House	185,195	--	Not sampled
Settling Tanks	187	187	TNT, 1,3,5 TNB, 2,4-DNT, 2,6-DNT, 3,4 DNT, 2-A-DNT, 4-A-DNT, 1,3 DNB
Settling Tanks Ditch	187	187	TNT, 2,4-DNT, 4-A-DNT
DNT Sweating/Graining House	182,192	192	2,4-DNT, 2,6-DNT, 4-A-2-NT, 3,4-DNT
Lindsley Ditch	NA	NA	TNT, 2,4-DNT, 4-A-2-DNT

* Data from D&M TNT Areas Site Investigation Report (D&M, 1997).

TNT = 2,4,6 Trinitrotoluene
1,3,5-TNB = 1,3,5 Trinitrobenzene
2,4-DNT = 2,4 Dinitrotoluene
2,6-DNT = 2,6 Dinitrotoluene
4-A-2-NT = 4-Amino-2-Nitrotoluene
3,4-DNT = 3,4 Dinitrotoluene
4-A-DNT = 4-Amino-2,6 Dinitrotoluene
2-A-DNT = 2-Amino-4,6 Dinitrotoluene
1,3-DNB = 1,3-Dinitrobenzene

Table 3-5

Soil Screening Samples to be Collected
Remedial Investigation at TNT Area A
Former Plum Brook Ordnance Works, Sandusky, Ohio

Sample Type	Sample Identification	Number of Samples	Sampling Depth (feet)
Screening Surface Soil	PBOW-00-SS-TNTA-SO001-AA0001-(00-01)	360	0 - 1.0'
	PBOW-00-SS-TNTA-SO002-AA0002-(00-01)		0 - 1.0'
	:		:
	:		:
	PBOW-00-SS-TNTA-SO100-AA0100-(00-01)		:
	PBOW-00-SS-TNTA-SO101-AA0101-(00-01)		:
	:		:
	:		:
	PBOW-00-SS-TNTA-SO200-AA0200-(00-01)		:
	PBOW-00-SS-TNTA-SO201-AA0201-(00-01)		:
	:		:
	:		:
	PBOW-00-SS-TNTA-SO359-AA0359-(00-01)		0 - 1.0'
	PBOW-00-SS-TNTA-SO360-AA0360-(00-01)		0 - 1.0'
Screening[a] Subsurface Soil	PBOW-00-SB-TNTA-SOxxx-AAxxxx-(depth)	40	2' - 10'

[a] Screening subsurface soil samples will be collected from selected surface screening locations exhibiting highest detections of nitroaromatic compound(s).

Table 3-6

Groundwater and QA/QC Samples to be Collected
Remedial Investigation at TNT Area A
Former Plum Brook Ordnance Works, Sandusky, Ohio

	Sample Identification	QA/QC Samples		
		Field Duplicate	Field Split	MS/MSD
Groundwater	PBOW-00-GW-TNTA-GW01-AA3001-0000			
	PBOW-00-GW-TNTA-GW02-AA3002-0000			
	PBOW-00-GW-TNTA-GW03-AA3003-0000			
	PBOW-00-GW-TNTA-GW04-AA3004-0000			
	PBOW-00-GW-TNTA-GW05-AA3005-0000			
	PBOW-00-GW-TNTA-GW06-AA3006-0000	x	x	x
	PBOW-00-GW-TNTA-GW07-AA3007-0000			
	PBOW-00-GW-TNTA-GW08-AA3008-0000			
	PBOW-00-GW-TNTA-GW09-AA3009-0000			
	PBOW-00-GW-TNTA-GW10-AA3010-0000			

MS/MSD - Matrix spike/matrix spike duplicate.
QA/QC - Quality assurance/quality control.

Table 3-7

Surface Water, Sediment, and QA/QC Samples to be Collected
Remedial Investigation at TNT Area A
Former Plum Brook Ordnance Works, Sandusky, Ohio

	Sample Identification[a]	QA/QC Samples		
		Field Duplicate	Field Split	MS/MSD
Surface Water	PBOW-00-SW-TNTA-SW01-AA2001-0000			
	PBOW-00-SW-TNTA-SW02-AA2002-0000			
	PBOW-00-SW-TNTA-SW03-AA2003-0000			
	PBOW-00-SW-TNTA-SW04-AA2004-0000			
	PBOW-00-SW-TNTA-SW05-AA2005-0000			
	PBOW-00-SW-TNTA-SW06-AA2006-0000	x	x	x
	PBOW-00-SW-TNTA-SW07-AA2007-0000			
	PBOW-00-SW-TNTA-SW08-AA2008-0000			
	PBOW-00-SW-TNTA-SW09-AA2009-0000			
	PBOW-00-SW-TNTA-SW10-AA2010-0000			
Sediment	PBOW-00-SD-TNTA-SD01-AA1001-0000			
	PBOW-00-SD-TNTA-SD02-AA1002-0000			
	PBOW-00-SD-TNTA-SD03-AA1003-0000			
	PBOW-00-SD-TNTA-SD04-AA1004-0000	x	x	x
	PBOW-00-SD-TNTA-SD05-AA1005-0000			
	PBOW-00-SD-TNTA-SD06-AA1006-0000			
	PBOW-00-SD-TNTA-SD07-AA1007-0000			
	PBOW-00-SD-TNTA-SD08-AA1008-0000			
	PBOW-00-SD-TNTA-SD09-AA1009-0000			
	PBOW-00-SD-TNTA-SD10-AA1010-0000			

[a] Surface water and sediment samples are co-located (i.e., SW01 and SD01 are from the same location).

MS/MSD - Matrix spike/matrix spike duplicate.
QA/QC - Quality assurance/quality control.

Table 3-8

Major TNT Production Buildings at TNT Area C
Former Plum Brook Ordnance Works, Sandusky, Ohio

Former Building Name	Building Number	Building Sampled*	Previous Data*
Mono House	681,691,601,611,621	--	Not sampled
Fortifier House	683,693,603,613,623	613	TNT, 2,4-DNT, 2-A-DNT, 4-A-DNT
Bi-Tri House	682,692,602,612,622	612	
Wash House	686,696,606,616,626	626	
Nail House	618,628,698	--	Not sampled
Recovery House	689,699,609,619,629	--	Not sampled
Settling Tanks	657	657	TNT
Settling Tanks Ditch	657	657	TNT, 2,4-DNT, 4-A-DNT

* Data from D&M TNT Areas Site Investigation Report (D&M, 1997).

TNT = 2,4,6 Trinitrotoluene
2,4-DNT = 2,4 Dinitrotoluene
4-A-DNT = 4-Amino-2,6 Dinitrotoluene
2-A-DNT = 2-Amino-4,6 Dinitrotoluene

Table 3-9

Soil Screening Samples to be Collected
Remedial Investigation at TNT Area C
Former Plum Brook Ordnance Works, Sandusky, Ohio

Sample Type	Sample Identification	Number of Samples	Sampling Depth (feet)
Screening Surface Soil	PBOW-00-SS-TNTC-SO001-AB0001-(00-01)	360	0 - 1.0'
	PBOW-00-SS-TNTC-SO002-AB0002-(00-01)		0 - 1.0'
	:		:
	:		:
	PBOW-00-SS-TNTC-SO100-AB0100-(00-01)		:
	PBOW-00-SS-TNTC-SO101-AB0101-(00-01)		:
	:		:
	:		:
	PBOW-00-SS-TNTC-SO200-AB0200-(00-01)		:
	PBOW-00-SS-TNTC-SO201-AB0201-(00-01)		:
	:		:
	:		:
	PBOW-00-SS-TNTC-SO359-AB0359-(00-01)		0 - 1.0'
	PBOW-00-SS-TNTC-SO360-AB0360-(00-01)		0 - 1.0'
Screening[a] Subsurface Soil	PBOW-00-SB-TNTC-SOxxx-ABxxxx-(depth)	40	2' - 10'

[a] Screening subsurface soil samples will be collected from selected surface screening locations exhibiting highest detections of nitroaromatic compound(s).

Table 3-10

Groundwater and QA/QC Samples to be Collected
Remedial Investigation at TNT Area C
Former Plum Brook Ordnance Works, Sandusky, Ohio

	Sample Identification	QA/QC Samples		
		Field Duplicate	Field Split	MS/MSD
Groundwater	PBOW-00-GW-TNTC-GW01-AB3001-0000			
	PBOW-00-GW-TNTC-GW02-AB3002-0000			
	PBOW-00-GW-TNTC-GW03-AB3003-0000			
	PBOW-00-GW-TNTC-GW04-AB3004-0000			
	PBOW-00-GW-TNTC-GW05-AB3005-0000			
	PBOW-00-GW-TNTC-GW06-AB3006-0000	x	x	x
	PBOW-00-GW-TNTC-GW07-AB3007-0000			
	PBOW-00-GW-TNTC-GW08-AB3008-0000			
	PBOW-00-GW-TNTC-GW09-AB3009-0000			
	PBOW-00-GW-TNTC-GW10-AB3010-0000			

MS/MSD - Matrix spike/matrix spike duplicate.
QA/QC - Quality assurance/quality control.

Table 3-11

Surface Water, Sediment, and QA/QC Samples to be Collected
Remedial Investigation at TNT Area C
Former Plum Brook Ordnance Works, Sandusky, Ohio

	Sample Identification[a]	QA/QC Samples		
		Field Duplicate	Field Split	MS/MSD
Surface Water	PBOW-00-SW-TNTC-SW01-AB2001-0000	x	x	x
	PBOW-00-SW-TNTC-SW02-AB2002-0000			
	PBOW-00-SW-TNTC-SW03-AB2003-0000			
	PBOW-00-SW-TNTC-SW04-AB2004-0000			
	PBOW-00-SW-TNTC-SW05-AB2005-0000			
	PBOW-00-SW-TNTC-SW06-AB2006-0000			
	PBOW-00-SW-TNTC-SW07-AB2007-0000			
	PBOW-00-SW-TNTC-SW08-AB2008-0000	x	x	x
	PBOW-00-SW-TNTC-SW09-AB2009-0000			
	PBOW-00-SW-TNTC-SW10-AB2010-0000			
	PBOW-00-SW-TNTC-SW11-AB2011-0000			
	PBOW-00-SW-TNTC-SW12-AB2012-0000			
	PBOW-00-SW-TNTC-SW13-AB2013-0000			
	PBOW-00-SW-TNTC-SW14-AB2014-0000			
	PBOW-00-SW-TNTC-SW15-AB2015-0000			
Sediment	PBOW-00-SD-TNTC-SD01-AB1001-0000	x	x	x
	PBOW-00-SD-TNTC-SD02-AB1002-0000			
	PBOW-00-SD-TNTC-SD03-AB1003-0000			
	PBOW-00-SD-TNTC-SD04-AB1004-0000			
	PBOW-00-SD-TNTC-SD05-AB1005-0000			
	PBOW-00-SD-TNTC-SD06-AB1006-0000			
	PBOW-00-SD-TNTC-SD07-AB1007-0000			
	PBOW-00-SD-TNTC-SD08-AB1008-0000	x	x	x
	PBOW-00-SD-TNTC-SD09-AB1009-0000			
	PBOW-00-SD-TNTC-SD10-AB1010-0000			
	PBOW-00-SD-TNTC-SD11-AB1011-0000			
	PBOW-00-SD-TNTC-SD12-AB1012-0000			
	PBOW-00-SD-TNTC-SD13-AB1013-0000			
	PBOW-00-SD-TNTC-SD14-AB1014-0000			
	PBOW-00-SD-TNTC-SD15-AB1015-0000			

[a] Surface water and sediment samples are co-located (i.e., SW01 and SD01 are from the same location).

MS/MSD - Matrix spike/matrix spike duplicate.
QA/QC - Quality assurance/quality control.

Table 4-1

Summary of Analytical Parameters and Methods
Remedial Investigation at TNT Area A and C
Former Plum Brook Ordnance Works, Sandusky, Ohio

Sample Media	Analytical Parameters[a]	Methods[b]
Screening Soils	Nitroaromatic Compounds	HPLC Screen[d]
Confirmation Soils	Nitroaromatic Compounds	EPA SW-846 8330
	TCL VOCs	EPA SW-846 5035/8260B
	TCL SVOCs	EPA SW-846 3540C/8270C
	TAL Metals[c]	EPA SW-846 3050B/6010B/7471A
	PCBs	EPA SW-846 3500B/8082
Groundwater	Nitroaromatic Compounds	EPA SW-846 8330
	TCL VOCs	EPA SW-846 5030B/8260B
	TCL SVOCs	EPA SW-846 3520C/8270C
	TAL Metals[c]	EPA SW-846 3005A/6010B/7470A
	PCBs	EPA SW-846 3500B/8082
Surface Water	Nitroaromatic Compounds	EPA SW-846 8330
	TCL VOCs	EPA SW-846 5030B/8260B
	TCL SVOCs	EPA SW-846 3520C/8270C
	TAL Metals	EPA SW-846 3005A/6010B/7470A
	PCBs	EPA SW-846 3500B/8082
Sediment	Nitroaromatic Compounds	EPA SW-846 8330
	TCL VOCs	EPA SW-846 5035/8260B
	TCL SVOCs	EPA SW-846 3540C/8270C
	TAL Metals	EPA SW-846 3050B/6010B/7471A
	PCBs	EPA SW-846 3500B/8082

[a] Target analyte list (TAL) and target compound list (TCL) are used to only designate analyte lists, with no requirements for Contract Laboratory Program (CLP) method quality control (QC) or data reporting packages.

[b] The analytical methods are found in the following references:

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, U.S. Environmental Protection Agency (EPA) Publication SW-846, Third edition, Update III, December 1996.

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, EPA Publication SW-846, Third edition, Update II, September 1994.

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, EPA Publication SW-846, Third edition, Update I, July 1992.

[c] TAL metals include Ag, Al, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, K, Mg, Mn, Na, Ni, Pb, Sb, Ti, V, As, Hg, Se, and Zn.

[d] The screening method is based on 8330 without second column confirmation.

HPLC - High Performance Liquid Chromatography

PCB - Polychlorinated biphenyl.

SVOC - Semivolatile organic compound.

VOC - Volatile organic compound.

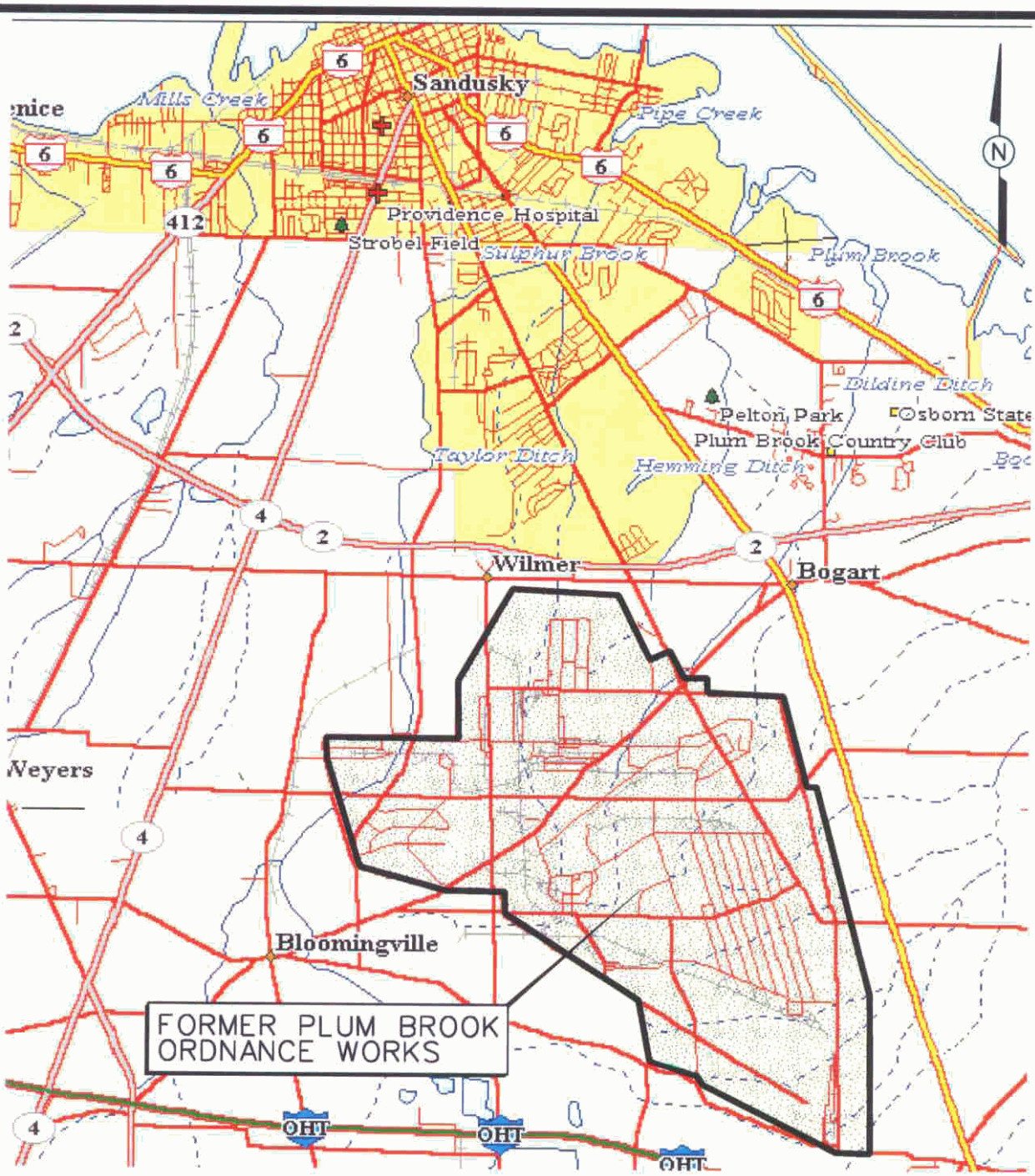
Table 5-1

Analytical Methods, Containers, Preservatives, and Holding Times
Remedial Investigations at TNT Area A and TNT Area C
Former Plum Brook Ordnance Works, Sandusky, Ohio

Matrix	Parameter	SW-846 Analytical Method	Sample Container	Preservation Requirements	Holding Time
Water	TAL Metals (T/D)	6010B/7470A	(2) 1 L HDPE	Cool to 4°C, HNO3 to pH <2	6 months (28 days for Hg)
	Nitroaromatics	8330	(2) 1 L amber glass	Cool to 4°C	Extraction 7 days/analysis 40 days
	TCL Semivolatiles	8270C	(2) 1 L amber glass	Cool to 4°C	Extraction 7 days/analysis 40 days
	TCL Volatiles	8260B	(3) 40 mL VOA vials	Cool to 4°C, HCL to pH <2	14 days
	PCBs	8082	(2) 1 L amber glass	Cool to 4°C	Extraction 7 days/analysis 40 days
Soils	TAL Metals	6010B/7471A	4 oz CWM glass with Teflon-lined lid	Cool to 4°C	6 months (28 days for Hg)
	Nitroaromatics	8330	4 oz CWM glass with Teflon-lined lid	Cool to 4°C	Extraction 14 days/analysis 40 days
	TCL Semivolatiles	8270C	4 oz CWM glass with Teflon-lined lid	Cool to 4°C	Extraction 14 days/analysis 40 days
	TCL Volatiles	8260B	(3) 5 g EnCore samplers	Cool to 4°C	Preservation 48 hrs/analysis 14 days
	PCBs	8082	4 oz CWM glass with Teflon-lined lid	Cool to 4°C	Extraction 14 days/analysis 40 days
Sediments	TAL Metals	6010B/7471A	4 oz CWM glass with Teflon-lined lid	Cool to 4°C	6 months (28 days for Hg)
	Nitroaromatics	8330	4 oz CWM glass with Teflon-lined lid	Cool to 4°C	Extraction 14 days/analysis 40 days
	TCL Semivolatiles	8270C	4 oz CWM glass with Teflon-lined lid	Cool to 4°C	Extraction 14 days/analysis 40 days
	TCL Volatiles	8260B	(2) 4 oz CWM glass with Teflon-lined lid	Cool to 4°C	Analysis 14 days
	PCBs	8082	4 oz CWM glass with Teflon-lined lid	Cool to 4°C	Extraction 14 days/analysis 40 days

Note: Extraction holding times are from time of sampling.
CWM - clear, wide-mouth jar.
HDPE - High density polyethylene.
PCB - Polychlorinated biphenyl.
TAL - Target analyte list.
TCL - Target compound list.

FIGURES



NOT TO SCALE

FIGURE 1-1
VICINITY MAP

FORMER PLUM BROOK ORDNANCE WORKS
SANDUSKY, OHIO

IT CORPORATION
A Member of The IT Group

STARTING DATE: 12/16/97	DATE LAST REV.:07/07/00	DRAFT. CHCK. BY:	INITIATOR: D. KESSLER	DWG. NO.: \773701 ES. 001
DRAWN BY: D. BILLINGSLEY	DRAWN BY: bvanderg	ENGR. CHCK. BY: D. KESSLER	PROJ. MGR.:M.SPANGBERG	PROJ. NO.:773701

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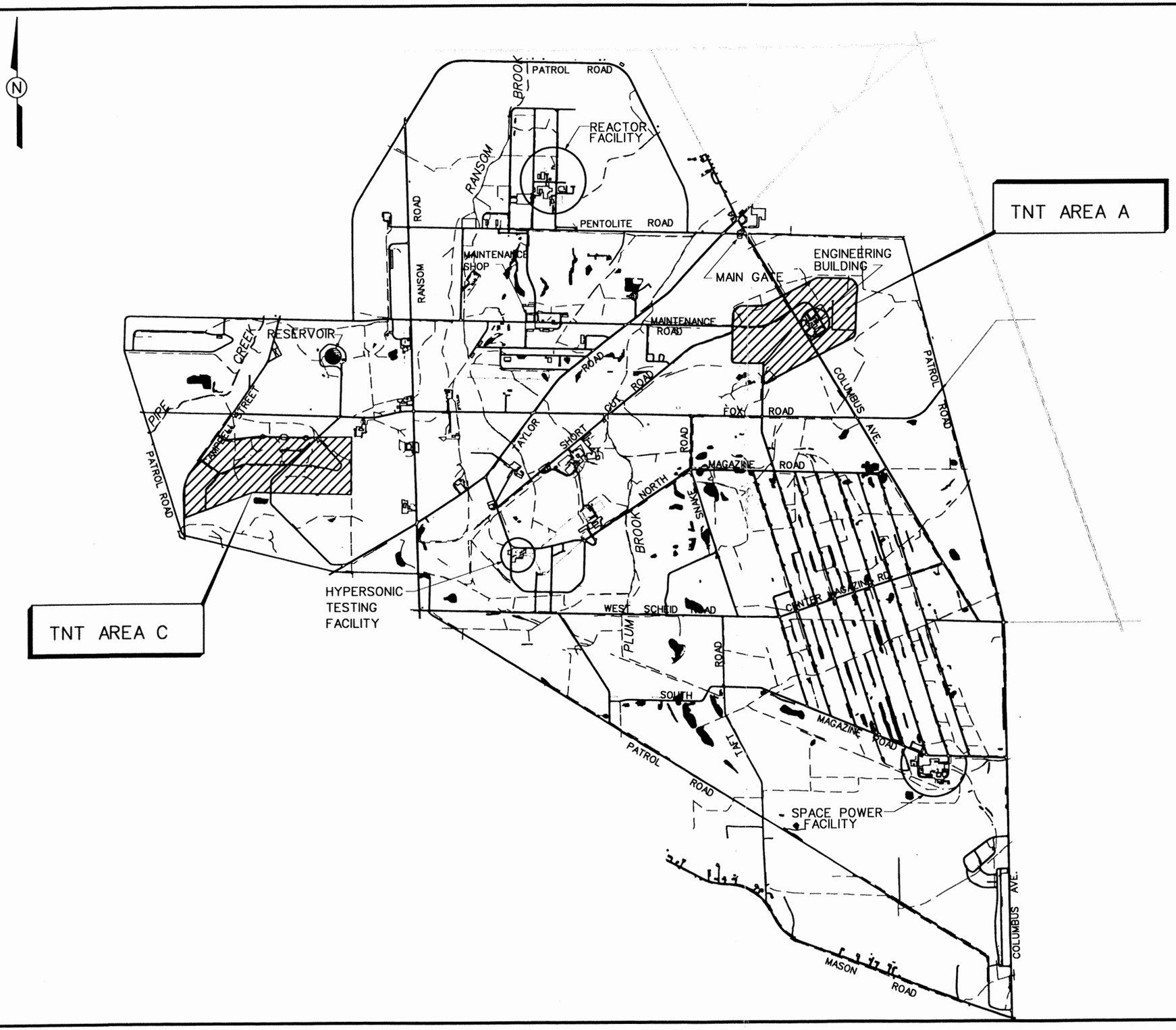

LEGEND:

- BUILDINGS
- STREAMS OR DITCHES
- ROAD
- SURFACE WATER
- AREA OF CONCERN

SCALE

0 2400 4800 FEET

FIGURE 1-2
TNT AREAS A AND C
LOCATION MAP

FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

IT CORPORATION
A Member of The IT Group

STARTING DATE: 04/25/00	DATE LAST REV.:	DRAFT. CHCK. BY:	INITIATOR: D. KESSLER	DWG. NO.: ...\807111es.001
DRAWN BY: P. COLEMAN	DRAWN BY:	ENGR. CHCK. BY: D. KESSLER	PROJ. MGR.: M.SPANGBERG	PROJ. NO.: 807111

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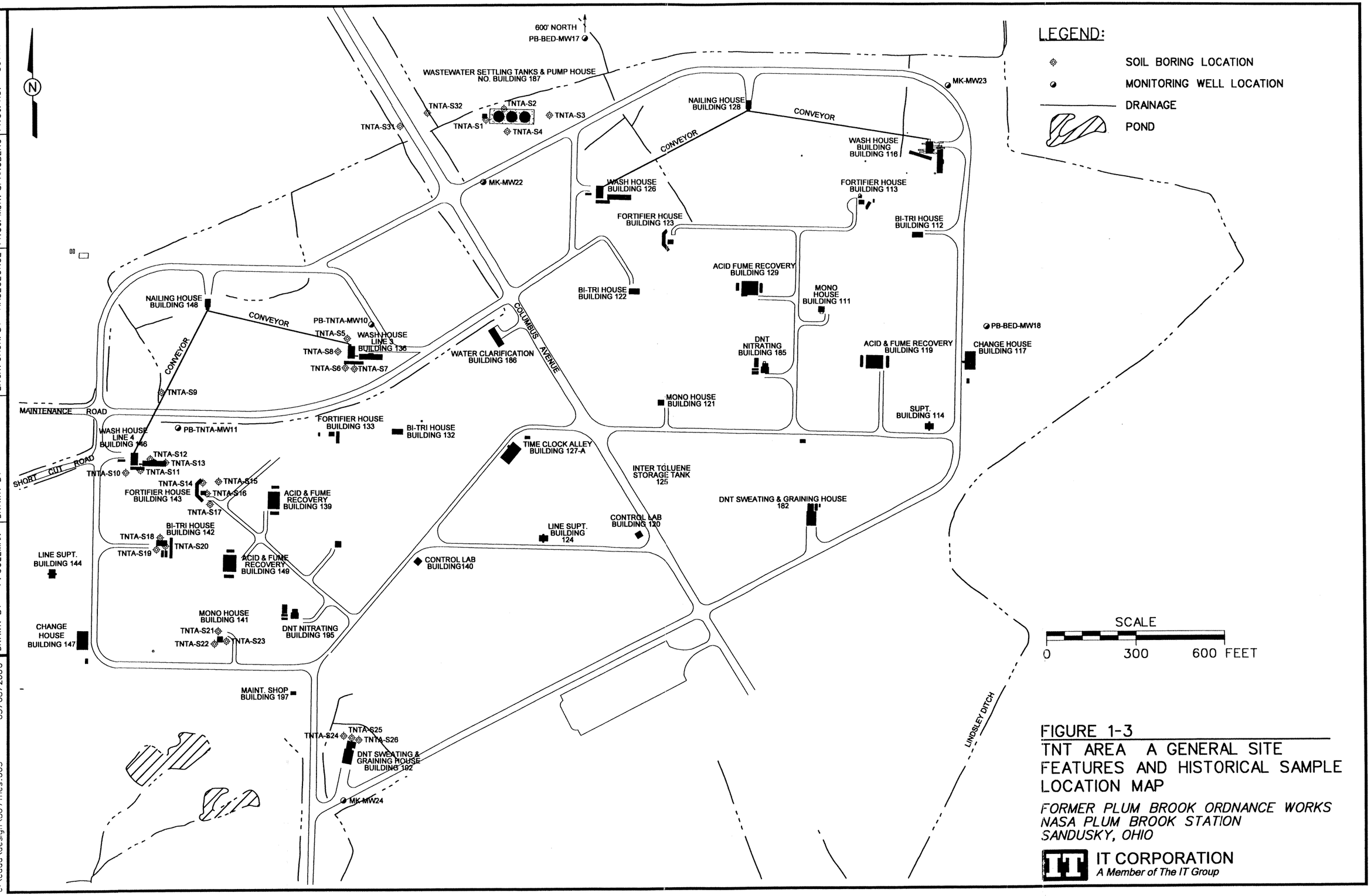

FIGURE 1-3
TNT AREA A GENERAL SITE FEATURES AND HISTORICAL SAMPLE LOCATION MAP

FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

IT CORPORATION
A Member of The IT Group

DRAFT. CHCK. BY: C. TUMLIN	INITIATOR: HAGEGEORGE	DWG. NO.:...\807111es.003	
ENGR. CHCK. BY: HAGEGEORGE	PROJ. MGR.: SPANGBERG	PROJ. NO.: 807111	
STARTING DATE: 4/25/00	DATE LAST REV.:		
DRAWN BY: P. COLEMAN	DRAWN BY:		

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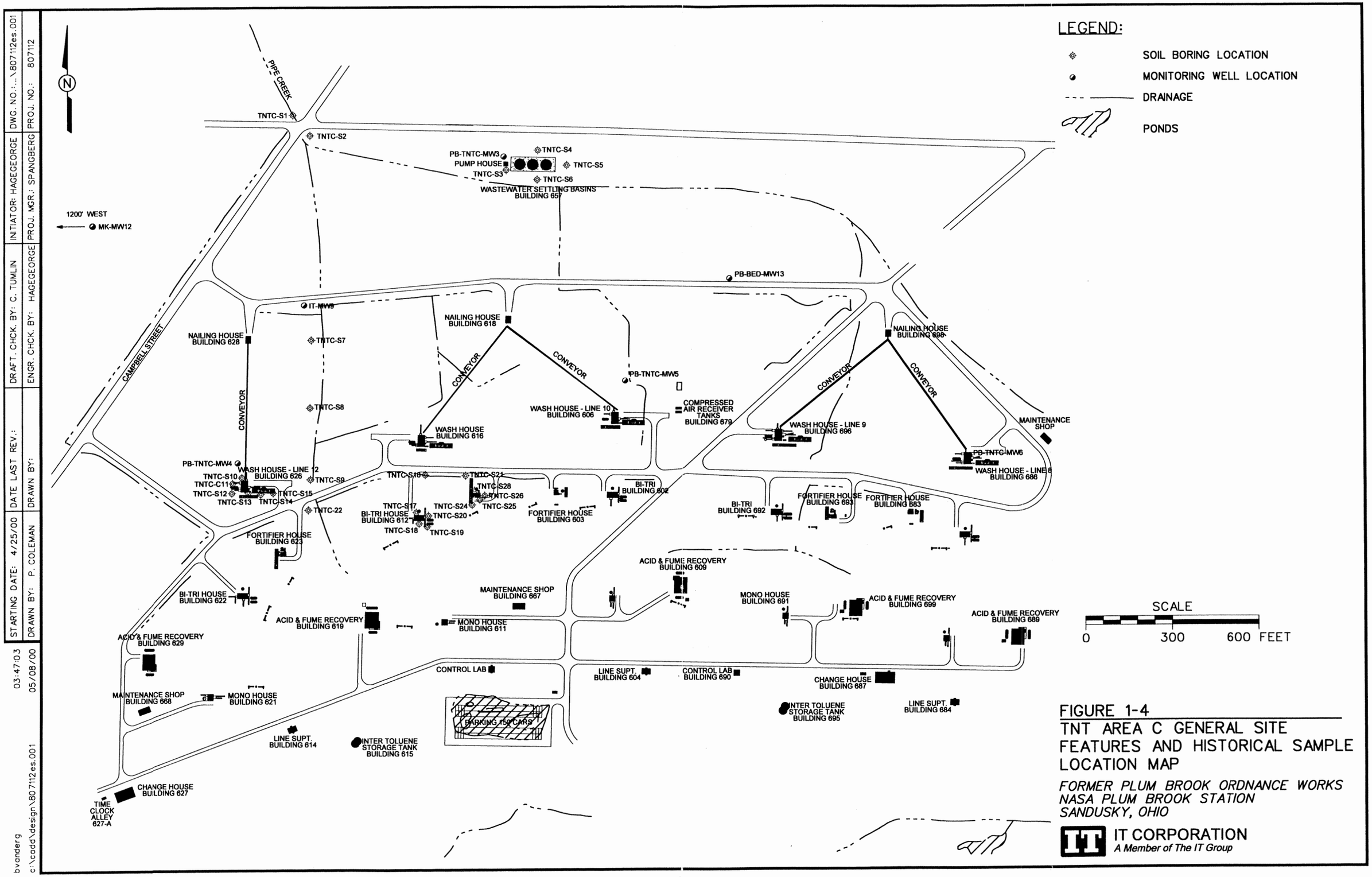


FIGURE 1-4
TNT AREA C GENERAL SITE FEATURES AND HISTORICAL SAMPLE LOCATION MAP

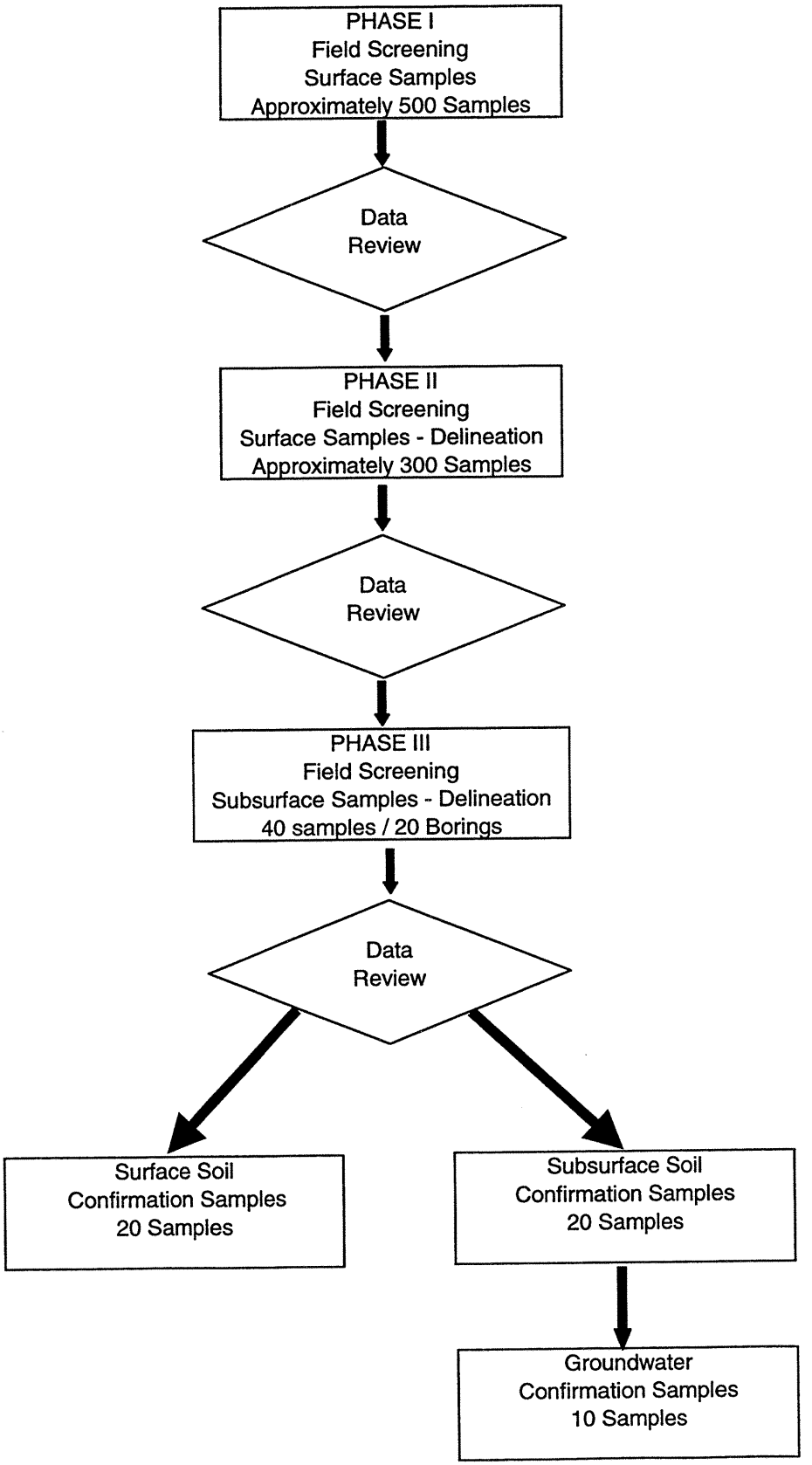
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

IT CORPORATION
A Member of The IT Group

DWG. NO.: ...\807112es.001
PROJ. NO.: 807112
INITIATOR: HAGEGEORGE
PROJ. MGR.: SPANGBERG
DRAFT. CHCK. BY: C. TUMLIN
ENGR. CHCK. BY: HAGEGEORGE
DATE LAST REV.:
DRAWN BY:
STARTING DATE: 4/25/00
DRAWN BY: P. COLEMAN
03:47:03
05/08/00
bvanderg
c:\cadd\design\807112es.001

Figure 2-1

Investigation Flow Chart
TNTA and TNTC Areas
Surface and Subsurface Soil and Groundwater Samples



NO	DATE	REVISION	BY	CHKD	DSGN ENGR	ENGR	PROJ MGR	APPR

STARTING DATE	INITIATOR	CHKD	DRAWN	CHKD	PROJECT MNGR
05/01/00	M. GUNDERSON		RKV		M. SPANGBERG

IT CORPORATION
A Member of The IT Group
KNOXVILLE, TENNESSEE

FIGURE 3-1. TNT AREA A PROPOSED SCREENING SOIL SAMPLE LOCATIONS MAP

PLUMBROOK ORDNANCE WORKS
SANDUSKY, OHIO

AREA	JOB NO.	DRAWING NO.	REV
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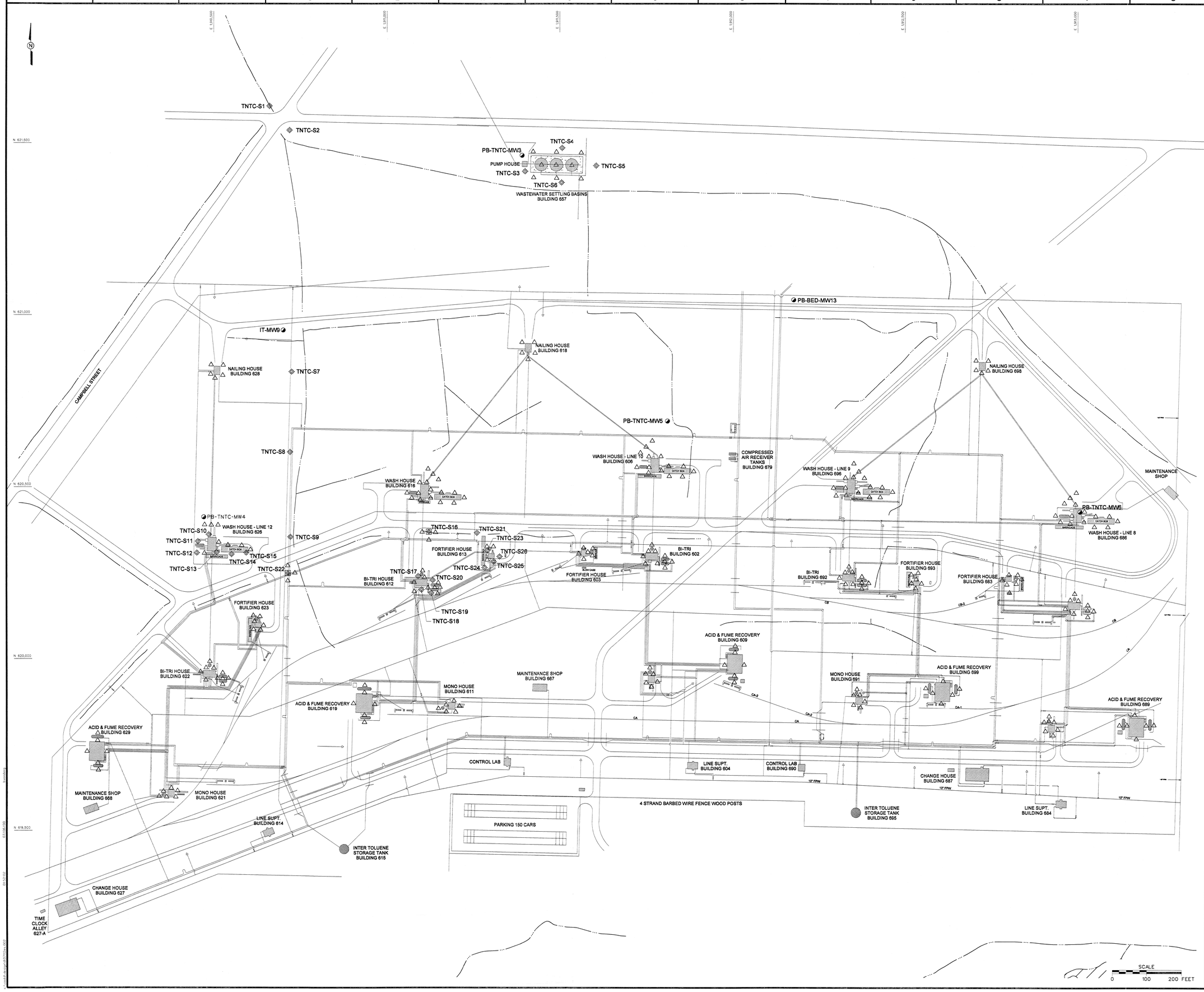

NO	DATE	REVISION	BY	CHK'D	DSGN ENGR	ENGR	PROJ MGR	APPR

STARTING DATE 05/01/00 | INITIATOR M. GUNDERSON / CHK'D | DRAWN RKV / CHK'D | PROJECT MNGR M SPANGBERG

IT CORPORATION
A Member of The IT Group
KNOXVILLE, TENNESSEE

FIGURE 3-2. TNT AREA C
PROPOSED SCREENING SOIL
SAMPLE LOCATIONS MAP

PLUMBROOK ORDNANCE WORKS
SANDUSKY, OHIO

AREA	JOB NO.	DRAWING NO.	REV
	807112	807112ES.002	

Attachment X

Site-Specific Health and Safety Plan
Remedial Investigations and Feasibility Studies
TNT Area A and TNT Area C

Former Plum Brook Ordnance Works
Sandusky, Ohio

Prepared by:

IT Corporation
312 Directors Drive
Knoxville, Tennessee 37923

Submitted to:

Commander
U.S. Army Engineer District, Nashville
Post Office Box 1070
Nashville, Tennessee 37202-1070

IT Project Nos. 807111 and 807112

July 2000
Revision 0

This Site-Specific Safety and Health Plan Attachment must be used in conjunction with the Sitewide Safety and Health Plan for Site Investigations and Groundwater Investigations at the former Plum Brook Ordnance Works, dated July 1997.

Reviews and Approvals

for ML Springberg — 7/7/00

Project Manager
IT Corporation — Date

7/7/00

Health and Safety Manager
IT Corporation — Date

for DL Kessler — 7/7/00

Site Coordinator
IT Corporation — Date

for DL Kessler — 7/7/00

Site Safety and Health Officer
IT Corporation — Date

Distribution List

Control Copy Nos. 1 through 17	Mrs. Linda Ingram
Control Copy No. 18	M. Spangberg
Control Copy No. 19	M. McMyler
Control Copy No. 20	M. Henderson
Control Copy No. 21	M. Gunderson
Control Copy No. 22	Project File
Control Copy Nos. 23, 24, and 25	Field personnel

Plum Brook Project Emergency Contacts

Note: All field crews will be provided 2-way radios from the Plum Brook Communications Center. In the event of an emergency, contact the Plum Brook Communications Center by radio and they will contact and coordinate emergency response personnel.

Fire Department	(419) 627-5837
Ambulance	911
Police Department	(419) 627-5863
Providence Hospital	(419) 621-7000
National Response Center	(800) 424-8802
Poison Control Center	(800) 462-0800
Ohio EPA Emergency Spill Number	(800) 282-9378
Linda Ingram, USACE Technical Coordinator	(615) 736-7122
Mike Spangberg, IT Project Manager	(860) 688-1151
Mike Gunderson, IT Site Manager	2-way radio
Mike Henderson, IT H&S Manager	(865) 690-3211
Dr. Elaine Theriault, IT Occupational Physician	(800) 299-3674

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5.0 Activity Hazard Analysis 7

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List of Acronyms

DNT	dinitrotoluene
NIOSH	National Institute of Occupational Safety and Health
PBOW	Plum Brook Ordnance Works
PPE	personal protective equipment
SHP	safety and health plan
SSHP	site safety and health plan

1.0 Site Work Plan Summary

Project Objective. The objectives of this investigation at the former Plum Brook Ordnance Works (PBOW), Sandusky, Ohio, are summarized as follows:

- Determine if there are hazardous substances present at the site in a manner that constitutes unacceptable risk to human health and the environment.
- Define site physical features and characteristics (aquifer background conditions).
- Evaluate fate and transport pathways (groundwater modeling).
- Determine current and future routes of exposure.

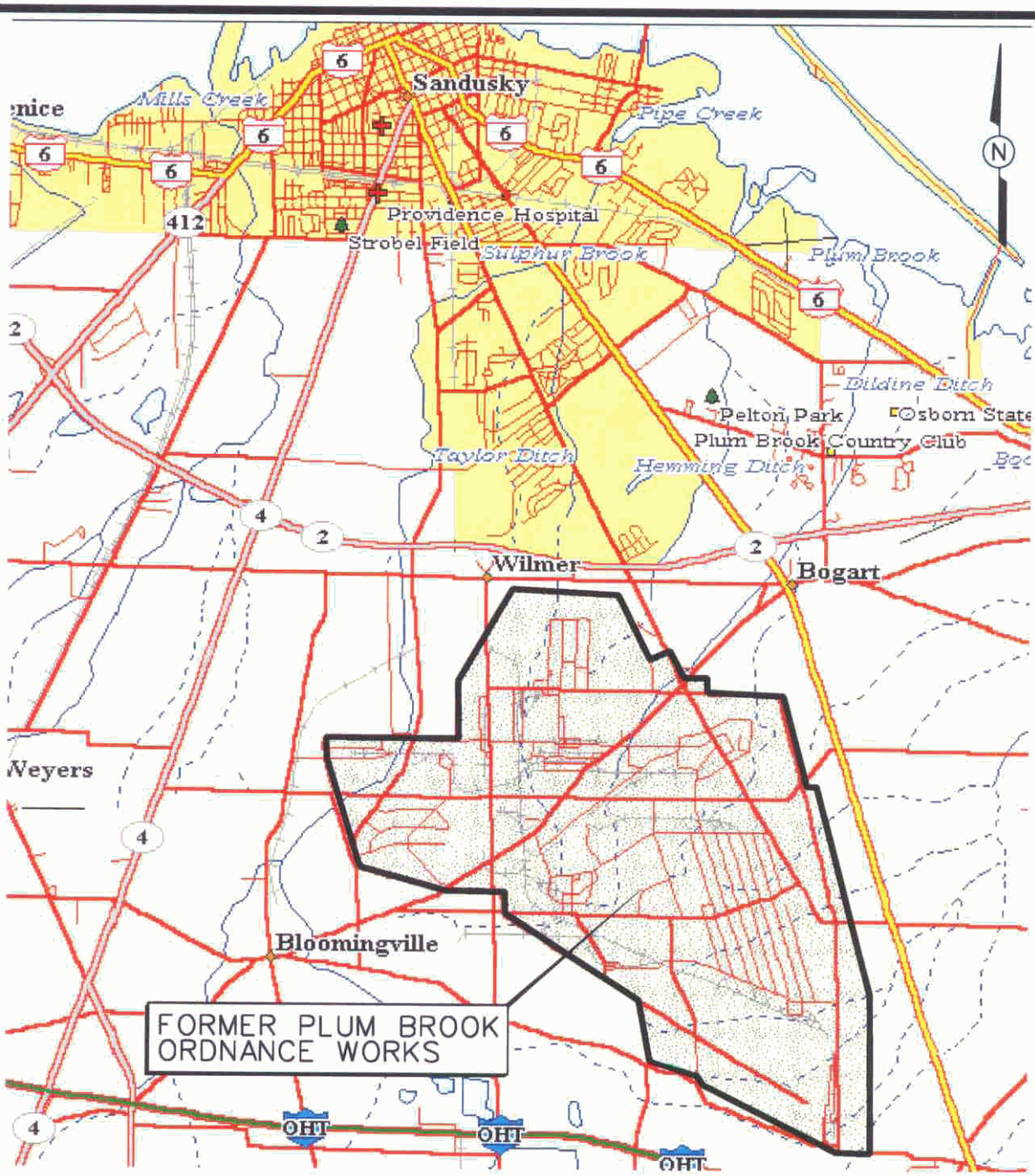
Project Tasks

- Surveying
- Soil boring and sampling
- Decontamination of equipment (high-pressure water jetting operations)
- Sediment/seep and surface water sampling.

Personnel Requirements. Up to 15 employees.

Note: All personnel on this site shall have received training, informational programs, and medical surveillance as outlined in the sitewide safety and health plan (SHP) for site investigations at PBOW, and be familiar with the requirements of this site-specific SHP (SSHP). Figure 1-1 presents PBOW and the hospital location map. Figure 1-2 shows the route from TNT Areas A and C to U.S. Highway 250. The TNT Area A and C work zones will change daily due to the large area to be sampled. Based on the sampling, sufficient work zone boundaries will be established at least 10 feet from surface sampling locations and 30 feet from all boring locations. A site reconnaissance is anticipated to be conducted by the USACE and IT personnel. In addition, visitors from the Restoration Advisory Board may also be present. Because RAB members are unlikely to have the necessary OSHA training, no intrusive work shall be conducted while they are onsite and areas of potential contamination will be avoided.

Project Schedule. Summer 2000.



NOT TO SCALE

FIGURE 1-1
VICINITY MAP

FORMER PLUM BROOK ORDNANCE WORKS
SANDUSKY, OHIO

IT CORPORATION
A Member of The IT Group

STARTING DATE: 12/16/97	DATE LAST REV.:07/07/00	DRAFT. CHCK. BY:	INITIATOR: D. KESSLER	DWG. NO.: \773701 ES. 001
DRAWN BY: D. BILLINGSLEY	DRAWN BY: bvanderg	ENGR. CHCK. BY: D. KESSLER	PROJ. MGR.:M.SPANGBERG	PROJ. NO.:773701

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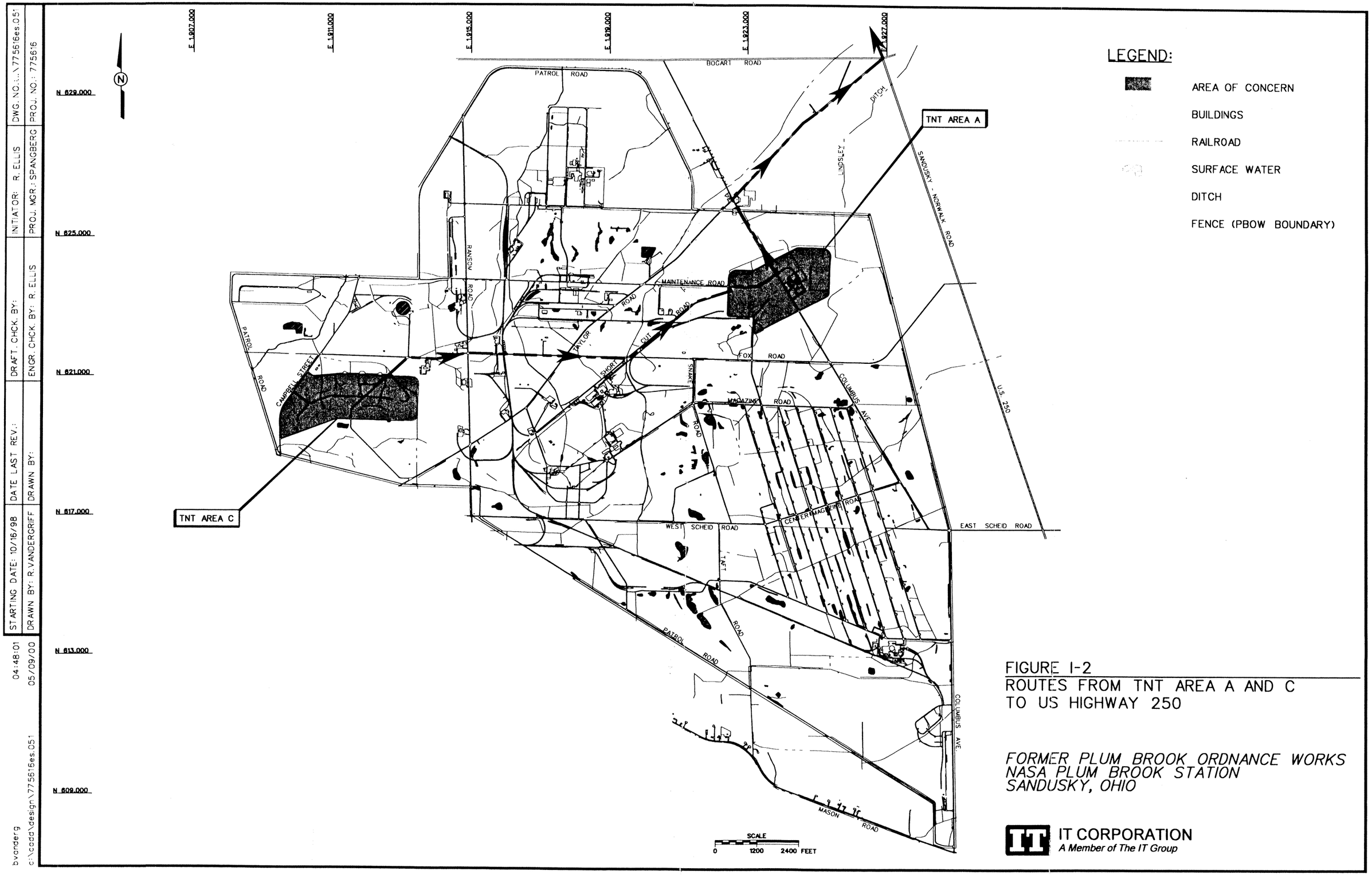

FIGURE I-2
ROUTES FROM TNT AREA A AND C
TO US HIGHWAY 250

FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

IT CORPORATION
A Member of The IT Group

STARTING DATE: 10/16/98	DATE LAST REV.:	DRAFT. CHCK. BY:	INITIATOR: R. ELLIS
DRAWN BY: R.VANDERGRIFF	DRAWN BY:	ENGR. CHCK. BY: R. ELLIS	PROJ. MGR.: SPANGBERG
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2.0 Site Characterization and Analysis

2.1 Anticipated Hazards

The activity hazard analysis in Chapter 5.0 contains project-specific practices utilized to reduce or eliminate anticipated site hazards. The activity hazard analysis indicates specific chemical and physical hazards that may be present and encountered during each task from on-site operations. Below each task is a list of hazards and specific actions that will be taken to control the respective hazards. These control measures may include work practice controls, engineering controls, and/or use of appropriate personal protective equipment (PPE).

The potential contaminants of concern include nitroaromatic compounds. Tables 2-1 and 2-2 indicate maximum concentrations of nitroaromatic contaminants detected in soils and groundwater, respectively, during previous investigations at TNT Areas A and C.

Table 2-3 contains chemicals anticipated and chemicals to be used during project activities.

2.2 General Site Information

A description of the site including location, site topography, and site accessibility is presented in Section 1.3 of the site-wide sampling and analysis plan prepared by IT Corporation in September 1996.

Table 2-1

Maximum Concentrations of Nitroaromatic Compounds in Soil Samples Collected Previously Plumb Brook Ordnance Works Sandusky, Ohio

Chemical	Maximum Soil Concentration, TNT Area A (mg/kg)	Maximum Soil Concentration, TNT Area C (mg/kg)
2,4,6-Trinitrotoluene	580	2.7
1,3,5-Trinitrobenzene	2.5	Not Detected
1,3-Dinitrobenzene	0.4	Not Detected
Nitrobenzene	Not Detected	0.3
2,4-Dinitrotoluene	45	8.7
2,6-Dinitrotoluene	47	1.9
3,4-Dinitrotoluene	8.9	1.2
2-Amino-4-Nitrotoluene	Not Detected	0.4
4-Amino-2-Nitrotoluene	0.4	Not Detected
2-Amino-4,6-Dinitrotoluene	7.0	4.7
4-Amino-2,6-Dinitrotoluene	5.6	1.0

Table 2-2

Maximum Concentrations of Nitroaromatic Compounds in Groundwater Samples Collected Previously Plumb Brook Ordnance Works Sandusky, Ohio

Chemical	Maximum Overburden Groundwater Concentration, TNT Area A (µg/L)	Maximum Groundwater Concentration, TNT Area C (µg/L)
2,4,6-Trinitrotoluene	10	Not Detected
1,3,5-Trinitrobenzene	0.43	Not Detected
1,3-Dinitrobenzene	Not Detected	Not Detected
Nitrobenzene	0.26	Not Detected
2,4-Dinitrotoluene	11	Not Detected
2,6-Dinitrotoluene	1.2	Not Detected
3-Nitrotoluene	13	Not Detected
2-Amino-4,6-Dinitrotoluene	31	Not Detected
4-Amino-2,6-Dinitrotoluene	8.7	Not Detected

Table 2-3

Toxicological and Physical Properties of Chemicals
Plum Brook Ordnance Works, Sandusky, Ohio

Substance [CAS]	IP[a] (eV)	Odor Threshold (ppm)	Route[b]	Symptoms of Exposure	Treatment	TWA[c]	STEL[d]	Source[e]	IDLH (NIOSH)[f]
1,3-Dinitrobenzene [99-65-0]	10.43		Inh Abs Ing Con	Anoxia, cyanosis, visual disturbances, central blind spot of vision, bad taste, burning of mouth, dry throat, thirsty; yellowing hair, eyes, and skin; anemia, liver damage.	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	1 mg/m^3 (skin) 0.15 ppm (skin) 1 mg/m^3 (skin)		PEL TLV REL	50 mg/m^3
Benzene [71-43-2]	9.24	34-119	Inh Abs Ing Con	Irritates eyes, nose, respiratory system; giddiness; headache, nausea, staggered gait; fatigue, anorexia, lassitude; dermatitis; bone-marrow depression. Carcinogenic.	Eye: Irrigate immediately Skin: Soap wash promptly Breath: Respiratory support Swallow: Immediate medical attention	1 ppm (10 ppm) NIC-0.1 skin 0.1 ppm	5 ppm C1 ppm (Ca)	PEL TLV REL	Ca [1,000 ppm]* *OSHA
Chromium (as Cr) [7440-47-3]	NA	NA	Inh Ing Con	Irritation of eyes, skin, and upper respiratory system; fibrosis of lungs.	Eye: Irrigate immediately Skin: Wash flush Breath: Respiratory support Swallow: Immediate medical attention	1 mg/m^3 0.5 mg/m^3	- -	PEL TLV	250mg/m^3 (as Cr)
Dinitrotoluene (DNT)	N/A	-	Inh Abs Ing Con	Anoxia, cyanosis, anemia, jaundice; reproductive effects. Animal carcinogen.	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	1.5 mg/^{3} (skin) NIC-0.2 mg/m^3 (skin) 1.5 mg/m^3 (skin)	- - -	PEL TLV REL	Ca [50 mg/m^3)
Ethyl benzene [100-41-4]	8.76	0.09-0.6	Inh Ing Con	Irritates eyes, mucous membranes; headache; dermatitis; narcosis, coma.	Eye: Irrigate immediately Skin: Water flush promptly Breath: Respiratory support Swallow: Immediate medical attention	100 ppm 100 ppm 100 ppm	125 ppm 125 ppm 125 ppm	PEL TLV REL	800 ppm

Table 2-3

Toxicological and Physical Properties of Chemicals
Plum Brook Ordnance Works, Sandusky, Ohio

Substance [CAS]	IP[a] (eV)	Odor Threshold (ppm)	Route[b]	Symptoms of Exposure	Treatment	TWA[c]	STEL[d]	Source[e]	IDLH (NIOSH)[f]
Gasoline [8006-61-9]	?	0.3	Inh Ing Con	Intoxication, headaches, blurred vision, dizziness, nausea; eye, nose, and throat irritation; potential kidney and other cancers. Carcinogenic.	Eye: Irrigate immediately (15 min) Skin: Soap wash promptly Breath: Respiratory support Swallow: Immediate medical attention	300 ppm 300 ppm Ca, lowest feasible conc. (LOQ 15 ppm)	500 ppm 500 ppm	PEL TLV REL	?
Methanol	10.85	4.2-5960	Inh Abs Ing Con	Irritated eyes, headache, drowsiness, lightheadedness, nausea, vomiting, disturbance in vision, blindness.	Eye: Irrigate immediately Skin: Water flush promptly Breath: Fresh air Swallow: Immediate medical attention		200 ppm (skin) 200 ppm (skin) 200 ppm	PEL TLV REL	6,000 ppm
Nitric acid [7697-37-2]	11.95	0.3-1	Inh Ing Con	Irritated eyes, mucous membranes, and skin; delayed pulmonary edema, pneumonitis, bronchitis; dental erosion.	Eye: Irrigate immediately Skin: Wash flush promptly Breath: Respiratory support Swallow: Immediate medical attention	2 ppm 2 ppm 2 ppm	4 ppm 4 ppm 4 ppm	PEL TLV REL	25 ppm
Nitrobenzene [98-95-3]	9.92	0.37	Inh Abs Ing Con	Irritation of eyes, skin, anoxia; dermatitis; anemia; methemoglobinemia; testicular effects.	Eye: Irrigate immediately Skin: Wash flush Breath: Respiratory support Swallow: Immediate medical attention	1 ppm (skin) 1 ppm (skin) 1 ppm (skin)		PEL TLV REL	200 ppm
Portland cement			Inh	Fine gray powder that can be irritating if inhaled or in eyes.	Eye: Irrigate immediately Skin: Soap wash flush Breath: Respiratory support Swallow: Immediate medical attention		10 mg/m^3 10 mg/m^3/total dust 5 mg/m^3 respirable fraction	TLV PEL/REL	
Toluene [108-88-3]	8.82	0.16-37	Inh Abs Ing Con	Fatigue, weakness; confusion, euphoria, dizziness, headache; dilated pupils, lacrimation; nervousness, muscular fatigue, insomnia; paralysis; dermatitis.	Eye: Irrigate immediately Skin: Soap wash promptly Breath: Respiratory support Swallow: Immediate medical attention	100 ppm 50 ppm (skin) 100 ppm	150 ppm 150 ppm	PEL TLV REL	500 ppm

Table 2-3

Toxicological and Physical Properties of Chemicals
Plum Brook Ordnance Works, Sandusky, Ohio

Substance [CAS]	IP[a] (eV)	Odor Threshold (ppm)	Route[b]	Symptoms of Exposure	Treatment	TWA[c]	STEL[d]	Source[e]	IDLH (NIOSH)[f]
1,3,5-Trinitrobenzene	?		Inh Ing Con Abs	Irritating to the skin, mucus membranes, and eyes; nausea, vomiting, diarrhea, and abdominal pain; liver damage.	Eye: Irrigate immediately Skin: Soap wash promptly Breath: Respiratory support Swallow: Immediate medical attention	0.1 mg/m^3 0.1 mg/m^3 0.1 mg/m^3	0.3 mg/m^3	PEL TLV REL	100 mg/m^3
Trinitrotoluene (TNT) [118-96-7]	10.59 ev		Inh Abs Ing Con	Irritation of skin, mucous membranes; liver damage, jaundice; cyanosis, sore throat; kidney damage; cardio irregularity.	Eye: Irrigate immediately Skin: Soap wash promptly Breath: Respiratory support Swallow: Immediate medical attention	1.5 mg/m^3 (skin) 0.1 mg/m^3 (skin) 0.5 mg/m^3 (skin)		PEL TLV REL	500 mg/m^3

[a]IP = Ionization potential (electron volts).
[b]Route = Inh, Inhalation; Abs, Skin absorption; Ing, Ingestion; Con, Skin and/or eye contact.
[c]TWA = Time-weighted average. The TWA concentration for a normal work day (usually 8 or 10 hours) and a 40-hour work week, to which nearly all workers may be repeatedly exposed, day after day without adverse effect.
[d]STEL = Short-term exposure limit. A 15-minute TWA exposure that should not be exceeded at any time during a work day, even if the TWA is not exceeded.
[e]PEL = Occupational Safety and Health Administration (OSHA) permissible exposure limit (29 CFR 1910.1000, Table Z).
TLV = American Conference of Governmental Industrial Hygiene (ACGIH) threshold limit value—TWA.
REL = National Institute for Occupational Safety and Health (NIOSH) recommended exposure limit.
[f]IDLH (NIOSH)—Immediately dangerous to life or health (NIOSH). Represents the maximum concentration from which, in the event of respirator failure, one could escape within 30 minutes without a respirator and without experiencing any escape-impairing or irreversible health effects.
NE = No evidence could be found for the existence of an IDLH (NIOSH Pocket Guide to Chemical Hazards, Pub. No. 90-117, 1990).
C = Ceiling limit value which should not be exceeded at any time.
Ca = Carcinogen.
NA = Not applicable.
NIC = Notice of intended change (ACGIH).

3.0 Personal Protective Equipment

The work activities will begin in the following levels of protection.

Task	Initial Level of PPE
Staging equipment	Level D
Surveying	Level D
Soil boring and sampling	Modified Level D*
Decontamination of equipment	Modified Level D*
Sediment/seep/surface water sampling	Level D**

* Initial level will be raised to Level C or higher if air monitoring results in the worker's breathing zone are above action levels. Note: If unusual conditions or odors are encountered and air monitoring instruments do not detect volatile organic chemicals or hydrogen sulfide, turn equipment off, evacuate the work area, and contact the Health and Safety Manager for further assistance.

** Nitrile gloves will be worn when conducting sampling operations.

A complete description of Level D, Modified Level D, and Level C follows.

Level D. The following equipment will be used for Level D protection:

- Coveralls or work clothing
- Steel-toed safety boots
- Safety glasses
- Hard hat
- Hearing protection (when working near/adjacent to operating equipment)
- U.S. Coast Guard-approved personal flotation device (where potential for drowning exists).

Modified Level D. The following equipment will be used for Modified Level D protection:

- Permeable Tyvek®, Kleenguard, or its equivalent
- Polyvinyl chloride boot covers
- Nitrile gloves (outer)
- Lightweight nitrile gloves (inner)
- Steel-toed safety boots
- Safety glasses
- Hard hat

- Hearing protection (when working near/adjacent to operating equipment).

Level C. Level C protection will not be used unless air monitoring data indicate the need for upgrade; however, the equipment shall be readily available on site. The following equipment will be used for Level C protection:

- National Institute of Occupational Safety and Health (NIOSH)-approved full face, air purifying respirators equipped with organic vapor/acid gas cartridge in combination with high-efficiency particulate air filter
- Hooded, saran-coated Tyvek®, taped at gloves, boots, and respirator
- Nitrile gloves (outer)
- Lightweight nitrile gloves (inner)
- Neoprene steel-toed boots or polyvinyl chloride overbooties/steel-toed safety boots
- Hard hat
- Hearing protection (when working near/adjacent to operating equipment).

Level B. Level protection will not be used unless air monitoring data indicate the need for upgrade will be used for Level B protection:

- Pressure-demand NIOSH-approved self-contained breathing apparatus
- Hooded, saran-coated Tyvek®, taped at gloves, boots, and respirator
- Nitrile gloves (outer)
- Latex or lightweight nitrile gloves (inner)
- Neoprene steel-toed boots or polyvinyl chloride overbooties/steel-toed safety boots
- Hard hat
- Hearing protection (when working near/adjacent to operating equipment).

Personnel Decontamination: All personnel working in the exclusion zone wearing modified Level D or higher must undergo personnel decontamination prior to entering the support zone. Level D will require no personnel decontamination. The personnel decontamination area shall consist of the following stations:

- ***Station 1.*** Personnel leaving the exclusion zone will remove the gross contamination from their outer clothing and boots by physical means (i.e., dislodging/displacement, rinsing, wiping, brushing etc.).

- ***Station 2.*** Equipment for this station may include plastic-lined waste receptacle, chair, clean damp cloths or paper towels, and plastic bags. At Station 2, personnel will remove their Tyvek® coveralls and gloves and deposit them in the lined waste receptacles. Personnel will wipe their respirators (if used), hard hats, and boots with clean, damp cloths and then remove those items. Those items are then hand-carried to the next station.

- ***Station 3.*** Equipment for this station may include a wash basin with soap and water and a respirator sanitation station. At this station, personnel will thoroughly wash their hands and face before leaving the decontamination zone. Respirators will be sanitized and then placed in a clean, plastic ziplock® bag.

Donning Procedures.

- Put on chemical-resistant boots or boots with boot covers and tape the coveralls over the boots at the ankles.

- Put on gloves.

- Tape the coveralls over the gloves at the wrist.

- If Level C PPE is required, don respirator and check for secure fit.

- Put hood or head covering over the respirator.

- Put on the remaining protective equipment (i.e., hard hat, safety glasses, etc.).

4.0 Site Monitoring

The environmental contaminants of concern are volatile and semivolatile chemicals including 2,4-dinitrotoluene (DNT); 2,6-DNT; 1,3,5-trinitrobenzene; and 2,4,6-trinitrotoluene.

Table 4-1 contains action levels for site monitoring.

Monitoring will be performed by the site safety and health officer initially for the location, then periodically during the performance of boring operations (sampling every 5- to 10-foot soil boring depth). A calibrated photoionization detector will be utilized to monitor the wells and breathing zones to determine if any organic vapors may be present that would necessitate upgrading of protection level. A calibrated combustible gas/oxygen meter will be utilized to monitor the work sites and breathing zones for explosive or flammable vapors. Benzene detector tubes will be utilized, as needed, to monitor breathing zones for benzene. Table 4-2 describes the air monitoring frequency and location.

No air monitoring is required for operations that do not disturb existing materials (i.e., site setup, surveying, decontamination, and miscellaneous support zone activities).

Table 4-1

Action Levels
Plum Brook Ordnance Works
Sandusky, Ohio

When in Level B PPE

Analyte	Action Level	Required Action
VOCs	≥ 50 ppm above background	Stop work; evacuate work area; contact H&S Manager
Benzene	≥ 10 ppm in BZ	Stop work; evacuate work area; contact H&S Manager
Dust	≥ 5 mg/cu. meter	Stop work; initiate dust suppression
LEL	≥ 10% of LEL	Stop work; evacuate work area; contact H&S Manager
O2	> 23 % < 20%	Stop work; evacuate work area; contact H&S Manager

When in Level C PPE

Analyte	Action Level	Required Action
VOCs	≥ 25 ppm above background	Stop work; evacuate work area; upgrade to Level B
Benzene	≥ 5 ppm in BZ	Stop work; evacuate work area; upgrade to Level B
Dust	≥ 5 mg/cu. meter	Stop work; initiate dust suppression
LEL	≥ 10% of LEL	Stop work; evacuate work area; contact H&S Manager
O2	> 23 % < 20%	Stop work; evacuate work area; contact H&S Manager

Table 4-1

Action Levels
Plum Brook Ordnance Works
Sandusky, Ohio

When in Modified Level D PPE/Level D PPE

Analyte	Action Level	Required Action
VOCs	≥ 5 ppm above background	Stop work; evacuate work area; upgrade to Level C PPE
Benzene	≥ 1 ppm in BZ	Stop work; evacuate work area; upgrade to Level C PPE
Dust	≥ 0.5 mg/cu. meter	Stop work; initiate dust suppression
LEL	≥ 10% of LEL	Stop work; evacuate work area; contact H&S Manager
O_2	> 23 % < 20%	Stop work; evacuate work area; contact H&S Manager

When in Support Zone

Analyte	Action Level	Required Action
Dust	≥ 0. 5 mg/cu. meter	Stop work; initiate dust suppression
VOCs	≥ 1 ppm above background	Stop work; evacuate work area; contact H&S Manager

BZ = Breathing zone.
LEL = Lower explosive limit.
VOCs = Volatile organic compounds.
ppm = parts per million
H&S = health and safety
mg/cu. meter = milligrams per cubic meter

Table 4-2

Air Monitoring Frequency and Location
Plum Brook Ordnance Works
Sandusky, Ohio

Work Activity	Instrument	Frequency	Location
Soil boring and sampling	OV Monitor CGI BDT, as needed	Continuously	BZ of employees and/or work area
Sediment/seep/surface water samples	OV Monitor CGI BDT, as needed	Continuously	BZ of employees and/or work area

OV = Organic vapor.
CGI = Combustible gas monitor.
BDT = Benzene detector tube.

5.0 Activity Hazard Analysis

The attached activity hazard analysis (Table 5-1) is provided for the following activities:

- Setup of equipment and general field activities
- Surveying
- Soil boring and sampling
- Decontamination (high-pressure water jetting operations)
- Sediment/seep and surface water sampling.

Table 5-1

Activity Hazard Analysis
Plum Brook Ordnance Works, Sandusky, Ohio

Activity	Potential Hazards	Recommended Controls
Setup of equipment and general field activities	Slip, trip, and fall hazards	• Determine best access route before transporting equipment. • Practice good housekeeping; keep work area picked up and clean as feasible. • Continually inspect the work area for slip, trip, and fall hazards. • Look before you step; ensure safe and secure footing.
	Heavy lifting	• Use proper lifting techniques. Lifts greater than 60 pounds require assistance or mechanical equipment.
	Falling objects	• Stay alert and clear of materials suspended overhead; wear hard hat and steel-toed boots.
	Flying debris, dirt, dust, etc.	• Wear safety glasses/goggles; ensure that eye wash is in proper working condition.
	Pinch points	• Keep hands, fingers, and feet clear of moving/suspended materials and equipment. • Beware of contact points. • Stay alert at all times!
	Cuts/bruises	• Use cotton or leather work gloves for material handling.
	Bees, spiders, and snakes	• Inspect work area carefully and avoid placing hands and feet into concealed areas.
	Fire	• Fire extinguishers shall be suitably placed, distinctly marked, readily accessible, and maintained in a fully charged and operable condition.
	Hazard communication	• Label all containers as to contents and dispose of properly. • Ensure Material Safety Data Sheets (MSDS) are available for hazardous chemicals used on site.
	Noise	• Sound levels above 85 A-weighted decibels (dBA) mandates hearing protection.
	Lighting	• Adequate lighting will be provided to ensure a safe working environment.
	Cold stress	• Workers should wear insulated clothing when temperatures drop below 40°F. • Drink warm beverages on breaks. Refrain from drinking caffeinated beverages. • Remove wet clothing promptly. • Take breaks in warm areas. • Reduce work periods as necessary. • Layer work clothing.

Table 5-1

Activity Hazard Analysis
Plum Brook Ordnance Works, Sandusky, Ohio

Activity	Potential Hazards	Recommended Controls
Setup of equipment and general field activities (continued)	Frostbite	• Personnel should wear inner cotton gloves and insulating socks to protect extremities from cold weather. • Take breaks in warm areas. • Remove wet gloves and socks promptly.
	Poison ivy/oak/sumac	• Avoid plant areas if possible. • Wear long sleeves and long pants. • Promptly wash clothing that has contacted poisonous plants. • Wash affected areas immediately with soap and water.
	Ticks	• Wear light-colored clothing (can see ticks better). • Mow vegetated and small brush areas. • Wear insect repellant. • Wear long sleeves and long pants. • Visually check oneself promptly and frequently after exiting the work area.
	Heat rash	• Keep the skin clean and dry. • Change perspiration-soaked clothing, as necessary. • Bathe at end of work shift or day. • Apply powder to affected area.
	Heat cramps	• Drink plenty of cool fluids even when not thirsty. • Provide cool fluid for work crews. • Move victim to shaded, cool area.
	Heat exhaustion	• Conduct physiological worker monitoring as needed (i.e., heart rate, oral temperature). • Set up work/rest periods. • Use the buddy system. • Allow workers time to acclimate. • Have ice packs available for use. • Take frequent breaks.
	Heat stroke	• Evaluate possibility of night work. • Perform physiological monitoring on workers during breaks. • Wear body cooling devices.

Table 5-1

Activity Hazard Analysis
Plum Brook Ordnance Works, Sandusky, Ohio

Activity	Potential Hazards	Recommended Controls
Setup of equipment and general field activities (continued)	Contact with moving equipment/vehicles	• Work area will be barricaded/demarcated. • Equipment will be laid out in an area free of traffic flow. • Barricades shall be used on or around work areas when it is necessary to prevent the inadvertent intrusion of pedestrian traffic. • Barriers shall be used to protect workers from vehicular traffic. • Barriers shall be used to guard excavations adjacent to streets or roadways. • Flagging shall be used for the short term (less than 24 hours) to identify hazards until proper barricades or barriers are provided. • Heavy equipment shall have backup alarms.
	Forklift operations	• • Use qualified and trained forklift operators. • The operator shall not exceed the load capacity rating for the forklift. • The load capacity shall be clearly visible on the forklift. • Forklift operators shall inform their supervisor of any prescribed medication that they are taking that would impair their judgement.
	Portable electric tools	• Portable electric tools which are unsafe due to faulty plugs, damaged cords, or other reason, shall be tagged (do not use) and be removed from service. • Portable electric tools and all cord and plug connected equipment shall be protected by a ground-fault circuit interrupter (GFCI) device. • Electrical tools shall be inspected daily prior to use.
	Extension cords	• Extension cords that have faulty plugs, damaged insulation, or are unsafe in any way shall be removed from service. • Cords shall be protected from damage from sharp edges, projections, pinch points (doorways), and vehicular traffic. • Cords shall be suspended with a nonconductive support (rope, plastic ties, etc.). • Cords shall be designed for hard duty. • Cords shall be inspected daily.

Table 5-1

Activity Hazard Analysis
Plum Brook Ordnance Works, Sandusky, Ohio

Activity	Potential Hazards	Recommended Controls
Setup of equipment and general field activities (continued)	Lightning strikes	• Whenever possible, halt activities and take cover. • If outdoors, stay low to the ground. • Limit the body surface area that is in contact with the ground (i.e., kneeling on one knee is better than laying on the ground). • Seek shelter in a building if possible. • Stay away from windows. • If available, crouch under a group of trees instead of one single tree. • Keep all body parts in contact with the ground as close as possible. • Remain 6 feet away from tree trunk if seeking shelter beneath tree(s). • If in a group, keep 6 feet of distance between people.
	Thunderstorms, tornadoes	• Listen to radio or TV announcements for pending weather information. • Cease field activities during thunderstorm or tornado warnings. • Seek shelter. Do not try to outrun a tornado.
Surveying	Slip, trip, fall	• Site workers will be required to wear hard hat, safety glasses with side shields, work gloves, and steel-toe boots when working in the field. • Provide adequate lighting in all work areas. • Whenever possible, avoid routing cords and hoses across walking pathways. • Flag or cover inconspicuous holes to protect against falls. • Work areas will be kept clean and orderly. • Garbage and trash will be disposed of daily in approved refuse containers. • Tools and accessories will be properly maintained and stored. • Work areas and floors will be kept free of dirt, grease, and slippery materials.
	Traffic accidents	• Place physical barrier (i.e., barricades, fencing) around work areas regularly occupied by pedestrians. • If working adjacent to roadways, have workers wear fluorescent orange vests. • Use warning signs or lights to alert oncoming traffic. • Assign flag person(s) if necessary to direct local traffic. • Set up temporary parking locations outside the immediate work area. • Motor vehicle operators shall obey all posted traffic signs, signals, and speed limits. • Pedestrians have the right-of-way. • Wear seat belts when vehicles are in motion.
	Wildlife hazards	• Workers should be cautious when driving through the site in order to avoid encounters with passing animals.

Table 5-1

Activity Hazard Analysis
Plum Brook Ordnance Works, Sandusky, Ohio

Activity	Potential Hazards	Recommended Controls
Soil Boring and Sampling	Overhead hazards	• Make sure no obstacles are within radius of boom. Always stay a safe distance from power lines.
	Faulty or damaged equipment being utilized to perform work	• All machinery or mechanized equipment will be inspected by a competent mechanic and be certified to be in safe operating condition. • Equipment will be inspected before being put to use and at the beginning of each shift. • Faulty/unsafe equipment will be tagged and if possible locked out. • Drill rigs shall be equipped with reverse signal alarm, backup warning lights, or the vehicle is backed up only when an observer signals it is safe to do so.
	Uneven terrain, poor ground support, inadequate clearances, contact with utilities	• Inspections or determinations of road conditions and structures shall be made in advance to ensure that clearances and load capacities are safe for the passage or placing of any machinery or equipment. • All mobile equipment and areas in which they are operated shall be adequately illuminated. • Aboveground and belowground utilities will be verified with NASA personnel, and delineated or flagged prior to staging equipment. • Whenever the equipment is parked, the parking brake shall be set. • Equipment parked on inclines will have the wheels chocked. • Inspect brakes and tire pressure on drill rig before staging for work.
	Inexperienced operator	• Machinery and mechanized equipment shall be operated only by designated personnel. • Operators shall inform their supervisor(s) of any prescribed medication that they are taking that would impair their judgment.
	Jacks/outriggers	• Ensure proper footing and cribbing.
	Falling objects	• Remove unsecured tools and materials before raising or lowering the derrick. • Stay alert and clear of materials suspended overhead.
	Pinch points	• Keep feet and hands clear of moving/suspended materials and equipment. • Stay alert at all times!
	Fire	• Mechanized equipment shall be shut down prior to and during fueling operations. • Have fire extinguishers inspected and readily available.
	Fall hazards	• Personnel are not allowed to work off of machinery or use machinery as ladders. • Use fall protection when working above 6 feet.

Table 5-1

Activity Hazard Analysis
Plum Brook Ordnance Works, Sandusky, Ohio

Activity	Potential Hazards	Recommended Controls
Soil Boring and Sampling (continued)	Noise	• Hearing protection is mandatory above 85 dBA.
	Contact with rotating or reciprocating machine parts	• Use machine guards; use long-handled shovels to remove auger cuttings. • Use safe lockout procedures for maintenance work.
	Heavy lifting	• Use proper lifting techniques. Lifts greater than 60 pounds require assistance or mechanical equipment; size-up the lift.
	Slip, trip, and fall hazards	• Practice good housekeeping; keep work area picked up and clean as feasible. • Continually inspect the work area for slip, trip, and fall hazards.
	Contact with potentially contaminated materials	• Real-time air monitoring will take place. If necessary, proper personal protective clothing and equipment will be utilized. • Stop immediately at any sign of obstruction. • Do not breathe air surrounding boring unless necessary. • Upgrade to respirator if necessary. • Avoid skin contact with soil cuttings. Wear gloves. • Stay clear of moving parts of drill rig.
	Drum handling	• Be careful not to breathe air from around open drum any more than necessary. Monitor with photoionization detector/flame ionization detector (PID/FID) equipment and upgrade to respirator if necessary. • When filling a drum (with either soil or water), be careful not to make contact with the contained waste. Wear appropriate gloves. Make sure lid or bung of drum is secure. • If moving a drum unassisted, be sure to leverage properly, use proper lifting techniques, and wear safety glasses and steel-toed boots. • When using a drum dolly, make sure straps and lid catch are securely attached. Leverage properly when tilting drum. Be sure toes stay away from drum.
High-Pressure Water Cleaning Operations	Heavy lifting	• Use proper lifting techniques. • Lifts greater than 60 pounds require assistance or mechanical equipment • Size-up the lift.
	Slip, trip, and fall hazards	• Good housekeeping shall be implemented. • The work area shall be kept clean as feasible. • Inspect the work area for slip, trip, and fall hazards.

Table 5-1

Activity Hazard Analysis
Plum Brook Ordnance Works, Sandusky, Ohio

Activity	Potential Hazards	Recommended Controls
High-Pressure Water Cleaning Operations (continued)	Fueling	• Only approved safety cans shall be used to store fuel. • Do not refuel equipment while it is operating or still hot to the touch. • Fire extinguishers shall be suitably placed, distinctly marked, readily accessible, and maintained in a fully charged and operable condition.
	Faulty or damaged equipment	• Equipment shall be inspected before being placed into service and at the beginning of each shift. • Preventive maintenance procedures recommended by the manufacturer shall be followed. • A lockout/tagout procedure shall be used for equipment found to be faulty or undergoing maintenance.
	High-pressure water	• Jetting gun operator must wear appropriate PPE including hard hat, impact-resistant safety glasses with side shields, water-resistant clothing, metatarsal guards for feet and legs, and hearing protection (if appropriate). • One standby person shall be available within the vicinity of the pump during jetting operation. • The work area shall be isolated and adequate barriers will be used to warn other site personnel.
	Unqualified operators	• Only qualified and trained personnel are permitted to operate machinery and mechanized equipment associated with water jet cutting and cleaning.
	Out of control equipment	• No machinery or equipment is permitted to run unattended. • Machinery or equipment will not be operated in a manner that will endanger persons or property nor will the safe operating speeds or loads be exceeded.
	Noise	• Sound levels above 85 dBA mandates hearing protection by nearby site personnel.
	Activation during repairs	• All machinery or equipment will be shut down and positive means taken to prevent its operation while repairs or manual lubrications are being done.
	Pinch points	• Keep feet and hands clear of moving/suspended materials and equipment. • Stay alert and clear of materials suspended
	Falling objects	• Hard hats are required by site personnel. • Stay alert and clear of material suspended overhead.
	Flying debris	• Impact-resistant safety glasses with side shields are required.
	Contact with potentially contaminated materials	• All site personnel will wear the appropriate PPE.

Table 5-1

Activity Hazard Analysis
Plum Brook Ordnance Works, Sandusky, Ohio

Activity	Potential Hazards	Recommended Controls
Surface Water/Sediment/ Seep Sampling	Drowning	• Personal flotation devices (PFD) will be provided and worn by workers over or near water where the danger of drowning exists. • PFDs shall be inspected prior to and after each use. • Defective PFDs will be tagged and removed from service. • Ring buoys with at least 90 feet of line shall be provided and readily available at locations where employees are working over or adjacent to water. • Use the "buddy system." • Personnel trained in launching and operating the skiff shall be readily available during work hours.
	Cross-contamination and contact with potentially contaminated materials	• Sampling technicians will wear proper protective clothing and equipment to safeguard against potential contamination. • Avoid skin contact with water. • Handle samples with care. • Only essential personnel will be in the work area. • Real-time air monitoring will take place before and during sampling activities. • All personnel will follow good hygiene practices. • Proper decontamination procedures will be followed. • All liquids and materials used for decontamination will be contained and disposed of in accordance with federal, state, and local regulations.
	Heat rash	• Keep the skin clean and dry. • Change perspiration-soaked clothing, as necessary. • Comply with IT Procedure HS 400 (May 13, 1999). • Bathe at end of work shift or day. • Apply powder to affected area.
	Heat cramps	• Drink plenty of cool fluids even when not thirsty. • Provide cool fluid for work crews. • Comply with IT Procedure HS 400 (May 13, 1999). • Move victim to shaded, cool area.
	Heat exhaustion	• Conduct physiological worker monitoring as needed (i.e., heart rate, oral temperature). • Set up work/rest periods. • Use the "buddy system." • Comply with IT Procedure HS 400 (May 13, 1999). • Allow workers time to acclimate. • Have ice packs available for use. • Take frequent breaks.
	Heat stroke	• Evaluate possibility of night work. • Perform physiological monitoring on workers during breaks. • Wear body cooling devices. • Comply with IT Procedure HS 400 (May 13, 1999).

Response to U.S. Army Corps of Engineers on the Site-Specific Sampling and Analysis Plan and Site-Specific Health and Safety Plan Remedial Investigations and Feasibility Studies, TNT Areas A & C Former Plum Brook Ordnance Works, Sandusky, Ohio

Comments from CELRN-ED-R-M (Ingram), 13 June 2000:

SSAP Comments:

Comment #1: **Page 1-1, 1st sentence: Suggest that the phrase "hazardous waste sites" be removed from this sentence.**

Response: Agree. The phrase "hazardous waste sites" has been deleted from this sentence.

Comment #2: **Page 1-1, 1st paragraph: No Figure 1-1 was provided.**

Response: Agree. Figure 1-1 has been provided.

Comment #3: **Section 1.2.1 and 1.2.2: Insert "Area" into each section heading.**

Response: Agree. "Area" has been inserted into each section heading.

Comment #4: **Page 1-3, Section 1.2.2, 4th line: Text indicates "Wastewater from TNTC was routed to the Pentolite Road Red Water Ponds." Wasn't it routed to the West Area Red Water Ponds?**

Response: Agree. Text has been revised to indicate "Wastewater from TNTC was routed to the West Area Red Water Ponds."

Comment #5: **Section 2.2, 1st sentence: Have we not already determined from previous investigations the presence of COPC?**

Response: Agree. However, the extent remains to be determined. The word "presence" has been replaced by the word "extent."

Comment #6: **Section 3.0: Edit first sentence.**

Response: The first sentence of the section has been edited.

Comment #7: **Section 3.1, 3rd sentence: Change "SW-346" to "SW-846."**

Response: Agree. "SW-346" has been changed to "SW-846."

Comment #8: **Section 3.1, 1st paragraph, 2nd sentence: Correct HPCL to HPLC.**

Response: Agree. "HPCL" has been replaced with "HPLC."

Comment #9: **Section 3.1, 1st paragraph, last sentence: Please define those attributes that make using HPLC a better field analytical choice than colorimetric screening methods.**

Response: Agree. The text has been rewritten defining the attributes that make using HPLC a better field analytical choice than colorimetric screening methods.

Comment #10: **Section 3.1, 2nd paragraph, next-to-last sentence: PRGs will be used to determine locations of borings; however, in Section 2.3.5 Region III RBC will be used to determine contamination. Will there be some overlapping of these two regulatory criteria and subsequently lead to confusion?**

Response: The reference to Region III RBCs is incorrect and will be changed to Region 9 PRGs.

Comment #11: **Page 3-1, Section 3.1, end of 2nd paragraph: Shouldn't "Figures 1-3 and 1-4" be "Figures 3-1 and 3-2"?**

Response: Agree. The text "Figures 1-3 and 1-4" has been replaced with "Figures 3-1 and 3-2."

Comment #12: **Page 3-1, Section 3.1, 3rd paragraph: CELRN concurs with the approach of using historical (PBOW TNT B, WVOW, and/or Volunteer) findings to better distribute screening samples. Thus if historically the Acid & Fume Recovery Building areas have not shown contamination then we don't need to plan as many screening samples there and can shift them to historically more likely locations.**

Response: Agree. The number of samples has been reduced to six samples at each Acid & Fume Recovery Building.

Comment #13: **Page 3-2, last sentence of Section 3.1: Should "contaminates" be "contaminants"?**

Response: Agree. "Contaminates" has been replaced with "contaminants."

Comment #14: **Section 3.2.1.1: Check verb use in first sentence.**

Response: Agree. "Were" has been changed to "was" to agree with the subject of the verb.

Comment #15: **Page 3-2, Section 3.2.1.1, bottom of page: "Phase 1" should be "Phase I." "Drowing" should be "drowning."**

Response: Agree. Phase 1 and drowing has been replaced with Phase I and drowning, respectively.

Comment #16: **Section 3.2.1.3, middle of paragraph: Has EPA agreed to not developing and purging groundwater wells?**

Response: Based on the OEPA comments received, the approval of not developing and purging the temporary piezometers is implied.

Comment #17: **Page 3-3, Section 3.2.1.3: Rather than Table 3-2, Table 3-1 should be cited. Table 3-2 concerns TNT C not TNT A.**

Response: Agree. Table 3-2 has been replaced with Table 3-1.

Comment #18: **Page 3-4, top of page: Is Figure 3-7 in IT, 1997? If so then change reference to "(Figure 3-7, IT, 1997)." Otherwise there is no Figure 3-7 in this SAP Attachment X.**

Response: Agree. The sentence has been rewritten to reference Figure 3-7 in the IT, 1997 report.

Comment #19: **Sections 3.2.1.4 and 3.2.2.4, last line: Change "site walk" to "site walk over."**

Response: Agree. "Site walk has been revised to "site walk over."

Comment #20: **Section 3.2.2.1: Reference is made to Figure 3-3. That figure was not included in the draft we received.**

Response: Agree. There is no Figure 3-3. Figure 3-3 has been deleted.

Comment #21: **Page 3-5, 3rd line: Change "bedrock it" to "bedrock if it."**

Response: Agree. "If" has been added.

Comment #22: **Section 3.2.2.3: See comment #16. (OEPA approval GW purging?)**

Response: See response to Comment #16.

Comment #23: **Page 3-6, Section 3.3.1.2, last full sentence on page: Check font of "using."**

Response: Agree. The font has been changed.

Comment #24: **Page 3-7, Section 3.3.2.2: Please confirm that VOC samples will not be placed in the plastic bag and mixed."**

Response: Agree. A statement has been added confirming that VOC samples will not be placed in the plastic bag and mixed.

Comment #25: **Page 4-2, Section 4.3: Change "Plumb Brook" to "Plum Brook."**

Response: Agree. 'Plumb Brook" has been changed to "Plum Brook."

Comment #26: **Page 6-1, Section 6.4: Please proofread the last sentence on page.**

Response: No on-site laboratory will be used and therefore, Section 6.4 has been deleted from the SSAP.

Comment #27: **Table 1-1: Separate analytical results for TNT Areas A and C into two tables and provide dates of investigations.**

Response: Agree. TNT A analytical results have been separated from the TNT C analytical results and dates of investigations added.

Comment #28: **Table 2-1: Have ecological receptors been excluded from the potential receptor list?**

Response: No. The ecological receptors are listed in Table 2-1.

Comment #29: **Tables 3-4 and 3-8: Please clarify as to whether the listed contaminants were detected above PRGs or were merely detected.**

Response: Agree. Footnotes have been added clarifying that the contaminants listed were merely detected.

Comment #30: **Figure 2-1: Provide approximate quantity of samples for Phase I and Phase II if approximate number of samples can be provided for Phase III.**

Response: Agreed.

<u>SSHP Comments</u>:

Comment #1: **The SSHP should employee hazard waste operator certification. When available, list personnel names to specific tasks on-site.**

Response: Agreed. The personnel to complete all work on-site will be provided to the on-site USACE representative.

Comment #2: **Are the medical surveillance requirements listed in a site-wide health and safety plan? The facility-wide health and safety plan should be available on-site during this round of field efforts.**

Response: The medical surveillance requirements are listed in the site-wide health and safety plan. A copy of the site-wide health and safety plan is kept on-site during any Plum Brook investigation.

Comment #3: **Decontamination procedures and work zones should be defined in the SSHP.**

Response: Decontamination procedures and work zones are discussed in Section 7.0 of the SSHP.

Comment #4: **There will be visitors accompanying the ecological recon. team for a non-invasive look at TNT A and C areas. The SSHP should include specific provisions for this event.**

Response: Agreed. Text will be inserted to specify that visitors will be accompanying the ecological recon team. Because of the likelihood that the visitors will not have had the OSHA 40 hour hazardous worker training, the text will state that no intrusive sampling activities will be conducted during the site walks and that all visitors will remain outside of areas of suspected contamination.

Response To Ohio EPA Comments on the Site-Specific Sampling and Analysis Plan and Site-Specific Health and Safety Plan, Remedial Investigations and Feasibility Studies, TNT Areas A & C Former Plum Brook Ordnance Works, Sandusky, Ohio

Comment 1: Section 2.0 Scope of Work and Objectives, General Comment: Please include a section in Part 2 of this work plan entitled "QAPP Review." Include a statement indicating that the QAPP (IT 1996) has been reviewed for accuracy and is still current. If this statement is incorrect, please indicate the necessary changes to the QAPP in this section and submit the appropriate changes to the QAPP.

Response: Agreed. The QAPP has been reviewed to ensure accuracy. Due to the fact that the QAPP is dated 1996, some items have changed, the most obvious of which are the analytical methods. The following table summarizes the general subject matter in the QAPP that has changed, the specific sections and text in the QAPP that are outdated, and the sections of the current TNTA and TNTC SSAP that modify the existing QAPP:

Subject	1996 QAPP	2000 SSAP
Analytical Methods	Table 1.1 – Analytical methods are not current.	Table 4-1 provides updated analytical methods.
Analytical Lab	Section 2.6 – Quantera is referenced as the laboratory for off-site sample analysis.	Section 5.0 Indicates GPL, Inc. will be the laboratory for all TNTA and TNTC samples.
Data Validation	Section 2.7 – STEP, Inc. is listed as the subcontractor that will do the data validation.	Specifying subcontractor that is responsible for data validation is not necessary in the SSAP. Data validation will be completed by DataChek, Inc.
Decontamination	Section 4.2.2 – Methanol is listed to be used for equipment decontamination	Section 4.3 indicates that isopropyl alcohol will be used for decontamination of sampling equipment that eliminates the generation of hazardous waste (i.e., methanol).
Sampling ID	Section 4.3 – Designation of SO used for soil samples sent to an off-site laboratory and SS for soil screening sample	Section 4.1 provides sample designations for both surface (SS) and subsurface (SB) soil screening samples.
Sample Containers	Section 4.9.4 – VOC sampling containers are incorrect for the VOC sampling to be conducted at TNTA and TNTC.	Section 5.0 and Table 5-1 includes the use of EnCore samplers for VOC analysis.

Subject	1996 QAPP	2000 SSAP
USACE Split Samples	Section 4.9.6 – the USACE laboratory lists the Ohio River Division Laboratory for QA samples.	Section 5.0 provides name and point of contact for the current USACE QA laboratory.
Container Requirements	Table 5-1 – no container requirements are listed for nitroaromatics in soil	Table 5-1 provides updated sample container requirements for all parameters
Analytical Methods	Tables 7-1 through 7-5 – analytical methods listed are no longer valid.	Table 5-1 provides updated analytical methods for all parameters
Blank Evaluation	Section 8.4 – indicates that CLP functional guidelines are used for blank evaluation.	Reference to blank correction is not included in the SSAP; however, blank evaluation will follow Region III guidelines.

Comment 2: Section 2.3.5, Page 2-3: This section references a hazard index of "0.1." Please revise this to a hazard index of 1.0.

Response: RBCs and HIs are incorrectly referenced in this section and have been replaced by PRGs.

Comment 3: Section 2.3.5, Page 2-3: Ohio EPA is unclear as to how ground water contamination will be confirmed during the remedial investigation at the TNT areas. For clarification, Ohio EPA recommends that IT Corp. add, in the SSAP, what standards will be used to compare to ground water analytical results; Region III ground water RBCs, Ohio drinking water standards, or other.

Response: Agreed. It will be stated that groundwater analytical results will be compared to Region IX PRGs.

Comment 4: Section 3.2.1.2, Page 3-3: Please indicate if process lines and waste water lines that ran between buildings were above ground or below ground. If the lines were below grade, investigation activities should determine if these lines are still present or were removed during decontamination activities. If lines are present, samples should be collected.

Response: Process lines were above ground and waste water lines were above and below ground. Previous decontamination procedures removed the below ground lines; however, decontamination was incomplete and lines remain at both TNTA and TNTC. Based on discussions with OEPA during the TNTA and TNTC kickoff meeting held at NASA Plum Brook Station on May 20, 2000, it was concluded that locating lines would be difficult due to map inaccuracies. However, borings will be

completed at locations near the Wash Houses where underground waste lines are suspected.

Comment 5: Section 3.2.1.3, Page 3-3: For clarification, IT Corp. should include specific text in the 4th sentence, stating that shallow ground water samples will be collected for total analyses (unfiltered). Inorganic (metals) analytical data should be evaluated as such.

Response: Disagree. However, text will be added stating "Groundwater samples collected will be analyzed at a fixed based laboratory for VOCs, SVOCs, nitroaromatic compounds, and TAL metals (Table 3-2). Selected groundwater samples will be filtered in the field using a 0.45 micron filter to determine the relationship between filtered and unfiltered data. It is anticipated that three groundwater samples will require filtration; however, the exact number of groundwater samples to be filtered is contingent on OEPA approval. "

Comment 6: Sections 3.2.1.3 and 3.2.2.3, Pages 3-3 and 3-5: For clarification, IT Corp. should include specific text, in that ground water samples will be analyzed by a fixed laboratory for confirmation of contamination and not for screening purposes. If shallow ground water samples are to be collected for both types of analyses, then this should be clearly stated in the text.

Response: Agree.

Comment 7: Sections 3.2.2.1 and/or 3.3.2.1, Pages 3-4 and 3-7: For clarification, IT Corp. should include specific text, in that subsurface soil samples will be collected using Geoprobe or similar direct-push methodologies. Section 3.3.2.1 of the text mentions acetate liners and sampling cores but not the method of installation.

Response: Agree. The text in the first sentence of Section 3.2.2.2 has been revised to read "Based on the surface soil field screening results at TNTC, 20 contaminated areas that exceed Region 9 PRGs will be further evaluated by collecting subsurface samples using direct push technology."

Comment 8: Section 3.2.2.2, Page 3-4: See comment number 4.

Response: See response to Comment 4.

Comment 9: Section 3.3.3, Page 3-8: IT Corp. states in the SSAP that temporary piezometers may be required to be installed in soil sampling boreholes for the purpose of ground water sampling if low yield conditions are encountered. IT Corp. should provide a brief discussion in this section as to the installation, construction, and materials associated with the temporary piezometers.

Response: Agreed. The following text will be inserted "Temporary piezometers will be installed inside 3-inch drive rod. The piezometers will be constructed of two-

inch diameter PVC with a 15 foot screen (0.010 slot). A surface seal will be completed using bentonite to prevent surface water from entering the borehole."

Comment 10: Section 3.3.3, Page 3-8: IT Corp. states in the SSAP that static water levels will be measured and recorded from both hydropunch and temporary piezometers prior to sampling. If IT Corp. intends to generate potentiometric surface maps of the shallow saturated zone based on these measurements, then any water level measurements collected contemporaneously from existing monitoring wells should not be incorporated into the maps. It is inappropriate to combine the two data sets due to their differences in construction, installation, development, and sampling protocols. IT Corp. can compare the two data sets but separate potentiometric surface maps should be generated for each.

Response: The Scope of Work does not include collecting water level data from any monitoring wells.

Comment 11: Section 3.4, Page 3-10: Please revise this section to state that if groundwater is encountered the boring will be backfilled with bentonite above the water bearing zone.

Response: A last sentence has been added to Section 3.4 reading "In the event groundwater is encountered, the boring will be backfilled above the water bearing zone with bentonite before grouting to the surface."

Comment 12: Section 4.2, Page 4-1: Recent correspondence from U.S. EPA indicates that Ordnance/Ammunition manufacturing has resulted in a contamination concern for perchlorate. The Ohio EPA Office of Federal Facilities Oversight (OFFO) has directed that this parameter be considered as a contaminant of concern (COC) for all former Ordnance facilities. Please review historical information and determine if perchlorate should be added to the Analytical Program.

Response: Information on perchlorate was reviewed. Based on the information provided by OEPA, perchlorate was used in the manufacture of rocket propellants and was not used in the manufacture of TNT. Therefore, perchlorate will not be added as a COC for this facility.

Comment 13: Section 4.2, Page 4-2: IT Corp. has not provided a discussion of the analyses of shallow ground water in the SSAP. Ohio EPA recommends that IT Corp. provide a statement of the analyses to be performed on shallow ground water or reference applicable portions of the SSAP (e.g., Sections 3.2.1.3 or 3.2.2.3) in this section for consistency/clarification.

Response: Agree. The analysis to be performed on shallow groundwater has been included in the last sentence of Section 4.2.

Comment 14: Tables 4-1 and 4-2 of this SSHP refer to "Plumb" Brook Ordnance Works. Please correct to "Plum" Brook Ordnance Works.

Response: Agree. The tables have been corrected.