Volume II - Baseline Human Health Risk Assessment

TNT Area B Remedial Investigation
Former Plum Brook Ordnance Works
Sandusky, Ohio

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Table of Contents

Page

List of Tables iii
List of Figures iv
List of Acronyms v
Executive Summary ES-1
1.0 Introduction 1-1
2.0 Data Evaluation 2-1
2.1 Identification of COPC 2-1
2.1.1 Sorting the Analytical Data 2-1
2.1.2 Evaluating Data Quality 2-1
2.1.3 Identifying Site-Related Chemicals 2-2
2.1.4 Risk-Based Screening 2-5
2.1.5 Evaluating Essential Nutrients 2-7
2.1.6 Summary of COPC Selection 2-7
2.1.6.1 Surface Soil 2-8
2.1.6.2 Subsurface Soil 2-9
2.1.6.3 Combined Surface and Subsurface Soil ("Total Soil") 2-10
2.1.6.4 Surface Water 2-10
2.1.6.5 Sediment 2-10
2.2 Developing Source-Term Concentrations 2-11
2.2.1 Soil, Surface Water, and Sediment 2-11
2.2.2 Groundwater 2-14
3.0 Exposure Assessment 3-1
3.1 Conceptual Site Exposure Model 3-1
3.1.1 Physical Setting 3-2
3.1.2 Contaminant Sources, Release Mechanisms, and Migration Pathways 3-2
3.1.3 Receptors and Exposure Pathways 3-2
3.1.3.1 Groundskeeper 3-3
3.1.3.2 Construction Worker 3-4
3.1.3.3 On-Site Resident 3-6
3.1.3.4 Indoor Worker 3-8

Table of Contents *(Continued)*

3.1.3.5 Other Receptors Not Considered 3-9
3.2 Quantification of Exposure-Point Concentrations 3-9
3.3 Quantification of Chemical Intake 3-18
3.3.1 Inhalation of COPC in Air 3-19
3.3.2 Incidental Ingestion of COPC in Soil 3-19
3.3.3 Incidental Ingestion of COPC in Sediment 3-20
3.3.4 Dermal Contact with COPC in Soil, Sediment, or Water 3-20
4.0 Toxicity Evaluation 4-1
4.1 Cancer Evaluation 4-1
4.2 Evaluation of Noncancer Effects 4-4
4.3 Target Organ Toxicity 4-5
4.4 Dermal Toxicity Values 4-5
4.5 Sources of Toxicity Information Used in the Risk Assessment 4-6
5.0 Risk Characterization 5-1
5.1 Carcinogenic Effects of Chemicals 5-1
5.2 Noncancer Effects of Chemicals 5-2
5.3 Risk Characterization Results and Discussion 5-3
5.3.1 Groundskeeper 5-4
5.3.2 Indoor Worker 5-5
5.3.3 Construction Worker 5-5
5.3.4 On-Site Resident 5-6
5.4 Risk-Based Remediation Criteria Development 5-7
5.4.1 Identification of COCs in Surface Soil 5-9
5.4.2 Identification of COCs in Total Soil 5-9
5.4.3 Identification of COCs in Surface Water 5-10
5.4.4 Identification of COCs in Sediment 5-10
6.0 Uncertainty Analysis 6-1
7.0 Summary and Conclusions 7-1
8.0 References 8-1
Appendix A - Analytical Results

Table of Contents *(Continued)*

Appendix B - Calculation of Residential Soil Preliminary Remediation Goal Concentrations for Chemicals without Values Tabulated by EPA Region 9

Appendix C - Wilcoxon Rank Sum Test for Comparison of Background Concentrations of Metals with Concentrations Measured in Surface Soil and Combined Surface and Subsurface Soil

Appendix D - Toxicological Profiles for the Chemicals of Potential Concern

List of Tables

Table	Title	Follows Tab
2-1	Statistical Summary and COPC Selection of Surface Soil Sample Analyses	
2-2	Statistical Summary and COPC Selection of Subsurface Soil Sample Analyses	
2-3	Screening of VOCs from Subsurface Soil in Indoor Air	
2-4	COPC Sselection of Total Soil	
2-5	Statistical Summary and COPC Selection of Surface Water Sample Analyses	
2-6	Statistical Summary and COPC Selection of Sediment Sample Analyses	
2-7	Background Concentrations of Metals in Soil	
3-1	Receptor/Exposure Scenarios	
3-2	Variables Used to Estimate Potential Chemical Intakes and Contact Rates for Receptors	
4-1	COPC-Specific Variable Values Used in Risk Assessment	
5-1	Cancer Risk and Noncancer Hazard Index: Groundskeeper Exposure to Surface Soil	
5-2	Cancer Risk and Noncancer Hazard Index: Indoor Worker Exposure to Surface Soil	
5-3	Cancer Risk and Noncancer Hazard Index: Construction Worker Exposure to Total Soils	
5-4	Cancer Risk and Noncancer Hazard Index: Construction Worker Exposure to Surface Water	
5-5	Cancer Risk and Noncancer Hazard Index: Construction Worker Exposure to Sediment	
5-6	Cancer Risk: On-Site Resident Exposure to Total Soils	
5-7	Noncancer Hazard: Child On-Site Resident Exposure to Total Soils	
5-8	Cancer Risk: On Site Resident Exposure to Surface Water	
5-9	Noncancer Hazard Index: On-Site Child Resident Exposure to Surface Water	
5-10	Cancer Risk: On-Site Resident Exposure to Sediment	
5-11	Noncancer Hazard: Child On-Site Resident Exposure to Sediment	
5-12	Summary of Total Hazard and Total Cancer Risk from Site-Related Chemicals of Concern	
5-13	Risk-Based Remedial Criteria for Chemicals of Concern, Groundskeeper Exposure to Surface Soil	

List of Tables (Continued)

Table	Title	Follows Tab
5-14	Risk-Based Remedial Criteria for Chemicals of Concern, Indoor Worker Exposure to Surface Soil	
5-15	Risk-Based Remedial Criteria for Chemicals of Concern, Construction Worker Exposure to Total Soil	
5-16	Risk-Based Remedial Criteria for Chemicals of Concern, On-Site Resident Exposure to Total Soil	
5-17	Risk-Based Remedial Criteria for Chemicals of Concern, Construction Worker Exposure to Sediment	
5-18	Risk-Based Remedial Criteria for Chemicals of Concern, On-Site Resident Exposure to Sediment	

List of Figures

Figure	Title	Follows Tab
3-1	Human Health Conceptual Site Exposure Model	

List of Acronyms

ABS	absorption factor
AF	adherence factor
ARAR	applicable or relevant and appropriate requirement
AT	averaging time
bgs	below ground surface
BLRA	baseline risk assessment
BSC	background screening criterion
BW	body weight
cm^2	square centimeters
COC	chemical(s) of concern
COPC	chemical(s) of potential concern
CSEM	conceptual site exposure model
CT	central tendency
DA	dose absorbed
D&M	Dames and Moore, Inc.
DNT	dinitrotoluene
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
ED	exposure duration
EF	exposure frequency
EPA	U.S. Environmental Protection Agency
ET	exposure time
FI	fractional term
GAF	gastrointestinal absorption factor
g/m^3	grams per cubic meter
HI	hazard index
HQ	hazard quotient
ILCR	incremental lifetime cancer risk
IMS	ion mobility spectroscopy
IT	IT Corporation
m^3	cubic meter
m^3/hour	cubic meters per hour

List of Acronyms *(Continued)*

m^3/day	cubic meters per day
MDC	maximum detected concentration
mg/cm^2	milligrams per square centimeter
mg/day	milligrams per day
mg/kg	milligrams per kilogram
mg/m^3	milligrams per cubic meter
NASA	National Aeronautics and Space Administration
OEPA	Ohio Environmental Protection Agency
PAH	polynuclear aromatic hydrocarbon
PBOW	Plum Brook Ordnance Works
PC	permeability coefficient
PCB	polychlorinated biphenyls
ppm	parts per million
PRG	preliminary remediation goal
RA	risk assessment
RBC	risk-based concentration
RBRC	risk-based remediation criteria
RBSC	risk-based screening concentration
RfC	reference concentration
RfD	reference dose
RME	reasonable maximum exposure
SA	surface area
SF	slope factor
SQL	sample quantitation limit
TNT	trinitrotoluene
TNTB	TNT Manufacturing Area B
UCL	upper confidence limit
USACE	U.S. Army Corps of Engineers
UTL	upper tolerance limit
VOC	volatile organic compound

Executive Summary

This report presents an assessment of potential human health risks related to U.S. Department of Defense activities at the former Plum Brook Ordnance Works (PBOW) located near Sandusky, Ohio. PBOW operated from 1941 to 1945 as a manufacturing plant for 2,4,6-trinitrotoluene (TNT), dinitrotoluene (DNT), and pentolite. Some operational areas were decontaminated in the 1950s and 1960s and other areas were decommissioned but not decontaminated. The site is currently owned by the National Aeronautics and Space Administration and portions of the site are used by other agencies including the Perkins Township Board of Education and the Ohio National Guard. Public access is restricted using a fence and security patrols except during the controlled annual deer hunting season.

TNT Area B (TNTB) is located north of West Scheid Road and south of the North Magazine Road in the south central part of PBOW. During operations, it consisted of three TNT manufacturing process lines and their associated buildings. Initial decontamination work was completed on or before 1963, although the thoroughness of the decontamination is questionable. It is likely that rough grading may have moved or obscured some surface contamination, and subsurface contamination associated with underground sewer and flume lines probably remains. Significant evidence of the former PBOW facility remains in the form of roads, building foundations and remnants of utilities.

TNTB is under the control of National Aeronautics and Space Administration, which has constructed a test building on the northwest corner of the site. Current use of the PBOW land is classified as industrial for the purpose of the risk assessment (RA). Because the future use of TNTB is not certain, the RA includes assumptions that the site might be developed for residential purposes and that construction activity may be performed.

It is assumed that bedrock groundwater may be developed as a source of potable water. The shallow or perched groundwater is transient and not considered a potential source of potable water. There are no plausible pathways by which receptors would be continually exposed to shallow groundwater. Because data from analysis of bedrock groundwater are not available at this writing, the RA is incomplete because total risks and hazards across media cannot be

determined. An addendum to the TNTB RA will be prepared when the groundwater data become available.

The RA is based on U.S. Environmental Protection Agency (EPA), U.S. Army Corps of Engineers, and Ohio Environmental Protection Agency guidance.

Data from analysis of soil, surface water and sediment samples collected in November 1998 are used in the RA. All sampling and analysis were conducted in accordance with approved work plans. Detected chemicals were identified as site-related chemicals of potential concern (COPC). Certain metals and polynuclear aromatic hydrocarbon (PAH) chemicals were identified as natural or anthropogenic background constituents at the site. Background chemicals were not eliminated but were included in an evaluation of background risk. Chemicals identified as related to TNTB operations were included in the evaluation of site-related risk. All chemicals were combined in an additional evaluation of total site risk.

Media evaluated in this RA include surface soil, subsurface soil, surface water and sediment. Certain receptors may also be exposed to shallow groundwater, or to deep (bedrock) groundwater developed as a source of potable water. However, groundwater data are not available at the time of this writing (August 2000). Therefore, the RA must be considered incomplete, in that total risk across all media cannot be assessed at this time. A final RA will be performed when the groundwater become available, at which time the risks calculated herein for soil, surface water, and sediment will be included to estimate total risk across all media for all receptors.

Receptor scenarios evaluated for this site include a groundskeeper, an indoor worker, a construction worker, and an on-site resident. These groundskeeper represents the upper-bound on long-term risk from exposure to soil for commercial/industrial future development of the site, while the on-site resident represents the upper-bound on risk from exposure to soil, surface water and sediment for long-term unrestricted or residential exposure. The construction worker scenario provides the upper-bound on noncancer hazard for shorter-term exposure to soil, surface water and sediment while the site is being developed. The potential for subterranean vapors from subsurface soil or shallow groundwater trapped in indoor air to contribute to inhalation risk is evaluated for the indoor worker and the on-site resident.

Several classes of chemicals were identified in samples taken from the environmental media at TNTB. Surface and subsurface soil yielded significant concentrations of metals, nitroaromatic compounds, polychlorintated byphenyls (PCB) and PAHs. The metals were shown to be present at levels consistent with background. Although background incremental lifetime cancer risk (ILCR) estimates for all receptors fell within the 1E-6 to 1E-4 risk management range, and the background hazard index (HI) for the construction worker exceeded the threshold of 1, this cannot be attributed to site-related activity. The nitroaromatic compounds are clearly site-related; there presence is consistent with the production and purification of explosives such as 2,4,6-TNT. The greatest cancer risk and noncancer hazard is associated with 2,4,6-TNT, but other nitroaromatic compounds, probably degradation products of 2,4,6-TNT, also contribute significant risk. Highest concentrations of 2,4,6-TNT were located in surface soil, reflecting the persistence of this compound on or near the surface. Highest concentrations of TNT degradation products were located in subsurface soil, suggesting that these products may be somewhat more mobile in soil.

The source of the PCBs is unclear. PCBs are not generally associated with the production of nitroaromatic explosives, but their widespread occurrence in 18 of 28 surface soil samples strongly suggests they are site related at TNTB.

PAHs are generally ubiquitous in the environment, readily forming from the combustion of organic material. Their presence in TNTB soils is not surprising, particularly if buildings or waste has been burned on the site. Higher concentrations are located in surface soil than in subsurface soil, because the PAHs are relatively immobile in soil. Background soil samples were not analyzed for PAHs, so a background data set could not be developed, and the PAHs must be regarded as site-related chemicals. Many of the PAH concentrations, however, fall within background levels for urban soil as compiled by Agency for Toxic Substances and Disease Registry (1995). The PAHs in soil are significant contributors to risk, yielding ILCR estimates near the middle of the 1E-6 to 1E-4 risk management range for the on-site resident.

Surface water is essentially clean; no chemicals of concern (COC) were identified for short-term (construction worker) or long-term (on-site resident) exposure. Arsenic was identified as a cancer-based COC in sediment for the on-site resident, and arsenic, iron and manganese were identified as noncancer-based COCs in sediment for the construction worker. Background data were not available for sediment, so these metals were regarded as if they were site-related.

Sediment concentrations of arsenic, however, were consistent with levels in background soil, suggesting that arsenic in sediment reflects background levels in the soil from which the sediment is derived. Furthermore, its ILCR for the on-site resident is at the lower end of the risk management range.

In summary, the soils are clearly contaminated with 2,4,6-TNT and other nitroaromatic chemicals as a result of former site operations. The nitroaromatics are associated with unacceptable cancer risk and noncancer hazard levels for either commercial/industrial or residential site use. PCBs and PAHs in soil also contribute significantly to cancer risk, although their ILCRs do not exceed the risk management range. The surface water is relatively clean and appears to pose no threat to plausible receptors. The sediment contains metals that contribute minimally to cancer risk. Noncancer hazards from metals in sediment, however, exceed the threshold of 1 for the construction worker. RBRCs were calculated for all site-related COCs in soil and sediment.

The total ILCR from all construction worker exposure pathways is within the 1E-6 to 1E-4 range considered acceptable by the EPA and the total HI exceeds the acceptable value of 1. The predominant ILCR and noncancer hazards (HI) are associated with chemicals from site operations. The COPCs that contribute significantly to cancer risk and noncancer hazard to the groundskeeper are: 2,4,6-TNT, 2-amino-4,6-DNT, 4-amino-2,6-DNT, 2,4-DNT, and 2,6-DNT.

The total ILCR and the noncancer HI for potential exposures of a future on-site resident to total soil pathways exceed the values considered acceptable by the EPA. Both the ILCR and HI are associated with the potential oral and dermal exposures to surface and subsurface soil. The predominant COPCs are 2,4-DNT, 2,6-DNT, 2,4,6-TNT, 2-amino-4,6-DNT, 4-amino-2,6-DNT, Aroclor-1254, Aroclor-1260, benzo(a)pyrene, and dibenz(a,h)anthracene.

The total ILCR and HI calculated for potential exposures of future on-site residents to surface water and sediment are less than values considered acceptable by the EPA (1990). Therefore, exposures to COPCs in surface water and sediment do not pose unacceptable risks associated with residential use of the site.

The above RA for hypothetical future residents and construction workers is based on the assumption that the exposures would occur at any randomly selected location within the TNTB

boundary. Examination of the soil sampling data shows that the above risk estimates are based primarily on samples obtained from the northeast quadrant of the site. That is, the upper estimate of risk to a future resident or construction worker would occur if the location of the exposures were in the northeast quadrant. Therefore, the above RA for these receptors is conservative when applied to the site as a whole.

An alternate location was evaluated to estimate the potential risk if the residence or construction project were randomly located anywhere on the TNTB site other than the northeast quadrant.

The total ILCR and noncancer hazard (HI) also exceed acceptable limits specified by the EPA for potential on-site resident at a randomly chosen alternate location. As for the northeast quadrant location, the predominant contributors to the total HI at the alternate location are associated with direct ingestion and dermal contact with 2-amino-4,6-DNT, 4-amino-2,6-DNT, 2,4-DNT, 2,6-DNT, and 2,4,6-TNT with a significant contribution from Aroclor-1254.

1.0 Introduction

Chemical contamination related to former U.S. Department of Defense (DOD) activities has been documented at the former Plum Brook Ordnance Works (PBOW) located near Sandusky, Ohio (U.S. Army Corps of Engineers [USACE], 1998a). PBOW operated from 1941 to 1945 as a manufacturing plant for 2,4,6-trinitrotoluene (TNT), dinitrotoluene (DNT), and pentolite. Some of the areas used by the DOD were decontaminated in the 1950s and 1960s; other areas have been decommissioned, but not decontaminated. The site is currently owned by the National Aeronautics and Space Administration (NASA) and is operated as the Plum Brook Station of the Lewis Research Center, which is headquartered in Cleveland, Ohio. In 1978, NASA declared approximately 2,152 acres of land as excess (IT Corporation [IT], 1997). The Perkins Township Board of Education acquired 46 acres of the excess for use as a bus transportation center. The Ohio National Guard has an agreement with the General Services Administration to use 604 acres of the facility. The areas surrounding PBOW are predominantly agricultural and residential. The facility is currently surrounded by a chain-link fence and the perimeter is regularly patrolled. Access by authorized personnel is limited to established checkpoints. Public access is restricted except during the controlled annual deer hunting season.

Two groundwater aquifer systems are utilized for drinking water in the area: a carbonate aquifer to the west and a shale aquifer to the east (USACE, 1998a). PBOW is located within the transition of the two systems. Upwards of 170 private drinking water wells permitted by the Erie County Health Department are located within 4 miles of PBOW. Permits are not required for agricultural wells. The Erie County Health Department does not permit using surface water as private drinking water. Lake Erie and Sandusky Bay, located approximately 3.5 miles north of PBOW, are used for recreational swimming, fishing, and boating.

Current land uses of the PBOW facility are classified as industrial for the purpose of identifying plausible human receptors and exposure pathways for evaluation in the risk assessment (RA). USACE (1998a) describes potential future uses of all or portions of the facility as:

- Continued industrial use (NASA activities and programs)
- Recreational use of portions of the site by hunters and fishermen

- Sale of portions of the site to state or local government or private individuals (no land-use restrictions were mentioned)
- Possible use of parts of the facility for residential or agricultural purposes
- Possible use of parts of the facility for training by the National Guard.

Construction activities may be performed during development of any of the sites.

TNT Manufacturing Area B (TNTB) is a roughly rectangular area approximately 55 acres located north of West Scheid Road and south of the North Magazine Road in the south central part of PBOW (Dames and Moore [D&M], 1997). During operations, it consisted of three TNT manufacturing process lines and their associated buildings. Initial decontamination consisted of removal of visible surface contamination, spot checking for contaminated tiles, flumes, and wastewater pipes and removal of same, removal and burning of the wood-frame buildings used in TNT manufacture, flashing, and removal of some of the concrete foundations and other debris, flashing of visibly contaminated surface soil, and rough grading the entire area. Apparently, this work was completed in or before 1963. The thoroughness of the decontamination is questionable; it is likely that rough grading may have moved or obscured some surface contamination, and subsurface contamination associated with underground sewer and flume lines probably remains.

Currently, TNTB is under the control of NASA, which has constructed a test building on the northwest corner of the site (D&M, 1997). Significant evidence of the former PBOW facility remains in the form of roads, building foundations and remnants of utilities. Surface water associated with TNTB is limited to the beginning of Ransom Brook, located north of the site. No explosive residues were identified by the analysis of one surface water and one sediment sample from this area. Additional surface water and sediment samples were taken; the analytical results are evaluated in a residential exposure scenario.

TNT Area B is largely overgrown with grass, brush, and small trees. Two NASA facilities, the Hypersonic Tesing Facility and Nitrogen Dewars, are located in the northwest and central portions of TNT Area B, respectively. Except for these two facilities, TNT Areas B is unused (USACE, 1998b). Current site use is considered industrial

The future use of TNTB is not certain. Although it is expected that future use will be industrial, the possibility exists that release of the site may, at some time in the future, result in development for residential purposes. Therefore, exposure scenarios evaluated for the site include both industrial and residential receptors (Section 3.1.3). It is assumed that bedrock groundwater may be developed as a source of potable water. The shallow or perched groundwater is transient and not considered a potential source of potable water.

Both shallow and deep groundwater associated with TNTB will be evaluated under a forthcoming site-wide RA, following additional groundwater characterization at PBOW. It is assumed that the deep groundwater aquifer could be developed as a source of potable water in the future. The shallow groundwater is not considered a plausible source of potable water under either current or future receptor scenarios. Incidental contact with shallow groundwater (dermal contact and inhalation of VOC emissions), however, is plausible during construction projects. Therefore, incidental contact with shallow groundwater, and the potential development of the deep groundwater as a source of potable water, will be developed and evaluated as plausible exposure scenarios in the forthcoming site-wide RA.

The RA is based on U.S. Environmental Protection Agency (EPA), USACE, and Ohio Environmental Protection Agency (OEPA) guidance, including, but not limited to, the following:

- Ohio Environmental Protection Agency, 1993, *Closure Plan Review Guidance for RCRA Facilities*, Interim Final, OEPA Division of Hazardous Waste Management, September 1.

- EPA, 1989a, *Risk Assessment Guidance for Superfund*, Volume I, Human Health Evaluation Manual (Part A), Interim Final, Office of Emergency and Remedial Response, Washington, DC, EPA/540/1-89/002.

- EPA, 1991, *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance, Standard Default Exposure Factors*, Interim Final, Office of Solid Waste and Emergency Response, OSWER Directive: 9285.6-03.

- EPA, 1992a, *Supplemental Guidance to RAGS: Calculating the Concentration Term*, Office of Solid Waste and Emergency Response, Washington, DC, Publication 9285.7-081.

- EPA, 1992c, "Guidance on Risk Characterization for Risk Managers and Risk Assessors," Memorandum from F. Henry Habicht II, Deputy Administrator, to Assistant Administrators, Regional Administrators, February 26, 1992.

- USACE, 1995, *Risk Assessment Handbook, Volume I: Human Health Evaluation*, Engineer Manual EM 200-1-4.

The remainder of this document is organized as follows. Chapter 2.0 describes data evaluation for the RA, which includes selection of chemicals of potential concern (COPC) for each medium of interest, and estimation of source-term concentrations for each COPC in each medium. Chapter 3.0 describes the exposure scenarios and the rationale by which plausible receptors are selected, the pathways by which they may be exposed, the exposure-point concentrations of COPC, and the estimated dose or contact rates for each of the COPC. Chapter 4.0 describes the hazard evaluation, i.e., the adverse health effects associated with each of the COPC, and the dose-response evaluation, i.e., the relationship between dose or contact rate and the magnitude or risk of the adverse effect. Chapter 5.0 combines the output of the exposure analysis and the toxicity analysis to quantify cancer risk and noncancer hazard to each receptor, identifies chemicals of concern (COC), which are the chemicals responsible for unacceptable risk or hazard estimates, develops applicable or relevant and appropriate requirements (ARAR) for the COC, and identifies risk-based remediation criteria (RBRC) for the COC. Chapter 6.0 describes the uncertainty associated with the point risk and hazard estimates in the RA. Chapter 7.0 briefly summarizes the protocol of the RA and interprets the results in the context of the uncertainty about their estimation. Chapter 8.0 presents the references used in the preparation of this document.

2.0 Data Evaluation

Data from analysis of soil, sediment and surface water samples collected in November 1998 are used in the RA. All sampling and analysis was conducted in accordance with the quality assurance project plan and the health and safety plan included in the approved work plans (IT, 1996, 1998a). Environmental samples were delivered under chain-of-custody to the laboratories for analysis according to EPA-specified methods. The analysis and data reports followed the methods specified, and the data were validated as described in the work plans.

2.1 Identification of COPC

Results of analysis for chemicals in soil, sediment, and surface water are provided in Appendix A. Lists of chemicals detected in site samples that include all chemicals detected in surface and subsurface soil, combined surface and subsurface soil, surface water, and sediment are shown in Tables 2-1 through 2-6 by site medium. COPC were selected from these lists as described below.

2.1.1 Sorting the Analytical Data

The data for each chemical were sorted by medium. Chemicals for which all samples yield nondetects in all samples from a medium were considered not to be present and were not evaluated further for that medium. Surface soil (0 to 1 foot below ground surface [bgs]) and subsurface soil (1 to 10 feet bgs) were considered as separate media. Surface and subsurface soil data were combined for assessment of exposures under the construction and residential land-use scenarios, which involve excavation and mixing of surface and subsurface soil. Combined surface and subsurface soil data are termed "total soil" in this RA. The combination consists of the higher source-term concentration for each COPC from the surface soil and subsurface soil evaluations.

2.1.2 Evaluating Data Quality

The data validation process incorporated qualifiers to the analytical results that indicate the level of confidence in the reported measurements. The data qualifiers introduced in the results of soil analysis and their meanings are (EPA, 1989a):

- U - Chemical was analyzed for but not detected; the associated value is the sample quantitation limit.

- J - Value is estimated, probably below the contract-required quantitation limit.
- N - The analysis indicates an analyte for which there is presumptive evidence to make a "tentative identification."
- NJ - The analysis indicates a "tentatively identified" analyte and the reported value represents its approximate concentration.
- UJ - The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
- R - QC indicates that the data are unusable (chemical may or may not be present).
- B - Inorganic chemicals: the concentration is less than the contract-required detection limit but greater than the instrument detection limit. Organic chemicals: the concentration in the sample is not sufficiently higher than concentration in the blank, using the five-times, ten-times (5x, 10x) rule. A chemical is considered a nondetect unless its concentration exceeds five times the blank concentration. For common laboratory contaminants (acetone, 2-butanone [methyl ethyl ketone], methylene chloride, toluene and the phthalate esters), the sample concentration must exceed ten times the blank concentration to be considered a detection.

"J", "N", and "NJ" qualified data are used in the RA; "R" and "B" qualified data are not. The handling of "U" and "UJ" qualified data (nondetects) in the RA is described in Section 2.2.

Two chemicals, 2,4-DNT and 2,6-DNT, were analyzed under two different analytical methods: Method 8330 for explosives and Method 8270B for semivolatile organic compounds. Generally, Method 8330 provides greater sensitivity for these two compounds, as reflected in slightly lower reporting limits for Method 8330 compared with Method 8270B. Therefore, only data from Method 8330 were used for evaluating 2,4- and 2,6-DNT in the RA.

2.1.3 Identifying Site-Related Chemicals

Identifying site-related and background chemicals is a matter of professional judgement that must be addressed for each chemical individually. Chemicals that are reasonably likely to be related to operations at the TNTB site are termed site-related chemicals in this RA. Chemicals present at naturally occurring concentrations or those present because of human activity entirely unrelated to army activity are termed background chemicals. Chemicals identified as site-related or background chemicals were evaluated in site-related risk and background risk, respectively.

Risks associated with all compounds identified were evaluated in total site risk. These designations are described fully in Chapter 5.0.

For most organic chemicals, identification at concentrations above levels in blanks (considering the 5x, 10x, rule; see Section 2.1.2) is presumptive evidence of site-related activity. Some organic chemicals, however, may occur as a result of activity not associated with site-related releases. Such chemicals, designated anthropogenic background, may include herbicides in agricultural areas where crops are grown, and polynuclear aromatic hydrocarbons (PAH), which form by natural or anthropogenic combustion of organic matter, including fossil fuels. PAHs were detected in samples collected at the site. However, the data are not sufficient to determine whether the concentrations measured represent anthropogenic background or site-related releases. In the absence of sufficient background data, all the PAHs in all media are considered to be site-related chemicals.

Chemicals detected at the TNTB site were identified for this RA according to the following general considerations: review of chemicals used during site operations, frequency of detection, and occurrence as natural background.

Chemicals Used During Area B Operations. Chemicals related to TNTB operations were identified in previous site investigation plans (IT, 1996; D&M, 1997; IT, 1998a). All soil samples except one were analyzed for explosives and nitroaromatic compounds, metals, polychlorinated biphenyls (PCB), volatile organic compounds (VOC), and semivolatile organic compounds including PAHs. The exception was analyzed for explosives only. Sediment and surface water samples were analyzed for the same analytes.

Frequency of Detection. Inorganic or organic chemicals not detected in any sample from a medium, such as soil, were excluded from the assessment of exposures to that medium.

Detection of a chemical in at least one sample of a medium requires further evaluation. A chemical that was detected infrequently at low concentrations may be an artifact in the data that does not reflect site-related activity. Chemicals detected infrequently at high concentrations may identify the existence of "hot spots" and should be retained in the evaluation, unless other information indicates that their presence is unlikely to be related to site activities. Decisions to

keep or exclude chemicals detected in fewer than 5 percent of the samples analyzed for a medium were based on professional judgement as described in context below.

Background Occurrence. Identifying site-related metals is complicated by the natural background occurrence of metals in most environmental media. Background concentrations of metals reported previously (IT, 1998b) were used to identify TNTB site-related chemicals by comparing site analytical data with background data (Table 2-7). The comparisons were based on statistical techniques and professional judgement.

The primary approach involves comparing the maximum detected concentration (MDC) from site data with a background screening criterion (BSC). The BSC represents a theoretical upper limit on background; i.e., if the MDC of site data does not exceed the BSC it is likely that site concentrations reflect background conditions rather than a site-related release, and the chemical is considered a "background chemical." Development of the BSC depends on the nature of the background data set, which is tested for normality or lognormality. If the background data set fits neither a normal nor a lognormal distribution, it is considered nonparametric. Nonparametric distributions fit no reliably predictable pattern, which means that an upper limit on background cannot be predicted with confidence. Therefore, the MDC of the background data set is conservatively selected as the BSC for nonparametric background data sets. Normal and lognormal distributions, however, are somewhat more predictable, and an upper limit on background, called an upper tolerance limit (UTL), can be estimated at a quantifiable level of confidence. The background UTL is the concentration, with a probability of 0.95 (or a confidence of 95 percent), that will capture (or cover) 95 percent of background samples if a large number of samples were taken. Chemicals with MDCs less than the background UTL are considered to represent a natural background metal for the baseline RA (BLRA).

The UTLs for normally distributed background data sets are calculated as follows (EPA, 1989b):

$$UTL = \bar{x} + k(a) \qquad \text{Eq. 2.1}$$

where:

UTL = upper tolerance limit of background concentration (confidence factor of 0.95 and coverage of 95 percent)

$\bar{x}$ = arithmetic mean

a = standard deviation
k = tolerance factor (Appendix B, EPA, 1989b).

The same equation is used to estimate the UTL for lognormal background data sets, but the data are log-transformed before the arithmetic mean and standard deviation are calculated.

If the MDC exceeds the BSC, the chemical is considered a site-related COPC or the more rigorous Wilcoxon Rank Sum test (EPA, 1992d) was applied when the assignment of a chemical was equivocal. The more rigorous statistical analysis consists of comparing the site and background data sets to determine if both are drawn from the same population. The Wilcoxon Rank Sum test is used for this purpose because it is applicable to all data distributions, including nonparametric.

Statistical analysis was used in this BLRA as a tool to aid the exercise of professional judgement. Site data from uncontaminated areas with concentrations at the high end of background may "fail" statistical testing. The probability of this error is 5 percent under the assumptions of this 95 percent confidence, and is usually caused by limitations of sample size; i.e., the full range of actual background and site variation was not captured. The identification of metals as a site-related or background chemical is discussed in detail for each medium below.

Metals and organic chemicals identified as anthropogenic background were not eliminated from the RA; instead, they were included and evaluated in total site risk and background risk, but not in site-related risk. These designations are described fully in Chapter 5.0.

2.1.4 Risk-Based Screening

Risk-based screening for human health was used to focus the assessment on the site-related chemicals that may contribute significantly to overall risk. In this screen, chemical concentrations were compared with very conservative levels derived for standard exposure scenarios. The MDC was compared with the appropriate risk-based screening concentration (RBSC). If the MDC was less than or equal to the RBSC, the chemical in this medium was not considered further. If the MDC exceeded the RBSC, the chemical was considered to be a COPC.

Chemicals whose concentrations were below the RBSC were not identified as COPCs for the RA because it is very unlikely that they would cause significant risk. RBSCs for soil were EPA Region IX "residential soil" preliminary remediation goal (PRG) values EPA (1999) adjusted to

reflect an incremental lifetime cancer risk (ILCR) of 1E-7 and a hazard index (HI) of 0.1. Because the PRG value for lead is not based on a risk calculation (EPA, 1999), the value of 400 parts per million (ppm) was used without modification in the screening of soil and sediment data. Because a few chemicals detected in soil are not listed among EPA Region IX PRG values, PRG values were calculated using EPA (1999) methodology to provide screening criteria (Appendix B).

The mechanisms by which receptors are exposed to sediment are similar to those for soil, but exposure to sediment is likely to be far less intensive. Therefore, the soil RBSCs are adjusted upward by an order of magnitude for application to sediment. In other words, the unadjusted EPA (1999) residential soil PRGs are considered to reflect an ILCR of 1E-7 and an HI of 0.1 when used for screening chemical concentrations in sediment. Similarly, exposure to surface water is likely to be far less intensive than exposure to tap water. Therefore, the tap water RBSCs are adjusted upward by an order of magnitude for application to surface water. In other words, the unadjusted EPA (1999) tap water PRGs are considered to reflect an ILCR of 1E-7 and an HI of 0.1 when used for screening chemical concentrations in surface water.

Concern has arisen regarding potential effects on human health from inhalation of VOCs in indoor air from volatilization from subsurface soil or shallow groundwater. Potential receptors for these pathways include the on-site resident and an indoor worker. Indoor airborne concentrations of VOCs from subsurface soil, estimated as described in Section 3.2, were screened against the EPA (1999) ambient air PRGs adjusted to reflect an ILCR of 1E-7 and an HI of 0.1 (Table 2-3).

It is assumed that VOC concentrations that might accumulate in a building from shallow groundwater would be no higher than those encountered by a construction worker in a utilities ditch. Therefore, airborne concentrations of VOC in a utilities ditch, estimated as described in Section 3.2, will be subjected to risk-based screening to determine the need for evaluating this pathway. RBSCs for indoor air will be the EPA (1999) ambient air PRGs adjusted to reflect an ILCR of 1E-7 and an HI of 0.1. This evaluation will be performed in the forthcoming site-wide RA when groundwater data become available.

The risk-based screening previously described assumes that the RBSCs reflect a sufficiently conservative evaluation of the relevant exposure pathways. The sediment RBSCs may not be

sufficiently conservative to screen sediment in water bodies from which fish could be harvested and consumed because they do not address bioaccumulation by fish. Similarly, the surface water RBSCs may not be sufficiently conservative to screen surface water from which fish are taken. These concerns pertain specifically to chemicals known to bioaccumulate in aquatic food chains (i.e., PCBs and mercury). However, fish consumption is not a concern at TNTB because Ransom Brook in the area of the site does not support sport or subsistence fishing. Therefore, PCBs and mercury were subjected to the same screening criteria used for other chemicals.

2.1.5 Evaluating Essential Nutrients

Essential nutrients such as calcium, iron, magnesium, potassium, and sodium are usually eliminated as COPC because they are generally considered innocuous in environmental media. Other essential nutrients including chloride, iodine and phosphorus may be eliminated as COPC, provided that their presence in a particular medium is judged to be unlikely to cause adverse effects on human health.

2.1.6 Summary of COPC Selection

Chemicals detected in soil, surface water or sediment at TNTB (Appendix A) were identified as site-related COPCs or background chemicals as described above. The results are shown in Tables 2-1 through 2-5. The table for each medium show the following information:

- Chemical name
- Frequency of detection
- Range of detected concentrations
- Range of detection limits
- Statistical distribution of the data
- Arithmetic mean of site concentrations
- Upper confidence limit (UCL) of the arithmetic mean
- Background screening criterion
- Appropriate RBSC
- Selection as site-related COPC
- Designation as a background COPC
- Source-term concentration.

Footnotes in the tables provide the rationale for rejection of a chemical as a COPC.

2.1.6.1 Surface Soil

Frequency of Detection. The frequency of detection for all chemicals detected in surface soil was greater than 5 percent except for five VOC compounds and 4,6-dinitro-2-methylphenol (Table 2-1). All were excluded as COPCs based on comparison of the MDC values with their respective risk-based concentrations (RBC).

Background COPC. The following metals were identified as background COPC in surface soil: aluminum, arsenic, copper, iron, manganese, and thallium (Table 2-1). All of the listed metals were identified based on comparison of the MDC with the BSC (Table 2-6) except for copper and thallium, which were not shown to be significantly above background by the Wilcoxon Rank Sum test (Appendix C). They were evaluated for their contribution to background risk and total risk.

Risk-Based Screening. Six metals, two Aroclors, several PAHs, and five nitroaromatic compounds were selected as COPC because their MDCs exceed their RBSCs. All except the metals were evaluated for their contribution to total risk and site-related risk.

Analysis for nitroaromatic compounds required dilution of samples #10620 and #10630 by factors of 1,000 and 100, respectively, to quantify the 2,4,6-TNT concentrations. Because the dilution factors were applied to the detection limits for all other nitroaromatic compounds, the reported detection limits for all other compounds in those samples were elevated to either 250 or 2,400 ppm (Table 2-1). The elevated detection limits are greater than the maximum quantitated concentrations in the undiluted samples and exceed the RBC values for 2,4-DNT and 2,6-DNT. When such elevated detection limits are encountered, EPA (1989a) guidance provides for removal of the values from the data set if they are greater than the maximum quantitated concentration.

This EPA guidance was applied to identify COPCs among nitroaromatics using professional judgement and is illustrated using 2,4-DNT as an example. Application of a dilution factor of 1,000 to the detection limit for an undiluted sample (0.25 ppm) resulted in a reported maximum detection limit of 250 ppm (Table 2-1). This elevated detection limit is more than a factor of 100 greater than the maximum quantitated concentration of 2.3 ppm. Therefore, the data from analysis of sample #10620 for 2,4-DNT was removed from further calculations. A reported

detection limit of 25 ppm (not shown in Table 2-1) also resulted from a dilution factor of 100 applied to the 0.25 ppm detection limit for an undiluted sample. This elevated detection limit is more than a factor of 10 greater than the maximum quantitated concentration of 2.3 ppm and the analysis of sample #10620 for 2,4-DNT was also removed. An additional sample was also diluted by a factor of 20 which resulted in an elevated detection limit of 5 ppm (Table 2-1). However, the elevated detection limit was judged to be sufficiently similar to the maximum quantitated value that it could reflect the true upper range of the 2,4-DNT concentration in surface soil at the site.

Exclusion of the two elevated detection limits from samples #10620 and #10630 removed two sources of uncertainty in the data. The resulting data set included twenty-seven of the twenty-nine original values, including seven detected values, such that the frequency of detection was substantially preserved. Two elevated detection limits from analysis of samples #10620 and #10630 were similarly excluded from 2,6-DNT data.

2.1.6.2 Subsurface Soil

Frequency of Detection. Because fewer than 20 subsurface samples were collected, screening of data for less than 5 percent frequency of detection was not done (Table 2-2).

Background COPC. The following metals were identified as background COPC in subsurface soil: aluminum, arsenic, chromium, iron, and manganese (Table 2-2). All of the listed metals were identified as background based on comparison of the MDC with the BSC (Table 2-6). They were evaluated for their contribution to background risk and total risk.

Risk-Based Screening. Five metals, two Aroclors, one PAH (benzo[a]pyrene) and seven nitroaromatic compounds were selected as COPC because their MDCs exceed their RBSCs. All except the metals were evaluated for their contribution to total risk and site-related risk.

Table 2-3 presents the results of risk-based screening of VOC concentrations in indoor air from volatilization from subsurface soil. Four VOCs were identified at low concentrations in subsurface soil. Modeled indoor air concentrations were orders of magnitude below the RBSCs. It is concluded that indoor workers or residents would be under no threat from airborne concentrations of VOCs, and this exposure pathway is not evaluated further.

2.1.6.3 Combined Surface and Subsurface Soil ("Total Soil")

Total soil (Table 2-4) consists of the higher source-term concentration for each COPC from the surface soil (Table 2-1) and subsurface soil (Table 2-2) evaluations.

2.1.6.4 Surface Water

Frequency of Detection. Because fewer than 20 surface water samples were collected, screening of data for less than 5 percent frequency of detection was not done (Table 2-5).

Background Analytes. Because no data are available to describe background concentrations of metals in surface water, COPCs were identified by risk-based screening only, and no background risk was evaluated for surface water exposures.

Risk-Based Screening. Arsenic, iron, lead, and manganese were identified as COPCs in surface water (Table 2-5), and were included in the assessment of site-related risk and total risk. All other chemicals were excluded based on comparison of the MDC with the "tap water" RBSC value.

2.1.6.5 Sediment

Frequency of Detection. Because fewer than 20 sediment samples were collected, screening of data for less than 5 percent frequency of detection was not done (Table 2-6).

Background Analytes. Data are not available to describe background concentrations of metals in sediment; therefore, COPC were identified by risk-based screening only, and no background risk was evaluated for exposure to sediment.

Risk-Based Screening. Arsenic, iron, and manganese were selected as COPC because their MDCs exceed their RBSCs. All were evaluated for their contribution to total risk and site-related risk.

2.2 Developing Source-Term Concentrations

2.2.1 Soil, Surface Water, and Sediment

Because of the uncertainty associated with characterizing contamination in environmental media, both the mean and the UCL of the mean were estimated for each COPC in each medium of interest. The upper 95 percent confidence limit on the mean is generally referred to as the UCL. Unusually high values are included in the calculation of the UCL because high values seldom appear as statistical outliers in environmental data and may identify areas that require evaluation as hot spots. Inclusion of outliers increases the overall conservatism of the risk estimate.

Data sets consisting of five or more data points were tested for normality and lognormality with the Shapiro-Wilks test (EPA, 1992d) using the software package STATISTICA™. Statistical analysis is performed only on those chemicals identified as background or site-related COPCs. Either a normal or lognormal UCL was calculated, whichever provides the better fit in the Shapiro-Wilks test. A nonparametric confidence limit was used when the data fitted neither a normal nor lognormal distribution.

The UCL was calculated for a normal distribution as follows (EPA, 1992a):

$$UCL = \bar{x} + t_{1-\alpha,n-1}\,(s/\sqrt{n}) \qquad \text{Eq. 2.2}$$

where:

UCL = upper 95th confidence limit on the arithmetic mean concentration (calculated)
$\bar{x}$ = sample arithmetic mean
t_1 = critical value for Student's *t*-test
α = 0.05 (95 percent confidence limit for a one-tailed test)
n = number of samples in the data set
s = sample standard deviation.

The UCL was calculated for a lognormal distribution as follows (Gilbert, 1987):

$$UCL = e^{\left(\bar{y} + (0.5 \cdot s_y^2) + \left[H_{0.95} \cdot \frac{s_y}{(n-1)^{0.5}}\right]\right)} \qquad \text{Eq. 2.3}$$

where:

UCL = upper 95th confidence limit on the arithmetic mean concentration (calculated)
$\bar{y}$ = $\sum y/n$ = sample arithmetic mean of the log-transformed data, $y = \ln x$
s_y = sample standard deviation of the log-transformed data
n = number of samples in the data set
$H_{0.95}$ = value for computing the one-sided upper 95 percent confidence limit on a lognormal mean from standard statistical tables (Land, 1975).

If the data distribution was nonparametric, the data point selected as the nonparametric UCL was estimated as the 95 percent UCL rank order on the arithmetic mean of the data set. It was estimated by ranking the data observations from smallest to largest. The arithmetic mean was converted to a percentile by interpolation. The rank order of the data point selected as the UCL was estimated from the following equation (Gilbert, 1987):

$$u = p(n+1) + Z_{1-\alpha}\sqrt{np(1-p)} \qquad \text{Eq. 2.4}$$

where:

u = rank order of value selected as UCL, calculated
p = percentile corresponding to the arithmetic mean
n = number of samples in the data set
α = confidence limit (95 percent)
$Z_{1-\alpha}$ = normal deviate variable.

Analytical results for a chemical were reported as "nondetects" ("U" qualifier) whenever measured concentrations in samples did not exceed the detection limit for the analytical procedure used (Appendix A).

The detection limit is the lowest concentration of a chemical that can be "seen" above the normal, random noise of an analytical method. A concentration value must be assigned to nondetects for application of the above statistical procedures. For this RA, nondetects are assumed to be present at one-half the sample quantitation limit (SQL) concentration (EPA, 1989a). Judgement is used in those cases where dilution drove the SQL unusually high (Section 2.1.6).

The UCL or MDC, whichever was smaller was selected as the source-term concentration, and is understood to represent a conservative estimate of average for use in the RA or in various

transport models used to estimate exposure-point concentrations. Application of this protocol is based on the assumption that exposure to the medium of interest occurs in a random fashion.

The soil at TNTB, however, presents special concerns. As previously noted, the site consists of a large area (approximately 55 acres) on which three process lines were located. Earlier investigations (D&M, 1997) revealed that contamination levels vary widely and are highest near the locations of the former buildings in the process lines. To ensure that areas of potentially high concentrations were not overlooked, USACE (1998a) specified that approximately 400 composite surface soil samples would be analyzed on the site for explosives by ion mobility spectroscopy (IMS). The baseline human health RA work plan (IT, 1998c) described the sampling and analysis method used at the site. Details of the field investigation are provided in Chapter 2.0 of the report of findings document (Volume I); details of the results of the composite and confirmation samples are presented in Chapter 4.0 of the report of findings document. The RA data consists of noncomposited soil samples analyzed for nitroaromatics by SW-846 Method 8330.

The exposure unit concept was applied in creating the data sets for use in the RA and developing source-term concentrations. The exposure unit represents the area to which a receptor would be exposed, within which this exposure is assumed to be random. For example, the groundskeeper was assumed to work at any random location on the entire 55-acre site and is not expected to work at any single location for the entire time assumed for exposure (25 years). Therefore, all site data were used to develop source-term concentrations to assess risks to the groundskeeper. On the other hand, a typical residence or the area of exposure for a construction worker may not exceed 1 acre and a subset of the total data might be more appropriate to assess the associated risks. Application of the unit exposure concept is discussed in Chapter 5.0.

For this RA, the groundskeeper was assumed to be exposed to surface soil in the current and future site-use evaluations. Therefore, data from all surface soil samples (Table 2-1) were used to calculate the source concentration for the groundskeeper exposure assessment.

The resident was assumed to be exposed to total soil, a combination of surface soil and subsurface soil, because residential development of the site would involve excavation and grading, which would distribute subsurface soil on the surface and obscure the distinction between surface and subsurface soil. It was assumed that the future resident would reside at a

randomly chosen lot on the site. Therefore, the combined data from surface and subsurface soil samples (Table 2-4) were used to calculate the source concentration for the on-site resident exposure assessment.

The construction worker was assumed to be exposed to total soil, a combination of surface soil and subsurface soil, in both the current and future site use scenarios, because construction activities are expected to involve excavation and grading. Similarly, it was assumed that the construction site might be randomly located on the site and the combined data from surface and subsurface soil samples (Table 2-4) were used for the construction workers' exposure assessment. Alternate potential construction sites were evaluated also (Chapter 5.0).

2.2.2 Groundwater

There are no groundwater sample analysis data available for the TNTB site. The RA for potential groundwater exposures will be completed when the data become available.

3.0 Exposure Assessment

Exposure is the contact of a receptor with a chemical or physical agent. An exposure assessment estimates the type and magnitude of potential exposure of a receptor to COPCs found at or migrating from a site (EPA, 1989a). An exposure assessment includes the following steps:

- Characterize the physical setting.
- Identify the contaminant sources, release mechanisms, and migration pathways.
- Identify the potentially exposed receptors.
- Identify the potential exposure pathways.
- Estimate exposure concentrations.
- Estimate chemical intakes or contact rates.

3.1 Conceptual Site Exposure Model

The conceptual site exposure model (CSEM) provides the basis for identifying and evaluating the potential risks to human health in the baseline RA. The CSEM (Figure 3-1) includes the receptors appropriate to all plausible land-use scenarios, and the potential exposure pathways. Graphically presenting all possible pathways by which a potential receptor may be exposed, including all sources, release and transport pathways, and exposure routes, facilitates consistent and comprehensive evaluation of risk to human health, and helps ensure that potential pathways are not overlooked. The elements of a CSEM include:

- Source (i.e., initially contaminated environmental) media
- Contaminant release mechanisms
- Contaminant transport pathways
- Intermediate or transport media
- Exposure media
- Receptors
- Routes of exposure.

Contaminant release mechanisms and transport pathways are not relevant for direct receptor contact with a contaminated source medium.

The receptors and pathways in Figure 3-1 reflect plausible scenarios developed from information regarding site background and history, topography, climate, and demographics as presented in the scope of work (USACE, 1998a) and the site investigation final report (D&M, 1997).

Asterisks identify exposure pathways that are complete and addressed in the RA. Justification for exclusion of other pathways is provided in the footnotes.

3.1.1 Physical Setting

The physical setting of TNTB is briefly summarized in Chapter 1.0. Although brief, the description supports the receptors and exposure pathways illustrated in Figure 3-1. Greater detail is provided in USACE (1998a) and D&M (1997).

3.1.2 Contaminant Sources, Release Mechanisms, and Migration Pathways

Briefly, TNT is made by nitrating toluene in a three-step process that uses nitric and sulfuric acids (D&M, 1997). The processing lines consist of individual buildings connected by pipelines that carry reagents and the reaction products. Contamination involved the inadvertent release of TNT, its precursors, contaminants and residues, acids or sellite from the process lines or drying or packaging areas. Releases occurred to the surface soil and, from leaking or damaged underground pipelines, to subsurface soil. Runoff and erosion may have spread contamination over the surrounding surface soil and carried it to Ransom Brook to the north of the site. Infiltration and leaching may have carried contaminants into the subsurface soil or groundwater. VOCs may volatize from soil or groundwater to ambient air or to air inside of buildings.

3.1.3 Receptors and Exposure Pathways

Receptors, selected to represent the upper bound on exposure from all plausibly exposed groups of people at TNTB, and the pathways by which they might be exposed, are summarized in Figure 3-1 and Table 3-1. The exposure variable values used in the contaminant intake models are compiled in Table 3-2. Chemical-specific variable values are compiled in Table 3-3.

The RA was based on a reasonable maximum exposure (RME) assumption. The intent of the RME assumption was to estimate the highest exposure level that could reasonably be expected to occur, but not necessarily the worst possible case (EPA, 1989a, 1991). It is interpreted as reflecting the upper 90 to 95th percentile of exposure. In keeping with EPA (1991) guidance, upper bounds of variables were chosen for the RME scenario for intake rate, exposure frequency (EF) and exposure duration (ED). Other variables, e.g., body weight (BW) and exposed skin surface area (SA), were central or average values. In the case of contact rates consisting of multiple components, e.g., dermal contact with soil or water, which consists of a dermal absorption factor (ABS) and soil-to-skin adherence factor (AF) for soil, and permeability coefficient (PC) and

exposure time (ET) for water, only one variable, ABS or PC needs to be an upper bound. The conservatism built into the individual variables ensures that the entire estimate for contact rate is more than sufficiently conservative.

The averaging time (AT) for noncancer evaluation was computed as the product of ED (years) times 365 days/year, to estimate an average daily dose over the entire exposure period (EPA, 1989a). For cancer evaluation, AT was computed as the product of 70 years, the assumed human lifetime, times 365 days/year, to estimate an average daily dose prorated over a lifetime, regardless of the frequency or duration of exposure. This methodology assumes that the risk from short-term exposure to a high dose of a given carcinogen is equivalent to long-term exposure to a correspondingly lower dose, provided that the total lifetime doses are equivalent. This approach is consistent with current EPA (1986) policy of carcinogen evaluation, although it introduced considerable uncertainty into the cancer RA.

A fractional term (FI) was included in the chemical intake equations to account for scenarios in which exposure to a potentially contaminated medium is less than total daily exposure to that medium. For example, if the site of interest is small, so that a groundskeeper may spend only one-half of his working time at the site, an FI of 0.5 was applied to the soil ingestion and dermal intake equations. An FI was used also if a receptor's exposure was split between two comparable media. For example, if an on-site resident was exposed to both soil and stream sediment, FIs were introduced that apportion his exposure between the two media. The default value of FI is 1.

3.1.3.1 Groundskeeper

The groundskeeper scenario was designed to evaluate the upper bound for site worker exposure to surface soil in the current and future site-use scenario. Direct exposure pathways include incidental ingestion and dermal contact with soil. Inhalation of dust, raised by operating lawn mowers or other equipment, was also evaluated. It was assumed that relatively high dust concentrations would be produced within the groundskeeper's breathing zone, with little opportunity for dilution by the large volume of ambient air. In the future, the groundskeeper may be exposed to groundwater developed as a source of potable water. Scenarios and pathways for exposure to groundwater will be developed in the site-wide RA when groundwater data become available.

Generally, in IT experience, surface soil that has been in place for extended periods and has not been recently contaminated is not a significant source of airborne VOCs because infiltration and dissipation over time would have reduced residues at the surface to toxicologically insignificant levels. VOCs, however, were detected in surface soil, albeit at concentrations below RBSCs, probably from soil at the bottom of the 0 to 1 foot bgs depth range from which surface soil samples were taken. Had VOCs in surface soil been identified as COPC, it would have been assumed that concentrations in air estimated by the activity-based dust emissions model would have been sufficiently conservative for the RA.

It was assumed that any contact with surface water or sediment would be infrequent, and groundskeeper exposure to these media is not considered.

The groundskeeper is assumed to be a 70-kilogram adult who works 8 hours per day, approximately 5 days per week year-round on the site for a total of 250 days per year for 25 years (EPA, 1991). The respiratory rate for the groundskeeper is assumed to be 20 cubic meters (m^3)/8-hour workday (2.5 m^3/hour), and the soil incidental ingestion rate is assumed to be 100 milligrams per day (mg/day).

Recent studies evaluating soil adherence that consider the nature of the activity performed and the different body regions were reviewed by EPA (1997a). Measurements of soil adherence to hands, arms, legs, feet, and face for 29 groundskeepers revealed AFs ranging from 8E-4 milligrams per square centimeter (mg/cm^2) (legs) to 1.5E-1 (hands). The AF weight-averaged across these body regions (i.e., adjusted to reflect the different surface areas of the different body regions) for males and females is 9E-3 mg/cm^2, which is used in this evaluation. The surface area of body regions evaluated for groundskeepers include approximately 11,300 cm^2 (EPA, 1997a).

3.1.3.2 Construction Worker

The construction worker scenario was created to evaluate short-term exposure to subsurface as well as surface soil in either a current or future land-use scenario. Relevant exposure pathways include incidental ingestion and dermal contact. Inhalation of VOC vapor and dust raised by operating construction equipment was also evaluated. Construction activity may uncover subsurface soil concentrations of VOCs, facilitating emission of the vapors into the construction worker's breathing zone.

The construction worker may also be exposed to surface water and sediment during projects such as installation of underground utilities. Dermal contact is the most significant pathway for exposure to surface water. Incidental ingestion of surface water is also possible, but is not expected to be nearly as significant as dermal contact. Inhalation of VOCs from surface water is also possible but the large volume of outdoor air and natural air currents are expected to dilute airborne concentrations so that this pathway is expected to less significant than dermal contact, which is quantified. For these reasons incidental ingestion and inhalation of VOCs are not quantified.

The construction worker may be exposed to shallow groundwater by dermal contact during construction projects. Inhalation of VOCs that volatilize from shallow groundwater is another plausible exposure pathway. In the future, the construction worker may be exposed to deep groundwater developed as a source of potable water. Scenarios and pathways for exposure to shallow and deep groundwater will be developed in the site-wide RA when groundwater data become available.

The construction worker was assumed to be a 70-kilogram adult who works 8 hours per day, approximately 5 days/week on the site for a total of 6 months (EPA, 1991). The respiratory rate for the construction worker was assumed to be 20 m^3/8-hour workday (2.5 m^3/hour) (EPA, 1991). Excavation, grading, installation, or repair of underground utilities and similar activities requiring constant contact with the soil or earth-moving or grading equipment result in intensive exposure to soil and were assumed to last for 3 months. Construction activities such as building erection result in less intensive exposure to soil and were also assumed to last for 3 months. Soil ingestion rates of 480 (EPA, 1993) and 100 mg/day (EPA, 1991) were assumed for the intensive and less intensive soil contact periods, respectively resulting in a time-weighted average rounded to 290 mg/day.

An AF for a construction worker of 8E-2 mg/cm^2 is estimated using the same method as previously described for the groundskeeper, combining EPA (1997a) data for construction workers, utility workers, and equipment operators to capture the full range of activities likely to be performed by this receptor. The body regions evaluated for construction workers include the hands, arms, legs, feet, and face, which total approximately 11,300 cm^2.

As noted above, the construction worker may be exposed to surface water and sediment during the 6-month construction period. Dermal exposure to surface water and sediment is assumed to occur on 4 hours per day, or one-half the normal workday. An FI of 0.5 is assumed for both the soil and sediment pathways to apportion the construction worker's time equally between the two media. The incidental ingestion rate for sediment is assumed to be 480 mg/day, because contact with sediment during the construction period may be intense. It is assumed that the arms, forearms, and hands, an SA of approximately 3,100 cm^2 (EPA, 1997a), is exposed to surface water and sediment. An AF for sediment of 0.24 mg/cm^2 (EPA, 1997a) is estimated for the hands and arms using the same method as described for the groundskeeper exposure to soil, using data for construction workers, utility workers, and equipment operators.

3.1.3.3 On-Site Resident

The on-site resident scenario was created to evaluate the upper bound for exposure to surface water, sediment, and soil under the future land-use scenario. The resident was assumed to be exposed to total surface and subsurface soil because residential development of the site would involve excavation and grading, which would mix surface and subsurface soil. Relevant pathways for soil exposure include incidental ingestion, dermal contact, and inhalation of VOC vapors and dust. For evaluating inhalation exposure to dust, it is assumed that 80 percent of the surface is covered with pavement or vegetation. Inhalation of VOCs released from subsurface soil and entrapped in indoor air is also evaluated. In the future, the resident may be exposed to groundwater developed as a source of potable water. Scenarios and pathways for exposure to grountwater will be developed in the site-wide risk assessment when groundwater data become available.

Airborne concentrations of VOCs from soil are not evaluated separately from levels generated by the wind erosion model because it is assumed that the topmost layer of soil, from which volatilization would be most significant, will remain relatively undisturbed and that most VOCs would have dissipated by the time construction is finished and occupation is established.

The resident could have access to Ransom Brook and could be exposed to surface water and sediment. Ransom Brook begins north of TNTB. In the area of the site is a shallow intermittent stream generally without water during the warmer periods of the year during which wading or water play would be more frequent. It was assumed that the resident would visit the brook for 8 hours per day, 2 days per week during the warmer half of the year (i.e., 52 days per year), during

which time he would be in contact with sediment. The resident was assumed to wade for 3 hours per day on 52 days per year, exposing his feet, lower legs, hands and forearms, or approximately 30 percent of his body surface area to surface water (EPA, 1997a). Plausible exposure pathways include dermal contact with surface water, inhalation of VOC vapors released from surface water, and incidental ingestion and dermal contact with sediment. Incidental ingestion of surface water in a wading scenario was assumed to be negligible.

Inhalation of VOC emissions from surface water is also possible, but the large volume of outdoor air and natural air currnets are expected to dilute airborne concentrations so that this pathway is expected to less significant than dermal contact, hwich is quantified. For these reasons, inhalation of VOC emissions from surface water is not quantified separately from dermal contact.

The on-site residential scenario was evaluated using both adults and children. Cancer risk was estimated as the sum of the risks calculated for the adult and the child. The child was used for the noncancer evaluation. This approach captures the greater conservatism of the larger incidental soil and sediment ingestion rates for the child, when normalized for BW.

The adult resident was assumed to be a 70-kilogram person with an incidental soil/sediment ingestion rate of 100 mg/day and an inhalation rate of 20 cubic meters per day (m^3/day) (0.83 m^3/hour) (EPA, 1991). Approximately 30 percent of his total body SA, or 5,450 cm^2, was assumed to be exposed to surface water while wading (EPA, 1992b). Body SA exposed to soil or sediment was assumed to be 25 percent of total SA, or approximately 4,550 cm^2 (EPA, 1992b). The adult resident was assumed to be exposed to soil 350 days per year for 24 years (EPA, 1991, 1999).

The resident child was assumed to be a 1- through 6 year-old with an average BW of 15 kilograms, a soil/sediment ingestion rate of 200 mg/day, and an inhalation rate of 10 m^3/day (0.42 m^3/hour) (EPA, 1999). Approximately 30 percent of total body SA or 2,100 cm^2 was assumed to be exposed to surface water while wading (EPA, 1992b). Body SA exposed to soil or sediment was assumed to be 25 percent of total SA, or approximately 1,750 cm^2 (EPA, 1992b). The child receptor was assumed to be exposed to soil for 350 days per year for 6 years.

EPA (1989a) permits the development of a fraction to reflect the proportion of total daily exposure that a receptor obtains from potentially contaminated medium. In this scenario, the FI was used to apportion the resident's time of exposure between site soil and sediment. It was assumed that the resident spends 16 hours per day awake and potentially exposed to soil or sediment. As previously noted, 350 days per year are available for contact with soil; 52 of those days are also available for contact with sediment. It was assumed that contact with soil and sediment does not occur simultaneously; i.e., on those days when the resident spends time at the brook, 8 hours would be spent in contact with surface soil and 8 hours would be spent in contact with sediment. The fraction of exposure to soil, therefore, is 16 hours/16 hours = 1 on the 298 days without time spent at the brook, and 8 hours/16 hours = 0.5 on the 52 days with some time spent at the brook. An overall weighted fraction of 0.93 (rounded to 0.9) is estimated for exposure to soil. An overall weighted fraction of 0.07 (rounded to 0.1) is estimated for exposure to sediment.

The inhalation rate of the adult resident, 20 m^3/day, is multiplied by 16.4 hours/24 hours per day to estimate a daily indoor inhalation rate of 13.7 m^3/day. An indoor inhalation rate of 6.8 m^3/day is estimated in the same manner for the child resident.

An average soil and sediment AF of 0.2 mg/cm^2 (EPA, 1992b) was used in this evaluation.

3.1.3.4 Indoor Worker

This receptor scenario is created to evaluate exposure to indoor airborne VOCs entrapped in a building. VOCs released from subsurface soil or shallow groundwater may enter a building through joints or cracks in the foundation or slab. The indoor worker is also potentially exposed to surface soil via incidental ingestion. Dermal exposure, although plausible, is expected to be far less significant than incidental ingestion and is not quantified separately. In the future, the indoor worker may be exposed to groundwater developed as a source of potable water. Scenarios and pathways for exposure to groundwater will be developed in the site-wide RA when groundwater data become available.

The indoor worker is assumed to be a 70-kilogram adult who works 8 hours per day, approximately 5 days per week year-round on the site for a total of 250 days per year for 25 years (EPA, 1991). His soil incidental ingestion rate is assumed to be 50 mg/day, and his inhalation rate is assumed to be 20 m^3/8-hour workday.

3.1.3.5 Other Receptors Not Considered

Other plausible site workers include office workers and delivery personnel. These workers, however, would be less intensively exposed to soil than the groundskeeper; therefore, their exposures were not evaluated. TNTB could become part of the area used for National Guard training activities. National Guard trainees, however, would be less exposed to any of the potentially contaminated media than the previously described receptors and their exposures were not evaluated. Parts of PBOW are used for fishing and hunting. Ransom Brook, however, is a shallow intermittent stream in the vicinity of TNTB and will not support sport fishing. Also, TNTB is in an active industrial area that is not hunted and does not provide favorable habitat for game animals. Furthermore, IT's experience has been that the game ingestion pathway generally is insignificant for contaminants other than the polychlorinated dibenzo-p-dioxin/dibenzofuran, and the previously described receptors would represent the upper bound for exposure to soil, surface water, and sediment. For these reasons, a hunting scenario was not evaluated. Much of the land around PBOW is used for agriculture, and it is possible that areas of PBOW could be farmed in the future. The areas around TNTB, however, are not ideally suited for agriculture. Also, experience has shown that ingestion of home-grown grains, fruits, meat, poultry, eggs, or milk is generally insignificant compared with direct exposure pathways, except for polychlorinated dibenzo-p-dioxin/dibenzofurans; therefore, indirect food-chain exposures were not evaluated.

The last receptor considered was a trespasser or site visitor who would use the site for recreation. This scenario, however, is not plausible under the current site-use scenario, because the facility is fenced and patrolled. The site visitor scenario is plausible under the future site-use scenario (the fence and patrols may be removed in the future), but the resident would represent the upper bound on exposure, and evaluation of a site visitor is not necessary.

3.2 Quantification of Exposure-Point Concentrations

The exposure-point concentrations of COPC for direct exposure pathways for soil, surface water, and sediment were the source-term concentrations estimated as described in Section 2.2.

Exposure-Point Concentrations in Air. No VOCs were identified as COPCs in soil (Table 2-1 through 2-5). Therefore, calculations of COPC concentrations in outdoor air were confined to estimating airborne dust concentrations. As noted above, there is concern for inhalation

exposure to VOCs that volatilize from subsurface soil and become entrapped in a building. This is a plausible exposure scenario for the indoor worker and the on-site resident.

COPC Concentrations from Dust. Inhalation exposure to particulate (dust) emissions from soils for the groundskeeper and construction worker evaluations arise from activities that raise dust. Therefore, the most appropriate approach to estimating chemical concentrations in ambient air is the use of an activity-based dust loading equation (U.S. Department of Energy [DOE], 1989):

$$C_a = (D)(C_{so})(CF2) \qquad \text{Eq. 3.1}$$

where:

C_a = contaminant concentration in air (mg/m^3, calculated)
D = dust loading factor (grams [g] of soil/m^3 of air)
C_{so} = contaminant concentration in soil (milligrams per kilogram [mg/kg])
CF2 = conversion factor (1E-3 kg/g).

Plausible values for D include 2E-4 grams per cubic meter (g/m^3) for agricultural activity (DOE, 1989), 6E-4 g/m^3 for construction work (DOE, 1983), and 1E-4 g/m^3 for other activity (National Council on Radiation Protection and Measurements, 1984). The value for D of 1E-4 g/m^3 for other activity was used for the groundskeeper. It was assumed that construction activities requiring intimate contact with soil, for which D = 6E-4 g/m^3 is appropriate, would last for one-half of a construction period. The remaining one-half of the time is more realistically characterized by D = 1E-4 g/m^3; therefore, a time-weighted average dust loading factor for construction work of 3.5E-4 g/m^3 was estimated for the construction worker.

The resident is more likely to be exposed to dust arising from wind erosion rather than from dust-raising activities on the site. EPA (1996) derived a model for estimating a dust particulate emission factor based on an "unlimited reservoir" model and the assumption that the source area is square:

$$PEF = Q/C \cdot \frac{3600}{0.036 \cdot (1 - V) \cdot (U_m/U_t)^3 \cdot F(x)} \qquad \text{Eq. 3.2}$$

where:

PEF = particulate emission factor (m^3/kg, calculated)
Q/C = inverse of the mean concentration at center of square source (43.08 g/m^2-second per kg/m^3, site-specific value from Table 3 in EPA, 1996 [Zone 7, Cleveland, 30-acre site])
3600 = seconds/hour
V = fraction of surface covered with vegetation (0.8, unitless, assumed)
U_m = mean annual wind speed (default, 4.69 m/second)
U_t = equivalent threshold value of wind speed at 7 m (default, 11.32 m/second)
F(x) = function dependent on U_m/U_t (default, 0.194).

The concentration of COPC in air is calculated as follows:

$$C_a = \frac{C_{so}}{PEF} \qquad \text{Eq. 3.3}$$

where:

C_a = contaminant concentration in air (mg/m^3)
C_{so} = contaminant concentration in soil (mg/kg)
PEF = particulate emission factor (m^3/kg).

COPC Concentrations in Indoor Air. The RBSCs applied to subsurface soil for COPC selection do not address this pathway; therefore, an EPA (1997b) modification of the Johnson and Ettinger model is used to estimate airborne concentrations in indoor air.

Estimating indoor airborne concentrations from subsurface soil can be considered to consist of three separate steps:

- Estimating VOC concentration in soil gas at source of contamination (C_{source})
- Estimating an attenuation coefficient that captures the decline in VOC concentration between soil gas at the source and indoor air (α)
- Combining C_{source} and α to estimate VOC concentration in indoor air in the building ($C_{building}$).

An "infinite source" assumption is selected to maintain consistency with the EPA (1996) methodology for particulate emission factor, and to impart a conservative bias to the evaluation. It is assumed that both the source of VOC contamination in subsurface soil and the foundation of the building are located above the groundwater saturation zone. It is also assumed that VOC contamination in soil does not exist in a nonaqueous phase. Because of the strongly conservative bias imparted by the infinite source assumption, average values are selected for model variables, when possible, if site-specific data are not available. Default values are taken preferentially from EPA (1996) to maintain consistency with the other models described in Section 3.2.1, then from EPA (1997b).

The first step in estimating indoor VOC concentrations in air is to relate the concentration of VOC in soil gas at the source of contamination to the concentration of VOC in soil, as follows:

$$C_{source} = \frac{(H')(C_s)(\rho_b)(CF_1)}{\theta_w + (K_d)(\rho_b) + (H')(\theta_a)} \qquad \text{Eq. 3.4}$$

where:

C_{source} = VOC concentration in soil gas at source of contamination (g/cm^3)

H' = dimensionless Henry's law constant (chemical-specific, may be estimated as $H \cdot 41$ [EPA, 1996])

H = Henry's law constant (atmosphere-m^3/mole, chemical-specific)

C_s = contaminant concentration in soil (mg/kg)

ρ_b = dry soil bulk density (1.5 g/cm^3, default [EPA, 1996], or site-specific)

CF_1 = conversion factor (10^{-6} kg/mg)

θ_w = water-filled soil porosity (0.15 L_{water}/L_{soil}, default [EPA, 1996], or site-specific)

K_d = soil-water partition coefficient (cm^3/g, chemical-specific, may be estimated as $K_{oc} \cdot f_{oc}$)

K_{oc} = soil organic carbon-water partition coefficient (cm^3/g, chemical-specific)

f_{oc} = organic carbon content of soil (0.006 g/g, default [EPA, 1996], or site-specific)

θ_a = air-filled soil porosity (0.28 unitless, default [EPA, 1996], or site-specific estimated as $n-\theta_w$)

n = total soil porosity (0.43 unitless, default [EPA, 1996], or site-specific estimated as $1-[\rho_b/\rho_s]$).

The next step in estimating indoor VOC concentrations in air is the estimation of an attenuation coefficient that reflects the phenomena that reduce concentration in air between the source and the interior of the building. Because of the many phenomena involved, it is helpful to break this step into several smaller segments.

Diffusion is probably the most important phenomenon involved in the transport of VOC vapors from source to building. The EPA (1997b) modification of the Johnson and Ettinger model provides for multiple layers; i.e., different soil types, each of which would have its own physical properties that affect diffusion, between the contaminant source and the foundation of the building. For the purposes of this evaluation, it is simplistically assumed that only one soil type – the predominant soil type in the area – intervenes between source and building foundation. The equation for effective diffusivity through the soil between the source and the building foundation is given as:

$$D^{eff} = D_a(\theta_a^{3.33} / n^2) + (D_w / H')(\theta_w^{3.33} / n^2) \qquad \text{Eq. 3.5}$$

where:

D^{eff} = effective diffusion coefficient across soil (cm^2/second, calculated)

D_a = diffusivity in air (cm^2/second, chemical specific)

θ_a = air-filled soil porosity (0.28 unitless, default [EPA, 1996], or site-specific estimated as $n-\theta_w$)

n = total soil porosity (0.43 unitless, default [EPA, 1996], or site-specific estimated as $1-[\rho_b/\rho_s]$)

D_w = diffusivity in water (cm^2/second, chemical specific)

H' = dimensionless Henry's law constant (chemical-specific, may be estimated as H · 41 [EPA, 1996])

θ_w = water-filled soil porosity (0.15 L_{water}/L_{soil}, default [EPA, 1996], or site-specific).

The equation for the attenuation coefficient is given as:

$$\alpha = \frac{\left(\left(\frac{D^{eff} A_B}{Q_{building} L_T}\right) x \exp\left(\frac{Q_{soil} L_{crack}}{D^{crack} A_{crack}}\right)\right)}{\left(\exp\left(\frac{Q_{soil} L_{crack}}{D^{crack} A_{crack}}\right) + \left(\frac{D^{eff} A_B}{Q_{building} L_T}\right) + \left(\frac{D^{eff} A_B}{Q_{soil} L_T}\right)\left(\exp\left(\frac{Q_{soil} L_{crack}}{D^{crack} A_{crack}}\right) - 1\right)\right)}$$

Eq. 3.6

where:

α = attenuation coefficient (unitless, calculated)

D^{eff} = effective diffusion coefficient across soil (cm^2/second)

A_B = area of enclosed space below grade (1.51E+6 cm^2, see below)

$Q_{building}$ = building ventilation rate (4.61E+4 cm^3/sec, see below)

L_T = distance from source to building (150 cm, approximately 5 ft, please see Section 1.3.2.3.2, Volume I)

Q_{soil} = flow rate of soil gas into enclosed space (cm^2/second, see below)

L_{crack} = foundation or slab thickness (15 cm, default [EPA, 1997b])

D^{crack} = effective diffusion coefficient through cracks (cm^2/second, assumed to be equivalent to D^{eff} [EPA, 1997b])

A_{crack} = area of total cracks (492 cm^2, see below).

No buildings are currently present on site from which to estimate several of the parameters required for Equation 3-4. However, some of the building characteristics can be estimated from data provided for the potable-water-to-air volatilization model in Section 3.2.1. EPA (1997a) reviewed several studies of the volumes of houses and recommends 369 m^3 as a central estimate of the volume of a house. Assuming the house has 8-foot (2.44 meters) ceilings and exists on one level, an area of 151.3 square meters, equivalent to 1.51E+6 cm^2, can be estimated as an upper bound on the area below grade.

An average building ventilation rate of 3,984 m^3/day was estimated for a home (EPA, 1997b), which is equivalent to 4.61E+4 cm^3/second.

EPA (1997b) assumes that the only crack available for the entry of soil gas is a 0.1-centimeters-wide gap at the interface of the floor and foundation. As noted above, it is assumed that the area of the basement floor is 151.3 square meters. Assuming that the house is square, the length of one side would be 12.3 meters, and the total length of the wall would be 49.2 meters (4,920 centimeters). Therefore, the area of the crack would be 492 square meters.

The equation for the flow rate of soil gas into enclosed space is:

$$Q_{soil} = \frac{2\pi \Delta P k_v X_{crack}}{\mu \ln(2 Z_{crack} / r_{crack})} \qquad \text{Eq. 3.7}$$

where:

Q_{soil}	=	flow rate of soil gas into enclosed space (cm^2/second, calculated)
ΔP	=	pressure differential between soil surface and enclosed space (20 g/cm-second^2)
k_v	=	soil vapor permeability (cm^2, see below)
X_{crack}	=	floor-wall seam perimeter (4,920 cm, see above)
μ	=	viscosity of air (1.83E+5 g/cm-second [EPA, 1992e])
Z_{crack}	=	crack depth below grade (108 cm, see below)

r_{crack} = equivalent crack radius (0.1 cm, see below).

Data were not located from which to estimate the crack depth below grade. Presumably, however, houses or other buildings may be built on slabs or on full foundations. EPA (1997b) provides default depths of 15 centimters for buildings on slabs and 200 cm for buildings on foundations. The average, 108 centimeters, is chosen for this evaluation.

Equation 3-7 assumes that vapor transport occurs solely by pressure-driven air flow to an idealized cylinder buried some distance (Z_{crack}) below grade. The length of the cylinder is assumed to be equal to X_{crack}. Therefore, the equivalent crack radius can be estimated as follows:

$$r_{crack} = \eta\left(\frac{A_B}{X_{crack}}\right) \qquad \text{Eq. 3.8}$$

where:

r_{crack} = equivalent crack radius (cm, calculated)
η = A_{crack}/A_B
A_{crack} = area of total cracks (492 cm^2, see above)
A_B = area of enclosed space below grade (1.51E+6 cm^2, see above)
X_{crack} = floor-wall seam perimeter (4,920 cm, see above).

From the foregoing, a value of 0.1 centimeter is estimated for r_{crack}.

Soil vapor permeability is a very sensitive parameter associated with convective transport of vapors within the zone of influence of a building (EPA, 1997b). It can be estimated as the product of soil intrinsic permeability and the relative air permeability at the estimated water-filled soil porosity (θ_w). Soil intrinsic permeability is estimated as follows:

$$k_i = \frac{K_s \mu_w}{\rho_w g} \qquad \text{Eq. 3.9}$$

where:

k_i	=	soil intrinsic permeability (cm^2, calculated)
K_s	=	soil saturation hydraulic conductivity (6.94E-5 cm/second, see below)
μ_w	=	dynamic viscosity of water (0.01307 g/cm-second [EPA, 1997b])
ρ_w	=	density of water (0.999 g/cm^2, [EPA, 1997b])
g	=	acceleration due to gravity (980.665 cm/$second^2$ [EPA, 1997b]).

Soil saturation hydraulic conductivity is related to soil texture. Section 1.3.2.2 of Volume I states that the overburden at TNTB consists predominately of silt overlying silty clay. Table 4 of EPA (1997b) provides an approximate value for K_s of 0.25 centimenters per hour for silt, which is equivalent to 6.94E-5 centimeters per second.

Relative air permeability is estimated as follows:

$$k_{rg} = \left(1 - S_{te}\right)^{0.5}\left(1 - S_{te}^{1/M}\right)^{2M} \qquad \text{Eq. 3.10}$$

where:

k_{rg}	=	relative air permeability (positive unitless value, calculated)
S_{te}	=	effective total fluid saturation (unitless, see below)
M	=	van Genuchten shape parameter (0.270 unitless, see below).

Section 1.3.2.2 of Volume I states that the overburden at TNTB consists predominately of silt overlying silty clay. Table 2 of EPA (1997b) provides a van Genuchten shape parameter of 0.270 for silt, which is used in this evaluation. S_{te} is calculated as follows:

$$S_{te} = \frac{\theta_w - \theta_r}{n - \theta_r} \qquad \text{Eq. 3.11}$$

where:

S_{te}	=	effective total fluid saturation (unitless, calculated)
θ_w	=	water-filled soil porosity (0.15 L_{water}/L_{soil}, default [EPA, 1996], or site-specific)

θ_r = soil water content (0.034 cm^3/cm^3, see belowtaken from Table 2 of EPA [1997b])

n = total soil porosity (0.43 unitless, default [EPA, 1996], or site-specific estimated as $1-[\rho_b/\rho_s]$).

The soil water content (θ_r) of 0.034 cm^3/cm^3 was the valued provided by EPA (1997b) for silt.

Soil vapor permeability is estimated as follows:

$$k_v = (k_i)(k_{rg}) \qquad \text{Eq. 3.12}$$

where:

k_v = soil vapor permeability (cm^2, calculated)
k_i = soil intrinsic permeability (cm^2)
k_{rg} = relative air permeability (unitless).

The foregoing permit calculation of the attenuation coefficient, which, in turn permits calculation of the concentration of the VOC in indoor air in the building, as follows:

$$C_{building} = \alpha\ CF_2\ C_{source} \qquad \text{Eq. 3.13}$$

where:

$C_{building}$ = VOC concentration in indoor air in the building (mg/m^3, calculated)
α = attenuation coefficient (unitless)
CF_2 = conversion factor (1E+9 mg-cm^3/g-m^3)
C_{source} = VOC concentration in soil gas at source of contamination (g/cm^3).

3.3 Quantification of Chemical Intake

This section describes the models used to quantify doses or intakes of the COPC by the identified exposure pathways. Models were taken or modified from EPA (1989a) unless otherwise indicated.

3.3.1 Inhalation of COPC in Air

The following equation was used to estimate the inhaled dose of COPC in air. The equation was applied to exposures of the groundskeeper, construction worker, and residents by inhalation of dust from soil.

$$I_a = \frac{(C_a)(FI_a)(IR_a)(EF)(ED)}{(BW)(AT)} \qquad \text{Eq. 3.14}$$

where:

I_a = inhaled dose of COPC (mg/kg-day, calculated)
C_a = concentration of COPC in air (mg/m^3)
FI_a = fraction of exposure attributed to site media (unitless)
IR_a = inhalation rate (m^3/day)
EF = exposure frequency (days/year)
ED = exposure duration (years)
BW = body weight (kg)
AT = averaging time (days).

3.3.2 Incidental Ingestion of COPC in Soil

The ingested dose of COPC in soil to groundskeeper, construction worker, and resident receptors was estimated from the equation:

$$I_{so} = \frac{(C_{so})(FI_{so})(IR_{so})(EF)(ED)(CF4)}{(BW)(AT)} \qquad \text{Eq. 3.15}$$

where:

I_{so} = ingested dose of COPC in soil (mg/kg-day, calculated)
C_{so} = concentration of COPC in soil (mg/kg)
FI_{so} = fraction of exposure attributed to site soil (unitless)
IR_{so} = ingestion rate of soil (mg/day)
EF = exposure frequency (days/year)
ED = exposure duration (years)
CF4 = conversion factor (1E-6 kg/mg)
BW = body weight (kg)
AT = averaging time (days).

3.3.3 Incidental Ingestion of COPC in Sediment

The ingested dose of COPC in sediment to adult residents and children were estimated from the equation:

$$I_{sd} = \frac{(C_{sd})(FI_{sd})(IR_{sd})(EF)(ED)(CF4)}{(BW)(AT)} \qquad \text{Eq. 3.16}$$

where:

I_{sd} = ingested dose of COPC in sediment (mg/kg-day, calculated)
C_{sd} = concentration of COPC in sediment (mg/kg)
FI_{sd} = fraction of exposure attributed to site sediment (unitless)
IR_{sd} = ingestion rate of sediment (mg/day)
EF = exposure frequency (days/year)
ED = exposure duration (years)
CF4 = conversion factor (1E-6 kg/mg)
BW = body weight (kg)
AT = averaging time (days).

3.3.4 Dermal Contact with COPC in Soil, Sediment, or Water

Unlike the methodologies for estimating inhaled or ingested dose of COPC, which quantify the dose presented to the barrier membrane (the pulmonary or gastrointestinal mucosa, respectively), dermal dose is estimated as the dose that crosses the skin and is systemically absorbed. For this reason, dermal toxicity values are also based on absorbed dose. The absorbed dose of COPC was estimated from the equation (EPA, 1992b):

$$DAD = \frac{(DA)(SA)(EF)(ED)}{(BW)(AT)} \qquad \text{Eq. 3.17}$$

where:

DAD = average dermally absorbed dose of COPC (mg/kg-day, calculated)
DA = dose absorbed per unit body surface area per day (mg/cm^2-day)
SA = SA_{so} for soil, SA_{sd} for sediment, SA_{sw} for surface water, SA_{gw} for ground-water, = surface area of the skin exposed (cm^2)
EF = exposure frequency (days/year)
ED = exposure duration (years)
BW = body weight (kg)
AT = averaging time (days).

Dose absorbed (DA) is calculated differently for dermal uptake from soil or sediment than from water. Dermal uptake of constituents from soil (groundskeeper, construction worker, resident) or sediment (resident) assumes that absorption is a function of the fraction of a dermally applied dose that is absorbed. It was calculated from the equation (EPA, 1992b):

$$DA = (C)(FI)(CF4)(AF)(ABS) \qquad \text{Eq. 3.18}$$

where:

DA = dose absorbed per unit body surface area per day (mg/cm^2-day, calculated)
C = C_{so} for soil, C_{sd} for sediment, = concentration of COPC in medium (mg/kg)
FI = FI_{so} for soil, FI_{sd} for sediment, = fraction of exposure attributed to site medium (unitless)
CF4 = conversion factor (1E-6 kg/mg)
AF = AF_{so} for soil, AF_{sd} for sediment, = soil- or sediment-to-skin adherence factor (mg/cm^2-day)
ABS = absorption fraction (unitless, chemical-specific).

ABS values have been empirically determined for very few chemicals. EPA (1992b) discussed the available empirical data, as well as several predictive approaches for estimating ABS, but refrains from recommending any single approach. OEPA (1998) offers ABS default values of 10 percent (0.1) for organic chemicals and 1 percent (0.01) for inorganic chemicals, consistent with EPA (1999). These default values were used when empirical data are not available. The ABS values for soil were used also for sediment.

Quantification of dermal uptake of COPC from surface water by a resident depends on a PC, which describes the rate of movement of a constituent from water across the dermal barrier to the systemic circulation (EPA, 1992b). The equation for dermal uptake of chemicals from water is the same as the equation for dermal uptake of chemicals from soil. DA for dermal uptake from water was calculated from the following equation:

$$DA = (C)(FI)(PC)(ET)(CF5) \qquad \text{Eq. 3.19}$$

where:

DA = dose absorbed per unit body surface area per day (mg/cm^2-day, calculated)

C = C_{sw} for surface water, C_{gw} for groundwater, = concentration of COPC in water (mg/L)

FI = FI_{sw} for surface water, FI_{gw} for groundwater, = fraction of exposure attributed to site medium (unitless)

PC = permeability coefficient (cm/hour)

ET = ET_{sw} for surface water, ET_{gw} for groundwater, = time of exposure (hours/day)

CF5 = conversion factor (1E-3 L/cm^3).

4.0 Toxicity Evaluation

Toxicity is defined as the ability of a chemical to induce adverse effects in biological systems. The purpose of the toxicity assessment is twofold:

- Identify the cancer and noncancer effects that may arise from exposure of humans to the COPC (hazard assessment).
- Provide an estimate of the quantitative relationship between the magnitude and duration of exposure and the probability or severity of adverse effects (dose-response assessment).

The latter is accomplished by the derivation of cancer and noncancer toxicity values, as described in the following sections.

4.1 Cancer Evaluation

A few chemicals are known, and many more are suspected, to be human carcinogens. The evaluation of the potential carcinogenicity of a chemical includes both a qualitative and a quantitative aspect (EPA, 1986). The qualitative aspect is a weight-of-evidence evaluation of the likelihood that a chemical might induce cancer in humans. The EPA recognizes six weight-of-evidence group classifications for carcinogenicity:

- Group A - Human Carcinogen: human data are sufficient to identify the chemical as a human carcinogen
- Group B1 - Probable Human Carcinogen: human data indicate that a causal association is credible, but alternative explanations cannot be dismissed
- Group B2 - Probable Human Carcinogen: human data are insufficient to support a causal association, but testing data in animals support a causal association
- Group C - Possible Human Carcinogen: human data are inadequate or lacking, but animal data suggest a causal association, although the studies have deficiencies that limit interpretation
- Group D - Not Classifiable as to Human Carcinogenicity: human and animal data are lacking or inadequate
- Group E - Evidence of Noncarcinogenicity to Humans: human data are negative or lacking, and adequate animal data indicate no association with cancer.

The toxicity value for carcinogenicity, called a cancer slope factor (SF), is an estimate of potency. Potency estimates are developed only for chemicals in Groups A, B1, B2, and C, and only if the data are sufficient. The potency estimates are statistically derived from the dose-response curve from the best human or animal study or studies of the chemical. Although human data are often considered to be more reliable than animal data because there is no need to extrapolate the results obtained in one species to another, most human studies have one or more of the following limitations:

- The duration of exposure is usually considerably less than a lifetime.
- The concentration or dose of chemical to which the humans were exposed can be approximated only crudely, usually from historical data.
- Concurrent exposure to other chemicals frequently confounds interpretation.
- Data regarding other factors (tobacco, alcohol, illicit or medicinal drug use, nutritional factors and dietary habits, heredity) are usually insufficient to eliminate confounding or quantify its effect on the results.
- Most epidemiologic studies are occupational investigations of workers, which may not accurately reflect the range of sensitivities of the general population.
- Most epidemiologic studies lack the statistical power (i.e., sample size) to detect a low, but chemical-related increased incidence of tumors.

Most potency estimates are derived from animal data, which present different limitations:

- It is necessary to extrapolate from results in animals to predict results in humans; usually done by estimating an equivalent human dose from the animal dose.
- The range of sensitivities arising from genotypic and phenotypic diversity in the human population is not reflected in the animal models ordinarily used in cancer studies.
- The controlled conditions of toxicology studies do not reflect the diversity in diet, nutrition, habits, culture, life style, climate, age, and concurrent disease of the general population.
- Usually very high doses of chemical are used, which may alter normal biology, creating a physiologically artificial state and introducing substantial uncertainty

regarding the extrapolation to the low-dose range expected with environmental exposure.

- Individual studies vary in quality (e.g., duration of exposure, group size, scope of evaluation, adequacy of control groups, appropriateness of dose range, absence of concurrent disease, sufficient long-term survival to detect tumors with long induction or latency periods).

The SF is usually expressed as "extra risk" per unit dose; that is, the additional risk above background in a population corrected for background incidence. It is calculated by the expression:

$$SF = (p_{(d)} - p_{(0)})/(1 - p_{(0)}) \qquad \text{Eq. 4.1}$$

where:

SF = cancer slope factor (per mg/kg-day)
$p_{(d)}$ = the probability of cancer associated with dose = 1 mg/kg-day
$p_{(0)}$ = the background probability of developing cancer at dose = 0 mg/kg-day.

The SF is expressed as risk per mg/kg-day. In order to be appropriately conservative, the SF is usually the 95 percent upper bound on the slope of the dose-response curve extrapolated from high (experimental) doses to the low-dose range expected in environmental exposure scenarios. EPA (1986) assumes that there are no thresholds for carcinogenic expression; therefore, any exposure represents some quantifiable risk.

The oral SF is usually derived directly from the experimental dose data, because oral dose is usually expressed as mg/kg-day. When the test chemical was administered in the diet or drinking water, oral dose first must be estimated from data for the concentration of the test chemical in the food or water, food or water intake data, and BW data.

The EPA (2000) Integrated Risk Information System expresses inhalation cancer potency as a unit risk factor based on concentration, or risk per microgram of chemical/m^3 of ambient air. Because cancer risk characterization requires a potency expressed as risk per mg/kg-day, the unit risk factor must be converted to the mathematical equivalent of an inhalation cancer SF, or risk per unit dose. Since the inhalation unit risk is based on continuous lifetime exposure of an adult human (assumed to inhale 20 m^3 of air/day and to weigh 70 kilograms) the mathematical

conversion consists of multiplying the unit risk (per micrograms per cubic meter) by 70 kilograms and by 1,000 micorgrams per milligram, and dividing the result by 20 m^3/day.

4.2 Evaluation of Noncancer Effects

Many chemicals, whether or not associated with carcinogenicity, are associated with noncarcinogenic effects. The evaluation of noncancer effects (EPA, 1989c) involves:

- Qualitative identification of the adverse effect(s) associated with the chemical; these may differ depending on the duration (e.g., acute or chronic) or route (e.g., oral or inhalation) of exposure
- Identification of the critical effect(s) for each duration of exposure (i.e., the first adverse effect(s) that occurs as dose is increased)
- Estimation of the threshold dose for the critical effect(s) for each duration of exposure
- Development of an uncertainty factor; i.e., quantification of the uncertainty associated with interspecies extrapolation, intraspecies variation in sensitivity, severity of the critical effect, slope of the dose-response curve, and deficiencies in the data base, in regard to developing a reference dose (RfD) for human exposure
- Identification of the target organ(s) for the critical effect(s) for each route of exposure.

These information points are used to derive an exposure route- and duration-specific toxicity value called an RfD, expressed as mg/kg-day, which is considered to be the dose for humans, with uncertainty of an order of magnitude or greater, at which adverse effects are not expected to occur. Mathematically, it is estimated as the ratio of the threshold dose to the uncertainty factor.

Integrated Risk Information System (EPA, 2000) and the Health Effects Assessment Summary Tables (EPA, 1997c) express the inhalation noncancer reference value as a reference concentration (RfC) in units of milligrams per cubic meter. Because noncancer risk characterization requires a reference value expressed as mg/kg-day, the RfC must be converted to an inhalation RfD. Since the inhalation RfC is based on continuous exposure of an adult human (assumed to inhale 20 m^3 of air/day and to weigh 70 kilograms), the mathematical conversion consists of multiplying the RfC (mg/m^3) by 20 m^3/day and dividing the result by 70 kilograms.

4.3 Target Organ Toxicity

As a matter of science policy, EPA (1989a) assumes dose- and effect-additivity for noncarcinogenic effects. This assumption provides the justification for adding the hazard quotients (HQ) or HIs in the risk characterization for noncancer effects resulting from exposure to multiple chemicals, pathways or media. EPA, however, acknowledges that adding all HQ or HI values may overestimate hazards, because the assumption of additivity is probably appropriate only for those chemicals that exert their toxicity by the same mechanism.

Mechanisms of toxicity data sufficient for predicting additivity with a high level of confidence are available for very few chemicals. In the absence of such data, EPA (1989a) assumes that chemicals that act on the same target organ may do so by the same mechanism of toxicity, unless the data clearly indicate otherwise. That is, the target organ serves as a surrogate for mechanism of toxicity. When total HI for all media for a receptor exceeds 1 due to the contributions of several chemicals, it may be appropriate to segregate the chemicals by route of exposure and mechanism of toxicity (i.e., target organ) and estimate separate HI values for each.

As a practical matter, since human environmental exposures are likely to involve near- or sub-threshold doses, the target organs chosen for a given chemical are the ones associated with the critical effects. If more than one organ is affected at the threshold, the more severely affected is chosen. Target organ is also selected on the basis of duration of exposure (i.e., the target organ for chronic or subchronic exposure to low or moderate doses is selected rather than the target organ for acute exposure to high doses) and route of exposure. Because dermal RfD values are derived from oral RfD values, the oral target organ is adopted as the dermal target organ. For some chemicals, no target organ is identified. This occurs when no adverse effects are observed or when adverse effects such as reduced longevity or growth rate are not accompanied by recognized organ- or system-specific functional or morphologic alteration.

4.4 Dermal Toxicity Values

Dermal RfDs and SFs are derived from the corresponding oral values, provided there is no evidence to suggest that dermal exposure induces exposure route-specific effects that are not appropriately modeled by oral exposure data. In the derivation of a dermal RfD, the oral RfD is multiplied by the gastrointestinal absorption factor (GAF), expressed as a decimal fraction. The resulting dermal RfD, therefore, is based on absorbed dose. The RfD based on absorbed dose is the appropriate value with which to compare a dermal dose, because dermal doses are expressed

as absorbed rather than exposure doses. The dermal SF is derived by dividing the oral SF by the GAF. The oral SF is divided, rather than multiplied, by the GAF because SFs are expressed as reciprocal doses.

4.5 Sources of Toxicity Information Used in the Risk Assessment

Toxicity values were chosen using the following hierarchy:

- EPA's on-line IRIS database (EPA, 2000) containing toxicity values that have undergone the most rigorous Agency review
- The latest version of the annual Health Effects Assessment Summary Table, including all supplements (EPA, 1997c)
- Other EPA documents, memoranda, former Environmental Criteria and Assessment Office, or National Center for Environmental Assessment derivations for the Superfund Technical Support Center.

All toxicity values, regardless of their source, were evaluated for appropriateness for use in RA (Table 4-1).

GAFs, used to derive dermal RfDs and SFs from the corresponding oral toxicity values, were obtained from the following sources:

- Oral absorption efficiency data compiled by the National Center for Environmental Assessment for the Superfund Health Risk Technical Support Center of the EPA
- Federal agency reviews of the empirical data, such as Agency for Toxic Substances and Disease Registry toxicological profiles and various EPA criteria documents
- Other published reviews of the empirical data
- The primary literature.

GAFs obtained from reviews were compared to empirical (especially more recent) data, when possible, and were evaluated for suitability for use for deriving dermal toxicity values from oral toxicity values. The suitability of the GAF increases when the following similarities are present in the oral toxicokinetic study from which the GAF is derived and in the key toxicity study from which the oral toxicity value is derived:

- The same strain, sex, age, and species of test animal were used.
- The same chemical form (e.g., the same salt or complex of an inorganic element or organic compound) was used.
- The same mode of administration (e.g., diet, drinking water or gavage vehicle) was used.
- Similar dose rates were used.

The most defensible GAF for each chemical was used in the RA. When quantitative data are insufficient, a default GAF of 1 was used (OEPA, 1999).

Toxicity profiles for the chemicals selected as COPC are provided in Appendix D.

5.0 Risk Characterization

Risk characterization is the combination of the results of the exposure assessment and toxicity assessment to yield a quantitative expression of cancer risk or noncancer hazard for the exposed receptors. This quantitative expression is the probability of developing cancer, or a nonprobabilistic comparison of estimated dose with a reference dose for noncancer effects. Quantitative estimates are developed for individual chemicals, exposure pathways, and exposure media for each receptor. The risk characterization is used to guide risk management decisions.

Generally, the risk characterization followed the methodology prescribed by EPA (1989a), as modified by more recent information and guidance. EPA methods are, appropriately, designed to be health-protective, and tend to overestimate, rather than underestimate, risk. The risk results, however, are generally overly conservative, because risk characterization involves multiplication of the conservatisms built into the estimation of source-term and exposure-point concentrations, the exposure (intake) estimates and the toxicity dose-response assessments.

Risk characterization is limited to those chemicals selected as COPC; i.e., present at concentrations that exceed RBSCs (Section 2.1.4). OEPA requires characterizing risk for all chemicals whose concentrations exceed their RBSCs, regardless of whether their concentrations are comparable to background. This approach, although consistent with EPA (1989a), obscures the risk associated with background chemicals, and may leave the mis-impression that the entire risk estimate is due to site-related activity. This potential misimpression is avoided by providing three separate risk estimates: total site risk, which includes all COPC identified; background risk, which includes the inorganic and organic COPC identified as natural or anthropogenic background; and site-related risk, which is limited to COPC not identified as background and presumed to be present as a result of former PBOW activity. Segregating risk estimates in this manner provides maximum useful information for site management.

5.1 Carcinogenic Effects of Chemicals

The risk from exposure to potential chemical carcinogens is estimated as the probability of an individual developing cancer over a lifetime, and is called the ILCR. In the low-dose range, which would be expected for most environmental exposures, cancer risk is estimated from the following linear equation (EPA, 1989a):

$$ILCR = (CDI)(SF) \qquad \text{Eq. 5.1}$$

where:

ILCR = incremental lifetime cancer risk, a unitless expression of the probability of developing cancer, adjusted for background incidence, calculated

CDI = chronic daily intake, averaged over 70 years (mg/kg-day)

SF = cancer slope factor (per mg/kg-day).

The chronic daily intake term in Equation 5.1 is equivalent to the "I", "DAD", or "DA" terms (intake or dose) in Equations 3.14 through 3.19, when these equations are evaluated for cancer intakes.

As a matter of policy, EPA (1986) considers the carcinogenic potency of simultaneous exposure to low doses of carcinogenic chemicals to be additive, regardless of the chemical's mechanisms of toxicity or sites (organs of the body) of action. Cancer risk arising from simultaneous exposure by a given pathway to multiple chemicals is estimated from the following equation:

$$Risk_p = ILCR_{(chem\,1)} + ILCR_{(chem\,2)} + \ldots ILCR_{(chem\,i)} \qquad \text{Eq. 5.2}$$

where:

$Risk_p$ = total pathway risk of cancer incidence, calculated
$ILCR(chem_i)$ = individual chemical cancer risk.

Cancer risk for a given receptor across pathways and across media is summed in the same manner.

5.2 Noncancer Effects of Chemicals

The hazards associated with noncancer effects of chemicals are evaluated by comparing an exposure level or intake with an RfD. The HQ, defined as the ratio of intake to RfD, is estimated as (EPA, 1989a):

$$HQ = I/RfD \qquad \text{Eq. 5.3}$$

where:

HQ = hazard quotient (unitless, calculated)

I = intake of chemical averaged over subchronic or chronic exposure period (mg/kg-day)

RfD = reference dose (mg/kg-day).

The I term in Equation 5.3 is equivalent to the "I", "DAD", or "DA" terms (intake or dose) in Equations 3.14 through 3.19, when these equations are evaluated for noncancer intakes.

Chemical noncancer hazards are evaluated using chronic RfD values. This approach is different from the probabilistic approach used to evaluate cancer risks. An HQ of 0.01 does not imply a 1 in 100 chance of an adverse effect, but indicates that the estimated intake is 100 times lower than the RfD. An HQ of unity indicates that the estimated intake equals the RfD. If the HQ is greater than unity, there may be concern for potential adverse health effects.

In the case of simultaneous exposure of a receptor to several chemicals, an HI is calculated as the sum of the HQs by:

$$HI = I_1 / RfD_1 + I_2 / RfD_2 + \ldots I_i / RfD_i \qquad \text{Eq. 5.4}$$

where:

HI = hazard index (unitless, calculated)
I_i = intake for the ith toxicant
RfD_i = reference dose for the ith toxicant.

If HI for a given pathway exceeds 1, individual HI values may be calculated for each target organ.

5.3 Risk Characterization Results and Discussion

The results and discussion of the risk characterization for soil and sediment at the TNTB site are described in the following subsections. The ILCR and HI are listed for each receptor in Tables 5-1 through 5-11.

ILCR, HQ, and HI estimates are surrounded by considerable uncertainty; therefore, EPA (1989a) recommends that they be rounded to one significant figure for presentation in a RA. However, in order to facilitate review and to more accurately estimate the contribution of individual chemicals and exposure pathways to the totals, these estimates are presented in the risk tables in scientific notation rounded to two places to the right of the decimal. Discussions in the text, however, follow the EPA (1989a) guidance and round the estimates to one significant figure. For example, Table 5-1 presents a total site-related ILCR for the groundskeeper summed across chemicals and exposure pathways of 1.07E-4, slightly above the EPA (1990) generally acceptable limit of 1E-4. In the text, however, the groundskeeper ILCR is rounded to 1E-4, and is considered to fall within the 1E-6 to 1E-4 risk management range requiring further evaluation.

For this discussion, a significant contribution to cancer risk is defined as an ILCR summed across all exposure pathways for a given source medium exceeding 1E-6; a significant contribution to hazard is defined as an HI across all pathways for a source medium exceeding 0.1. The COC were selected because of their cancer risk (cancer COC) or noncancer hazard (noncancer COC).

5.3.1 Groundskeeper

ILCR and HI values for potential exposures of the groundskeeper to surface soil are shown in Table 5-1. The total ILCR from all exposure pathways falls within the 1E-6 to 1E-4 risk management range requiring further evaluation. Comparison of total ILCR values calculated for total risk, background risk and site-related risk shows that site-related risk is the predominant contributor to the total risk. That is, the predominant calculated risk is associated with COPCs associated with TNTB operations (Table 5-1). 2,4,6-TNT and Aroclor-1260 contribute the majority of the estimated cancer risk and benzo(a)pyrene and dibenz(a,h)anthracene contribute significant risk. Further examination shows that these risks are associated with oral ILCR and dermal ILCR values indicating the importance of direct contact exposures in the RA (Table 5-1). The ILCR calculated for exposure to Aroclor-1254 is not significant.

The total HI from all exposure pathways exceeds the threshold value of 1 considered acceptable by the EPA (1990). Comparison of total HI values calculated for total risk, background risk and site-related risk indicates that the site-related risk is the predominant contributor to the total HI and that 2,4,6-TNT is the only significant contributor. The oral HQ and dermal HQ values both

exceed the acceptable HI value, further indicating the importance of direct contact exposure pathways (Table 5-1).

The COPCs in surface soil that contribute significantly to cancer risk and noncancer hazard to the groundskeeper are: 2,4,6-TNT, Aroclor-1260, benzo(a)pyrene, and dibenz(a,h)anthracene.

5.3.2 Indoor Worker

ILCR and HI values for potential exposures of the indoor worker to surface soil via incidental ingestion are shown in Table 5-2. The total ILCR falls within the 1E-6 to 1E-4 risk management range requiring further evaluation. Comparison of total ILCR values for total risk, background risk, and site-related risk shows that site-related risk is the predominant contributor to total risk. 2,4,6-TNT contributes most, with significant contributions also from Aroclor-1260 and benzo(a)pyrene.

The total HI exceeds the threshold value of 1. Site-related risk is the predominant contributor to total HI; 2,4,6-TNT is the only significant contributor. The COPCs that contribute significantly to cancer risk and noncancer hazard to the indoor worker are: 2,4,6-TNT, Aroclor-1260 and benzo(a)pyrene.

5.3.3 Construction Worker

ILCR and HI values for potential construction worker exposures to total soil are shown in Table 5-3. The total ILCR from all exposure pathways is within the 1E-6 to 1E-4 risk management range requiring further evaluation. Comparison of total ILCR values calculated for total risk, background risk, and site-related risk shows that site-related risk is the predominant contributor to the total risk. That is, the predominant calculated risk is associated with COPCs from TNTB operations (Table 5-3). 2,4,6-TNT is the predominant contributor to site-related risk with significant contributions also from 2,4-DNT and 2,6-DNT. ILCR values calculated for other COPCs are below the risk management range (Table 5-2).

The total HI from all exposure pathways exceeds the threshold value of 1. 2,4,6-TNT and its degradation products: 2-amino-4,6-DNT and 4-amino-2,6-DNT are the predominant contributors, with significant contributions also from 2,4-DNT and 2,6-DNT. It should be noted that the HI summed across chemicals and pathways for background risk exceeds the threshold of

1, due predominantly to manganese, with significant contributions also from aluminum, arsenic, and iron.

The COPCs in total soil that contribute significantly to cancer risk and noncancer hazard to the construction worker are: 2,4,6-TNT, 2-amino-4,6-DNT, 4-amino-2,6-DNT, 2,4-DNT, and 2,6-DNT.

ILCR and HI values for potential exposures of the construction worker to surface water are shown in Table 5-4. All ILCR values are below the 1E-6 to 1E-4 risk management range, and all HI values are below the threshold of 1.

ILCR and HI values for potential exposures of the construction worker to sediment are shown in Table 5-5. All ILCR values are below the 1E-6 to 1E-4 risk management range. The total HI exceeds the threshold of 1, due largely to iron, with significant contributions from arsenic and manganese as well.

5.3.4 On-Site Resident

ILCR and HI values for potential exposures of future on-site residents to total surface and subsurface soil are shown in Tables 5-6 and 5-7.

The total ILCR for potential exposures of a future on-site resident to total surface and subsurface soil from all exposure pathways exceeds the 1E-6 to 1E-4 risk management range. Comparison of total ILCR values calculated for total risk, background risk, and site-related risk shows that the predominant calculated risk is associated with COPCs from TNTB operations (Table 5-6). 2,4-DNT, 2,6-DNT and 2,4,6-TNT are the predominant contributors to site-related risk with significant contributions from Aroclor-1254, Aroclor-1260, bernzo(a)anthracene, benzo(a)-pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene. Further examination shows that these risks are associated with oral ILCR and dermal ILCR values indicating the importance of direct contact exposures in the residential RA.

Ingestion and dermal contact rates for children are greater than adults; therefore, noncancer hazards to future residents were calculated only for potential exposures to children. The resulting HI calculations are expected to overestimate the HI for exposures to adults, and thus are conservative. The total HI calculated for potential exposures of children from all exposure pathways

exceeds the threshold value of 1 and the predominant contributors to the total HI are from COPCs associated with TNTB operations (Table 5-7). The predominant COPCs are the five nitroaromatic compounds (2-amino-4,6-DNT, 4-amino-2,6-DNT, 2,4-DNT, 2,6-DNT, and 2,4,6-TNT), with significant contributions from 2-nitrotoluene and Aroclor-1254.

It should be noted that the HI summed across chemicals and pathways for background risk (Table 5-7) exceeds the threshold of 1, due predominantly to iron and manganese, with significant contributions also from arsenic, copper, and thallium.

ILCR and HI values for potential exposures of future on-site residents to surface water are shown in Tables 5-8 and 5-9, respectively. All ILCR values (Table 5-8) are below the risk management range and all HI values are below the threshold of 1.

ILCR and HI values calculated for exposures to sediment are shown in Tables 5-10 and 5-11. All site-related ILCR values calculated for potential exposures of adults and children are at the lower end of the 1E-6 to 1E-4 risk management range (Table 5-10). All HI values calculated for potential exposures of children (Table 5-11) are below the threshold HI value of 1.

ILCR and HI values calculated for potential exposures of groundskeepers, construction workers, and future residents to COPCs in soil, surface water and sediment are summarized in Table 5-12.

5.4 Risk-Based Remediation Criteria Development

RBRC development performed as part of the RA provides support for risk management decisions. RBRC are site-specific RBCs that reflect the exposure and toxicity assumptions applied in the BLRA. Consequently, the RBRC are source medium-, receptor-, and chemical-specific.

The first step in RBRC development is selection of COC. Either of two conditions result in designation of a COPC as a COC:

- The concentration of the COPC exceeds its medium-specific ARAR, provided one is available.
- The COPC contributes significantly to cancer risk or hazard as described below.

COCs based on cancer are selected for any medium for which the total ILCR (summed across chemicals and exposure pathways) exceeds 1E-6; COCs based on noncancer are selected for any medium for which the total HI (summed across chemicals and exposure pathways) exceeds 1. An individual COPC in that medium must have an ILCR (summed across exposure pathways) exceeding 1E-6 to be selected as a cancer-based COC. An individual COPC in that medium must have an HI (summed across exposure pathways) exceeding 0.1 to be selected as a noncancer-based COC.

There are no ARARs for soil, surface water or sediment; therefore, only the risk-based conditions are evaluated in COC selection.

RBRC are risk- or hazard-specific concentrations of chemicals developed only for the COC in media selected by the criteria described above. In this RA, COCs were selected for exposures to surface soil (groundskeeper and indoor worder), total soil and sediment (construction worker and on-site resident).

RBRC for cancer COC are estimated for soil or sediment from the following equation:

$$RBRC_{coc} = \frac{ST_{coc}\,TR}{ILCR_{COC}} \qquad \text{Eq. 5.5}$$

where:

$RBRC_{coc}$	=	risk-based remedial criterion for a given COC, receptor and source medium (calculated)
ST_{coc}	=	source-term concentration of the COC in the given medium
TR	=	target risk level (1E-6, 1E-5, 1E-4)
$ILCR_{coc}$	=	total incremental lifetime cancer risk for a given COC, receptor and source medium.

RBRC for noncancer COC are estimated as follows:

$$RBRC_{coc} = \frac{ST_{coc}\,THI}{HI_{COC}} \qquad \text{Eq. 5.6}$$

where:

$RBRC_{coc}$ = risk-based remedial criterion for a given COC, receptor and source medium (calculated)

ST_{coc} = source-term concentration of the COC in the given medium

THI = target hazard index (0.1, 1)

HI_{coc} = total hazard index for a given COC, receptor and source medium.

All concentrations in Equations 5.5 and 5.6 are in units of mg/kg (ppm).

5.4.1 Identification of COCs in Surface Soil

COPCs in surface soil were identified in the RA for the groundskeeper (Section 5.3.1). The following chemicals contributed significantly to site-specific risks or hazards (Table 5-1) and are therefore identified as COCs: 2,4,6-TNT, Aroclor-1260, benzo(a)pyrene, and dibenz(a,h)-anthracene. RBSCs for these COCs are shown in Table 5-13.

5.4.2 Identification of COCs in Total Soil

COPCs in surface soil were identified for the indoor worker (Section 5.3.2). The following chemicals contributed significantly to site-specific risks or hazards (Table 5-2) and are therefore identified as COCs: 2,4,6-TNT, Aroclor-1260, and benzo(a)pyrene. RBSCs for these COCs are shown in Table 5-14.

COPCs in total soil were identified for the construction worker (Section 5.3.3). The following chemicals contributed significantly to site-specific risks or hazards (Table 5-3) and are therefore identified as COCs: 2,4,6-TNT, Aroclor-1260, and benzo(a)pyrene. RBSCs for these COCs are shown in Table 5-15.

COPCs in total soil were identified for the on-site resident (Section 5.3.4). The following chemicals contributed significantly to site-specific risks or hazards (Tables 5-6 and 5-7) and are therefore identified as COCs: 2-amino, 4,6-DNT, 4-amino-2,6-DNT, 2,4-DNT, 2,6-DNT, 2-nitrotoluene, 2,4,6-TNT, Aroclor-1254, Aroclor-1260, benzo(a) anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene. RBSCs for these COCs are shown in Table 5-16.

5.4.3 Identification of COCs in Surface Water

ILCR estimates summed across chemicals and exposure pathways for surface water did not exceed 1E-6, the point of departure for risk management, for any receptor. HI estimates summed across chemicals and exposure pathways for surface water did not exceed the threshold value of 1 for any receptor. Therefore, COCs were not identified and RBRCs were not developed for any chemicals in surface water.

5.4.4 Identification of COCs in Sediment

COPCs in sediment were identified for the construction worker (Section 5.3.3). The following chemicals contributed significantly to site-specific risks or hazards (Table 5-5) and are therefore identified as COCs: arsenic, iron, and manganese. RBSCs for these COCs are shown in Table 5-17.

COPCs in sediment were identified for the on-site resident (Section 5.3.4). The following chemicals contributed significantly to site-specific risks or hazards (Tables 5-10 and 5-11) and are therefore identified as COCs: arsenic. RBSCs for this COC are shown in Table 5-18.

6.0 Uncertainty Analysis

This chapter explores the uncertainties inherent in the RA process. Uncertainty is a factor in each step of the data evaluation and exposure and toxicity assessments presented in the preceding sections. Uncertainties associated with earlier stages of the RA become magnified when they are concentrated with other uncertainties in the latter stages. It is not possible to eliminate all uncertainty; however, a recognition of the uncertainties is fundamental to the understanding and reasonable use of the RA results.

Generally, RAs carry two types of uncertainty. Measurement uncertainty refers to the usual variance that accompanies scientific measurements, e.g., instrument uncertainty (accuracy and precision) associated with contaminant concentrations. The results of the RA reflect the accumulated variances of the individual measured values. A different kind of uncertainty stems from data gaps, i.e., additional information needed to complete the database for the assessment. Often, the data gap is significant, such as imprecision regarding the number of days that an on-site resident might become exposed to surface water in Ransom Brook, or the absence of information on the effects of human exposure to a chemical (EPA, 1992c).

EPA (1992c) guidance urges risk assessors to address or provide descriptions of individual risk to include the "high end" portions and "central tendency" (CT) of the risk distribution. One way of fulfilling this request, if either cancer or noncancer risk exceed generally acceptable limits (cancer risk greater than 1E-5 or target organ-specific HI greater than 1), is to recompute the ILCRs or HIs using CT values for as many intake model variables as possible. In contrast to the RME evaluation, which prevails in RAs, and uses upper-end values for intake or contact rates, exposure frequency and exposure duration, the CT evaluation chooses average or mid-range values for these variables (EPA, 1991). The intent is to present a quantified risk/hazard estimate more typical for the receptor of interest.

The CT exposure evaluation, however, falls short of its stated intent for several reasons. First, the same source-term concentration is usually used for the CT evaluation as is used for the RME evaluation. EPA (1993) considers that the UCL or MDC selected as a conservative estimate of average for the RME is appropriate for the CT estimates. Second, there is little information available as to what constitutes a reliable CT estimate for most exposure variables, with the possible exception of a simple on-site residential scenario. For these reasons, RME values are

still used. In addition, no CT toxicity values are available, except the SF for the Aroclors, so the undertainty about the toxicity assessment is not included. A CT evaluation, therefore, usually provides little relief, compared with the RME, particularly for exposure scenarios such as the construction worker, for which no reliable estimation of most exposure variable values can be made. It should be stated that management decisions are generally based on RME rather than CT evaluations. The CT evaluation, within the described limitations, simply adds perspective regarding the magnitude of uncertainty about the RME estimates.

A Monte Carlo simulation can provide a comprehensive description of the uncertainty about an RME point estimate of risk or hazard because it presents the risk as a collection of estimates with probability densities. In this RA, the distribution of nitroaromatic compound concentrations in soil at the TNTB site presents a source of uncertainty that is not readily addressed by a Monte Carlo simulation. The soil samples evaluated were collected near the buildings where TNT manufacturing occurred, resulting in clusters of samples (this report, Vol. I, Figure 2-1). This sampling strategy was correctly designed to characterize the expected areas of highest concentrations and therefore provides an estimate of the expected greatest risk at the site. That is, the sampling strategy is consistent with an RME risk evaluation. A Monte Carlo simulation based on these soil data, however, cannot describe risks at locations which were not sampled. Therefore, its use in this RA would also reflect the higher risk estimates without providing a further refinement of the overall uncertainty.

7.0 Summary and Conclusions

An RA was performed to evaluate the potential risk to plausible receptors exposed to contaminants in various media at TNTB. The area was formerly used for the production of TNT and related explosives during earlier war efforts. It is now under control of NASA.

Media evaluated in this RA include surface soil, subsurface soil, surface water and sediment. Certain receptors may also be exposed to shallow groundwater, or to deep (bedrock) groundwater developed as a source of potable water. However, groundwater data are not available at the time of this writing (August 2000). Therefore, the RA must be considered incomplete, in that total risk across all media cannot be assessed at this time. A final RA will be performed when the groundwater become available, at which time the risks calculated herein for soil, surface water and sediment will be included to estimate total risk across all media for all receptors.

Receptor scenarios evaluated for this site include a groundskeeper, an indoor worker, a construction worker and an on-site resident. These groundskeeper represents the upper-bound on long-term risk from exposure to soil for commercial/industrial future development of the site, while the on-site resident represents the upper-bound on risk from exposure to soil, surface water and sediment for long-term unrestricted or residential exposure. The construction worker scenario provides the upper-bound on noncancer hazard for shorter-term exposure to soil, surface water and sediment while the site is being developed. The potential for subterranean vapors from subsurface soil or shallow groundwater trapped in indoor air to contribute to inhalation risk is evaluated for the indoor worker and the on-site resident.

Several classes of chemicals were identified in samples taken from the environmental media at TNTB. Surface and subsurface soil yielded significant concentrations of metals, nitroaromatic compounds, PCBs, and PAHs. The metals were shown to be present at levels consistent with background. Although background ILCR estimates for all receptors fell within the 1E-6 to 1E-4 risk management range, and the background HI for the construction worker exceeded the threshold of 1, this cannot be attributed to site-related activity. The nitroaromatic compounds are clearly site-related; their presence is consistent with the production and purification of explosives such as 2,4,6-TNT. The greatest cancer risk and noncancer hazard is associated with 2,4,6-TNT, but other nitroaromatic compounds, probably degradation products of 2,4,6-TNT, also contribute significant risk. Highest concentrations of 2,4,6-TNT were located in surface soil, reflecting the

persistence of this compound on or near the surface. Highest concentrations of TNT degradation products were located in subsurface soil, suggesting that these products may be somewhat more mobile in soil.

The source of the PCBs is unclear. PCBs are not generally associated with the production of nitroaromatic explosives, but their widespread occurrence in 18 of 28 surface soil samples strongly suggests they are site related at TNTB.

PAHs are generally ubiquitous in the environment, readily forming from the combustion of organic material. Their presence in TNTB soils is not surprising, particularly if buildings or waste has been burned on the site. Higher concentrations are located in surface soil than in subsurface soil, because the PAHs are relatively immobile in soil. Background soil samples were not analyzed for PAHs, so a background data set could not be developed, and the PAHs must be regarded as site-related chemicals. Many of the PAH concentrations, however, fall within background levels for urban soil as compiled by Agency for Toxic Substances and Disease Registry (1995). The PAHs in soil are significant contributors to risk, yielding ILCR estimates near the middle of the 1E-6 to 1E-4 risk management range for the on-site resident.

Surface water is essentially clean; no COCs were identified for short-term (construction worker) or long-term (on-site resident) exposure. Arsenic was identified as a cancer-based COC in sediment for the on-site resident, and arsenic, iron and manganese were identified as noncancer-based COCs in sediment for the construction worker. Background data were not available for sediment, so these metals were regarded as if they were site-related. Sediment concentrations of arsenic, however, were consistent with levels in background soil, suggesting that arsenic in sediment reflects background levels in the soil from which the sediment is derived. Furthermore, its ILCR for the on-site resident is at the lower end of the risk management range.

In summary, the soils are clearly contaminated with 2,4,6-TNT and other nitroaromatic chemicals as a result of former site operations. The nitroaromatics are associated with unacceptable cancer risk and noncancer hazard levels for either commercial/industrial or residential site use. PCBs and PAHs in soil also contribute significantly to cancer risk, although their ILCRs do not exceed the risk management range. The surface water is relatively clean and appears to pose no threat to plausible receptors. The sediment contains metals that contribute minimally to cancer risk. Noncancer hazards from metals in sediment, however, exceed the

threshold of 1 for the construction worker. RBRCs were calculated for all site-related COCs in soil and sediment.

8.0 References

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TABLES

Table 2-1

Statistical Summary and COPC Selection of Surface Soil [a] Sample Anaylses
TNT Area B, Plum Brook Ordnance Works, Sandusky, Ohio

Chemical Name (mg/kg)	Frequency of Detection	Range of Detected, Concentrations	Range of Reporting Limits	Statistical Distribution	Arithmetic Mean	95% UCL [b]	Background Screening Criterion [c]	Risk-Based Screening Criterion [d]	COPC? [e,f]	Source Term Concentration
Inorganics										
Aluminum	28 / 28	3050 - 8400	21.8 - 26.5	N	5.52E+03	5.93E+03	2.69E+04	7.60E+03	Y (b)	5.93E+03
Arsenic	28 / 28	1.7 - 29.4	1.1 - 1.3	N	1.15E+01	1.34E+01	7.10E+01	3.90E-02	Y (b)	1.34E+01
Barium	27 / 28	24.1 - 112	21.8 - 26.5	N	6.04E+01		1.30E+03	5.40E+02	N (a)	--
Beryllium	15 / 28	0.61 - 0.87	0.54 - 0.66	NP	5.37E-01		1.17E+00	1.50E+01	N (a)	--
Cadmium	4 / 28	0.63 - 1.3	0.54 - 2.9	NP	4.31E-01			3.70E+00	N (a)	--
Calcium	28 / 28	807 - 90900	544 - 2920	NP	8.98E+03			Nutrient	N (b)	--
Chromium	28 / 28	6 - 20.5	1.1 - 5.8	L	1.16E+01		2.90E+01	2.10E+01 g	N (a)	--
Cobalt	25 / 28	5.9 - 15.9	5.4 - 6.6	N	9.83E+00		2.48E+02	4.70E+02	N (a)	--
Copper	28 / 28	6.9 - 445	2.7 - 3.3	NP	4.49E+01	4.45E+02	1.47E+02	2.90E+02	Y (b)	4.45E+02
Iron	28 / 28	7340 - 32800	10.9 - 13.2	N	1.89E+04	2.10E+04	3.58E+05	2.30E+03	Y (b)	2.10E+04
Lead	28 / 28	9.7 - 245	0.33 - 0.4	L	5.25E+01		5.13E+01	4.00E+02 h	N (a)	--
Magnesium	27 / 28	660 - 9190	544 - 662	NP	1.60E+03			Nutrient	N (b)	--
Manganese	28 / 28	24 - 504	1.6 - 2	N	2.33E+02	2.67E+02	3.51E+03	1.80E+02	Y (b)	2.67E+02
Mercury	24 / 28	0.038 - 0.13	0.036 - 0.044	N	5.91E-02		5.60E-01	2.30E+00	N (a)	--
Nickel	28 / 28	6.5 - 56.3	4.4 - 5.3	L	2.30E+01		7.79E+01	1.60E+02	N (a)	--
Potassium	24 / 28	735 - 1930	544 - 662	N	9.35E+02			Nutrient	N (b)	--
Selenium	24 / 28	0.64 - 2.4	0.54 - 0.66	N	1.08E+00		2.00E+00	3.90E+01	N (a)	--
Thallium	2 / 28	1.4 - 1.4	1.1 - 1.3	NP	6.57E-01	1.40E+00	1.30E+00	5.10E-01 i	Y (b)	1.40E+00
Vanadium	5 / 21	8.2 - 13	5.8 - 6.6	NP	4.80E+00		8.31E+01	5.50E+01	N (a)	--
Zinc	28 / 28	17.7 - 282	2.2 - 2.6	L	1.03E+02		3.22E+02	2.30E+03	N (a)	--
Nitroaromatics										
2-Amino-4,6-dinitrotoluene	16 / 29 (27)	0.3 - 7.6	0.25 - 250 (5)	NP	1.88E+00	3.80E+00 j		3.70E-01 i	Y (a)	3.80E+00
4-Amino-2,6-dinitrotoluene	17 / 29 (27)	0.34 - 8.8	0.25 - 2400 (16)	NP	2.07E+00	4.16E+00 j		3.70E-01 i	Y (a)	4.16E+00
2,4-Dinitrotoluene	7 / 29 (27)	0.26 - 2.3	0.25 - 250 (5)	NP	4.26E-01	2.35E+00 j		7.20E-02 k	Y (a)	2.30E+00
2,6-Dinitrotoluene	2 / 29 (27)	0.28 - 0.83	0.25 - 250 (5)	NP	2.81E-01	2.32E+00 j		7.20E-02 k	Y (a)	8.30E-01
2,4,6-Trinitrotoluene	24 / 29	0.26 - 6900	0.25 - 250	NP	2.61E+02	6.90E+03		1.60E+00	Y (a)	6.90E+03
PCBs										
Aroclor 1254	6 / 28	0.12 - 0.53	0.036 - 7.2	NP	2.22E-01	3.60E+00		2.20E-02	Y (a)	5.30E-01
Aroclor 1260	18 / 28	0.041 - 15	0.036 - 3.9	NP	7.22E-01	1.50E+01		2.20E-02	Y (a)	1.50E+01
Semivolatile Organics										
2-Methylnaphthalene	6 / 28	0.053 - 0.17	0.36 - 2	NP	2.03E-01			1.20E+02 i	N (a)	--
4,6-Dinitro-2-methylphenol	1 / 28	0.062 - 0.062	1.7 - 9.6	NP	1.07E+00			6.10E-01 i	N (a)	--
Acenaphthene	2 / 28	0.068 - 0.093	0.36 - 2	NP	2.19E-01			3.70E+02	N (a)	--
Acenaphthylene	3 / 28	0.075 - 0.38	0.36 - 2	NP	2.33E-01			3.70E+02 i	N (a)	--
Anthracene	6 / 28	0.027 - 0.92	0.36 - 2	NP	2.43E-01			2.20E+03	N (a)	--
Benzo(a)anthracene	16 / 28	0.04 - 2.4	0.36 - 2	NP	2.87E-01	2.40E+00		6.20E-02	Y (a)	2.40E+00
Benzo(a)pyrene	20 / 28	0.028 - 2	0.36 - 2	NP	2.60E-01	2.00E+00		6.20E-03	Y (a)	2.00E+00
Benzo(b)fluoranthene	19 / 28	0.037 - 1.8	0.36 - 2	NP	2.67E-01	1.80E+00		6.20E-02	Y (a)	1.80E+00
Benzo(ghi)perylene	12 / 28	0.034 - 0.88	0.36 - 2	NP	2.26E-01			2.30E+02 i	N (a)	--
Benzo(k)fluoranthene	15 / 28	0.055 - 2	0.36 - 2	NP	2.88E-01	2.00E+00		6.20E-01	Y (a)	2.00E+00
Carbazole	2 / 28	0.2 - 0.25	0.36 - 2	NP	2.29E-01			2.40E+00	N (a)	--

Table 2-1

Statistical Summary and COPC Selection of Surface Soil [a] Sample Anaylses
TNT Area B, Plum Brook Ordnance Works, Sandusky, Ohio

Chemical Name (mg/kg)	Frequency of Detection	Range of Detected Concentrations	Range of Reporting Limits	Statistical Distribution	Arithmetic Mean	95% UCL [b]	Background Screening Criterion [c]	Risk-Based Screening Criterion [d]	COPC? [e,f]	Source Term Concentration
Chrysene	19 / 28	0.042 - 2.4	0.36 - 2	NP	2.91E-01			6.20E+00	N (a)	--
Dibenz(a,h)anthracene	4 / 28	0.032 - 0.55	0.36 - 2	NP	2.39E-01	5.50E-01		6.20E-03	Y (a)	5.50E-01
Dibenzofuran	2 / 28	0.13 - 0.18	0.36 - 2	NP	2.24E-01			2.90E+01	N (a)	--
Fluoranthene	22 / 28	0.039 - 5	0.36 - 2	NP	4.60E-01			2.30E+02	N (a)	--
Fluorene	2 / 28	0.17 - 0.36	0.36 - 2	NP	2.32E-01			2.60E+02	N (a)	--
Indeno(1,2,3-cd)pyrene	11 / 28	0.037 - 1	0.36 - 2	NP	2.39E-01	1.00E+00		6.20E-02	Y (a)	1.00E+00
Naphthalene	3 / 28	0.041 - 0.073	0.36 - 2	NP	2.12E-01			5.60E+00	N (a)	--
Phenanthrene	14 / 28	0.045 - 3	0.36 - 2	NP	3.49E-01			2.30E+02	N (a)	--
Pyrene	20 / 28	0.037 - 3.6	0.36 - 2	NP	3.65E-01			2.30E+02	N (a)	--
Volatile Organics										
Acetone	1 / 15	0.01 - 0.01	0.023 - 0.026	NP	1.21E-02			1.60E+02	N (a)	--
Carbon disulfide	1 / 28	0.0022 - 0.0022	0.0054 - 0.0066	NP	2.99E-03			3.60E+01	N (a)	--
Ethylbenzene	1 / 28	0.0017 - 0.0017	0.0054 - 0.0066	NP	2.97E-03			1.50E+02	N (a)	--
Toluene	1 / 25	0.011 - 0.011	0.0054 - 0.0066	NP	3.33E-03			5.90E+01	N (a)	--
Total xylenes	1 / 28	0.0084 - 0.0084	0.0054 - 0.0066	NP	3.21E-03			1.40E+02	N (a)	--
Trichloroethene	1 / 28	0.0018 - 0.0018	0.0054 - 0.0066	NP	2.98E-03			2.80E-01	N (a)	--

COPC - Chemical of Potential Concern; UCL - Upper Confidence Limit
L - Data are found to have lognormal distribution; N - Data are found to have normal distribution; NP - Nonparmametric; data are found to be neither normally nor lognormally distributed.
mg/kg - milligram per kilogram

[a] Surface soil is defined by samples taken from 0 to 1 foot below ground surface.
[b] Method of estimation based on statistical distribution (please see Section 5.2.2).
[c] Please see Table 2-6.
[d] Residential Soil PRGs from EPA, 1999, "Region 9 Preliminary Remediation Goals (PRGs), December 3, 1999," adjusted to reflect a cancer risk of 1E-7 and a hazard index of 0.1.
[e] N = Chemical is not chosen as a COPC:
(a) = maximum detection is less than the Risk Based Screening Concentration (RBSC).
(b) = essential nutrient.
(c) = frequency of detection is less than 5%.
[f] Y = Chemical is chosen as COPC:
(a) = maximum detection is greater than RBSC.
(b) = included in background risk calculation
[g] Based on PRG for total chromium.
[h] Level in bare soil at or below which adverse effects are not expected in regularly exposed children (EPA, 1994, "Guidance on Residential Lead-Based Paint, Lead-Contaminated Dust, and Lead-Contaminated Soil," Memorandum from L.R. Goldman to regional directors, 14 July).
[i] Calculated; reference Appendix B.
[j] Detection limits from samples #10620 and #10630 were deleted when calculating the mean and UCL for this compound, because the detection limits were elevated by dilution factors of 1000 and 100 times, respectively, which greatly exceed the maximum detected concentration and would bias the UCL unrealistically high. Adjusted frequency of detection and maximum detection limits are shown in parentheses.
[k] Based on PRG for mixed dinitrotoluene.

Table 2-2

Statistical Summary and COPC Selection of Subsurface Soil [a] Sample Analyses
TNT Area B, Plum Brook Ordnance Works, Sandusky, Ohio

Chemical Name (mg/kg)	Frequency of Detection	Range of Detected [1] Concentrations	Range of Reporting Limits	Statistical Distribution	Arithmetic Mean	95% UCL [b]	Background Screening Criterion [c]	Risk-Based Screening Criterion [d]	COPC? [e,f]	Source Term Concentration
Inorganics										
Aluminum	11 / 11	2990 - 9350	21.9 - 26.7	L	5.83E+03	7.15E+03	2.69E+04	7.60E+03	Y (b)	7.15E+03
Arsenic	11 / 11	8.7 - 35.6	1.1 - 1.3	N	1.92E+01	2.36E+01	7.10E+01	3.90E-02	Y (b)	2.36E+01
Barium	11 / 11	38.9 - 496	21.9 - 26.7	NP	1.15E+02		1.30E+03	5.40E+02	N (a)	--
Beryllium	9 / 11	0.57 - 1.8	0.55 - 0.67	L	8.15E-01		1.17E+00	1.50E+01	N (a)	--
Cadmium	1 / 11	1.1 - 1.1	0.55 - 0.67	NP	3.75E-01			3.70E+00	N (a)	--
Calcium	11 / 11	922 - 8110	548 - 668	L	3.13E+03			Nutrient	N (b)	--
Chromium	11 / 11	6.2 - 24.9	1.1 - 1.3	L	1.22E+01	1.59E+01	2.90E+01	2.10E+01 g	Y (b)	1.59E+01
Cobalt	9 / 11	8.1 - 54.1	5.5 - 6.7	L	1.29E+01		2.48E+02	4.70E+02	N (a)	--
Copper	11 / 11	16.9 - 66.7	2.7 - 3.3	N	4.26E+01		1.47E+02	2.90E+02	N (a)	--
Iron	11 / 11	12500 - 80000	11 - 59.4	L	3.28E+04	5.03E+04	3.58E+05	2.30E+03	Y (b)	5.03E+04
Lead	11 / 11	16.1 - 80.7	0.33 - 0.4	NP	3.23E+01		5.13E+01	4.00E+02 h	N (a)	--
Magnesium	11 / 11	655 - 2000	548 - 668	L	1.19E+03			Nutrient	N (b)	--
Manganese	11 / 11	87.5 - 3110	1.6 - 2	NP	4.84E+02	3.11E+03	3.51E+03	1.80E+02	Y (b)	3.11E+03
Mercury	7 / 11	0.043 - 0.081	0.036 - 0.044	N	4.52E-02		5.60E-01	2.30E+00	N (a)	--
Nickel	11 / 11	8.8 - 55.5	4.4 - 5.3	N	3.15E+01		7.79E+01	1.60E+02	N (a)	--
Potassium	10 / 11	677 - 1390	548 - 668	N	9.56E+02			Nutrient	N (b)	--
Selenium	11 / 11	0.64 - 3.9	0.55 - 0.67	L	1.72E+00		2.00E+00	3.90E+01	N (a)	--
Zinc	11 / 11	40.6 - 285	2.2 - 2.7	NP	1.00E+02		3.22E+02	2.30E+03	N (a)	--
Nitroaromatics										
2-Amino-4,6-dinitrotoluene	7 / 11	1 - 93	0.25 - 62	L	1.99E+01	8.59E+03		3.70E-01 i	Y (a)	9.30E+01
4-Amino-2,6-dinitrotoluene	6 / 11 (9)	1.7 - 45	0.25 - 400 (12)	L	9.11E+00	2.55E+03 j		3.70E-01 i	Y (a)	4.50E+01
2,4-Dinitrotoluene	7 / 11	1.4 - 240	0.25 - 62	L	2.81E+01	2.43E+03		7.20E-02 k	Y (a)	2.40E+02
2,6-Dinitrotoluene	3 / 11	0.49 - 180	0.25 - 62	L	2.07E+01	4.24E+03		7.20E-02 k	Y (a)	1.80E+02
2-Nitrotoluene	1 / 11	82 - 82	0.25 - 62	NP	1.17E+01	8.20E+01		3.70E+01	Y (a)	8.20E+01
4-Nitrotoluene	1 / 11	67 - 67	0.25 - 62	NP	1.04E+01	6.70E+01		3.70E+01	Y (a)	6.70E+01
2,4,6-Trinitrotoluene	10 / 11	0.27 - 2200	0.25 - 62	L	2.68E+02	1.10E+06		1.60E+00	Y (a)	2.20E+03
PCBs										
Aroclor 1254	2 / 11	0.063 - 0.14	0.039 - 2.5	NP	2.58E-01	1.25E+00		2.20E-02	Y (a)	1.40E-01
Aroclor 1260	4 / 11	0.11 - 4.6	0.039 - 0.72	NP	8.16E-01	4.60E+00		2.20E-02	Y (a)	4.60E+00
Semivolatile Organics										
2-Methylnaphthalene	2 / 11	0.12 - 0.96	0.36 - 0.44	NP	2.62E-01			1.20E+02 i	N (a)	--
4,6-Dinitro-2-methylphenol	1 / 11	0.17 - 0.17	1.8 - 2.1	NP	8.93E-01			6.10E-01 i	N (a)	--
Benzo(a)anthracene	1 / 11	0.037 - 0.037	0.36 - 0.44	NP	1.84E-01			6.20E-02	N (a)	--
Benzo(a)pyrene	1 / 11	0.033 - 0.033	0.36 - 0.44	NP	1.84E-01	1.95E-01		6.20E-03	Y (a)	3.30E-02
Benzo(b)fluoranthene	2 / 11	0.041 - 0.053	0.36 - 0.44	NP	1.72E-01			6.20E-02	N (a)	--
Benzo(k)fluoranthene	1 / 11	0.055 - 0.055	0.36 - 0.44	NP	1.86E-01			6.20E-01	N (a)	--

Table 2-2

Statistical Summary and COPC Selection of Subsurface Soil [a] Sample Analyses
TNT Area B, Plum Brook Ordnance Works, Sandusky, Ohio

Chemical Name (mg/kg)	Frequency of Detection	Range of Detected [i] Concentrations	Range of Reporting Limits	Statistical Distribution	Arithmetic Mean	95% UCL [b]	Background Screening Criterion [c]	Risk-Based Screening Criterion [d]	COPC? [e,f]	Source Term Concentration
Chrysene	1 / 11	0.11 - 0.11	0.36 - 0.44	NP	1.91E-01			6.20E+00	N (a)	--
Dibenzofuran	1 / 11	0.045 - 0.045	0.36 - 0.44	NP	1.85E-01			2.90E+01	N (a)	--
Fluoranthene	1 / 11	0.13 - 0.13	0.36 - 0.44	NP	1.93E-01			2.30E+02	N (a)	--
Naphthalene	1 / 11	0.28 - 0.28	0.36 - 0.44	NP	2.06E-01			5.60E+00	N (a)	--
Phenanthrene	2 / 11	0.048 - 0.28	0.36 - 0.44	NP	1.94E-01			2.30E+02	N (a)	--
Pyrene	1 / 11	0.12 - 0.12	0.36 - 0.44	NP	1.92E-01			2.30E+02	N (a)	--
Volatile Organics										
2-Butanone	1 / 2	0.015 - 0.015	0.022 - 0.025	L	1.30E-02			7.30E+02	N (a)	--
Acetone	5 / 6	0.022 - 0.56	0.022 - 0.059	L	1.32E-01			1.60E+02	N (a)	--
Toluene	7 / 9	0.0026 - 0.021	0.0055 - 0.0067	NP	5.38E-03			5.90E+01	N (a)	--
Total xylenes	2 / 11	0.0024 - 0.0025	0.0055 - 0.0067	N	2.90E-03			1.40E+02	N (a)	--

COPC - Chemical of Potential Concern
L - Data are found to have lognormal distribution; N - Data are found to have normal distribution; NP - Nonparmetric; data are found to be of neither normal or lognormal distribution.
UCL - Upper Confidence Limit
mg/kg - milligram per kilogram

[a] Subsurface soil is defined by samples taken from 1 to 10 feet below ground surface.
[b] Method of estimation based on statistical distribution (please see Section 5.2.2).
[c] Please see Table 2-6.
[d] Residential Soil PRGs from EPA, 1999, "Region 9 Preliminary Remediation Goals (PRGs), December 3,1999," adjusted to reflect a cancer risk of 1E-7 and a hazard index of 0.1.
[e] N = Chemical is not chosen as a COPC:
(a) = maximum detection is less than the Risk Based Screening concentration (RBSC).
(b) = essential nutrient.
[f] Y = Chemical is chosen as COPC:
(a) = maximum detection is greater than RBSC.
(b) = included in background risk calculation
[g] Based on PRG for total chromium.
[h] Level in bare soil at or below which adverse effects are not expected in regularly exposed children (EPA, 1994, "Guidance on Residential Lead-Based Paint, Lead-Contaminated Dust, and Lead-Contaminated Soil," Memorandum from L.R. Goldman to regional directors, 14 July).
[i] Calculated; reference Appendix B.
[j] Detection limits from samples 10620 and 10630 were deleted when calculating the mean and UCL for this compound, because the detection limits were elevated by dilution factors of 1000 and 100 times, respectively, which greatly exceed the maximum detected concentration and would bias the UCL unrealistically high. Adjusted frequency of detection and maximum detection limits are shown in parentheses.
[k] Based on PRG for mixed dinitrotoulene.

Table 2-3

Screening of VOCs from Subsurface Soil in Indoor Air
TNT Area B, Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Chemical Concentration In Soil (mg/kg)	VOC Concentration In Soil Gas C_{source} (g/cm^3)	Effective Diffusion Coefficient D^{eff} (cm^2/sec)	Attenuation Coefficient α (unitless)	VOC Concentration in Indoor Air In the Building (mg/m^3)	Risk-Based Screening Criterion [a] (mg/m^3)	COPC?
Volatile Organics							
2-Butanone	1.50E-02	2.27E-10	6.36E-03	4.51E-06	1.02E-06	1.00E-01	No
Acetone	5.60E-01	8.48E-09	9.74E-03	6.91E-06	5.86E-05	6.10E-02	No
Toluene	2.10E-02	2.74E-08	6.79E-03	4.81E-06	1.32E-04	4.00E-02	No
Total xylenes	2.50E-03	3.16E-09	5.46E-03	3.87E-06	1.23E-05	7.30E-02	No

COPC = chemical of potential concern

[a] Ambient Air PRGs from EPA, 1999, "Region 9 Preliminary Remediation Goals (PRGs), December 3,1999," adjusted to reflect a cancer risk of 1E-7 and a hazard index of 0.1.

Table 2-4

COPC Selection of Total Soil[a]
TNT Area B, Plum Brook Ordnance Works, Sandusky, Ohio

Chemical Name (mg/kg)	Background Screening Criterion [b]	Risk-Based Screening Criterion [c]		COPC? [d]	Source Term Concentration
Inorganics					
Aluminum	2.69E+04	7.60E+03		Y (b)	7.15E+03
Arsenic	7.10E+01	3.90E-02		Y (b)	2.36E+01
Chromium	2.90E+01	2.10E+01	e	Y (b)	1.59E+01
Copper	1.47E+02	2.90E+02		Y (b)	4.45E+02
Iron	3.58E+05	2.30E+03		Y (b)	5.03E+04
Manganese	3.51E+03	1.80E+02		Y (b)	3.11E+03
Thallium	1.30E+00	5.10E-01	f	Y (b)	1.40E+00
Nitroaromatics					
2-Amino-4,6-dinitrotoluene		3.70E-01	f	Y (a)	9.30E+01
4-Amino-2,6-dinitrotoluene		3.70E-01	f	Y (a)	4.50E+01
2,4-Dinitrotoluene		7.20E-02	g	Y (a)	2.40E+02
2,6-Dinitrotoluene		7.20E-02	g	Y (a)	1.80E+02
2-Nitrotoluene		3.70E+01		Y (a)	8.20E+01
4-Nitrotoluene		3.70E+01		Y (a)	6.70E+01
2,4,6-Trinitrotoluene		1.60E+00		Y (a)	6.90E+03
PCBs					
Aroclor 1254		2.20E-02		Y (a)	5.30E-01
Aroclor 1260		2.20E-02		Y (a)	1.50E+01
Semivolatile Organics					
Benzo(a)anthracene		6.20E-02		Y (a)	2.40E+00
Benzo(a)pyrene		6.20E-03		Y (a)	2.00E+00
Benzo(b)fluoranthene		6.20E-02		Y (a)	1.80E+00
Benzo(k)fluoranthene		6.20E-01		Y (a)	2.00E+00
Dibenz(a,h)anthracene		6.20E-03		Y (a)	5.50E-01
Indeno(1,2,3-cd)pyrene		6.20E-02		Y (a)	1.00E+00

COPC - Chemical of Potential Concern; UCL - Upper Confidence Limit; mg/kg - milligram per kilogram

[a] Total soil is defined in Section 2.1.1 of the text.

[b] Please see Table 2-6.

[c] Residential Soil PRGs from EPA, 1999, "Region 9 Preliminary Remediation Goals (PRGs), December 3,1999," adjusted to reflect a cancer risk of 1E-7 and a hazard index of 0.1.

[d] Y = Chemical is chosen as COPC:
(a) = maximum detection is greater than RBSC.
(b) = included in background risk calculation

[e] Based on PRG for total chromium.

[f] Calculated; reference Appendix B.

[g] Based on PRG for mixed dinitrotoulene.

Table 2-5

Statistical Summary and COPC Selection of Surface Water Sample Analyses
TNT Manufacturing Area B, Plum Brook Ordnance Works, Sandusky, Ohio

Chemical Name (ug/L)	Frequency of Detection	Range of Detected Concentrations	Range of Reporting Limits	Statistical Distribution [a]	Arithmetic Mean	95% UCL [a]	Risk-Based Screening Criterion [b]	COPC? [c,d]	Source Term Concentration
Inorganics (Unfiltered)									
Aluminum	2 / 2	969 - 14900	200 - 200	NA	7.93E+03	NA	3.60E+04	N (a)	---
Arsenic	2 / 2	21.1 - 30.9	10 - 10	NA	2.60E+01	NA	4.50E-02	Y	3.09E+01
Calcium	2 / 2	126000 - 140000	5000 - 5000	NA	1.33E+05	NA	Nutrient	N (b)	---
Chromium	2 / 2	11.5 - 18.8	10 - 10	NA	1.52E+01	NA	1.10E+02 [e]	N (a)	---
Copper	1 / 2	34.2 - 34.2	25 - 25	NA	2.34E+01	NA	1.40E+03	N (a)	---
Iron	2 / 2	35000 - 167000	100 - 100	NA	1.01E+05	NA	1.10E+04	Y	1.67E+05
Lead	2 / 2	7.8 - 20.5	3 - 3	NA	1.42E+01	NA	1.50E+01 [f]	Y	2.05E+01
Magnesium	2 / 2	23900 - 34200	5000 - 5000	NA	2.91E+04	NA	Nutrient	N (b)	---
Manganese	2 / 2	793 - 1440	15 - 15	NA	1.12E+03	NA	8.80E+02	Y	1.44E+03
Nickel	1 / 2	43.1 - 43.1	40 - 40	NA	3.16E+01	NA	7.30E+02	N (a)	---
Potassium	1 / 2	16200 - 16200	5000 - 5000	NA	9.35E+03	NA	Nutrient	N (b)	---
Selenium	1 / 2	6 - 6	5 - 5	NA	4.25E+00	NA	1.80E+02	N (a)	---
Sodium	2 / 2	17600 - 20600	5000 - 5000	NA	1.91E+04	NA	Nutrient	N (b)	---
Zinc	2 / 2	57.8 - 58.8	20 - 20	NA	5.83E+01	NA	1.10E+04	N (a)	---
Volatile Organics									
1,1-Dichloroethane	1 / 2	0.51 - 0.51	1 - 1	NA	5.05E-01	NA	8.10E+02	N (a)	---
2-Butanone	1 / 1	1.2 - 1.2	5 - 5	NA	1.20E+00	NA	1.90E+03	N (a)	---
Carbon disulfide	1 / 2	1.2 - 1.2	1 - 1	NA	8.50E-01	NA	1.00E+03	N (a)	---
Toluene	1 / 1	3.4 - 3.4	1 - 1	NA	3.40E+00	NA	7.20E+02	N (a)	---

UCL - Upper Confidence Limit
COPC - Chemical of Potential Concern
NA - not applicable
ug/L - micrograms per Liter

[a] Insufficient number of samples (less than 5), to determine statistical distribution or calculate a UCL.
[b] EPA, 1999, Region IX Preliminary Remediation Goals (PRGs), December 3, 1999, S. J. Smucker, Ph.D., unadjusted tap water PRGs.
[c] N = Chemical is not chosen as a COPC:
(a) = maximum detection is less than the Risk Based Screening concentration (RBSC).
(b) = essential nutrient.
[d] Y = Chemical is chosen as COPC.
[e] RBSC based on the PRG for chromium VI.
[f] EPA, 1996, ***Drinking Water Regulations and Health Advisories***, Office of Water, Washington, DC, October.

Table 2-6

Statistical Summary and COPC Selection of Sediment Sample Analyses
TNT Area B, Plum Brook Ordnance Works, Sandusky, Ohio

Chemical Name (mg/kg)	Frequency of Detection	Range of Detected Concentrations	Range of Reporting Limits	Statistical Distribution	Arithmetic Mean	95% UCL [a]	Risk-Based Screening Criterion [c]	COPC? [d,e]	Source Term Concentration
Inorganics									
Aluminum	5 / 5	4210 - 20000	29.7 - 123	N	1.29E+04		7.60E+04	N (a)	---
Arsenic	5 / 5	15.9 - 32.5	1.5 - 6.1	L	2.23E+01	3.23E+01	3.90E-01	Y	3.23E+01
Barium	5 / 5	57.4 - 174	29.7 - 123	L	1.02E+02		5.40E+03	N (a)	---
Beryllium	3 / 5	1.4 - 6.9	0.74 - 3.1	L	3.28E+00		1.50E+02	N (a)	---
Calcium	5 / 5	1580 - 10200	742 - 3070	L	4.79E+03		Nutrient	N (b)	---
Chromium	5 / 5	11.3 - 24.9	1.5 - 6.1	L	1.71E+01		2.10E+02 f	N (a)	---
Cobalt	2 / 5	74.2 - 137	7.4 - 30.7	L	4.56E+01		4.70E+03	N (a)	---
Copper	5 / 5	40.2 - 66	3.7 - 15.3	N	5.26E+01		2.90E+03	N (a)	---
Iron	5 / 5	26400 - 196000	14.8 - 61.3	L	9.38E+04	1.12E+06	2.30E+04	Y	1.96E+05
Lead	5 / 5	15.4 - 25.8	0.45 - 1.8	N	2.10E+01		4.00E+02 g	N (a)	---
Magnesium	1 / 5	1350 - 1350	742 - 3070	N	1.09E+03		Nutrient	N (b)	---
Manganese	5 / 5	58.1 - 2060	2.2 - 9.2	L	5.71E+02	1.43E+05	1.80E+03	Y	2.06E+03
Nickel	5 / 5	15.9 - 178	5.9 - 24.5	L	8.53E+01		1.60E+03	N (a)	---
Potassium	4 / 5	1450 - 3320	742 - 3070	L	1.97E+03		Nutrient	N (b)	---
Selenium	4 / 5	0.86 - 4	0.74 - 3.1	N	2.18E+00		3.90E+02	N (a)	---
Zinc	5 / 5	31.3 - 340	3 - 12.3	L	1.61E+02		2.30E+04	N (a)	---
Nitroaromatics									
2,4,6-Trinitrotoluene	1 / 5	0.96 - 0.96	0.25 - 0.25	NP	2.92E-01		1.60E+01	N (a)	---
2-Amino-4,6-dinitrotoluene	1 / 5	0.56 - 0.56	0.25 - 0.25	NP	2.12E-01		3.70E+00 h	N (a)	---
Semivolatile Organics									
2-Methylnaphthalene	1 / 5	0.38 - 0.38	0.49 - 2	L	6.33E-01		1.20E+03 h	N (a)	---
Benzo(a)pyrene	1 / 5	0.047 - 0.047	0.49 - 2	N	5.48E-01		6.20E-02	N (a)	---
Fluoranthene	1 / 5	0.082 - 0.082	0.49 - 2	N	5.55E-01		2.30E+03	N (a)	---
Naphthalene	1 / 5	0.078 - 0.078	0.49 - 2	N	5.73E-01		5.60E+01	N (a)	---
Phenanthrene	1 / 5	0.17 - 0.17	0.49 - 2	N	5.91E-01		2.30E+03 h	N (a)	---
Pyrene	1 / 5	0.059 - 0.059	0.49 - 2	N	5.51E-01		2.30E+03	N (a)	---
Volatile Organics									
2-Butanone	4 / 5	0.0072 - 0.062	0.03 - 0.12	N	3.66E-02		7.30E+03	N (a)	---
Acetone	4 / 4	0.048 - 0.27	0.03 - 0.12	L	1.55E-01		1.60E+03	N (a)	---
Carbon disulfide	1 / 5	0.0025 - 0.0025	0.0074 - 0.031	N	9.10E-03		3.60E+02	N (a)	---

COPC - Chemical of Potential Concern
L - Data are found to have lognormal distribution; N - Data are found to have normal distribution;
NP - Nonparmametric, data are found to be neither normally nor lognormally distributed.

Table 2-6

Statistical Summary and COPC Selection of Sediment Sample Analyses
TNT Area B, Plum Brook Ordnance Works, Sandusky, Ohio

UCL - Upper Confidence Limit
mg/kg - milligram per kilogram

[a] Method of estimation based on statistical distribution (please see Section 5.2.2).

[c] EPA, 1999, Region IX Preliminary Remediation Goals (PRGs), December 3, 1999, S. J. Smucker, Ph.D., unadjusted residential soil PRG.

[d] N = Chemical is not chosen as a COPC:
(a) = maximum detection is less than the Risk Based Screening Concentration (RBSC).
(b) = essential nutrient.

[e] Y = Chemical is chosen as a COPC.

[f] PRG based on total chromium.

[g] Level in bare soil at or below which adverse effects are not expected in regularly exposed children (EPA, 1994, "Guidance on Residential Lead-Based Paint, Lead-Contaminated Dust, and Lead-Contaminated Soil," Memorandum from L.R. Goldman to regional directors, 14 July).

[h] Calculated; reference Appendix B.

Table 2-7

Background Concentrations of Metals in Soil
TNT Manufacturing Area B, Plum Brook Ordnance Works, Sandusky, Ohio

Chemical Name (mg/kg)	Frequency of Detection	Range of Detected Concentrations	Range of Reporting Limits	Statistical Distribution	Arithmetic Mean	95% UTL [a]	Background Screening Criterion [b]
Aluminum	12 / 12	3520 - 15500	NA	L	8.43E+03	2.69E+04	2.69E+04
Antimony	9 / 25	5.9 - 9.3	5.4 - 74	NP	4.68E+00	NA	9.30E+00
Arsenic	23 / 26	2.1 - 36.5	1.2 - 3.7	L	1.08E+01	7.10E+01	7.10E+01
Barium	9 / 12	35.6 - 826	23.2 - 24.7	L	1.16E+02	1.30E+03	1.30E+03
Beryllium	6 / 25	0.57 - 1	0.57 - 1.2	L	5.65E-01	1.17E+00	1.17E+00
Cadmium	0 / 25	NA	0.57 - 1.2	NP	4.49E-01	NA	NA
Chromium	25 / 26	4.4 - 29	12.3 - 12.3	NP	1.34E+01	NA	2.90E+01
Cobalt	9 / 12	9.6 - 116	5.8 - 6.2	L	2.26E+01	2.48E+02	2.48E+02
Copper	23 / 26	2.3 - 56.2	2.2 - 2.9	L	1.70E+01	1.47E+02	1.47E+02
Iron	12 / 12	5880 - 234000	NA	L	4.01E+04	3.58E+05	3.58E+05
Lead	26 / 26	1.9 - 48.6	NA	L	1.28E+01	5.13E+01	5.13E+01
Manganese	26 / 26	21 - 13300	NA	L	7.29E+02	3.51E+03	3.51E+03
Mercury	2 / 26	0.085 - 0.085	0.037 - 0.3	L	9.06E-02	5.60E-01	5.60E-01
Nickel	26 / 26	5.4 - 55.1	NA	L	2.28E+01	7.79E+01	7.79E+01
Selenium	5 / 25	0.61 - 2	0.57 - 4.9	NP	1.55E+00	NA	2.00E+00
Silver	2 / 26	1.1 - 11.1	1.1 - 1.3	NP	1.00E+00	NA	1.11E+01
Thallium	2 / 25	1.2 - 1.3	1.1 - 6.1	NP	1.91E+00	NA	1.30E+00
Vanadium	11 / 12	9 - 40.9	61.7 - 61.7	L	2.48E+01	8.31E+01	8.31E+01
Zinc	26 / 26	6.6 - 655	NA	L	7.30E+01	3.22E+02	3.22E+02

NA = Not applicable; not available.

[a] 95% UTL = 95% upper tolerance limit calculated as described in Section 2.1.3 and rounded to 3 significant figures.

[b] The maximum detected concentration is used as the background screening criterion for nonparametric data sets.

Note: Reporting limits from sample 6990 were deleted when calculating the mean and UTL for antimony, beryllium, cadmium, selenium and thallium, because the reporting limits were elevated by dilution factors.

Table 3-1

Receptor/Exposure Scenarios
TNT Manufacturing Area B, Plum Brook Ordnance Works, Sandusky, Ohio

Source Medium	Model	Exposure Medium	Exposure Pathway
Groundskeeper			
Surface soil	None	Soil	Incidental ingestion
			Dermal contact
	Volatilization from soil	Air	Inhalation
	Dust emissions based on activity	Air	Inhalation
Total soil	Not quantified[a]		
Surface water	Not quantified[b]		
Sediment	Not quantified[b]		
Groundwater	Not evaluated at this time[c]		
Indoor Worker			
Surface soil	None	Soil	Incidental ingestion
Subsurface soil	Volatilization from soil	Indoor air	Inhalation
Total soil	Not quantified[a]		
Surface water	Not quantified[a]		
Sediment	Not quantified[a]		
Groundwater	Not evaluated at this time[c]		

Table 3-1

Receptor/Exposure Scenarios
TNT Manufacturing Area B, Plum Brook Ordnance Works, Sandusky, Ohio

Source Medium	Model	Exposure Medium	Exposure Pathway
Construction Worker			
Total soil	None	Soil	Incidental ingestion
			Dermal contact
	Volatilization from soil	Air	Inhalation
	Dust emissions based on activity	Air	Inhalation
Surface water	None	Surface water	Dermal contact
	Volatilization from water	Air	Inhalation[d]
Sediment	None	Sediment	Incidental ingestion
			Dermal contact
Groundwater	Not evaluated at this time[c]		

Table 3-1

Receptor/Exposure Scenarios
TNT Manufacturing Area B, Plum Brook Ordnance Works, Sandusky, Ohio

Source Medium	Model	Exposure Medium	Exposure Pathway
Future On-Site Resident			
Total soil	None	Soil	Incidental ingestion
			Dermal contact
	Volatilization from soil	Air	Inhalation
	Dust emissions based on wind erosion	Air	Inhalation[e]
Subsurface soil	Volatilization from soil	Indoor air	Inhalation
Groundwater	Not evaluated at this time[c]		
Surface water	None	Surface water	Dermal contact
	Volatilization from water	Air	Inhalation[d]
Sediment	None	Sediment	Incidental ingestion
			Dermal contact

[a] There is no plausible pathway for exposure to this medium.
[b] Although contact with this medium is possible, exposure would be sporadic, rather than continuous or predictable. Such exposures do not lend themselves to evaluation under the chronic toxicity paradigm used in a baseline risk assessment.
[c] No groundwater data are available at this writing. Future groundwater exposures will be assessed when data become available.
[d] Although theoretically complete, this pathway is not quantified as explained in text.
[e] It is assumed that residential soil is 80 percent covered with pavement or vegetation for evaluating inhalation exposure via dust emissions.

Table 3-2

Variables Used to Estimate Potential Chemical Intakes and Contact Rates for Receptors TNT Area B, Plum Brook Ordnance Works, Sandusky, Ohio

Pathway Variable	Grounds-keeper	Construction Worker	On-Site Resident	Indoor Worker
General Variables Used in All Intake Models				
Exposure duration (ED), years	25[a]	0.5[b]	Child: 6[c] Adult: 24[c]	25[a]
Body weight (BW), kg	70[a]	70[a]	Child: 15[c] Adult: 70[a]	70[a]
Averaging time, noncancer (AT), days[d]	9125	183	Child: 2190 Adult: 8760	9125
Averaging time, cancer (AT), days[e]	25550	25550	25550	25550
Inhalation of VOCs and Resuspended Dust from Soil				
Fraction exposed to contaminated medium (FI_a), unitless	1[b]	1[b]	1[b]	NA
Inhalation rate (IR_a), m^3/day	20[a]	20[a]	Child: 10[c] Adult: 20[a]	NA
Exposure frequency (EF), days/year	250[a]	250[a]	350[a]	NA
Inhalation of VOCs, Entrapped in Building				
Fraction exposed to contaminated medium (FI_a), unitless	NA	NA	1[b]	1[b]
Inhalation rate (IR_a), m^3/day	NA	NA	Child: 6.8[b] Adult: 13.7[b]	20[a]
Exposure frequency (EF), days/year	NA	NA	350[a]	250[a]

Table 3-2

Variables Used to Estimate Potential Chemical Intakes and Contact Rates for Receptors TNT Area B, Plum Brook Ordnance Works, Sandusky, Ohio

Pathway Variable	Grounds-keeper	Construction Worker	On-Site Resident	Indoor Worker
Incidental Ingestion of Soil				
Fraction exposed to contaminated medium (FI_{so}), unitless	1[b]	0.5[b]	0.9[b]	1[b]
Soil incidental ingestion rate (IR_{so}), mg/day	100[a]	290[b]	Child: 200[c] Adult: 100[a]	50[a]
Exposure frequency (EF), days/year	250[a]	250[a]	350[a]	250[a]
Incidental Ingestion of Sediment				
Fraction exposed to contaminated medium (FI_{sd}), unitless	NA	0.5[b]	0.1[b]	NA
Sediment incidental ingestion rate (IR_{sd}), mg/day	NA	480[b]	Child: 200[c] Adult: 100[a]	NA
Exposure frequency (EF), days/year	NA	250[a]	52[b]	NA
Dermal Contact with Soil				
Fraction exposed to contaminated medium ($_{FIso}$), unitless	1[b]	0.5[b]	0.9[b]	NA
Body surface area exposed to soil (SA_{so}), cm^2	11,300[f]	11,300[f]	Child: 1750[g] Adult: 4550[g]	NA
Soil-to-skin adherence factor (AF_{so}), mg/cm^2	0.009[f]	0.08[f]	0.2[g]	NA
Dermal absorption factor (ABS), unitless	csv	csv	csv	NA
Exposure frequency (EF), days/year	250[a]	250[a]	350[a]	NA

Table 3-2

Variables Used to Estimate Potential Chemical Intakes and Contact Rates for Receptors TNT Area B, Plum Brook Ordnance Works, Sandusky, Ohio

Pathway Variable	Grounds-keeper	Construction Worker	On-Site Resident	Indoor Worker
Dermal Contact with Sediment				
Fraction exposed to contaminated medium (FI_{sd}), unitless	NA	0.5[b]	0.1[b]	NA
Body surface area exposed to sediment (SA_{sd}), cm^2	NA	3100[f]	Child: 1750[g] Adult: 4550[g]	NA
Sediment-to-skin adherence factor (AF_{sd}), mg/cm^2	NA	0.24[f]	0.2[g]	NA
Dermal absorption factor (ABS), unitless	NA	csv	csv	NA
Exposure frequency (EF), days/year	NA	250[a]	52[b]	NA
Dermal Contact with Surface Water				
Body surface area exposed to surface water, (SA_{sw}), cm^2	NA	3100[f]	Child: 2100[g] Adult: 5450[g]	NA
Permeability coefficient (PC), cm/hour	NA	csv	csv	NA
Exposure time (ET_{sw}), hour/day	NA	4[b]	3[b]	NA
Exposure frequency (EF), days/year	NA	250[a]	52[b]	NA

Table 3-2

Variables Used to Estimate Potential Chemical Intakes and Contact Rates for Receptors TNT Area B, Plum Brook Ordnance Works, Sandusky, Ohio

[a] U.S. Environmental Protection Agency (EPA), 1991, *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance, Standard Default Exposure Factors*, Interim Final, Office of Solid Waste and Emergency Response, OSWER Directive: 9285.603.

[b] Assumed; see text.

[c] U.S. Environmental Protection Agency (EPA), 1999, *EPA Region 9: Preliminary Remediation Goals (PRGs) 1999*, 3 December, on-line.

[d] Calculated as the product of ED (years) x 365 days/year.

[e] Calculated as the product of 70 years (assumed human lifetime) x 365 days/year.

[f] U.S. Environmental Protection Agency (EPA), 1997a, *Exposure Factors Handbook*, Final, National Center for Environmental Assessment, Washington, DC, EPA/600/P-95/002Fa, August.

[g] EPA, 1992b, *Dermal Exposure Assessment: Principles and Applications*, Interim Report, Office of Research and Development, Washington, DC, EPA/600/8-91/011B, including Supplemental Guidance dated August 18, 1992.

NA = not applicable to this receptor; csv = chemical-specific value (see Table 4-1).

Table 4-1

COPC-Specific Variable Values[a] Used in Risk Assessment
TNT Manufacturing Area B
Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	GAF	Oral RfD (mg/kg-day)	Target Organs (Oral)	Dermal RfD (mg/kg-day)	Inhalation RfD (mg/kg-day)	Target Organs (Inhalation)	Cancer Weight-of-Evidence Group	Oral SF (/mg/kg-day)	Dermal SF (/mg/kg-day)	Inhalation SF (/mg/kg-day)
Inorganics										
Aluminum	0.27	1.00E+00	N	2.70E-01	1.40E-03	N	ND	ND	ND	ND
Arsenic	0.95	3.00E-04	S, CV	2.85E-04	ND	NA	A	1.50E+00	1.58E+00	1.50E+01
Chromium	0.01	1.50E+00	ND	7.50E-02	2.90E-05	Lung	A	ND	ND	4.20E+01
Copper	0.6	4.00E-02	L, K, E, GI	2.40E-02	ND	NA	D	ND	ND	ND
Iron	1	3.00E-01	None [b]	3.00E-02	ND	NA	ND	ND	ND	ND
Lead	0.1	ND	NA	ND	ND	NA	B2	ND	ND	ND
Manganese	0.05	4.70E-02	N	1.41E-03	1.40E-05	N	D	ND	ND	ND
Thallium	1	6.50E-05	S, L	6.50E-05	ND	NA	D	ND	ND	ND
Nitroaromatics										
2-Amino-4,6-dinitrotoluene	0.6	6.00E-05	L, E	3.60E-05	ND	NA	D	ND	ND	ND
4-Amino-2,6-dinitrotoluene	0.6	6.00E-05	L, E	3.60E-05	ND	NA	D	ND	ND	ND
2,4-Dinitrotoluene	1	2.00E-03	N, E, L	1.80E-03	ND	NA	B2	6.80E-01	7.56E-01	ND
2,6-Dinitrotoluene	1	1.00E-03	N, E, L, K	9.00E-04	ND	NA	B2	6.80E-01	7.56E-01	ND
2-Nitrotoluene	1	1.00E-02	L, Spleen, K	1.00E-02	ND	NA	ND	ND	ND	ND
4-Nitrotoluene	1	1.00E-02	L, Spleen, K	1.00E-02	ND	NA	ND	ND	ND	ND
2,4,6-Trinitrotoluene	0.6	5.00E-04	L, E	3.00E-04	ND	NA	C	3.00E-02	5.00E-02	ND
PCBs										
Aroclor 1254	0.9 [c]	2.00E-05	I, S	1.80E-05	ND	NA	B2	2.00E+00	2.00E+00	2.00E+00
Aroclor 1260	0.9 [c]	ND	NA	ND	ND	NA	B2	2.00E+00	2.00E+00	2.00E+00
Semivolatile Organics										
Benzo(a)anthracene	0.5	ND	NA	ND	ND	NA	B2	7.30E-01	1.46E+00	3.10E-01
Benzo(a)pyrene	0.5	ND	NA	ND	ND	NA	B2	7.30E+00	1.46E+01	3.10E+00
Benzo(b)fluoranthene	0.5	ND	NA	ND	ND	NA	B2	7.30E-01	1.46E+00	3.10E-01
Benzo(k)fluoranthene	0.5	ND	NA	ND	ND	NA	B2	7.30E-02	1.46E-01	3.10E-02
Dibenz(a,h)anthracene	0.8	ND	NA	ND	ND	NA	B2	7.30E+00	9.13E+00	3.10E+00
Indeno(1,2,3-cd)pyrene	0.5	ND	NA	ND	ND	NA	B2	7.30E-01	1.46E+00	3.10E-01

ND = no data; NA = not applicable
a Please see toxicity profiles in Appendix D for documentation of the values.
b The mechanism of iron toxicity is unique; its hazard index is not summed with others in a target organ analysis
c The GAF is not used to estimate a dermal slope factor (please see toxicity profile).

Target Organs:
N = nervous system, S = skin, CV = cardiovascular, L = liver, K = kidney, E = erythrocyte, GI = gastrointestinal, I = immune system.

Weight of Evidence Group:
A - Human carcinogen; B1 - Probable human carcinogen (human data); B2 - Probable human carcinogen (animal data);
C - Possible human carcinogen; D - Not classifiable as to carcinogenicity to humans.

Table 5-1
Cancer Risk and Noncancer Hazard Index: Groundskeeper Exposure to Surface Soil
TNT Area B, Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Source-Term Concentration (mg/kg)	Incidental Ingestion: Noncancer Dose (mg/kg-day)	Incidental Ingestion: Cancer Dose (mg/kg-day)	Oral HQ	Oral ILCR	DA mg/cm2-day	Dermal Absorption: Noncancer Dose (mg/kg-day)	Dermal Absorption: Cancer Dose (mg/kg-day)	Dermal HQ	Dermal ILCR	Concentration in Air (mg/m³)	Inhalation: Noncancer Dose (mg/kg-day)	Inhalation: Cancer Dose (mg/kg-day)	Inhalation HQ	Inhalation ILCR	Total HI All Pathways	Total ILCR All Pathways
TOTAL RISK																	
Inorganics																	
Aluminum	5.93E+03	5.81E-03	2.07E-03	5.81E-03	NA	5.34E-07	5.90E-05	2.11E-05	2.19E-04	NA	5.93E-04	1.16E-04	4.15E-05	8.29E-02	NA	8.90E-02	NA
Arsenic	1.34E+01	1.31E-05	4.69E-06	4.38E-02	7.04E-06	1.21E-09	1.34E-07	4.77E-08	4.69E-04	7.53E-08	1.34E-06	2.63E-07	9.38E-08	NA	1.41E-06	4.43E-02	8.52E-06
Copper	4.45E+02	4.35E-04	1.56E-04	1.09E-02	NA	4.01E-08	4.43E-06	1.58E-06	1.85E-04	NA	4.45E-05	8.71E-06	3.11E-06	NA	NA	1.11E-02	NA
Iron	2.10E+04	2.05E-02	7.33E-03	6.84E-02	NA	1.89E-06	2.09E-04	7.45E-05	6.96E-04	NA	2.10E-03	4.10E-04	1.47E-04	NA	NA	6.91E-02	NA
Manganese	2.67E+02	2.62E-04	9.34E-05	5.57E-03	NA	2.41E-08	2.66E-06	9.50E-07	1.13E-03	NA	2.67E-05	5.23E-06	1.87E-06	3.74E-01	NA	3.80E-01	NA
Thallium	1.40E+00	1.37E-06	4.89E-07	2.11E-02	NA	1.26E-10	1.39E-08	4.98E-09	2.14E-04	NA	1.40E-07	2.74E-08	9.78E-09	NA	NA	2.13E-02	NA
Nitroaromatics																	
2-Amino-4,6-dinitrotoluene	3.80E+00	3.72E-06	1.33E-06	6.19E-02	NA	3.42E-09	3.78E-07	1.35E-07	1.05E-02	NA	3.80E-07	7.43E-08	2.65E-08	NA	NA	7.24E-02	NA
4-Amino-2,6-dinitrotoluene	4.16E+00	4.07E-06	1.45E-06	6.79E-02	NA	3.75E-09	4.14E-07	1.48E-07	1.15E-02	NA	4.16E-07	8.15E-08	2.91E-08	NA	NA	7.94E-02	NA
2,4-Dinitrotoluene	2.30E+00	2.25E-06	8.04E-07	1.13E-03	5.47E-07	2.07E-09	2.29E-07	8.17E-08	1.14E-04	5.56E-08	2.30E-07	4.50E-08	1.61E-08	NA	NA	1.24E-03	6.02E-07
2,6-Dinitrotoluene	8.30E-01	8.12E-07	2.90E-07	8.12E-04	1.97E-07	7.47E-10	8.26E-08	2.95E-08	8.26E-05	2.01E-08	8.30E-08	1.62E-08	5.80E-09	NA	NA	8.95E-04	2.17E-07
2,4,6-Trinitrotoluene	6.90E+03	6.75E-03	2.41E-03	1.35E+01	7.23E-05	6.21E-06	6.87E-04	2.45E-04	2.29E+00	1.23E-05	6.90E-04	1.35E-04	4.82E-05	NA	NA	1.58E+01	8.46E-05
PCBs																	
Aroclor 1254	5.30E-01	5.19E-07	1.85E-07	2.59E-02	3.70E-07	2.86E-10	3.16E-08	1.13E-08	1.76E-03	2.26E-08	5.30E-08	1.04E-08	3.70E-09	NA	7.41E-09	2.77E-02	4.00E-07
Aroclor 1260	1.50E+01	1.47E-05	5.24E-06	NA	1.05E-05	8.10E-09	8.96E-07	3.20E-07	NA	6.40E-07	1.50E-06	2.94E-07	1.05E-07	NA	2.10E-07	NA	1.13E-05
Semivolatile Organics																	
Benzo(a)anthracene	2.40E+00	2.35E-06	8.39E-07	NA	6.12E-07	2.16E-09	2.39E-07	8.53E-08	NA	1.25E-07	2.40E-07	4.70E-08	1.68E-08	NA	5.20E-09	NA	7.42E-07
Benzo(a)pyrene	2.00E+00	1.96E-06	6.99E-07	NA	5.10E-06	1.80E-09	1.99E-07	7.11E-08	NA	1.04E-06	2.00E-07	3.91E-08	1.40E-08	NA	4.33E-08	NA	6.18E-06
Benzo(b)fluoranthene	1.80E+00	1.76E-06	6.29E-07	NA	4.59E-07	1.62E-09	1.79E-07	6.40E-08	NA	9.34E-08	1.80E-07	3.52E-08	1.26E-08	NA	3.90E-09	NA	5.56E-07
Benzo(k)fluoranthene	2.00E+00	1.96E-06	6.99E-07	NA	5.10E-08	1.80E-09	1.99E-07	7.11E-08	NA	1.04E-08	2.00E-07	3.91E-08	1.40E-08	NA	4.33E-10	NA	6.18E-08
Dibenz(a,h)anthracene	5.50E-01	5.38E-07	1.92E-07	NA	1.40E-06	4.95E-10	5.47E-08	1.95E-08	NA	1.78E-07	5.50E-08	1.08E-08	3.84E-09	NA	1.19E-08	NA	1.59E-06
Indeno(1,2,3-cd)pyrene	1.00E+00	9.78E-07	3.49E-07	NA	2.55E-07	9.00E-10	9.95E-08	3.55E-08	NA	5.19E-08	1.00E-07	1.96E-08	6.99E-09	NA	2.17E-09	NA	3.09E-07
Total HI				1.38E+01					2.32E+00					4.57E-01		1.66E+01	
Total ILCR					9.89E-05					1.46E-05					1.69E-06		1.15E-04
BACKGROUND RISK																	
Inorganics																	
Aluminum	5.93E+03	5.81E-03	2.07E-03	5.81E-03	NA	5.34E-07	5.90E-05	2.11E-05	2.19E-04	NA	5.93E-04	1.16E-04	4.15E-05	8.29E-02	NA	8.90E-02	NA
Arsenic	1.34E+01	1.31E-05	4.69E-06	4.38E-02	7.04E-06	1.21E-09	1.34E-07	4.77E-08	4.69E-04	7.53E-08	1.34E-06	2.63E-07	9.38E-08	NA	1.41E-06	4.43E-02	8.52E-06
Copper	4.45E+02	4.35E-04	1.56E-04	1.09E-02	NA	4.01E-08	4.43E-06	1.58E-06	1.85E-04	NA	4.45E-05	8.71E-06	3.11E-06	NA	NA	1.11E-02	NA
Iron	2.10E+04	2.05E-02	7.33E-03	6.84E-02	NA	1.89E-06	2.09E-04	7.45E-05	6.96E-04	NA	2.10E-03	4.10E-04	1.47E-04	NA	NA	6.91E-02	NA
Manganese	2.67E+02	2.62E-04	9.34E-05	5.57E-03	NA	2.41E-08	2.66E-06	9.50E-07	1.13E-03	NA	2.67E-05	5.23E-06	1.87E-06	3.74E-01	NA	3.80E-01	NA
Thallium	1.40E+00	1.37E-06	4.89E-07	2.11E-02	NA	1.26E-10	1.39E-08	4.98E-09	2.14E-04	NA	1.40E-07	2.74E-08	9.78E-09	NA	NA	2.13E-02	NA
Total HI				1.34E-01					2.31E-03					4.57E-01		8.15E-01	
Total ILCR					7.04E-06					7.53E-08					1.41E-06		8.52E-06
SITE-RELATED RISK																	
Nitroaromatics																	
2-Amino-4,6-dinitrotoluene	3.80E+00	3.72E-06	1.33E-06	6.19E-02	NA	3.42E-09	3.78E-07	1.35E-07	1.05E-02	NA	3.80E-07	7.43E-08	2.65E-08	NA	NA	7.24E-02	NA
4-Amino-2,6-dinitrotoluene	4.16E+00	4.07E-06	1.45E-06	6.79E-02	NA	3.75E-09	4.14E-07	1.48E-07	1.15E-02	NA	4.16E-07	8.15E-08	2.91E-08	NA	NA	7.94E-02	NA
2,4-Dinitrotoluene	2.30E+00	2.25E-06	8.04E-07	1.13E-03	5.47E-07	2.07E-09	2.29E-07	8.17E-08	1.14E-04	5.56E-08	2.30E-07	4.50E-08	1.61E-08	NA	NA	1.24E-03	6.02E-07
2,6-Dinitrotoluene	8.30E-01	8.12E-07	2.90E-07	8.12E-04	1.97E-07	7.47E-10	8.26E-08	2.95E-08	8.26E-05	2.01E-08	8.30E-08	1.62E-08	5.80E-09	NA	NA	8.95E-04	2.17E-07
2,4,6-Trinitrotoluene	6.90E+03	6.75E-03	2.41E-03	1.35E+01	7.23E-05	6.21E-06	6.87E-04	2.45E-04	2.29E+00	1.23E-05	6.90E-04	1.35E-04	4.82E-05	NA	NA	1.58E+01	8.46E-05
PCBs																	
Aroclor 1254	5.30E-01	5.19E-07	1.85E-07	2.59E-02	3.70E-07	2.86E-10	3.16E-08	1.13E-08	1.76E-03	2.26E-08	5.30E-08	1.04E-08	3.70E-09	NA	7.41E-09	2.77E-02	4.00E-07
Aroclor 1260	1.50E+01	1.47E-05	5.24E-06	NA	1.05E-05	8.10E-09	8.96E-07	3.20E-07	NA	6.40E-07	1.50E-06	2.94E-07	1.05E-07	NA	2.10E-07	NA	1.13E-05
Semivolatile Organics																	
Benzo(a)anthracene	2.40E+00	2.35E-06	8.39E-07	NA	6.12E-07	2.16E-09	2.39E-07	8.53E-08	NA	1.25E-07	2.40E-07	4.70E-08	1.68E-08	NA	5.20E-09	NA	7.42E-07
Benzo(a)pyrene	2.00E+00	1.96E-06	6.99E-07	NA	5.10E-06	1.80E-09	1.99E-07	7.11E-08	NA	1.04E-06	2.00E-07	3.91E-08	1.40E-08	NA	4.33E-08	NA	6.18E-06
Benzo(b)fluoranthene	1.80E+00	1.76E-06	6.29E-07	NA	4.59E-07	1.62E-09	1.79E-07	6.40E-08	NA	9.34E-08	1.80E-07	3.52E-08	1.26E-08	NA	3.90E-09	NA	5.56E-07
Benzo(k)fluoranthene	2.00E+00	1.96E-06	6.99E-07	NA	5.10E-08	1.80E-09	1.99E-07	7.11E-08	NA	1.04E-08	2.00E-07	3.91E-08	1.40E-08	NA	4.33E-10	NA	6.18E-08
Dibenz(a,h)anthracene	5.50E-01	5.38E-07	1.92E-07	NA	1.40E-06	4.95E-10	5.47E-08	1.95E-08	NA	1.78E-07	5.50E-08	1.08E-08	3.84E-09	NA	1.19E-08	NA	1.59E-06
Indeno(1,2,3-cd)pyrene	1.00E+00	9.78E-07	3.49E-07	NA	2.55E-07	9.00E-10	9.95E-08	3.55E-08	NA	5.19E-08	1.00E-07	1.96E-08	6.99E-09	NA	2.17E-09	NA	3.09E-07
Total HI				1.37E+01					2.31E+00					NA		1.60E+01	
Total ILCR					9.18E-05					1.45E-05					2.84E-07		1.07E-04

HQ = Hazard quotient; HI = Hazard index; ILCR = incremental lifetime cancer risk
DA = dose absorbed per unit body surface area per day
NA = not applicable

Table 5-2
Cancer Risk and Noncancer Hazard Index: Indoor Worker Exposure to Surface Soil
TNT Area B, Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Source-Term Concentration (mg/kg)	Incidental Ingestion Noncancer Dose (mg/kg-day)	Incidental Ingestion Cancer Dose (mg/kg-day)	Oral HQ	Oral ILCR
TOTAL RISK					
Inorganics					
Aluminum	5.93E+03	2.90E-03	1.04E-03	2.90E-03	NA
Arsenic	1.34E+01	6.57E-06	2.35E-06	2.19E-02	3.52E-06
Copper	4.45E+02	2.18E-04	7.78E-05	5.44E-03	NA
Iron	2.10E+04	1.03E-02	3.66E-03	3.42E-02	NA
Manganese	2.67E+02	1.31E-04	4.67E-05	2.78E-03	NA
Thallium	1.40E+00	6.85E-07	2.45E-07	1.05E-02	NA
Nitroaromatics					
2-Amino-4,6-dinitrotoluene	3.80E+00	1.86E-06	6.63E-07	3.10E-02	NA
4-Amino-2,6-dinitrotoluene	4.16E+00	2.04E-06	7.27E-07	3.39E-02	NA
2,4-Dinitrotoluene	2.30E+00	1.13E-06	4.02E-07	5.63E-04	2.73E-07
2,6-Dinitrotoluene	8.30E-01	4.06E-07	1.45E-07	4.06E-04	9.86E-08
2,4,6-Trinitrotoluene	6.90E+03	3.38E-03	1.21E-03	6.75E+00	3.62E-05
PCBs					
Aroclor 1254	5.30E-01	2.59E-07	9.26E-08	1.30E-02	1.85E-07
Aroclor 1260	1.50E+01	7.34E-06	2.62E-06	NA	5.24E-06
Semivolatile Organics					
Benzo(a)anthracene	2.40E+00	1.17E-06	4.19E-07	NA	3.06E-07
Benzo(a)pyrene	2.00E+00	9.78E-07	3.49E-07	NA	2.55E-06
Benzo(b)fluoranthene	1.80E+00	8.81E-07	3.15E-07	NA	2.30E-07
Benzo(k)fluoranthene	2.00E+00	9.78E-07	3.49E-07	NA	2.55E-08
Dibenz(a,h)anthracene	5.50E-01	2.69E-07	9.61E-08	NA	7.02E-07
Indeno(1,2,3-cd)pyrene	1.00E+00	4.89E-07	1.75E-07	NA	1.28E-07
Total HI				**6.91E+00**	
Total ILCR					**4.94E-05**
BACKGROUND RISK					
Inorganics					
Aluminum	5.93E+03	2.90E-03	1.04E-03	2.90E-03	NA
Arsenic	1.34E+01	6.57E-06	2.35E-06	2.19E-02	3.52E-06
Copper	4.45E+02	2.18E-04	7.78E-05	5.44E-03	NA
Iron	2.10E+04	1.03E-02	3.66E-03	3.42E-02	NA
Manganese	2.67E+02	1.31E-04	4.67E-05	2.78E-03	NA
Thallium	1.40E+00	6.85E-07	2.45E-07	1.05E-02	NA
Total HI				**7.78E-02**	
Total ILCR					**3.52E-06**
SITE-RELATED RISK					
Nitroaromatics					
2-Amino-4,6-dinitrotoluene	3.80E+00	1.86E-06	6.63E-07	3.10E-02	NA
4-Amino-2,6-dinitrotoluene	4.16E+00	2.04E-06	7.27E-07	3.39E-02	NA
2,4-Dinitrotoluene	2.30E+00	1.13E-06	4.02E-07	5.63E-04	2.73E-07
2,6-Dinitrotoluene	8.30E-01	4.06E-07	1.45E-07	4.06E-04	9.86E-08
2,4,6-Trinitrotoluene	6.90E+03	3.38E-03	1.21E-03	6.75E+00	3.62E-05
PCBs					
Aroclor 1254	5.30E-01	2.59E-07	9.26E-08	1.30E-02	1.85E-07
Aroclor 1260	1.50E+01	7.34E-06	2.62E-06	NA	5.24E-06
Semivolatile Organics					
Benzo(a)anthracene	2.40E+00	1.17E-06	4.19E-07	NA	3.06E-07
Benzo(a)pyrene	2.00E+00	9.78E-07	3.49E-07	NA	2.55E-06
Benzo(b)fluoranthene	1.80E+00	8.81E-07	3.15E-07	NA	2.30E-07
Benzo(k)fluoranthene	2.00E+00	9.78E-07	3.49E-07	NA	2.55E-08
Dibenz(a,h)anthracene	5.50E-01	2.69E-07	9.61E-08	NA	7.02E-07
Indeno(1,2,3-cd)pyrene	1.00E+00	4.89E-07	1.75E-07	NA	1.28E-07
Total HI				**6.83E+00**	
Total ILCR					**4.59E-05**

HQ = Hazard quotient; HI = Hazard index; ILCR = Incremental lifetime cancer risk
NA = not applicable

Table 5-3
Cancer Risk and Noncancer Hazard Index: Construction Worker Exposure to Total Soils
TNT Area B, Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Source-Term Concentration (mg/kg)	Incidental Ingestion Noncancer Dose (mg/kg-day)	Incidental Ingestion Cancer Dose (mg/kg-day)	Oral HQ	Oral ILCR	DA mg/cm²-day	Dermal Absorption Noncancer Dose (mg/kg-day)	Dermal Absorption Cancer Dose (mg/kg-day)	Dermal HQ	Dermal ILCR	Concentration in Air (mg/m³)	Inhalation Noncancer Dose (mg/kg-day)	Inhalation Cancer Dose (mg/kg-day)	Inhalation HQ	Inhalation ILCR	Total HI All Pathways	Total ILCR All Pathways
TOTAL RISK																	
Inorganics																	
Aluminum	7.15E+03	2.02E-02	1.45E-04	2.02E-02	NA	5.72E-06	6.30E-04	4.51E-06	2.33E-03	NA	2.50E-03	4.88E-04	3.50E-06	3.49E-01	NA	3.71E-01	NA
Arsenic	2.36E+01	6.69E-05	4.79E-07	2.23E-01	7.18E-07	1.89E-08	2.08E-06	1.49E-08	7.31E-03	2.36E-08	8.27E-06	1.61E-06	1.16E-08	NA	1.73E-07	2.30E-01	9.16E-07
Chromium	1.59E+01	4.49E-05	3.21E-07	2.99E-05	NA	1.27E-08	1.40E-06	1.00E-08	9.33E-05	NA	5.56E-06	1.08E-06	7.76E-09	3.74E-02	3.26E-07	3.75E-02	3.26E-07
Copper	4.45E+02	1.26E-03	9.02E-06	3.15E-02	NA	3.56E-07	3.93E-05	2.81E-07	1.64E-03	NA	1.56E-04	3.04E-05	2.18E-07	NA	NA	3.31E-02	NA
Iron	5.03E+04	1.42E-01	1.02E-03	4.74E-01	NA	4.02E-05	4.44E-03	3.18E-05	1.48E-02	NA	1.76E-02	3.43E-03	2.46E-05	NA	NA	4.89E-01	NA
Manganese	3.11E+03	8.80E-03	6.30E-05	1.87E-01	NA	2.49E-06	2.74E-04	1.96E-06	1.17E-01	NA	1.09E-03	2.12E-04	1.52E-06	1.52E+01	NA	1.55E+01	NA
Thallium	1.40E+00	3.96E-06	2.84E-08	6.09E-02	NA	1.12E-09	1.23E-07	8.85E-10	1.90E-03	NA	4.90E-07	9.56E-08	6.85E-10	NA	NA	6.28E-02	NA
Nitroaromatics																	
2-Amino-4,6-dinitrotoluene	9.30E+01	2.63E-04	1.88E-06	4.39E+00	NA	7.44E-07	8.20E-05	5.88E-07	2.28E+00	NA	3.26E-05	6.35E-06	4.55E-08	NA	NA	6.67E+00	NA
4-Amino-2,6-dinitrotoluene	4.50E+01	1.27E-04	9.12E-07	2.12E+00	NA	3.60E-07	3.97E-05	2.84E-07	1.10E+00	NA	1.58E-05	3.07E-06	2.20E-08	NA	NA	3.23E+00	NA
2,4-Dinitrotoluene	2.40E+02	6.79E-04	4.86E-06	3.40E-01	3.31E-06	1.92E-06	2.12E-04	1.52E-06	1.06E-01	1.03E-06	8.40E-05	1.64E-05	1.17E-07	NA	NA	4.45E-01	4.34E-06
2,6-Dinitrotoluene	1.80E+02	5.09E-04	3.65E-06	5.09E-01	2.48E-06	1.44E-06	1.59E-04	1.14E-06	1.59E-01	7.73E-07	6.30E-05	1.23E-05	8.81E-08	NA	NA	6.68E-01	3.25E-06
2-Nitrotoluene	8.20E+01	2.32E-04	1.66E-06	2.32E-02	NA	6.56E-07	7.23E-05	5.18E-07	7.23E-03	NA	2.87E-05	5.60E-06	4.01E-08	NA	NA	3.04E-02	NA
4-Nitrotoluene	6.70E+01	1.90E-04	1.36E-06	1.90E-02	NA	5.36E-07	5.91E-05	4.23E-07	5.91E-03	NA	2.35E-05	4.58E-06	3.28E-08	NA	NA	2.49E-02	NA
2,4,6-Trinitrotoluene	6.90E+03	1.95E-02	1.40E-04	3.91E+01	4.20E-06	5.52E-06	6.09E-03	4.36E-05	2.03E+01	2.18E-06	2.42E-03	4.71E-04	3.38E-06	NA	NA	5.93E+01	6.38E-06
PCBs																	
Aroclor 1254	5.30E-01	1.50E-06	1.07E-08	7.50E-02	2.15E-08	2.54E-09	2.81E-07	2.01E-09	1.56E-02	4.02E-09	1.86E-07	3.62E-08	2.59E-10	NA	5.19E-10	9.06E-02	2.60E-08
Aroclor 1260	1.50E+01	4.24E-05	3.04E-07	NA	6.08E-07	7.20E-08	7.94E-06	5.69E-08	NA	1.14E-07	5.25E-06	1.02E-06	7.34E-09	NA	1.47E-08	NA	7.38E-07
Semivolatile Organics																	
Benzo(a)anthracene	2.40E+00	6.79E-06	4.86E-08	NA	3.55E-08	1.92E-09	2.12E-06	1.52E-08	NA	2.21E-08	8.40E-07	1.64E-07	1.17E-09	NA	3.64E-10	NA	5.80E-08
Benzo(a)pyrene	2.00E+00	5.66E-06	4.05E-08	NA	2.96E-07	1.60E-09	1.76E-06	1.26E-08	NA	1.84E-07	7.00E-07	1.37E-07	9.78E-10	NA	3.03E-09	NA	4.83E-07
Benzo(b)fluoranthene	1.80E+00	5.09E-06	3.65E-08	NA	2.66E-08	1.44E-09	1.59E-06	1.14E-08	NA	1.66E-08	6.30E-07	1.23E-07	8.81E-10	NA	2.73E-10	NA	4.35E-08
Benzo(k)fluoranthene	2.00E+00	5.66E-06	4.05E-08	NA	2.96E-09	1.60E-09	1.76E-06	1.26E-08	NA	1.84E-09	7.00E-07	1.37E-07	9.78E-10	NA	3.03E-11	NA	4.83E-09
Dibenz(a,h)anthracene	5.60E-01	1.58E-06	1.11E-08	NA	8.14E-08	4.40E-09	4.85E-07	3.47E-09	NA	3.17E-08	1.93E-07	3.76E-08	2.69E-10	NA	8.34E-10	NA	1.14E-07
Indeno(1,2,3-cd)pyrene	1.00E+00	2.83E-06	2.03E-08	NA	1.48E-08	8.00E-09	8.82E-07	6.32E-09	NA	9.22E-09	3.50E-07	6.83E-08	4.89E-10	NA	1.52E-10	NA	2.42E-08
Total HI				4.75E+01					2.41E+01					1.56E+01		8.72E+01	
Total ILCR					1.16E-05					4.39E-06					5.19E-07		1.67E-05
BACKGROUND RISK																	
Inorganics																	
Aluminum	7.15E+03	2.02E-02	1.45E-04	2.02E-02	NA	5.72E-06	6.30E-04	4.51E-06	2.33E-03	NA	2.50E-03	4.88E-04	3.50E-06	3.49E-01	NA	3.71E-01	NA
Arsenic	2.36E+01	6.69E-05	4.79E-07	2.23E-01	7.18E-07	1.89E-08	2.08E-06	1.49E-08	7.31E-03	2.36E-08	8.27E-06	1.61E-06	1.16E-08	NA	1.73E-07	2.30E-01	9.16E-07
Chromium	1.59E+01	4.49E-05	3.21E-07	2.99E-05	NA	1.27E-08	1.40E-06	1.00E-08	9.33E-05	NA	5.56E-06	1.08E-06	7.76E-09	3.74E-02	3.26E-07	3.76E-02	3.26E-07
Copper	4.45E+02	1.26E-03	9.02E-06	3.15E-02	NA	3.56E-07	3.93E-05	2.81E-07	1.64E-03	NA	1.56E-04	3.04E-05	2.18E-07	NA	NA	3.31E-02	NA
Iron	5.03E+04	1.42E-01	1.02E-03	4.74E-01	NA	4.02E-05	4.44E-03	3.18E-05	1.48E-02	NA	1.76E-02	3.43E-03	2.46E-05	NA	NA	4.89E-01	NA
Manganese	3.11E+03	8.80E-03	6.30E-05	1.87E-01	NA	2.49E-06	2.74E-04	1.96E-06	1.17E-01	NA	1.09E-03	2.12E-04	1.52E-06	1.52E+01	NA	1.55E+01	NA
Thallium	1.40E+00	3.96E-06	2.84E-08	6.09E-02	NA	1.12E-09	1.23E-07	8.85E-10	1.90E-03	NA	4.90E-07	9.56E-08	6.85E-10	NA	NA	6.28E-02	NA
Total HI				6.97E-01					1.46E-01					1.56E+01		1.67E+01	
Total ILCR					7.16E-07					2.36E-08					4.99E-07		1.24E-06
SITE-RELATED RISK																	
Nitroaromatics																	
2-Amino-4,6-dinitrotoluene	9.30E+01	2.63E-04	1.88E-06	4.39E+00	NA	7.44E-07	8.20E-05	5.88E-07	2.28E+00	NA	3.26E-05	6.35E-06	4.55E-08	NA	NA	6.67E+00	NA
4-Amino-2,6-dinitrotoluene	4.50E+01	1.27E-04	9.12E-07	2.12E+00	NA	3.60E-07	3.97E-05	2.84E-07	1.10E+00	NA	1.58E-05	3.07E-06	2.20E-08	NA	NA	3.23E+00	NA
2,4-Dinitrotoluene	2.40E+02	6.79E-04	4.86E-06	3.40E-01	3.31E-06	1.92E-06	2.12E-04	1.52E-06	1.06E-01	1.03E-06	8.40E-05	1.64E-05	1.17E-07	NA	NA	4.45E-01	4.34E-06
2,6-Dinitrotoluene	1.80E+02	5.09E-04	3.65E-06	5.09E-01	2.48E-06	1.44E-06	1.59E-04	1.14E-06	1.59E-01	7.73E-07	6.30E-05	1.23E-05	8.81E-08	NA	NA	6.68E-01	3.25E-06
2-Nitrotoluene	8.20E+01	2.32E-04	1.66E-06	2.32E-02	NA	6.56E-07	7.23E-05	5.18E-07	7.23E-03	NA	2.87E-05	5.60E-06	4.01E-08	NA	NA	3.04E-02	NA
4-Nitrotoluene	6.70E+01	1.90E-04	1.36E-06	1.90E-02	NA	5.36E-07	5.91E-05	4.23E-07	5.91E-03	NA	2.35E-05	4.58E-06	3.28E-08	NA	NA	2.49E-02	NA
2,4,6-Trinitrotoluene	6.90E+03	1.95E-02	1.40E-04	3.91E+01	4.20E-06	5.52E-06	6.09E-03	4.36E-05	2.03E+01	2.18E-06	2.42E-03	4.71E-04	3.38E-06	NA	NA	5.93E+01	6.38E-06
PCBs																	
Aroclor 1254	5.30E-01	1.50E-06	1.07E-08	7.50E-02	2.15E-08	2.54E-09	2.81E-07	2.01E-09	1.56E-02	4.02E-09	1.86E-07	3.62E-08	2.59E-10	NA	5.19E-10	9.06E-02	2.60E-08
Aroclor 1260	1.50E+01	4.24E-05	3.04E-07	NA	6.08E-07	7.20E-08	7.94E-06	5.69E-08	NA	1.14E-07	5.25E-06	1.02E-06	7.34E-09	NA	1.47E-08	NA	7.38E-07
Semivolatile Organics																	
Benzo(a)anthracene	2.40E+00	6.79E-06	4.86E-08	NA	3.55E-08	1.92E-09	2.12E-06	1.52E-08	NA	2.21E-08	8.40E-07	1.64E-07	1.17E-09	NA	3.64E-10	NA	5.80E-08
Benzo(a)pyrene	2.00E+00	5.66E-06	4.05E-08	NA	2.96E-07	1.60E-09	1.76E-06	1.26E-08	NA	1.84E-07	7.00E-07	1.37E-07	9.78E-10	NA	3.03E-09	NA	4.83E-07
Benzo(b)fluoranthene	1.80E+00	5.09E-06	3.65E-08	NA	2.66E-08	1.44E-09	1.59E-06	1.14E-08	NA	1.66E-08	6.30E-07	1.23E-07	8.81E-10	NA	2.73E-10	NA	4.35E-08
Benzo(k)fluoranthene	2.00E+00	5.66E-06	4.05E-08	NA	2.96E-09	1.60E-09	1.76E-06	1.26E-08	NA	1.84E-09	7.00E-07	1.37E-07	9.78E-10	NA	3.03E-11	NA	4.83E-09
Dibenz(a,h)anthracene	5.60E-01	1.58E-06	1.11E-08	NA	8.14E-08	4.40E-09	4.85E-07	3.47E-09	NA	3.17E-08	1.93E-07	3.76E-08	2.69E-10	NA	8.34E-10	NA	1.14E-07
Indeno(1,2,3-cd)pyrene	1.00E+00	2.83E-06	2.03E-08	NA	1.48E-08	8.00E-09	8.82E-07	6.32E-09	NA	9.22E-09	3.50E-07	6.83E-08	4.89E-10	NA	1.52E-10	NA	2.42E-08
Total HI				4.68E+01					2.40E+01					NA		7.05E+01	
Total ILCR					1.11E-05					4.37E-06					1.99E-08		1.55E-05

HQ = Hazard quotient; HI = Hazard index; ILCR = incremental lifetime cancer risk
DA = dose absorbed per unit body surface area per day
NA = not applicable

Table 5-4

Cancer Risk and Noncancer Hazard Index: Construction Worker Exposure to Surface Water
TNT Area B, Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Source Term Concentration (mg/L)	DA (mg/cm^2-day)	Dermal Absorption: Noncancer Dose (mg/kg-day)	Dermal Absorption: Cancer Dose (mg/kg-day)	Dermal HQ	Dermal ILCR
TOTAL RISK						
Inorganics						
Arsenic	3.09E-02	1.24E-07	3.74E-06	2.68E-08	1.31E-02	4.23E-08
Iron	1.67E+02	6.68E-04	2.02E-02	1.45E-04	6.74E-02	NA
Lead	2.05E-02	3.28E-10	9.92E-09	7.11E-11	NA	NA
Manganese	1.44E+00	5.76E-06	1.74E-04	1.25E-06	7.41E-02	NA
Total HI					**1.55E-01**	**4.23E-08**
BACKGROUND RISK						
NA	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
SITE-RELATED RISK						
Inorganics						
Arsenic	3.09E-02	1.24E-07	3.74E-06	2.68E-08	1.31E-02	4.23E-08
Iron	1.67E+02	6.68E-04	2.02E-02	1.45E-04	6.74E-02	NA
Lead	2.05E-02	3.28E-10	9.92E-09	7.11E-11	NA	NA
Manganese	1.44E+00	5.76E-06	1.74E-04	1.25E-06	7.41E-02	NA
Total HI					**1.55E-01**	**4.23E-08**

HQ = Hazard quotient; HI = Hazard index; ILCR = Incremental lifetime cancer risk
DA = dose absorbed per unit body surface area per day
NA = not applicable

Table 5-5

Cancer Risk and Noncancer Hazard Index: Construction Worker Exposure to Sediment
TNT Area B, Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Source Term Concentration (mg/kg)	Incidental Ingestion Noncancer Dose (mg/kg-day)	Incidental Ingestion Cancer Dose (mg/kg-day)	Oral HQ	Oral ILCR	DA (mg/cm^2-day)	Dermal Absorption Noncancer Dose (mg/kg-day)	Dermal Absorption Cancer Dose (mg/kg-day)	Dermal HQ	Dermal ILCR	Total HI All Pathways	Total ILCR All Pathways
TOTAL RISK												
Inorganics												
Arsenic	3.23E+01	7.57E-05	5.42E-07	2.52E-01	8.14E-07	3.88E-08	1.17E-06	8.41E-09	4.12E-03	1.33E-08	2.57E-01	8.27E-07
Iron	1.96E+05	4.59E-01	3.29E-03	1.53E+00	NA	2.35E-04	7.11E-03	5.10E-05	2.37E-02	NA	1.55E+00	NA
Manganese	2.06E+03	4.82E-03	3.46E-05	1.03E-01	NA	2.47E-06	7.48E-05	5.36E-07	3.18E-02	NA	1.34E-01	NA
Total HI				**1.89E+00**					**5.97E-02**		**1.94E+00**	
Total ILCR					**8.14E-07**					**1.33E-08**		**8.27E-07**
BACKGROUND RISK	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
SITE RELATED RISK												
Inorganics												
Arsenic	3.23E+01	7.57E-05	5.42E-07	2.52E-01	8.14E-07	3.88E-08	1.17E-06	8.41E-09	4.12E-03	1.33E-08	2.57E-01	8.27E-07
Iron	1.96E+05	4.59E-01	3.29E-03	1.53E+00	NA	2.35E-04	7.11E-03	5.10E-05	2.37E-02	NA	1.55E+00	NA
Manganese	2.06E+03	4.82E-03	3.46E-05	1.03E-01	NA	2.47E-06	7.48E-05	5.36E-07	3.18E-02	NA	1.34E-01	NA
Total HI				**1.89E+00**					**5.97E-02**		**1.94E+00**	
Total ILCR					**8.14E-07**					**1.33E-08**		**8.27E-07**

HQ = Hazard Quotient; HI = Hazard Index; ILCR = Incremental Lifetime Cancer Risk
DA = dose absorbed per unit body surface area per day
NA = not applicable

Table 5-6

Cancer Risk: On-Site Resident Exposure to Total Soils
TNT Area B, Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Source Term Concentration (mg/kg)	Incidental Ingestion: Adult Cancer Dose (mg/kg-day)	Incidental Ingestion: Child Cancer Dose (mg/kg-day)	On-Site Resident Oral ILCR	DA (mg/cm²-day)	Dermal Absorption: Adult Cancer Dose (mg/kg-day)	Dermal Absorption: Child Cancer Dose (mg/kg-day)	On-Site Resident Dermal ILCR	Concentration in Air (mg/m³)	Inhalation of Dust: Adult Cancer Dose (mg/kg-day)	Inhalation of Dust: Child Cancer Dose (mg/kg-day)	On-Site Resident Inhalation ILCR	Total ILCR All Pathways
TOTAL RISK													
Inorganics													
Aluminum	7.15E+03	3.02E-03	7.05E-03	NA	1.29E-05	2.75E-04	1.23E-04	NA	4.58E-06	4.30E-07	2.51E-07	NA	NA
Arsenic	2.36E+01	9.98E-06	2.33E-05	4.99E-05	4.25E-08	9.08E-07	4.08E-07	2.08E-06	1.51E-08	1.42E-09	8.29E-10	3.37E-08	5.20E-05
Chromium	1.59E+01	6.70E-06	1.56E-05	NA	2.86E-08	6.10E-07	2.74E-07	NA	1.02E-08	9.54E-10	5.57E-10	6.35E-08	6.35E-08
Copper	4.45E+02	1.88E-04	4.39E-04	NA	8.01E-07	1.71E-05	7.68E-06	NA	2.85E-07	2.68E-08	1.56E-08	NA	NA
Iron	5.03E+04	2.13E-02	4.96E-02	NA	9.05E-05	1.93E-03	8.68E-04	NA	3.22E-05	3.03E-06	1.76E-06	NA	NA
Manganese	3.11E+03	1.31E-03	3.07E-03	NA	5.60E-06	1.20E-04	5.37E-05	NA	1.99E-06	1.87E-07	1.09E-07	NA	NA
Thallium	1.40E+00	5.92E-07	1.38E-06	NA	2.52E-09	5.39E-08	2.42E-08	NA	8.97E-10	8.42E-11	4.91E-11	NA	NA
Nitroaromatics													
2-Amino-4,6-dinitrotoluene	9.30E+01	3.93E-05	9.17E-05	NA	1.67E-08	3.58E-05	1.61E-05	NA	5.96E-08	5.60E-09	3.26E-09	NA	NA
4-Amino-2,6-dinitrotoluene	4.50E+01	1.90E-05	4.44E-05	NA	8.10E-07	1.73E-05	7.77E-06	NA	2.88E-08	2.71E-09	1.58E-09	NA	NA
2,4-Dinitrotoluene	2.40E+02	1.01E-04	2.37E-04	2.30E-04	4.32E-08	9.23E-05	4.14E-05	9.09E-05	1.54E-07	1.44E-08	8.42E-09	NA	3.21E-04
2,6-Dinitrotoluene	1.80E+02	7.61E-05	1.78E-04	1.72E-04	3.24E-08	6.92E-05	3.11E-05	6.82E-05	1.16E-07	1.08E-08	6.32E-09	NA	2.41E-04
2-Nitrotoluene	8.20E+01	3.47E-05	8.09E-05	NA	1.48E-08	3.15E-05	1.42E-05	NA	5.25E-08	4.93E-09	2.88E-09	NA	NA
4-Nitrotoluene	6.70E+01	2.83E-05	6.61E-05	NA	1.21E-08	2.58E-05	1.16E-05	NA	4.29E-08	4.03E-09	2.35E-09	NA	NA
2,4,6-Trinitrotoluene	6.90E+03	2.92E-03	6.81E-03	2.92E-04	1.24E-04	2.65E-03	1.19E-03	1.92E-04	4.42E-06	4.15E-07	2.42E-07	NA	4.84E-04
PCBs													
Aroclor 1254	5.30E-01	2.24E-07	5.23E-07	1.49E-08	5.72E-09	1.22E-07	5.49E-08	3.54E-07	3.39E-10	3.19E-11	1.86E-11	1.01E-10	1.85E-06
Aroclor 1260	1.50E+01	6.34E-06	1.48E-05	4.23E-05	1.62E-07	3.46E-06	1.55E-06	1.00E-05	9.61E-09	9.02E-10	5.26E-10	2.86E-09	5.23E-05
Semivolatile Organics													
Benzo(a)anthracene	2.40E+00	1.01E-06	2.37E-06	2.47E-06	4.32E-08	9.23E-07	4.14E-07	1.95E-06	1.54E-09	1.44E-10	8.42E-11	7.09E-11	4.42E-06
Benzo(a)pyrene	2.00E+00	8.45E-07	1.97E-06	2.06E-05	3.60E-08	7.69E-07	3.45E-07	1.63E-05	1.28E-09	1.20E-10	7.02E-11	5.91E-10	3.68E-05
Benzo(b)fluoranthene	1.80E+00	7.61E-07	1.78E-06	1.85E-06	3.24E-08	6.92E-07	3.11E-07	1.46E-06	1.15E-09	1.08E-10	6.32E-11	5.32E-11	3.32E-06
Benzo(k)fluoranthene	2.00E+00	8.45E-07	1.97E-06	2.06E-07	3.60E-08	7.69E-07	3.45E-07	1.63E-07	1.28E-09	1.20E-10	7.02E-11	5.91E-12	3.68E-07
Dibenz(a,h)anthracene	5.50E-01	2.32E-07	5.42E-07	5.66E-06	9.90E-09	2.12E-07	9.49E-08	2.80E-06	3.52E-10	3.31E-11	1.93E-11	1.62E-10	8.45E-06
Indeno(1,2,3-cd)pyrene	1.00E+00	4.23E-07	9.88E-07	1.03E-06	1.80E-08	3.85E-07	1.73E-07	8.14E-07	6.41E-10	6.02E-11	3.51E-11	2.95E-11	1.84E-06
Total ILCR				8.20E-04				3.87E-04				1.01E-07	1.21E-03
BACKGROUND RISK													
Inorganics													
Aluminum	7.15E+03	3.02E-03	7.05E-03	NA	1.29E-05	2.75E-04	1.23E-04	NA	4.58E-06	4.30E-07	2.51E-07	NA	NA
Arsenic	2.36E+01	9.98E-06	2.33E-05	4.99E-05	4.25E-08	9.08E-07	4.08E-07	2.08E-06	1.51E-08	1.42E-09	8.29E-10	3.37E-08	5.20E-05
Chromium	1.59E+01	6.70E-06	1.56E-05	NA	2.86E-08	6.10E-07	2.74E-07	NA	1.02E-08	9.54E-10	5.57E-10	6.35E-08	6.35E-08
Copper	4.45E+02	1.88E-04	4.39E-04	NA	8.01E-07	1.71E-05	7.68E-06	NA	2.85E-07	2.68E-08	1.56E-08	NA	NA
Iron	5.03E+04	2.13E-02	4.96E-02	NA	9.05E-05	1.93E-03	8.68E-04	NA	3.22E-05	3.03E-06	1.76E-06	NA	NA
Manganese	3.11E+03	1.31E-03	3.07E-03	NA	5.60E-06	1.20E-04	5.37E-05	NA	1.99E-06	1.87E-07	1.09E-07	NA	NA
Thallium	1.40E+00	5.92E-07	1.38E-06	NA	2.52E-09	5.39E-08	2.42E-08	NA	8.97E-10	8.42E-11	4.91E-11	NA	NA
Total ILCR				4.99E-05				2.08E-06				9.72E-08	5.21E-05
SITE-RELATED RISK													
Nitroaromatics													
2-Amino-4,6-dinitrotoluene	9.30E+01	3.93E-05	9.17E-05	NA	1.67E-08	3.58E-05	1.61E-05	NA	5.96E-08	5.60E-09	3.26E-09	NA	NA
4-Amino-2,6-dinitrotoluene	4.50E+01	1.90E-05	4.44E-05	NA	8.10E-07	1.73E-05	7.77E-06	NA	2.88E-08	2.71E-09	1.58E-09	NA	NA
2,4-Dinitrotoluene	2.40E+02	1.01E-04	2.37E-04	2.30E-04	4.32E-08	9.23E-05	4.14E-05	9.09E-05	1.54E-07	1.44E-08	8.42E-09	NA	3.21E-04
2,6-Dinitrotoluene	1.80E+02	7.61E-05	1.78E-04	1.72E-04	3.24E-08	6.92E-05	3.11E-05	6.82E-05	1.15E-07	1.08E-08	6.32E-09	NA	2.41E-04
2-Nitrotoluene	8.20E+01	3.47E-05	8.09E-05	NA	1.48E-08	3.15E-05	1.42E-05	NA	5.25E-08	4.93E-09	2.88E-09	NA	NA
4-Nitrotoluene	6.70E+01	2.83E-05	6.61E-05	NA	1.21E-08	2.58E-05	1.16E-05	NA	4.29E-08	4.03E-09	2.35E-09	NA	NA
2,4,6-Trinitrotoluene	6.90E+03	2.92E-03	6.81E-03	2.92E-04	1.24E-04	2.65E-03	1.19E-03	1.92E-04	4.42E-06	4.15E-07	2.42E-07	NA	4.84E-04
PCBs													
Aroclor 1254	5.30E-01	2.24E-07	5.23E-07	1.49E-08	5.72E-09	1.22E-07	5.49E-08	3.54E-07	3.39E-10	3.19E-11	1.86E-11	1.01E-10	1.85E-06
Aroclor 1260	1.50E+01	6.34E-06	1.48E-05	4.23E-05	1.62E-07	3.46E-06	1.55E-06	1.00E-05	9.61E-09	9.02E-10	5.26E-10	2.86E-09	5.23E-05
Semivolatile Organics													
Benzo(a)anthracene	2.40E+00	1.01E-06	2.37E-06	2.47E-06	4.32E-08	9.23E-07	4.14E-07	1.95E-06	1.54E-09	1.44E-10	8.42E-11	7.09E-11	4.42E-06
Benzo(a)pyrene	2.00E+00	8.45E-07	1.97E-06	2.06E-05	3.60E-08	7.69E-07	3.45E-07	1.63E-05	1.28E-09	1.20E-10	7.02E-11	5.91E-10	3.68E-05
Benzo(b)fluoranthene	1.80E+00	7.61E-07	1.78E-06	1.85E-06	3.24E-08	6.92E-07	3.11E-07	1.46E-06	1.15E-09	1.08E-10	6.32E-11	5.32E-11	3.32E-06
Benzo(k)fluoranthene	2.00E+00	8.45E-07	1.97E-06	2.06E-07	3.60E-08	7.69E-07	3.45E-07	1.63E-07	1.28E-09	1.20E-10	7.02E-11	5.91E-12	3.68E-07
Dibenz(a,h)anthracene	5.50E-01	2.32E-07	5.42E-07	5.66E-06	9.90E-09	2.12E-07	9.49E-08	2.80E-06	3.52E-10	3.31E-11	1.93E-11	1.62E-10	8.45E-06
Indeno(1,2,3-cd)pyrene	1.00E+00	4.23E-07	9.88E-07	1.03E-06	1.80E-08	3.85E-07	1.73E-07	8.14E-07	6.41E-10	6.02E-11	3.51E-11	2.95E-11	1.84E-06
Total ILCR				7.70E-04				3.86E-04				3.97E-09	1.16E-03

ILCR = incremental Lifetime Cancer Risk
DA = dose absorbed per unit body surface area per day
NA = not applicable

Table 5-7

Noncancer Hazard: Child On-Site Resident Exposure to Total Soils
TNT Area B, Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Source Term Concentration (mg/kg)	Ingested Noncancer Dose (mg/kg-day)	Oral HQ	DA (mg/cm^2-day)	Dermally Absorbed Noncancer Dose (mg/kg-day)	Dermal HQ	Concentration In Air (mg/m^3)	Inhalation of Dust Noncancer Dose (mg/kg-day)	Inhalation HQ	Total HI All Pathways
TOTAL RISK										
Inorganics										
Aluminum	7.15E+03	8.22E-02	8.22E-02	1.29E-05	1.44E-03	5.33E-03	4.58E-06	2.93E-06	2.09E-03	8.96E-02
Arsenic	2.36E+01	2.72E-04	9.06E-01	4.25E-08	4.76E-06	1.67E-02	1.51E-08	9.67E-09	NA	9.22E-01
Chromium	1.59E+01	1.83E-04	1.22E-04	2.86E-08	3.19E-06	2.13E-04	1.02E-08	6.49E-09	2.24E-04	5.59E-04
Copper	4.45E+02	5.12E-03	1.28E-01	8.01E-07	8.96E-05	3.73E-03	2.85E-07	1.82E-07	NA	1.32E-01
Iron	5.03E+04	5.79E-01	1.93E+00	9.05E-05	1.01E-02	3.38E-02	3.22E-05	2.06E-05	NA	1.96E+00
Manganese	3.11E+03	3.58E-02	7.61E-01	5.60E-06	6.26E-04	2.66E-01	1.99E-06	1.27E-06	9.10E-02	1.12E+00
Thallium	1.40E+00	1.61E-05	2.48E-01	2.52E-09	2.82E-07	4.34E-03	8.97E-10	5.73E-10	NA	2.52E-01
Nitroaromatics										
2-Amino-4,6-dinitrotoluene	9.30E+01	1.07E-03	1.78E+01	1.67E-06	1.87E-04	5.20E+00	5.96E-08	3.81E-08	NA	2.30E+01
4-Amino-2,6-dinitrotoluene	4.50E+01	5.18E-04	8.63E+00	8.10E-07	9.06E-05	2.52E+00	2.88E-08	1.84E-08	NA	1.11E+01
2,4-Dinitrotoluene	2.40E+02	2.76E-03	1.38E+00	4.32E-06	4.83E-04	2.42E-01	1.54E-07	9.83E-08	NA	1.62E+00
2,6-Dinitrotoluene	1.80E+02	2.07E-03	2.07E+00	3.24E-06	3.62E-04	3.62E-01	1.15E-07	7.37E-08	NA	2.43E+00
2-Nitrotoluene	8.20E+01	9.44E-04	9.44E-02	1.48E-06	1.65E-04	1.65E-02	5.25E-08	3.36E-08	NA	1.11E-01
4-Nitrotoluene	6.70E+01	7.71E-04	7.71E-02	1.21E-06	1.35E-04	1.35E-02	4.29E-08	2.74E-08	NA	9.06E-02
2,4,6-Trinitrotoluene	6.90E+03	7.94E-02	1.59E+02	1.24E-04	1.39E-02	4.63E+01	4.42E-06	2.83E-06	NA	2.05E+02
PCBs										
Aroclor 1254	5.30E-01	6.10E-06	3.05E-01	5.72E-09	6.40E-07	3.56E-02	3.39E-10	2.17E-10	NA	3.41E-01
Aroclor 1260	1.50E+01	1.73E-04	NA	1.62E-07	1.81E-05	NA	9.61E-09	6.14E-09	NA	NA
Semivolatile Organics										
Benzo(a)anthracene	2.40E+00	2.76E-05	NA	4.32E-08	4.83E-06	NA	1.54E-09	9.83E-10	NA	NA
Benzo(a)pyrene	2.00E+00	2.30E-05	NA	3.60E-08	4.03E-06	NA	1.28E-09	8.19E-10	NA	NA
Benzo(b)fluoranthene	1.80E+00	2.07E-05	NA	3.24E-08	3.62E-06	NA	1.15E-09	7.37E-10	NA	NA
Benzo(k)fluoranthene	2.00E+00	2.30E-05	NA	3.60E-08	4.03E-06	NA	1.28E-09	8.19E-10	NA	NA
Dibenz(a,h)anthracene	5.50E-01	6.33E-06	NA	9.90E-09	1.11E-06	NA	3.52E-10	2.25E-10	NA	NA
Indeno(1,2,3-cd)pyrene	1.00E+00	1.15E-05	NA	1.80E-08	2.01E-06	NA	6.41E-10	4.09E-10	NA	NA
Total HI			**1.93E+02**			**5.50E+01**			**9.33E-02**	**2.48E+02**
BACKGROUND RISK										
Inorganics										
Aluminum	7.15E+03	8.22E-02	8.22E-02	1.29E-05	1.44E-03	5.33E-03	4.58E-06	2.93E-06	2.09E-03	8.96E-02
Arsenic	2.36E+01	2.72E-04	9.06E-01	4.25E-08	4.76E-06	1.67E-02	1.51E-08	9.67E-09	NA	9.22E-01
Chromium	1.59E+01	1.83E-04	1.22E-04	2.86E-08	3.19E-06	2.13E-04	1.02E-08	6.49E-09	2.24E-04	5.59E-04
Copper	4.45E+02	5.12E-03	1.28E-01	8.01E-07	8.96E-05	3.73E-03	2.85E-07	1.82E-07	NA	1.32E-01
Iron	5.03E+04	5.79E-01	1.93E+00	9.05E-05	1.01E-02	3.38E-02	3.22E-05	2.06E-05	NA	1.96E+00
Manganese	3.11E+03	3.58E-02	7.61E-01	5.60E-06	6.26E-04	2.66E-01	1.99E-06	1.27E-06	9.10E-02	1.12E+00
Thallium	1.40E+00	1.61E-05	2.48E-01	2.52E-09	2.82E-07	4.34E-03	8.97E-10	5.73E-10	NA	2.52E-01
Total HI			**4.05E+00**			**3.31E-01**			**9.33E-02**	**4.48E+00**
SITE-RELATED RISK										
Inorganics										
Nitroaromatics										
2-Amino-4,6-dinitrotoluene	9.30E+01	1.07E-03	1.78E+01	1.67E-06	1.87E-04	5.20E+00	5.96E-08	3.81E-08	NA	2.30E+01
4-Amino-2,6-dinitrotoluene	4.50E+01	5.18E-04	8.63E+00	8.10E-07	9.06E-05	2.52E+00	2.88E-08	1.84E-08	NA	1.11E+01
2,4-Dinitrotoluene	2.40E+02	2.76E-03	1.38E+00	4.32E-06	4.83E-04	2.42E-01	1.54E-07	9.83E-08	NA	1.62E+00
2,6-Dinitrotoluene	1.80E+02	2.07E-03	2.07E+00	3.24E-06	3.62E-04	3.62E-01	1.15E-07	7.37E-08	NA	2.43E+00
2-Nitrotoluene	8.20E+01	9.44E-04	9.44E-02	1.48E-06	1.65E-04	1.65E-02	5.25E-08	3.36E-08	NA	1.11E-01
4-Nitrotoluene	6.70E+01	7.71E-04	7.71E-02	1.21E-06	1.35E-04	1.35E-02	4.29E-08	2.74E-08	NA	9.06E-02
2,4,6-Trinitrotoluene	6.90E+03	7.94E-02	1.59E+02	1.24E-04	1.39E-02	4.63E+01	4.42E-06	2.83E-06	NA	2.05E+02
PCBs										
Aroclor 1254	5.30E-01	6.10E-06	3.05E-01	5.72E-09	6.40E-07	3.56E-02	3.39E-10	2.17E-10	NA	3.41E-01
Aroclor 1260	1.50E+01	1.73E-04	NA	1.62E-07	1.81E-05	NA	9.61E-09	6.14E-09	NA	NA
Semivolatile Organics										
Benzo(a)anthracene	2.40E+00	2.76E-05	NA	4.32E-08	4.83E-06	NA	1.54E-09	9.83E-10	NA	NA
Benzo(a)pyrene	2.00E+00	2.30E-05	NA	3.60E-08	4.03E-06	NA	1.28E-09	8.19E-10	NA	NA
Benzo(b)fluoranthene	1.80E+00	2.07E-05	NA	3.24E-08	3.62E-06	NA	1.15E-09	7.37E-10	NA	NA
Benzo(k)fluoranthene	2.00E+00	2.30E-05	NA	3.60E-08	4.03E-06	NA	1.28E-09	8.19E-10	NA	NA
Dibenz(a,h)anthracene	5.50E-01	6.33E-06	NA	9.90E-09	1.11E-06	NA	3.52E-10	2.25E-10	NA	NA
Indeno(1,2,3-cd)pyrene	1.00E+00	1.15E-05	NA	1.80E-08	2.01E-06	NA	6.41E-10	4.09E-10	NA	NA
Total HI			**1.89E+02**			**5.47E+01**			**NA**	**2.44E+02**

HQ = Hazard quotient; HI = Hazard index
DA = dose absorbed per unit body surface area per day
NA = not applicable

Table 5-8

Cancer Risk: On-Site Resident Exposure to Surface Water
TNT Area B, Plum Brook Ordnance Works, Sandusky, Ohio

	Source Term Concentration (mg/L)	DA (mg/cm^2-day)	Adult Resident: Dermally Absorbed Dose (mg/kg-day)	Adult Resident: Dermal ILCR	Child Resident: Dermally Absorbed Dose (mg/kg-day)	Child Resident: Dermal ILCR	On-Site Resident Total ILCR
TOTAL RISK							
Inorganics							
Arsenic	3.09E-02	9.27E-08	1.76E-07	2.78E-07	7.92E-08	1.25E-07	4.03E-07
Iron	1.67E+02	5.01E-04	9.53E-04	NA	4.28E-04	NA	NA
Lead	2.05E-02	2.46E-10	4.68E-10	NA	2.10E-10	NA	NA
Manganese	1.44E+00	4.32E-06	8.21E-06	NA	3.69E-06	NA	NA
Total ILCR				**2.78E-07**		**1.25E-07**	**4.03E-07**
BACKGROUND RISK							
NA	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	
SITE-RELATED RISK							
Inorganics							
Arsenic	3.09E-02	9.27E-08	1.76E-07	2.78E-07	7.92E-08	1.25E-07	4.03E-07
Iron	1.67E+02	5.01E-04	9.53E-04	NA	4.28E-04	NA	NA
Lead	2.05E-02	2.46E-10	4.68E-10	NA	2.10E-10	NA	NA
Manganese	1.44E+00	4.32E-06	8.21E-06	NA	3.69E-06	NA	NA
Total ILCR				**2.78E-07**		**1.25E-07**	**4.03E-07**

ILCR = Incremental lifetime cancer risk
DA = dose absorbed per unit body surface area per day
NA = not applicable

Table 5-9

Noncancer Hazard Index: On-Site Child Resident Exposure to Surface Water
TNT Area B, Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Source Term Concentration (mg/L)	DA (mg/cm^2-day)	Dermally Absorbed Dose (mg/kg-day)	Dermal HQ
TOTAL RISK				
Inorganics				
Arsenic	3.09E-02	9.27E-08	9.24E-07	3.24E-03
Iron	1.67E+02	5.01E-04	5.00E-03	1.67E-02
Lead	2.05E-02	2.46E-10	2.45E-09	NA
Manganese	1.44E+00	4.32E-06	4.31E-05	1.83E-02
Total HI				**3.82E-02**
BACKGROUND RISK				
NA	NA	NA	NA	NA
SITE-RELATED RISK				
Inorganics				
Arsenic	3.09E-02	9.27E-08	9.24E-07	3.24E-03
Iron	1.67E+02	5.01E-04	5.00E-03	1.67E-02
Lead	2.05E-02	2.46E-10	2.45E-09	NA
Manganese	1.44E+00	4.32E-06	4.31E-05	1.83E-02
Total HI				**3.82E-02**

HQ = Hazard quotient; HI = Hazard index
DA = dose absorbed per unit body surface area per day
NA = not applicable

Table 5-10

Cancer Risk: On-Site Resident Exposure to Sediment
TNT Area B, Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Source Term Concentration (mg/kg)	Adult Ingested Dose (mg/kg-day)	Child Ingested Dose (mg/kg-day)	On-Site Resident Oral ILCR	DA (mg/cm^2-day)	Adult Dermally Absorbed Dose (mg/kg-day)	Child Dermally Absorbed Dose (mg/kg-day)	On-Site Resident Dermal ILCR	On-Site Resident Total All Pathways ILCR
TOTAL RISK									
Inorganics									
Arsenic	3.23E+01	2.26E-07	5.27E-07	1.13E-06	6.47E-09	2.05E-08	9.22E-09	4.70E-08	1.18E-06
Iron	1.96E+05	1.37E-03	3.19E-03	NA	3.92E-05	1.24E-04	5.58E-05	NA	NA
Manganese	2.06E+03	1.44E-05	3.35E-05	NA	4.12E-07	1.31E-06	5.87E-07	NA	NA
Total ILCR				**1.13E-06**				**4.70E-08**	**1.18E-06**
BACKGROUND RISK	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
SITE RELATED RISK									
Inorganics									
Arsenic	3.23E+01	2.26E-07	5.27E-07	1.13E-06	6.47E-09	2.05E-08	9.22E-09	4.70E-08	1.18E-06
Iron	1.96E+05	1.37E-03	3.19E-03	NA	3.92E-05	1.24E-04	5.58E-05	NA	NA
Manganese	2.06E+03	1.44E-05	3.35E-05	NA	4.12E-07	1.31E-06	5.87E-07	NA	NA
Total ILCR				**1.13E-06**				**4.70E-08**	**1.18E-06**

ILCR = Incremental Lifetime Cancer Risk
DA = dose absorbed per unit body surface area per day
NA = not applicable

Table 5-11

Noncancer Hazard: Child On-Site Resident Exposure to Sediment
TNT Area B, Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Source Term Concentration (mg/kg)	Child Ingested Dose (mg/kg-day)	Child Resident Oral HQ	DA (mg/cm^2-day)	Child Dermally Absorbed Dose (mg/kg-day)	Child Resident Dermal HQ	Child Resident Total All Pathways HI
TOTAL RISK							
Inorganics							
Arsenic	3.23E+01	6.14E-06	2.05E-02	6.47E-09	1.08E-07	3.77E-04	2.09E-02
Iron	1.96E+05	3.72E-02	1.24E-01	3.92E-05	6.52E-04	2.17E-03	1.26E-01
Manganese	2.06E+03	3.91E-04	8.33E-03	4.12E-07	6.85E-06	2.91E-03	1.12E-02
Total HI			**1.53E-01**			**5.46E-03**	**1.58E-01**
BACKGROUND RISK	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
SITE RELATED RISK							
Inorganics							
Arsenic	3.23E+01	6.14E-06	2.05E-02	6.47E-09	1.08E-07	3.77E-04	2.09E-02
Iron	1.96E+05	3.72E-02	1.24E-01	3.92E-05	6.52E-04	2.17E-03	1.26E-01
Manganese	2.06E+03	3.91E-04	8.33E-03	4.12E-07	6.85E-06	2.91E-03	1.12E-02
Total HI			**1.53E-01**			**5.46E-03**	**1.58E-01**

HI = Hazard Index; HQ = Hazard Quotient
DA = dose absorbed per unit body surface area per day
NA = not applicable

Table 5-12

Summary of Total Hazard and Total Cancer Risk from Site-Related Chemicals of Concern
TNT Area B, Plum Brook Ordnance Works, Sandusky, Ohio

	Groundskeeper		Indoor Worker		Construction Worker		On-Site Resident	
Contaminant Source	Total HI	Total ILCR	Total HI	Total ILCR	Total HI	Total ILCR	Total HI	Total ILCR
Surface Soil	1.60E+01	1.07E-04	6.83E+00	4.59E-05	NA	NA	NA	NA
Total Soil	NA	NA	NA	NA	7.05E+01	1.55E-05	2.44E+02	1.15E-03
Surface Water	NA	NA	NA	NA	1.55E-01	4.23E-08	3.82E-02	4.03E-07
Sediment	NA	NA	NA	NA	1.94E+00	8.27E-07	1.58E-01	1.18E-06
Total across all media	**1.60E+01**	**1.07E-04**	**6.83E+00**	**4.59E-05**	**7.26E+01**	**1.63E-05**	**2.44E+02**	**1.16E-03**

HI = Hazard index
ILCR = Incremental lifetime cancer risk
NA = not applicable

Table 5-13

Risk-Based Remdial Criteria for Chemicals of Concern
Groundskeeper Exposure to Surface Soil
TNT Area B, Plum Brook Ordnance Works
Sandusky, Ohio

Chemical	Source-Term Concentration (mg/kg)	Total HI All Pathways	RBRC (mg/kg) for Target Hazard Index: 1.0	RBRC (mg/kg) for Target Hazard Index: 0.1	Total ILCR All Pathways	RBRC (mg/kg) for Target Risk Level: 1.00E-06	RBRC (mg/kg) for Target Risk Level: 1.00E-05
Nitroaromatics							
2,4,6-Trinitrotoluene	6.90E+03	1.58E+01	4.37E+02	4.37E+01	8.46E-05	8.16E+01	8.16E+02
PCBs							
Aroclor 1260	1.50E+01	NA	NA	NA	1.13E-05	1.32E+00	1.32E+01
Semivolatile Organics							
Benzo(a)pyrene	2.00E+00	NA	NA	NA	6.18E-06	3.23E-01	3.23E+00
Dibenz(a,h)anthracene	5.50E-01	NA	NA	NA	1.59E-06	3.45E-01	3.45E+00

RBRC = Risk-Based Remedial Criterion
HI = Hazard Index
ILCR = Incremental Lifetime Cancer Risk
NA = not applicable

Table 5-14

Risk-Based Remedial Criteria for Chemicals of Concern
Indoor Worker Exposure to Surface Soil
TNT Area B, Plum Brook Ordnance Works
Sandusky, Ohio

Chemical	Source-Term Concentration (mg/kg)	Total HI All Pathways	RBRC (mg/kg) for Target Hazard Index: 1.0	RBRC (mg/kg) for Target Hazard Index: 0.1	Total ILCR All Pathways	RBRC (mg/kg) for Target Risk Level: 1.00E-06	RBRC (mg/kg) for Target Risk Level: 1.00E-05
Nitroaromatics							
2,4,6-Trinitrotoluene	6.90E+03	6.75E+00	1.02E+03	1.02E+02	3.62E-05	1.91E+02	1.91E+03
PCBs							
Aroclor 1260	1.50E+01	NA	NA	NA	5.24E-06	2.86E+00	2.86E+01
Semivolatile Organics							
Benzo(a)pyrene	2.00E+00	NA	NA	NA	2.55E-06	7.84E-01	7.84E+00

RBRC = Risk-Based Remedial Criterion
HI = Hazard Index
ILCR = Incremental Lifetime Cancer Risk
NA = not applicable

Table 5-15

Risk-Based Remedial Criteria for Chemicals of Concern
Construction Worker Exposure to Total Soil
TNT Area B, Plum Brook Ordnance Works
Sandusky, Ohio

Chemical	Source-Term Concentration (mg/kg)	Total HI All Pathways	RBRC (mg/kg) for Target Hazard Index: 1.0	RBRC (mg/kg) for Target Hazard Index: 0.1	Total ILCR All Pathways	RBRC (mg/kg) for Target Risk Level: 1.00E-06	RBRC (mg/kg) for Target Risk Level: 1.00E-05
Nitroaromatics							
2-Amino-4,6-dinitrotoluene	9.30E+01	6.67E+00	1.40E+01	1.40E+00	NA	NA	NA
4-Amino-2,6-dinitrotoluene	4.50E+01	3.23E+00	1.40E+01	1.40E+00	NA	NA	NA
2,4-Dinitrotoluene	2.40E+02	4.45E-01	5.39E+02	5.39E+01	4.34E-06	5.53E+01	5.53E+02
2,6-Dinitrotoluene	1.80E+02	6.68E-01	2.69E+02	2.69E+01	3.25E-06	5.53E+01	5.53E+02
2,4,6-Trinitrotoluene	6.90E+03	5.93E+01	1.16E+02	1.16E+01	6.38E-06	1.08E+03	1.08E+04

RBRC = Risk-Based Remedial Criterion
HI = Hazard Index
ILCR = Incremental Lifetime Cancer Risk
NA = not applicable

Table 5-16

Risk-Based Remedial Criteria for Chemicals of Concern
On-Site Resident Exposure to Total Soil
TNT Area B, Plum Brook Ordnance Works
Sandusky, Ohio

Chemical	Source-Term Concentration (mg/kg)	Total HI All Pathways	RBRC (mg/kg) for On-Site Child Resident Target Hazard Index: 1.0	RBRC (mg/kg) for On-Site Child Resident Target Hazard Index: 0.1	Total ILCR All Pathways	RBRC (mg/kg) for On-Site Resident Target Risk Level: 1.00E-06	RBRC (mg/kg) for On-Site Resident Target Risk Level: 1.00E-05
Nitroaromatics							
2-Amino-4,6-dinitrotoluene	9.30E+01	2.30E+01	4.04E+00	4.04E-01	NA	NA	NA
4-Amino-2,6-dinitrotoluene	4.50E+01	1.11E+01	4.04E+00	4.04E-01	NA	NA	NA
2,4-Dinitrotoluene	2.40E+02	1.62E+00	1.48E+02	1.48E+01	3.21E-04	7.48E-01	7.48E+00
2,6-Dinitrotoluene	6.70E+01	2.43E+00	2.75E+01	2.75E+00	2.41E-04	2.78E-01	2.78E+00
2-Nitrotoluene	8.20E+01	1.11E-01	7.40E+02	7.40E+01	NA	NA	NA
2,4,6-Trinitrotoluene	6.90E+03	2.05E+02	3.36E+01	3.36E+00	4.84E-04	1.43E+01	1.43E+02
PCBs							
Aroclor 1254	5.30E-01	3.41E-01	1.56E+00	1.56E-01	1.85E-06	2.87E-01	2.87E+00
Aroclor 1260	1.50E+01	NA	NA	NA	5.23E-05	2.87E-01	2.87E+00
Semivolatile Organics							
Benzo(a)anthracene	2.40E+00	NA	NA	NA	4.42E-06	5.43E-01	5.43E+00
Benzo(a)pyrene	2.00E+00	NA	NA	NA	3.68E-05	5.43E-02	5.43E-01
Benzo(b)fluoranthene	1.80E+00	NA	NA	NA	3.32E-06	5.43E-01	5.43E+00
Dibenz(a,h)anthracene	5.50E-01	NA	NA	NA	8.45E-06	6.51E-02	6.51E-01
Indeno(1,2,3-cd)pyrene	1.00E+00	NA	NA	NA	1.84E-06	5.43E-01	5.43E+00

RBRC = Risk-Based Remedial Criterion
HI = Hazard Index
ILCR = Incremental Lifetime Cancer Risk
NA = not applicable

Table 5-17

Risk-Based Remedial Criteria for Chemicals of Concern
Construction Worker Exposure to Sediment
TNT Area B, Plum Brook Ordnance Works
Sandusky, Ohio

Chemical	Source-Term Concentration (mg/kg)	Total HI All Pathways	RBRC (mg/kg) for Target Hazard Index: 1.0	RBRC (mg/kg) for Target Hazard Index: 0.1	Total ILCR All Pathways	RBRC (mg/kg) for Target Risk Level: 1.00E-06	RBRC (mg/kg) for Target Risk Level: 1.00E-05
Inorganics							
Arsenic	3.23E+01	2.57E-01	1.26E+02	1.26E+01	NA	NA	NA
Iron	1.96E+05	1.55E+00	1.26E+05	1.26E+04	NA	NA	NA
Manganese	2.06E+03	1.34E-01	1.53E+04	1.53E+03	NA	NA	NA

RBRC = Risk-Based Remedial Criterion
HI = Hazard Index
ILCR = Incremental Lifetime Cancer Risk
NA = not applicable

Table 5-18

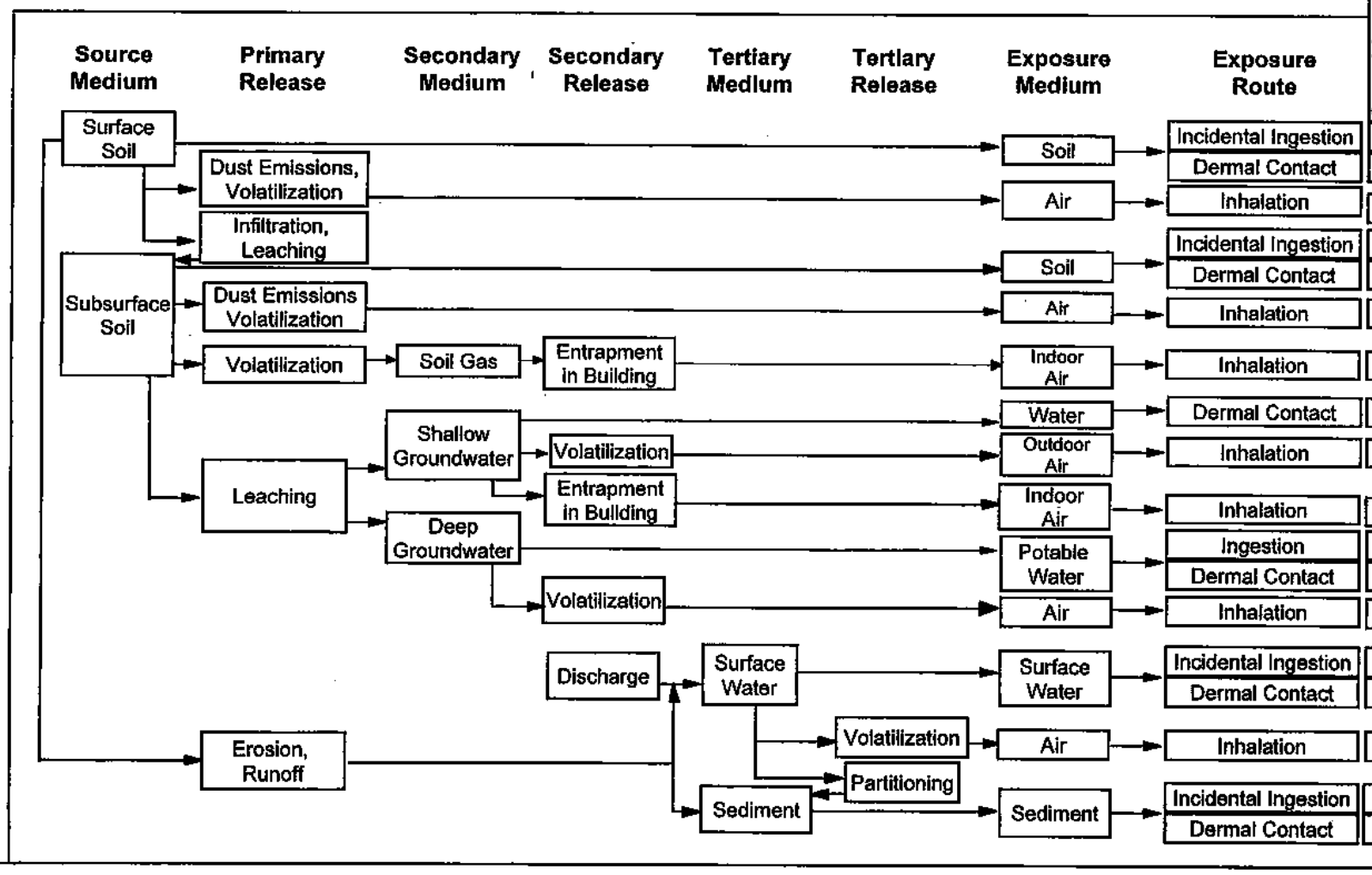
Risk-Based Remedial Criteria for Chemicals of Concern
On-Site Resident Exposure to Sediment
TNT Area B, Plum Brook Ordnance Works
Sandusky, Ohio

Chemical	Source-Term Concentration (mg/kg)	Total HI All Pathways	RBRC (mg/kg) for On-Site Child Resident Target Hazard Index: 1.0	RBRC (mg/kg) for On-Site Child Resident Target Hazard Index: 0.1	Total ILCR All Pathways	RBRC (mg/kg) for On-Site Resident Target Risk Level: 1.00E-06	RBRC (mg/kg) for On-Site Resident Target Risk Level: 1.00E-05
Inorganics							
Arsenic	3.23E+01	NA	NA	NA	1.18E-06	2.75E+01	2.75E+02

RBRC = Risk-Based Remedial Criterion
HI = Hazard Index
ILCR = Incremental Lifetime Cancer Risk
NA = not applicable

FIGURES

Figure 3-1
Human Health Conceptual Site Exposure Model
TNT Area B, Plum Brook Ordnance Works, Sandusky, Ohio



Exposure Route	Groundskeeper (Current)	Construction Worker (Current)	Groundskeeper (Future)	Construction Worker (Future)	On-site Resident (Future)	Indoor Worker (Future)
Incidental Ingestion	*	*	*	*	*	*
Dermal Contact	*	*	*	*	*	3
Inhalation	*	*	*	*	*	3
Incidental Ingestion	1	*	1	*	*	1
Dermal Contact	1	*	1	*	*	1
Inhalation	1	*	1	*	*	1
Inhalation	1	1	1	1	*	*
Dermal Contact	1	*	1	*	1	1
Inhalation	1	*	1	*	1	1
Inhalation	1	1	1	1	*	*
Ingestion	1	1	2	2	2	2
Dermal Contact	1	1	2	2	2	3
Inhalation	1	1	3	3	2	3
Incidental Ingestion	4	3	4	3	*	1
Dermal Contact	4	*	4	*	*	1
Inhalation	3	3	3	3	*	1
Incidental Ingestion	4	*	4	4	*	1
Dermal Contact	4	*	4	4	*	1

* = Complete exposure route quantified in the risk assessment
1 = There is no plausible pathway for exposure to this medium.
2 = Although a complete pathway, no groundwater data are available. Future groundwater exposures will be assessed when data become available.
3 = Although theoretically complete, this pathway is not quantified as explained in text.
4 = Contact with this medium, although plausible, is not part of this receptor's normal or expected activities; therefore contact would be sporadic and is not quantified.

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APPENDIX A

ANALYTICAL RESULTS

Plum Brook Ordnance Works
TNT Area B
Data Summary Report
Surface Water

Report Date: 08/28/00

Sample Location:			TNTB-SW01		TNTB-SW02	
Associated Site:			TNTB		TNTB	
Sample No:			12000		12010	
Sample Date:			04-NOV-98		04-NOV-98	
VOLATILES	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr
1,1,1-Trichloroethane		ug/L	1.0	U	1.0	U
1,1,2,2-Tetrachloroethane		ug/L	1.0	U	1.0	U
1,1,2-Trichloroethane		ug/L	1.0	U	1.0	U
1,1-Dichloroethane		ug/L	1.0	U	0.51	J
1,1-Dichloroethene		ug/L	1.0	U	1.0	U
1,2-Dichloroethane		ug/L	1.0	U	1.0	U
1,2-Dichloroethene		ug/L	1.0	U	1.0	U
1,2-Dichloropropane		ug/L	1.0	U	1.0	U
2-Butanone		ug/L	1.2	J	5.0	R
2-Hexanone		ug/L	5.0	U	5.0	U
4-Methyl-2-pentanone		ug/L	5.0	U	5.0	U
Acetone		ug/L	13	B	4.7	B
Benzene		ug/L	1.0	U	1.0	U
Bromodichloromethane		ug/L	1.0	U	1.0	U
Bromoform		ug/L	1.0	U	1.0	U
Bromomethane		ug/L	2.0	UJ	2.0	UJ
Carbon disulfide		ug/L	1.2		1.0	U
Carbon tetrachloride		ug/L	1.0	U	1.0	U
Chlorobenzene		ug/L	1.0	U	1.0	U
Chloroethane		ug/L	2.0	U	2.0	U
Chloroform		ug/L	1.0	U	1.0	U
Chloromethane		ug/L	2.0	U	2.0	U
Dibromochloromethane		ug/L	1.0	U	1.0	U
Ethylbenzene		ug/L	1.0	U	1.0	U
Methylene chloride		ug/L	1.0	U	1.0	U
Styrene		ug/L	1.0	U	1.0	U
Tetrachloroethene		ug/L	1.0	U	1.0	U
Toluene		ug/L	3.4		0.47	B
Total xylenes		ug/L	1.0	U	1.0	U

Sample Location:			TNTB-SW01		TNTB-SW02	
Associated Site:			TNTB		TNTB	
Sample No:			12000		12010	
Sample Date:			04-NOV-98		04-NOV-98	
VOLATILES	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr
Trichloroethene		ug/L	1.0	U	1.0	U
Vinyl chloride		ug/L	2.0	U	2.0	U
cis-1,3-Dichloropropene		ug/L	1.0	U	1.0	U
trans-1,3-Dichloropropene		ug/L	1.0	U	1.0	U

Sample Location:			TNTB-SW01		TNTB-SW02	
Associated Site:			TNTB		TNTB	
Sample No:			12000		12010	
Sample Date:			04-NOV-98		04-NOV-98	
SEMIVOLATILES3	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr
1,2,4-Trichlorobenzene		ug/L	10	U	10	U
1,2-Dichlorobenzene		ug/L	10	U	10	U
1,3-Dichlorobenzene		ug/L	10	U	10	U
1,4-Dichlorobenzene		ug/L	10	U	10	U
2,4,5-Trichlorophenol		ug/L	10	U	10	U
2,4,6-Trichlorophenol		ug/L	10	U	10	U
2,4-Dichlorophenol		ug/L	10	U	10	U
2,4-Dimethylphenol		ug/L	10	U	10	U
2,4-Dinitrophenol		ug/L	50	U	50	U
2,4-Dinitrotoluene		ug/L	10	U	10	U
2,6-Dinitrotoluene		ug/L	10	U	10	U
2-Chloronaphthalene		ug/L	10	U	10	U
2-Chlorophenol		ug/L	10	U	10	U
2-Methylnaphthalene		ug/L	10	U	10	U
2-Methylphenol		ug/L	10	U	10	U
2-Nitroaniline		ug/L	50	U	50	U
2-Nitrophenol		ug/L	10	U	10	U
3,3'-Dichlorobenzidine		ug/L	50	U	50	U
3-Nitroaniline		ug/L	50	U	50	U
4,6-Dinitro-2-methylphenol		ug/L	50	U	50	U
4-Bromophenyl phenyl ether		ug/L	10	U	10	U
4-Chloro-3-methylphenol		ug/L	10	U	10	U
4-Chloroaniline		ug/L	10	U	10	U
4-Chlorophenyl phenyl ether		ug/L	10	U	10	U
4-Methylphenol		ug/L	10	U	10	U
4-Nitroaniline		ug/L	50	U	50	U
4-Nitrophenol		ug/L	50	U	50	U
Acenaphthene		ug/L	10	U	10	U
Acenaphthylene		ug/L	10	U	10	U

Sample Location:			TNTB-SW01		TNTB-SW02	
Associated Site:			TNTB		TNTB	
Sample No:			12000		12010	
Sample Date:			04-NOV-98		04-NOV-98	
SEMIVOLATILES3	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr
Anthracene		ug/L	10	U	10	U
Benzo(a)anthracene		ug/L	10	U	10	U
Benzo(a)pyrene		ug/L	10	U	10	U
Benzo(b)fluoranthene		ug/L	10	U	10	U
Benzo(ghi)perylene		ug/L	10	U	10	U
Benzo(k)fluoranthene		ug/L	10	U	10	U
Butyl benzyl phthalate		ug/L	10	U	10	U
Carbazole		ug/L	10	U	10	U
Chrysene		ug/L	10	U	10	U
Dibenz(a,h)anthracene		ug/L	10	U	10	U
Dibenzofuran		ug/L	10	U	10	U
Diethyl phthalate		ug/L	10	U	10	U
Dimethyl phthalate		ug/L	10	U	10	U
Fluoranthene		ug/L	10	U	10	U
Fluorene		ug/L	10	U	10	U
Hexachlorobenzene		ug/L	10	U	10	U
Hexachlorobutadiene		ug/L	10	U	10	U
Hexachlorocyclopentadiene		ug/L	50	U	50	U
Hexachloroethane		ug/L	10	U	10	U
Indeno(1,2,3-cd)pyrene		ug/L	10	U	10	U
Isophorone		ug/L	10	U	10	U
Naphthalene		ug/L	10	U	10	U
Nitrobenzene		ug/L	10	U	10	U
Pentachlorophenol		ug/L	50	U	50	U
Phenanthrene		ug/L	10	U	10	U
Phenol		ug/L	2.2	B	4.8	B
Pyrene		ug/L	10	U	10	U
bis(2-Chloroethoxy)methane		ug/L	10	U	10	U
bis(2-Chloroethyl)ether		ug/L	10	U	10	U

Sample Location:			TNTB-SW01		TNTB-SW02	
Associated Site:			TNTB		TNTB	
Sample No:			12000		12010	
Sample Date:			04-NOV-98		04-NOV-98	
SEMIVOLATILES3	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr
bis(2-Chloroisopropyl)ether		ug/L	10	U	10	U
bis(2-Ethylhexyl)phthalate		ug/L	10	U	10	U
di-n-Butyl phthalate		ug/L	10	U	10	U
di-n-Octyl phthalate		ug/L	10	U	10	U
n-Nitroso-di-n-propylamine		ug/L	10	U	10	U
n-Nitrosodiphenylamine		ug/L	10	U	10	U

Sample Location:			TNTB-SW01		TNTB-SW02	
Associated Site:			TNTB		TNTB	
Sample No:			12000		12010	
Sample Date:			04-NOV-98		04-NOV-98	
PCB3	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr
Aroclor 1016		ug/L	2.1	U	1.9	U
Aroclor 1221		ug/L	2.1	U	1.9	U
Aroclor 1232		ug/L	2.1	U	1.9	U
Aroclor 1242		ug/L	2.1	U	1.9	U
Aroclor 1248		ug/L	2.1	U	1.9	U
Aroclor 1254		ug/L	2.1	U	1.9	U
Aroclor 1260		ug/L	2.1	U	1.9	U

Sample Location:			TNTB-SW01		TNTB-SW02	
Associated Site:			TNTB		TNTB	
Sample No:			12000		12010	
Sample Date:			04-NOV-98		04-NOV-98	
METALS3-W	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr
Aluminum		ug/L	14900	J	969	J
Aluminum	Y	ug/L	200	U	200	U
Antimony		ug/L	60.0	U	60.0	U
Antimony	Y	ug/L	60.0	U	60.0	U
Arsenic		ug/L	21.1		30.9	J
Arsenic	Y	ug/L	10.0	U	10.0	U
Barium		ug/L	200	U	200	U
Barium	Y	ug/L	200	U	200	U
Beryllium		ug/L	5.0	U	5.0	U
Beryllium	Y	ug/L	5.0	U	5.0	U
Cadmium		ug/L	5.0	U	5.0	U
Cadmium	Y	ug/L	5.0	U	5.0	U
Calcium		ug/L	140000		126000	
Calcium	Y	ug/L	132000		124000	
Chromium		ug/L	18.8		11.5	J
Chromium	Y	ug/L	10.0	U	10.0	U
Cobalt		ug/L	50.0	U	50.0	U
Cobalt	Y	ug/L	50.0	U	50.0	U
Copper		ug/L	34.2		25.0	U
Copper	Y	ug/L	25.0	U	25.0	U
Iron		ug/L	35000		167000	J
Iron	Y	ug/L	267		683	J
Lead		ug/L	20.5		7.8	J
Lead	Y	ug/L	3.0	U	3.0	U
Magnesium		ug/L	34200		23900	J
Magnesium	Y	ug/L	31900		24400	
Manganese		ug/L	793		1440	J
Manganese	Y	ug/L	555		855	
Mercury		ug/L	0.20	U	0.20	U

Sample Location:			TNTB-SW01		TNTB-SW02	
Associated Site:			TNTB		TNTB	
Sample No:			12000		12010	
Sample Date:			04-NOV-98		04-NOV-98	
METALS3-W	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr
Mercury	Y	ug/L	0.20	U	0.20	U
Nickel		ug/L	43.1		40.0	U
Nickel	Y	ug/L	40.0	U	40.0	U
Potassium		ug/L	16200		5000	U
Potassium	Y	ug/L	13300		5000	U
Selenium		ug/L	5.0	U	6.0	J
Selenium	Y	ug/L	5.0	U	5.0	U
Silver		ug/L	10.0	U	10.0	U
Silver	Y	ug/L	10.0	U	10.0	U
Sodium		ug/L	20600		17600	
Sodium	Y	ug/L	20700		18500	
Thallium		ug/L	10.0	U	10.0	U
Thallium	Y	ug/L	10.0	U	10.0	U
Vanadium		ug/L	50.0	U	50.0	U
Vanadium	Y	ug/L	50.0	U	50.0	U
Zinc		ug/L	58.8		57.8	J
Zinc	Y	ug/L	20.0	U	20.0	U

Sample Location:			TNTB-SW01		TNTB-SW02	
Associated Site:			TNTB		TNTB	
Sample No:			12000		12010	
Sample Date:			04-NOV-98		04-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene		ug/L	0.20	UJ	0.20	UJ
1,3-Dinitrobenzene		ug/L	0.20	UJ	0.20	UJ
2,4,6-Trinitrotoluene		ug/L	0.20	UJ	0.20	UJ
2,4-Dinitrotoluene		ug/L	0.20	UJ	0.20	UJ
2,6-Dinitrotoluene		ug/L	0.20	UJ	0.20	UJ
2-Amino-4,6-dinitrotoluene		ug/L	0.20	UJ	0.20	UJ
2-Nitrotoluene		ug/L	0.20	UJ	0.20	UJ
3-Nitrotoluene		ug/L	0.20	UJ	0.20	UJ
4-Amino-2,6-dinitrotoluene		ug/L	0.20	UJ	0.20	UJ
4-Nitrotoluene		ug/L	0.20	UJ	0.20	UJ
HMX		ug/L	0.50	UJ	0.50	UJ
Nitrobenzene		ug/L	0.20	UJ	0.51	UJ
RDX		ug/L	0.50	UJ	0.50	UJ
Tetryl		ug/L	0.20	UJ	0.20	UJ

Plum Brook Ordinance Works
TNT Area B
Data Summary Report
Surface Water

Report Date: 08/28/00

Sample Location:			TNTB-SW01		TNTB-SW02	
Associated Site:			TNTB		TNTB	
Sample No:			12000		12010	
Sample Date:			04-NOV-98		04-NOV-98	
VOLATILES	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr
1,1,1-Trichloroethane		ug/L	1.0	U	1.0	U
1,1,2,2-Tetrachloroethane		ug/L	1.0	U	1.0	U
1,1,2-Trichloroethane		ug/L	1.0	U	1.0	U
1,1-Dichloroethane		ug/L	1.0	U	0.51	J
1,1-Dichloroethene		ug/L	1.0	U	1.0	U
1,2-Dichloroethane		ug/L	1.0	U	1.0	U
1,2-Dichloroethene		ug/L	1.0	U	1.0	U
1,2-Dichloropropane		ug/L	1.0	U	1.0	U
2-Butanone		ug/L	1.2	J	5.0	R
2-Hexanone		ug/L	5.0	U	5.0	U
4-Methyl-2-pentanone		ug/L	5.0	U	5.0	U
Acetone		ug/L	13	B	4.7	B
Benzene		ug/L	1.0	U	1.0	U
Bromodichloromethane		ug/L	1.0	U	1.0	U
Bromoform		ug/L	1.0	U	1.0	U
Bromomethane		ug/L	2.0	UJ	2.0	UJ
Carbon disulfide		ug/L	1.2		1.0	U
Carbon tetrachloride		ug/L	1.0	U	1.0	U
Chlorobenzene		ug/L	1.0	U	1.0	U
Chloroethane		ug/L	2.0	U	2.0	U
Chloroform		ug/L	1.0	U	1.0	U
Chloromethane		ug/L	2.0	U	2.0	U
Dibromochloromethane		ug/L	1.0	U	1.0	U
Ethylbenzene		ug/L	1.0	U	1.0	U
Methylene chloride		ug/L	1.0	U	1.0	U
Styrene		ug/L	1.0	U	1.0	U
Tetrachloroethene		ug/L	1.0	U	1.0	U
Toluene		ug/L	3.4		0.47	B
Total xylenes		ug/L	1.0	U	1.0	U

Plum Brook Ordinance Works
TNT Area B
Data Summary Report
Surface Water

Report Date: 08/28/00

Sample Location:			TNTB-SW01		TNTB-SW02	
Associated Site:			TNTB		TNTB	
Sample No:			12000		12010	
Sample Date:			04-NOV-98		04-NOV-98	
VOLATILES	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr
Trichloroethene		ug/L	1.0	U	1.0	U
Vinyl chloride		ug/L	2.0	U	2.0	U
cis-1,3-Dichloropropene		ug/L	1.0	U	1.0	U
trans-1,3-Dichloropropene		ug/L	1.0	U	1.0	U

Sample Location:			TNTB-SW01		TNTB-SW02	
Associated Site:			TNTB		TNTB	
Sample No:			12000		12010	
Sample Date:			04-NOV-98		04-NOV-98	
SEMIVOLATILES3	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr
1,2,4-Trichlorobenzene		ug/L	10	U	10	U
1,2-Dichlorobenzene		ug/L	10	U	10	U
1,3-Dichlorobenzene		ug/L	10	U	10	U
1,4-Dichlorobenzene		ug/L	10	U	10	U
2,4,5-Trichlorophenol		ug/L	10	U	10	U
2,4,6-Trichlorophenol		ug/L	10	U	10	U
2,4-Dichlorophenol		ug/L	10	U	10	U
2,4-Dimethylphenol		ug/L	10	U	10	U
2,4-Dinitrophenol		ug/L	50	U	50	U
2,4-Dinitrotoluene		ug/L	10	U	10	U
2,6-Dinitrotoluene		ug/L	10	U	10	U
2-Chloronaphthalene		ug/L	10	U	10	U
2-Chlorophenol		ug/L	10	U	10	U
2-Methylnaphthalene		ug/L	10	U	10	U
2-Methylphenol		ug/L	10	U	10	U
2-Nitroaniline		ug/L	50	U	50	U
2-Nitrophenol		ug/L	10	U	10	U
3,3'-Dichlorobenzidine		ug/L	50	U	50	U
3-Nitroaniline		ug/L	50	U	50	U
4,6-Dinitro-2-methylphenol		ug/L	50	U	50	U
4-Bromophenyl phenyl ether		ug/L	10	U	10	U
4-Chloro-3-methylphenol		ug/L	10	U	10	U
4-Chloroaniline		ug/L	10	U	10	U
4-Chlorophenyl phenyl ether		ug/L	10	U	10	U
4-Methylphenol		ug/L	10	U	10	U
4-Nitroaniline		ug/L	50	U	50	U
4-Nitrophenol		ug/L	50	U	50	U
Acenaphthene		ug/L	10	U	10	U
Acenaphthylene		ug/L	10	U	10	U

Sample Location:			TNTB-SW01		TNTB-SW02	
Associated Site:			TNTB		TNTB	
Sample No:			12000		12010	
Sample Date:			04-NOV-98		04-NOV-98	
SEMIVOLATILES3	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr
Anthracene		ug/L	10	U	10	U
Benzo(a)anthracene		ug/L	10	U	10	U
Benzo(a)pyrene		ug/L	10	U	10	U
Benzo(b)fluoranthene		ug/L	10	U	10	U
Benzo(ghi)perylene		ug/L	10	U	10	U
Benzo(k)fluoranthene		ug/L	10	U	10	U
Butyl benzyl phthalate		ug/L	10	U	10	U
Carbazole		ug/L	10	U	10	U
Chrysene		ug/L	10	U	10	U
Dibenz(a,h)anthracene		ug/L	10	U	10	U
Dibenzofuran		ug/L	10	U	10	U
Diethyl phthalate		ug/L	10	U	10	U
Dimethyl phthalate		ug/L	10	U	10	U
Fluoranthene		ug/L	10	U	10	U
Fluorene		ug/L	10	U	10	U
Hexachlorobenzene		ug/L	10	U	10	U
Hexachlorobutadiene		ug/L	10	U	10	U
Hexachlorocyclopentadiene		ug/L	50	U	50	U
Hexachloroethane		ug/L	10	U	10	U
Indeno(1,2,3-cd)pyrene		ug/L	10	U	10	U
Isophorone		ug/L	10	U	10	U
Naphthalene		ug/L	10	U	10	U
Nitrobenzene		ug/L	10	U	10	U
Pentachlorophenol		ug/L	50	U	50	U
Phenanthrene		ug/L	10	U	10	U
Phenol		ug/L	2.2	B	4.8	B
Pyrene		ug/L	10	U	10	U
bis(2-Chloroethoxy)methane		ug/L	10	U	10	U
bis(2-Chloroethyl)ether		ug/L	10	U	10	U

Sample Location:			TNTB-SW01		TNTB-SW02	
Associated Site:			TNTB		TNTB	
Sample No:			12000		12010	
Sample Date:			04-NOV-98		04-NOV-98	
SEMIVOLATILES3	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr
bis(2-Chloroisopropyl)ether		ug/L	10	U	10	U
bis(2-Ethylhexyl)phthalate		ug/L	10	U	10	U
di-n-Butyl phthalate		ug/L	10	U	10	U
di-n-Octyl phthalate		ug/L	10	U	10	U
n-Nitroso-di-n-propylamine		ug/L	10	U	10	U
n-Nitrosodiphenylamine		ug/L	10	U	10	U

Report Date: 08/28/00

Sample Location:			TNTB-SW01		TNTB-SW02	
Associated Site:			TNTB		TNTB	
Sample No:			12000		12010	
Sample Date:			04-NOV-98		04-NOV-98	
PCB3	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr
Aroclor 1016		ug/L	2.1	U	1.9	U
Aroclor 1221		ug/L	2.1	U	1.9	U
Aroclor 1232		ug/L	2.1	U	1.9	U
Aroclor 1242		ug/L	2.1	U	1.9	U
Aroclor 1248		ug/L	2.1	U	1.9	U
Aroclor 1254		ug/L	2.1	U	1.9	U
Aroclor 1260		ug/L	2.1	U	1.9	U

Sample Location:			TNTB-SW01		TNTB-SW02	
Associated Site:			TNTB		TNTB	
Sample No:			12000		12010	
Sample Date:			04-NOV-98		04-NOV-98	
METALS3-W	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr
Aluminum		ug/L	14900	J	969	J
Aluminum	Y	ug/L	200	U	200	U
Antimony		ug/L	60.0	U	60.0	U
Antimony	Y	ug/L	60.0	U	60.0	U
Arsenic		ug/L	21.1		30.9	J
Arsenic	Y	ug/L	10.0	U	10.0	U
Barium		ug/L	200	U	200	U
Barium	Y	ug/L	200	U	200	U
Beryllium		ug/L	5.0	U	5.0	U
Beryllium	Y	ug/L	5.0	U	5.0	U
Cadmium		ug/L	5.0	U	5.0	U
Cadmium	Y	ug/L	5.0	U	5.0	U
Calcium		ug/L	140000		126000	
Calcium	Y	ug/L	132000		124000	
Chromium		ug/L	18.8		11.5	J
Chromium	Y	ug/L	10.0	U	10.0	U
Cobalt		ug/L	50.0	U	50.0	U
Cobalt	Y	ug/L	50.0	U	50.0	U
Copper		ug/L	34.2		25.0	U
Copper	Y	ug/L	25.0	U	25.0	U
Iron		ug/L	35000		167000	J
Iron	Y	ug/L	267		683	J
Lead		ug/L	20.5		7.8	J
Lead	Y	ug/L	3.0	U	3.0	U
Magnesium		ug/L	34200		23900	J
Magnesium	Y	ug/L	31900		24400	
Manganese		ug/L	793		1440	J
Manganese	Y	ug/L	555		855	
Mercury		ug/L	0.20	U	0.20	U

Sample Location:			TNTB-SW01		TNTB-SW02	
Associated Site:			TNTB		TNTB	
Sample No:			12000		12010	
Sample Date:			04-NOV-98		04-NOV-98	
METALS3-W	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr
Mercury	Y	ug/L	0.20	U	0.20	U
Nickel		ug/L	43.1		40.0	U
Nickel	Y	ug/L	40.0	U	40.0	U
Potassium		ug/L	16200		5000	U
Potassium	Y	ug/L	13300		5000	U
Selenium		ug/L	5.0	U	6.0	J
Selenium	Y	ug/L	5.0	U	5.0	U
Silver		ug/L	10.0	U	10.0	U
Silver	Y	ug/L	10.0	U	10.0	U
Sodium		ug/L	20600		17600	
Sodium	Y	ug/L	20700		18500	
Thallium		ug/L	10.0	U	10.0	U
Thallium	Y	ug/L	10.0	U	10.0	U
Vanadium		ug/L	50.0	U	50.0	U
Vanadium	Y	ug/L	50.0	U	50.0	U
Zinc		ug/L	58.8		57.8	J
Zinc	Y	ug/L	20.0	U	20.0	U

Sample Location:			TNTB-SW01		TNTB-SW02	
Associated Site:			TNTB		TNTB	
Sample No:			12000		12010	
Sample Date:			04-NOV-98		04-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene		ug/L	0.20	UJ	0.20	UJ
1,3-Dinitrobenzene		ug/L	0.20	UJ	0.20	UJ
2,4,6-Trinitrotoluene		ug/L	0.20	UJ	0.20	UJ
2,4-Dinitrotoluene		ug/L	0.20	UJ	0.20	UJ
2,6-Dinitrotoluene		ug/L	0.20	UJ	0.20	UJ
2-Amino-4,6-dinitrotoluene		ug/L	0.20	UJ	0.20	UJ
2-Nitrotoluene		ug/L	0.20	UJ	0.20	UJ
3-Nitrotoluene		ug/L	0.20	UJ	0.20	UJ
4-Amino-2,6-dinitrotoluene		ug/L	0.20	UJ	0.20	UJ
4-Nitrotoluene		ug/L	0.20	UJ	0.20	UJ
HMX		ug/L	0.50	UJ	0.50	UJ
Nitrobenzene		ug/L	0.20	UJ	0.51	UJ
RDX		ug/L	0.50	UJ	0.50	UJ
Tetryl		ug/L	0.20	UJ	0.20	UJ

Plum Brook Ordnance Works
TNT Area B
Data Summary Report
Soils

Report Date: 08/28/00

Sample Location:		TNTB-SO01		TNTB-SO02		TNTB-SO03		TNTB-SO04		TNTB-SO05	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10500		10510		10520		10530		10540	
Sample Date:		09-NOV-98		09-NOV-98		09-NOV-98		09-NOV-98		09-NOV-98	
Depth:		.5 - 2		3.5 - 4		3 - 4		5 - 6		2.5 - 3.5	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,1,1-Trichloroethane	mg/kg	.0059	U	.0056	U	.0057	U	.0067	U	.0064	U
1,1,2,2-Tetrachloroethane	mg/kg	.0059	U	.0056	UJ	.0057	UJ	.0067	UJ	.0064	UJ
1,1,2-Trichloroethane	mg/kg	.0059	U	.0056	U	.0057	U	.0067	U	.0064	UJ
1,1-Dichloroethane	mg/kg	.0059	U	.0056	U	.0057	U	.0067	U	.0064	U
1,1-Dichloroethene	mg/kg	.0059	U	.0056	U	.0057	U	.0067	U	.0064	U
1,2-Dichloroethane	mg/kg	.0059	U	.0056	U	.0057	U	.0067	U	.0064	UJ
1,2-Dichloroethene	mg/kg	.0059	U	.0056	U	.0057	U	.0067	U	.0064	UJ
1,2-Dichloropropane	mg/kg	.0059	U	.0056	U	.0057	U	.0067	U	.0064	UJ
2-Butanone	mg/kg	.024	R	.022	U	.023	R	.027	R	.026	R
2-Hexanone	mg/kg	.024	U	.022	U	.023	U	.027	U	.026	UJ
4-Methyl-2-pentanone	mg/kg	.024	U	.022	U	.023	U	.027	U	.026	UJ
Acetone	mg/kg	.56	D	.022	U	.023	R	.047	J	.044	J
Benzene	mg/kg	.0059	U	.0056	U	.0057	U	.0067	U	.0064	UJ
Bromodichloromethane	mg/kg	.0059	U	.0056	U	.0057	U	.0067	U	.0064	UJ
Bromoform	mg/kg	.0059	U	.0056	U	.0057	U	.0067	U	.0064	UJ
Bromomethane	mg/kg	.012	U	.011	U	.011	U	.013	U	.013	U
Carbon disulfide	mg/kg	.0059	U	.0056	U	.0057	U	.0067	U	.0064	U
Carbon tetrachloride	mg/kg	.0059	U	.0056	U	.0057	U	.0067	U	.0064	UJ
Chlorobenzene	mg/kg	.0059	U	.0056	U	.0057	U	.0067	U	.0064	UJ
Chloroethane	mg/kg	.012	U	.011	U	.011	U	.013	U	.013	U
Chloroform	mg/kg	.0059	U	.0056	U	.0057	U	.0067	U	.0064	U
Chloromethane	mg/kg	.012	U	.011	U	.011	U	.013	U	.013	U
Dibromochloromethane	mg/kg	.0059	U	.0056	U	.0057	U	.0067	U	.0064	UJ
Ethylbenzene	mg/kg	.0059	U	.0056	U	.0057	U	.0067	U	.0064	UJ
Methylene chloride	mg/kg	.0038	B	.0051	B	.0036	B	.0067	B	.0062	B
Styrene	mg/kg	.0059	U	.0056	U	.0057	U	.0067	U	.0064	UJ
Tetrachloroethene	mg/kg	.0059	U	.0056	U	.0057	U	.0067	U	.0064	UJ
Toluene	mg/kg	.0059	U	.0034	J	.0014	B	.0039	J	.0041	J
Total xylenes	mg/kg	.0059	U	.0056	U	.0025	J	.0067	U	.0064	UJ
Trichloroethene	mg/kg	.0059	U	.0056	U	.0057	U	.0067	U	.0064	UJ

Plum Brook Ordnance Works

TNT Area B

Data Summary Report

Soils

Report Date: 08/28/00

Sample Location:		TNTB-SO06		TNTB-SO07		TNTB-SO08		TNTB-SO09		TNTB-SO10	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10550		10560		10570		10580		10590	
Sample Date:		09-NOV-98		10-NOV-98		09-NOV-98		11-NOV-98		10-NOV-98	
Depth:		4 - 5		3 - 4		6 - 8		0 - 1		4 - 6	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,1,1-Trichloroethane	mg/kg	.0057	U	.0055	U	.0061	U	.0059	U	.006	U
1,1,2,2-Tetrachloroethane	mg/kg	.0057	U	.0055	U	.0061	UJ	.0059	UJ	.006	UJ
1,1,2-Trichloroethane	mg/kg	.0057	U	.0055	U	.0061	UJ	.0059	UJ	.006	U
1,1-Dichloroethane	mg/kg	.0057	U	.0055	U	.0061	U	.0059	U	.006	U
1,1-Dichloroethene	mg/kg	.0057	U	.0055	U	.0061	U	.0059	U	.006	U
1,2-Dichloroethane	mg/kg	.0057	U	.0055	U	.0061	UJ	.0059	UJ	.006	U
1,2-Dichloroethene	mg/kg	.0057	U	.0055	U	.0061	UJ	.0059	UJ	.006	U
1,2-Dichloropropane	mg/kg	.0057	U	.0055	U	.0061	UJ	.0059	UJ	.006	U
2-Butanone	mg/kg	.023	R	.022	R	.025	R	.024	U	.024	R
2-Hexanone	mg/kg	.023	U	.022	U	.025	UJ	.024	UJ	.024	U
4-Methyl-2-pentanone	mg/kg	.023	U	.022	U	.025	UJ	.024	UJ	.024	U
Acetone	mg/kg	.022	J	.022	R	.011	B	.024	U	.024	R
Benzene	mg/kg	.0057	U	.0055	U	.0061	UJ	.0059	UJ	.006	U
Bromodichloromethane	mg/kg	.0057	U	.0055	U	.0061	UJ	.0059	UJ	.006	U
Bromoform	mg/kg	.0057	U	.0055	U	.0061	UJ	.0059	UJ	.006	U
Bromomethane	mg/kg	.011	U	.011	U	.012	U	.012	U	.012	U
Carbon disulfide	mg/kg	.0057	U	.0055	U	.0061	U	.0059	U	.006	U
Carbon tetrachloride	mg/kg	.0057	U	.0055	U	.0061	UJ	.0059	UJ	.006	U
Chlorobenzene	mg/kg	.0057	U	.0055	U	.0061	UJ	.0059	UJ	.006	U
Chloroethane	mg/kg	.011	U	.011	U	.012	U	.012	U	.012	U
Chloroform	mg/kg	.0057	U	.0055	U	.0061	U	.0059	U	.006	U
Chloromethane	mg/kg	.011	U	.011	U	.012	U	.012	U	.012	U
Dibromochloromethane	mg/kg	.0057	U	.0055	U	.0061	UJ	.0059	UJ	.006	U
Ethylbenzene	mg/kg	.0057	U	.0055	U	.0061	UJ	.0059	UJ	.006	U
Methylene chloride	mg/kg	.003	B	.0028	B	.0052	B	.0035	B	.0034	B
Styrene	mg/kg	.0057	U	.0055	U	.0061	UJ	.0059	UJ	.006	U
Tetrachloroethene	mg/kg	.0057	U	.0055	U	.0061	UJ	.0059	UJ	.006	U
Toluene	mg/kg	.0018	B	.0055	U	.0045	J	.0059	UJ	.0026	J
Total xylenes	mg/kg	.0057	U	.0055	U	.0061	UJ	.0059	UJ	.006	U
Trichloroethene	mg/kg	.0057	U	.0055	U	.0061	UJ	.0059	UJ	.006	U

Sample Location:		TNTB-SO11		TNTB-SO12		TNTB-SO14		TNTB-SO15		TNTB-SO16	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10600		10610		10630		10640		10650	
Sample Date:		10-NOV-98		10-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98	
Depth:		8 - 10		4 - 5		0 - 1		0 - 1		0 - 1	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,1,1-Trichloroethane	mg/kg	.0063	U	.0062	U	.0063	U	.0062	UJ	.0061	U
1,1,2,2-Tetrachloroethane	mg/kg	.0063	UJ	.0062	UJ	.0063	U	.0062	UJ	.0061	UJ
1,1,2-Trichloroethane	mg/kg	.0063	UJ	.0062	U	.0063	U	.0062	UJ	.0061	UJ
1,1-Dichloroethane	mg/kg	.0063	U	.0062	U	.0063	U	.0062	UJ	.0061	U
1,1-Dichloroethene	mg/kg	.0063	U	.0062	U	.0063	U	.0062	UJ	.0061	U
1,2-Dichloroethane	mg/kg	.0063	UJ	.0062	U	.0063	U	.0062	UJ	.0061	UJ
1,2-Dichloroethene	mg/kg	.0063	UJ	.0062	U	.0063	U	.0062	UJ	.0061	UJ
1,2-Dichloropropane	mg/kg	.0063	UJ	.0062	U	.0063	U	.0062	UJ	.0061	UJ
2-Butanone	mg/kg	.015	J	.025	R	.025	U	.025	UJ	.024	U
2-Hexanone	mg/kg	.025	UJ	.025	U	.025	U	.025	UJ	.024	UJ
4-Methyl-2-pentanone	mg/kg	.025	UJ	.025	U	.025	U	.025	UJ	.024	UJ
Acetone	mg/kg	.11	J	.025	R	.025	U	.025	R	.024	U
Benzene	mg/kg	.0063	UJ	.0062	U	.0063	U	.0062	UJ	.0061	UJ
Bromodichloromethane	mg/kg	.0063	UJ	.0062	U	.0063	U	.0062	UJ	.0061	UJ
Bromoform	mg/kg	.0063	UJ	.0062	U	.0063	U	.0062	UJ	.0061	UJ
Bromomethane	mg/kg	.013	U	.012	U	.013	U	.012	UJ	.012	U
Carbon disulfide	mg/kg	.0063	U	.0062	U	.0063	U	.0062	UJ	.0061	U
Carbon tetrachloride	mg/kg	.0063	UJ	.0062	U	.0063	U	.0062	UJ	.0061	UJ
Chlorobenzene	mg/kg	.0063	UJ	.0062	U	.0063	U	.0062	UJ	.0061	UJ
Chloroethane	mg/kg	.013	U	.012	U	.013	U	.012	UJ	.012	U
Chloroform	mg/kg	.0063	U	.0062	U	.0063	U	.0062	UJ	.0061	U
Chloromethane	mg/kg	.013	U	.012	U	.013	U	.012	UJ	.012	U
Dibromochloromethane	mg/kg	.0063	UJ	.0062	U	.0063	U	.0062	UJ	.0061	UJ
Ethylbenzene	mg/kg	.0063	UJ	.0062	U	.0063	U	.0062	UJ	.0061	UJ
Methylene chloride	mg/kg	.0068	B	.0066	B	.0025	B	.0036	B	.0031	B
Styrene	mg/kg	.0063	UJ	.0062	U	.0063	U	.0062	UJ	.0061	UJ
Tetrachloroethene	mg/kg	.0063	UJ	.0062	U	.0063	U	.0062	UJ	.0061	UJ
Toluene	mg/kg	.021	J	.0032	J	.0063	U	.0062	UJ	.0061	UJ
Total xylenes	mg/kg	.0024	J	.0062	U	.0063	U	.0062	UJ	.0061	UJ
Trichloroethene	mg/kg	.0063	UJ	.0062	U	.0063	U	.0062	UJ	.0061	UJ

Sample Location:		TNTB-SO17		TNTB-SO18		TNTB-SO19		TNTB-SO20		TNTB-SO21	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10660		10670		10680		10690		10700	
Sample Date:		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1		0 - 1	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,1,1-Trichloroethane	mg/kg	.006	U	.0066	UJ	.0066	UJ	.006	U	.0061	UJ
1,1,2,2-Tetrachloroethane	mg/kg	.006	UJ	.0066	UJ	.0066	UJ	.006	UJ	.0061	UJ
1,1,2-Trichloroethane	mg/kg	.006	U	.0066	UJ	.0066	UJ	.006	U	.0061	UJ
1,1-Dichloroethane	mg/kg	.006	U	.0066	UJ	.0066	UJ	.006	U	.0061	UJ
1,1-Dichloroethene	mg/kg	.006	U	.0066	UJ	.0066	UJ	.006	U	.0061	UJ
1,2-Dichloroethane	mg/kg	.006	U	.0066	UJ	.0066	UJ	.006	U	.0061	UJ
1,2-Dichloroethene	mg/kg	.006	U	.0066	UJ	.0066	UJ	.006	U	.0061	UJ
1,2-Dichloropropane	mg/kg	.006	U	.0066	UJ	.0066	UJ	.006	U	.0061	UJ
2-Butanone	mg/kg	.024	R	.026	UJ	.026	UJ	.024	U	.024	UJ
2-Hexanone	mg/kg	.024	U	.026	UJ	.026	UJ	.024	U	.024	UJ
4-Methyl-2-pentanone	mg/kg	.024	U	.026	UJ	.026	UJ	.024	U	.024	UJ
Acetone	mg/kg	.024	R	.026	UJ	.026	UJ	.024	U	.024	UJ
Benzene	mg/kg	.006	U	.0066	UJ	.0066	UJ	.006	U	.0061	UJ
Bromodichloromethane	mg/kg	.006	U	.0066	UJ	.0066	UJ	.006	U	.0061	UJ
Bromoform	mg/kg	.006	U	.0066	UJ	.0066	UJ	.006	U	.0061	UJ
Bromomethane	mg/kg	.012	U	.013	UJ	.013	UJ	.012	U	.012	UJ
Carbon disulfide	mg/kg	.006	U	.0066	UJ	.0066	UJ	.006	U	.0061	UJ
Carbon tetrachloride	mg/kg	.006	U	.0066	UJ	.0066	UJ	.006	U	.0061	UJ
Chlorobenzene	mg/kg	.006	U	.0066	UJ	.0066	UJ	.006	U	.0061	UJ
Chloroethane	mg/kg	.012	U	.013	UJ	.013	UJ	.012	U	.012	UJ
Chloroform	mg/kg	.006	U	.0066	UJ	.0066	UJ	.006	U	.0061	UJ
Chloromethane	mg/kg	.012	U	.013	UJ	.013	UJ	.012	U	.012	UJ
Dibromochloromethane	mg/kg	.006	U	.0066	UJ	.0066	UJ	.006	U	.0061	UJ
Ethylbenzene	mg/kg	.006	U	.0066	UJ	.0066	UJ	.006	U	.0061	UJ
Methylene chloride	mg/kg	.0061	B	.0039	B	.0042	B	.0032	B	.0038	B
Styrene	mg/kg	.006	U	.0066	UJ	.0066	UJ	.006	U	.0061	UJ
Tetrachloroethene	mg/kg	.006	U	.0066	UJ	.0066	UJ	.006	U	.0061	UJ
Toluene	mg/kg	.006	U	.0028	B	.0066	UJ	.006	U	.0061	UJ
Total xylenes	mg/kg	.006	U	.0066	UJ	.0066	UJ	.006	U	.0061	UJ
Trichloroethene	mg/kg	.006	U	.0066	UJ	.0066	UJ	.006	U	.0061	UJ

Sample Location:		TNTB-SO22		TNTB-SO23		TNTB-SO24		TNTB-SO25		TNTB-SO26	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10710		10720		10730		10740		10750	
Sample Date:		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1		0 - 1	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,1,1-Trichloroethane	mg/kg	.0061	U	.0054	U	.0058	U	.0061	U	.0061	U
1,1,2,2-Tetrachloroethane	mg/kg	.0061	UJ	.0054	U	.0058	UJ	.0061	UJ	.0061	U
1,1,2-Trichloroethane	mg/kg	.0061	U	.0054	U	.0058	U	.0061	UJ	.0061	U
1,1-Dichloroethane	mg/kg	.0061	U	.0054	U	.0058	U	.0061	U	.0061	U
1,1-Dichloroethene	mg/kg	.0061	U	.0054	U	.0058	U	.0061	U	.0061	U
1,2-Dichloroethane	mg/kg	.0061	U	.0054	U	.0058	U	.0061	UJ	.0061	U
1,2-Dichloroethene	mg/kg	.0061	U	.0054	U	.0058	U	.0061	UJ	.0061	U
1,2-Dichloropropane	mg/kg	.0061	U	.0054	U	.0058	U	.0061	UJ	.0061	U
2-Butanone	mg/kg	.024	U	.022	U	.023	U	.025	U	.024	U
2-Hexanone	mg/kg	.024	U	.022	U	.023	U	.025	UJ	.024	U
4-Methyl-2-pentanone	mg/kg	.024	U	.022	U	.023	U	.025	UJ	.024	U
Acetone	mg/kg	.024	R	.022	R	.023	U	.025	U	.024	U
Benzene	mg/kg	.0061	U	.0054	U	.0058	U	.0061	UJ	.0061	U
Bromodichloromethane	mg/kg	.0061	U	.0054	U	.0058	U	.0061	UJ	.0061	U
Bromoform	mg/kg	.0061	U	.0054	U	.0058	U	.0061	UJ	.0061	U
Bromomethane	mg/kg	.012	U	.011	U	.012	U	.012	U	.012	U
Carbon disulfide	mg/kg	.0061	U	.0054	U	.0058	U	.0061	U	.0061	U
Carbon tetrachloride	mg/kg	.0061	U	.0054	U	.0058	U	.0061	UJ	.0061	U
Chlorobenzene	mg/kg	.0061	U	.0054	U	.0058	U	.0061	UJ	.0061	U
Chloroethane	mg/kg	.012	U	.011	U	.012	U	.012	U	.012	U
Chloroform	mg/kg	.0061	U	.0054	U	.0058	U	.0061	U	.0061	U
Chloromethane	mg/kg	.012	U	.011	U	.012	U	.012	U	.012	U
Dibromochloromethane	mg/kg	.0061	U	.0054	U	.0058	U	.0061	UJ	.0061	U
Ethylbenzene	mg/kg	.0061	U	.0054	U	.0058	U	.0061	UJ	.0061	U
Methylene chloride	mg/kg	.0032	B	.0033	B	.0057	B	.0044	B	.0031	B
Styrene	mg/kg	.0061	U	.0054	U	.0058	U	.0061	UJ	.0061	U
Tetrachloroethene	mg/kg	.0061	U	.0054	U	.0058	U	.0061	UJ	.0061	U
Toluene	mg/kg	.0061	U	.0054	U	.0018	B	.0021	B	.0061	U
Total xylenes	mg/kg	.0061	U	.0054	U	.0058	U	.0061	UJ	.0061	U
Trichloroethene	mg/kg	.0061	U	.0054	U	.0018	J	.0061	UJ	.0061	U

Sample Location:		TNTB-SO27		TNTB-SO28		TNTB-SO29		TNTB-SO30		TNTB-SO31	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10760		10770		10780		10790		10800	
Sample Date:		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98		12-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1		0 - 1	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,1,1-Trichloroethane	mg/kg	.0062	U	.006	U	.0061	U	.0062	U	.006	U
1,1,2,2-Tetrachloroethane	mg/kg	.0062	UJ	.006	U	.0061	UJ	.0062	U	.006	UJ
1,1,2-Trichloroethane	mg/kg	.0062	U	.006	U	.0061	UJ	.0062	U	.006	U
1,1-Dichloroethane	mg/kg	.0062	U	.006	U	.0061	U	.0062	U	.006	U
1,1-Dichloroethene	mg/kg	.0062	U	.006	U	.0061	U	.0062	U	.006	U
1,2-Dichloroethane	mg/kg	.0062	U	.006	U	.0061	UJ	.0062	U	.006	U
1,2-Dichloroethene	mg/kg	.0062	U	.006	U	.0061	UJ	.0062	U	.006	U
1,2-Dichloropropane	mg/kg	.0062	U	.006	U	.0061	UJ	.0062	U	.006	U
2-Butanone	mg/kg	.025	U	.024	U	.024	U	.025	U	.024	R
2-Hexanone	mg/kg	.025	U	.024	U	.024	UJ	.025	U	.024	U
4-Methyl-2-pentanone	mg/kg	.025	U	.024	U	.024	UJ	.025	U	.024	U
Acetone	mg/kg	.025	U	.024	U	.024	U	.025	U	.024	R
Benzene	mg/kg	.0062	U	.006	U	.0061	UJ	.0062	U	.006	U
Bromodichloromethane	mg/kg	.0062	U	.006	U	.0061	UJ	.0062	U	.006	U
Bromoform	mg/kg	.0062	U	.006	U	.0061	UJ	.0062	U	.006	U
Bromomethane	mg/kg	.012	U	.012	U	.012	U	.012	U	.012	U
Carbon disulfide	mg/kg	.0062	U	.006	U	.0061	U	.0062	U	.006	U
Carbon tetrachloride	mg/kg	.0062	U	.006	U	.0061	UJ	.0062	U	.006	U
Chlorobenzene	mg/kg	.0062	U	.006	U	.0061	UJ	.0062	U	.006	U
Chloroethane	mg/kg	.012	U	.012	U	.012	U	.012	U	.012	U
Chloroform	mg/kg	.0062	U	.006	U	.0061	U	.0062	U	.006	U
Chloromethane	mg/kg	.012	U	.012	U	.012	U	.012	U	.012	U
Dibromochloromethane	mg/kg	.0062	U	.006	U	.0061	UJ	.0062	U	.006	U
Ethylbenzene	mg/kg	.0062	U	.006	U	.0061	UJ	.0062	U	.006	U
Methylene chloride	mg/kg	.0037	B	.0031	B	.0041	B	.0032	B	.0049	B
Styrene	mg/kg	.0062	U	.006	U	.0061	UJ	.0062	U	.006	U
Tetrachloroethene	mg/kg	.0062	U	.006	U	.0061	UJ	.0062	U	.006	U
Toluene	mg/kg	.0062	U	.006	U	.0061	UJ	.0062	U	.006	U
Total xylenes	mg/kg	.0062	U	.006	U	.0061	UJ	.0062	U	.006	U
Trichloroethene	mg/kg	.0062	U	.006	U	.0061	UJ	.0062	U	.006	U

Sample Location:		TNTB-SO32		TNTB-SO33		TNTB-SO34		TNTB-SO35		TNTB-SO36	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10810		10820		10830		10840		10850	
Sample Date:		12-NOV-98		12-NOV-98		12-NOV-98		11-NOV-98		12-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1		0 - 1	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,1,1-Trichloroethane	mg/kg	.0059	UJ	.0055	U	.0056	U	.006	U	.006	U
1,1,2,2-Tetrachloroethane	mg/kg	.0059	UJ	.0055	U	.0056	U	.006	UJ	.006	UJ
1,1,2-Trichloroethane	mg/kg	.0059	UJ	.0055	U	.0056	U	.006	U	.006	UJ
1,1-Dichloroethane	mg/kg	.0059	UJ	.0055	U	.0056	U	.006	U	.006	U
1,1-Dichloroethene	mg/kg	.0059	UJ	.0055	U	.0056	U	.006	U	.006	U
1,2-Dichloroethane	mg/kg	.0059	UJ	.0055	U	.0056	U	.006	U	.006	UJ
1,2-Dichloroethene	mg/kg	.0059	UJ	.0055	U	.0056	U	.006	U	.006	UJ
1,2-Dichloropropane	mg/kg	.0059	UJ	.0055	U	.0056	U	.006	U	.006	UJ
2-Butanone	mg/kg	.023	UJ	.022	U	.022	U	.024	U	.024	U
2-Hexanone	mg/kg	.023	UJ	.022	U	.022	U	.024	U	.024	UJ
4-Methyl-2-pentanone	mg/kg	.023	UJ	.022	U	.022	U	.024	U	.024	UJ
Acetone	mg/kg	.017	B	.022	R	.022	R	.024	R	.024	R
Benzene	mg/kg	.0059	UJ	.0055	U	.0056	U	.006	U	.006	UJ
Bromodichloromethane	mg/kg	.0059	UJ	.0055	U	.0056	U	.006	U	.006	UJ
Bromoform	mg/kg	.0059	UJ	.0055	U	.0056	U	.006	U	.006	UJ
Bromomethane	mg/kg	.012	UJ	.011	U	.011	U	.012	U	.012	U
Carbon disulfide	mg/kg	.0022	J	.0055	U	.0056	U	.006	U	.006	U
Carbon tetrachloride	mg/kg	.0059	UJ	.0055	U	.0056	U	.006	U	.006	UJ
Chlorobenzene	mg/kg	.0059	UJ	.0055	U	.0056	U	.006	U	.006	UJ
Chloroethane	mg/kg	.012	UJ	.011	U	.011	U	.012	U	.012	U
Chloroform	mg/kg	.0059	UJ	.0055	U	.0056	U	.006	U	.006	U
Chloromethane	mg/kg	.012	UJ	.011	U	.011	U	.012	U	.012	U
Dibromochloromethane	mg/kg	.0059	UJ	.0055	U	.0056	U	.006	U	.006	UJ
Ethylbenzene	mg/kg	.0017	J	.0055	U	.0056	U	.006	U	.006	UJ
Methylene chloride	mg/kg	.0047	B	.0023	B	.0022	B	.0033	B	.0028	B
Styrene	mg/kg	.0059	UJ	.0055	U	.0056	U	.006	U	.006	UJ
Tetrachloroethene	mg/kg	.0059	UJ	.0055	U	.0056	U	.006	U	.006	UJ
Toluene	mg/kg	.011	J	.0055	U	.0056	U	.006	U	.006	UJ
Total xylenes	mg/kg	.0084	J	.0055	U	.0056	U	.006	U	.006	UJ
Trichloroethene	mg/kg	.0059	UJ	.0055	U	.0056	U	.006	U	.006	UJ

Sample Location:		TNTB-SO37		TNTB-SO38		TNTB-SO39		TNTB-SO40	
Associated Site:		TNTB		TNTB		TNTB		TNTB	
Sample No:		10860		10870		10880		10890	
Sample Date:		12-NOV-98		12-NOV-98		12-NOV-98		12-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,1,1-Trichloroethane	mg/kg	.0062	UJ	.0061	UJ	.0058	UJ	.0059	U
1,1,2,2-Tetrachloroethane	mg/kg	.0062	UJ	.0061	UJ	.0058	UJ	.0059	UJ
1,1,2-Trichloroethane	mg/kg	.0062	UJ	.0061	UJ	.0058	UJ	.0059	UJ
1,1-Dichloroethane	mg/kg	.0062	UJ	.0061	UJ	.0058	UJ	.0059	U
1,1-Dichloroethene	mg/kg	.0062	UJ	.0061	UJ	.0058	UJ	.0059	U
1,2-Dichloroethane	mg/kg	.0062	UJ	.0061	UJ	.0058	UJ	.0059	UJ
1,2-Dichloroethene	mg/kg	.0062	UJ	.0061	UJ	.0058	UJ	.0059	UJ
1,2-Dichloropropane	mg/kg	.0062	UJ	.0061	UJ	.0058	UJ	.0059	UJ
2-Butanone	mg/kg	.025	UJ	.024	UJ	.023	UJ	.024	U
2-Hexanone	mg/kg	.025	UJ	.024	UJ	.023	UJ	.024	UJ
4-Methyl-2-pentanone	mg/kg	.025	UJ	.024	UJ	.023	UJ	.024	UJ
Acetone	mg/kg	.025	R	.024	R	.023	R	.01	J
Benzene	mg/kg	.0062	UJ	.0061	UJ	.0058	UJ	.0059	UJ
Bromodichloromethane	mg/kg	.0062	UJ	.0061	UJ	.0058	UJ	.0059	UJ
Bromoform	mg/kg	.0062	UJ	.0061	UJ	.0058	UJ	.0059	UJ
Bromomethane	mg/kg	.012	UJ	.012	UJ	.012	UJ	.012	U
Carbon disulfide	mg/kg	.0062	UJ	.0061	UJ	.0058	UJ	.0059	U
Carbon tetrachloride	mg/kg	.0062	UJ	.0061	UJ	.0058	UJ	.0059	UJ
Chlorobenzene	mg/kg	.0062	UJ	.0061	UJ	.0058	UJ	.0059	UJ
Chloroethane	mg/kg	.012	UJ	.012	UJ	.012	UJ	.012	U
Chloroform	mg/kg	.0062	UJ	.0061	UJ	.0058	UJ	.0059	U
Chloromethane	mg/kg	.012	UJ	.012	UJ	.012	UJ	.012	U
Dibromochloromethane	mg/kg	.0062	UJ	.0061	UJ	.0058	UJ	.0059	UJ
Ethylbenzene	mg/kg	.0062	UJ	.0061	UJ	.0058	UJ	.0059	UJ
Methylene chloride	mg/kg	.0036	B	.0037	B	.0026	B	.0027	B
Styrene	mg/kg	.0062	UJ	.0061	UJ	.0058	UJ	.0059	UJ
Tetrachloroethene	mg/kg	.0062	UJ	.0061	UJ	.0058	UJ	.0059	UJ
Toluene	mg/kg	.0062	UJ	.0061	UJ	.0058	UJ	.0059	UJ
Total xylenes	mg/kg	.0062	UJ	.0061	UJ	.0058	UJ	.0059	UJ
Trichloroethene	mg/kg	.0062	UJ	.0061	UJ	.0058	UJ	.0059	UJ

Report Date: 08/28/00

Sample Location:		TNTB-SO01		TNTB-SO02		TNTB-SO03		TNTB-SO04		TNTB-SO05	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10500		10510		10520		10530		10540	
Sample Date:		09-NOV-98		09-NOV-98		09-NOV-98		09-NOV-98		09-NOV-98	
Depth:		.5 - 2		3.5 - 4		3 - 4		5 - 6		2.5 - 3.5	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Vinyl chloride	mg/kg	.012	U	.011	U	.011	U	.013	U	.013	U
cis-1,3-Dichloropropene	mg/kg	.0059	U	.0056	U	.0057	U	.0067	U	.0064	UJ
trans-1,3-Dichloropropene	mg/kg	.0059	U	.0056	U	.0057	U	.0067	U	.0064	UJ

Sample Location:		TNTB-SO06		TNTB-SO07		TNTB-SO08		TNTB-SO09		TNTB-SO10	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10550		10560		10570		10580		10590	
Sample Date:		09-NOV-98		10-NOV-98		09-NOV-98		11-NOV-98		10-NOV-98	
Depth:		4 - 5		3 - 4		6 - 8		0 - 1		4 - 6	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Vinyl chloride	mg/kg	.011	U	.011	U	.012	U	.012	U	.012	U
cis-1,3-Dichloropropene	mg/kg	.0057	U	.0055	U	.0061	UJ	.0059	UJ	.006	U
trans-1,3-Dichloropropene	mg/kg	.0057	U	.0055	U	.0061	UJ	.0059	UJ	.006	U

Sample Location:		TNTB-SO11		TNTB-SO12		TNTB-SO14		TNTB-SO15		TNTB-SO16	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10600		10610		10630		10640		10650	
Sample Date:		10-NOV-98		10-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98	
Depth:		8 - 10		4 - 5		0 - 1		0 - 1		0 - 1	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Vinyl chloride	mg/kg	.013	U	.012	U	.013	U	.012	UJ	.012	U
cis-1,3-Dichloropropene	mg/kg	.0063	UJ	.0062	U	.0063	U	.0062	UJ	.0061	UJ
trans-1,3-Dichloropropene	mg/kg	.0063	UJ	.0062	U	.0063	U	.0062	UJ	.0061	UJ

Sample Location:		TNTB-SO17		TNTB-SO18		TNTB-SO19		TNTB-SO20		TNTB-SO21	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10660		10670		10680		10690		10700	
Sample Date:		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1		0 - 1	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Vinyl chloride	mg/kg	.012	U	.013	UJ	.013	UJ	.012	U	.012	UJ
cis-1,3-Dichloropropene	mg/kg	.006	U	.0066	UJ	.0066	UJ	.006	U	.0061	UJ
trans-1,3-Dichloropropene	mg/kg	.006	U	.0066	UJ	.0066	UJ	.006	U	.0061	UJ

Sample Location:		TNTB-SO22		TNTB-SO23		TNTB-SO24		TNTB-SO25		TNTB-SO26	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10710		10720		10730		10740		10750	
Sample Date:		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1		0 - 1	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Vinyl chloride	mg/kg	.012	U	.011	U	.012	U	.012	U	.012	U
cis-1,3-Dichloropropene	mg/kg	.0061	U	.0054	U	.0058	U	.0061	UJ	.0061	U
trans-1,3-Dichloropropene	mg/kg	.0061	U	.0054	U	.0058	U	.0061	UJ	.0061	U

Sample Location:		TNTB-SO27		TNTB-SO28		TNTB-SO29		TNTB-SO30		TNTB-SO31	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10760		10770		10780		10790		10800	
Sample Date:		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98		12-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1		0 - 1	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Vinyl chloride	mg/kg	.012	U	.012	U	.012	U	.012	U	.012	U
cis-1,3-Dichloropropene	mg/kg	.0062	U	.006	U	.0061	UJ	.0062	U	.006	U
trans-1,3-Dichloropropene	mg/kg	.0062	U	.006	U	.0061	UJ	.0062	U	.006	U

Sample Location:		TNTB-SO32		TNTB-SO33		TNTB-SO34		TNTB-SO35		TNTB-SO36	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10810		10820		10830		10840		10850	
Sample Date:		12-NOV-98		12-NOV-98		12-NOV-98		11-NOV-98		12-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1		0 - 1	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Vinyl chloride	mg/kg	.012	UJ	.011	U	.011	U	.012	U	.012	U
cis-1,3-Dichloropropene	mg/kg	.0059	UJ	.0055	U	.0056	U	.006	U	.006	UJ
trans-1,3-Dichloropropene	mg/kg	.0059	UJ	.0055	U	.0056	U	.006	U	.006	UJ

Report Date: 08/28/00

Sample Location:		TNTB-SO37		TNTB-SO38		TNTB-SO39		TNTB-SO40	
Associated Site:		TNTB		TNTB		TNTB		TNTB	
Sample No:		10860		10870		10880		10890	
Sample Date:		12-NOV-98		12-NOV-98		12-NOV-98		12-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Vinyl chloride	mg/kg	.012	UJ	.012	UJ	.012	UJ	.012	U
cis-1,3-Dichloropropene	mg/kg	.0062	UJ	.0061	UJ	.0058	UJ	.0059	UJ
trans-1,3-Dichloropropene	mg/kg	.0062	UJ	.0061	UJ	.0058	UJ	.0059	UJ

Sample Location:		TNTB-SO01		TNTB-SO02		TNTB-SO03		TNTB-SO04		TNTB-SO05	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10500		10510		10520		10530		10540	
Sample Date:		09-NOV-98		09-NOV-98		09-NOV-98		09-NOV-98		09-NOV-98	
Depth:		.5 - 2		3.5 - 4		3 - 4		5 - 6		2.5 - 3.5	
SEMIVOLATILES3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,2,4-Trichlorobenzene	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U
1,2-Dichlorobenzene	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U
1,3-Dichlorobenzene	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U
1,4-Dichlorobenzene	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U
2,4,5-Trichlorophenol	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U
2,4,6-Trichlorophenol	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U
2,4-Dichlorophenol	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U
2,4-Dimethylphenol	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U
2,4-Dinitrophenol	mg/kg	1.9	U	1.8	U	1.8	U	2.1	U	2	U
2,4-Dinitrotoluene	mg/kg	.39	U	.66		13	D	.28	J	.42	U
2,6-Dinitrotoluene	mg/kg	.39	U	.15	J	3		.44	U	.42	U
2-Chloronaphthalene	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U
2-Chlorophenol	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U
2-Methylnaphthalene	mg/kg	.39	U	.12	J	.96		.44	U	.42	U
2-Methylphenol	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U
2-Nitroaniline	mg/kg	1.9	U	1.8	U	1.8	U	2.1	U	2	U
2-Nitrophenol	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U
3,3'-Dichlorobenzidine	mg/kg	1.9	U	1.8	U	1.8	U	2.1	U	2	U
3-Nitroaniline	mg/kg	1.9	U	1.8	U	1.8	U	2.1	U	2	U
4,6-Dinitro-2-methylphenol	mg/kg	1.9	U	1.8	U	1.8	U	2.1	U	2	U
4-Bromophenyl phenyl ether	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U
4-Chloro-3-methylphenol	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U
4-Chloroaniline	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U
4-Chlorophenyl phenyl ether	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U
4-Methylphenol	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U
4-Nitroaniline	mg/kg	1.9	U	1.8	U	1.8	U	2.1	U	2	U
4-Nitrophenol	mg/kg	1.9	U	1.8	U	1.8	U	2.1	U	2	U
Acenaphthene	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U
Acenaphthylene	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U
Anthracene	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U

Sample Location:		TNTB-SO06		TNTB-SO07		TNTB-SO08		TNTB-SO09		TNTB-SO10	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10550		10560		10570		10580		10590	
Sample Date:		09-NOV-98		10-NOV-98		09-NOV-98		11-NOV-98		10-NOV-98	
Depth:		4 - 5		3 - 4		6 - 8		0 - 1		4 - 6	
SEMIVOLATILES3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,2,4-Trichlorobenzene	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
1,2-Dichlorobenzene	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
1,3-Dichlorobenzene	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
1,4-Dichlorobenzene	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
2,4,5-Trichlorophenol	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
2,4,6-Trichlorophenol	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
2,4-Dichlorophenol	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
2,4-Dimethylphenol	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
2,4-Dinitrophenol	mg/kg	1.8	U	1.8	U	2	U	1.9	U	1.9	U
2,4-Dinitrotoluene	mg/kg	3.6		.43		3.2		.15	J	.044	J
2,6-Dinitrotoluene	mg/kg	2.4		.15	J	.49		.046	J	.39	U
2-Chloronaphthalene	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
2-Chlorophenol	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
2-Methylnaphthalene	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
2-Methylphenol	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
2-Nitroaniline	mg/kg	1.8	U	1.8	U	2	U	1.9	U	1.9	U
2-Nitrophenol	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
3,3'-Dichlorobenzidine	mg/kg	1.8	U	1.8	U	2	U	1.9	U	1.9	U
3-Nitroaniline	mg/kg	1.8	U	1.8	U	2	U	1.9	U	1.9	U
4,6-Dinitro-2-methylphenol	mg/kg	.17	J	1.8	U	2	U	1.9	U	1.9	U
4-Bromophenyl phenyl ether	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
4-Chloro-3-methylphenol	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
4-Chloroaniline	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
4-Chlorophenyl phenyl ether	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
4-Methylphenol	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
4-Nitroaniline	mg/kg	1.8	U	1.8	U	2	U	1.9	U	1.9	U
4-Nitrophenol	mg/kg	1.8	U	1.8	U	2	U	1.9	U	1.9	U
Acenaphthene	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
Acenaphthylene	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
Anthracene	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U

Sample Location:		TNTB-SO11		TNTB-SO12		TNTB-SO14		TNTB-SO15		TNTB-SO16	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10600		10610		10630		10640		10650	
Sample Date:		10-NOV-98		10-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98	
Depth:		8 - 10		4 - 5		0 - 1		0 - 1		0 - 1	
SEMIVOLATILES3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,2,4-Trichlorobenzene	mg/kg	.42	U	.41	U	.41	U	.41	U	.4	U
1,2-Dichlorobenzene	mg/kg	.42	U	.41	U	.41	U	.41	U	.4	U
1,3-Dichlorobenzene	mg/kg	.42	U	.41	U	.41	U	.41	U	.4	U
1,4-Dichlorobenzene	mg/kg	.42	U	.41	U	.41	U	.41	U	.4	U
2,4,5-Trichlorophenol	mg/kg	.42	U	.41	U	.41	U	.41	U	.4	U
2,4,6-Trichlorophenol	mg/kg	.42	U	.41	U	.41	U	.41	U	.4	U
2,4-Dichlorophenol	mg/kg	.42	U	.41	U	.41	U	.41	U	.4	U
2,4-Dimethylphenol	mg/kg	.42	U	.41	U	.41	U	.41	U	.4	U
2,4-Dinitrophenol	mg/kg	2	U	2	U	2	U	2	U	1.9	U
2,4-Dinitrotoluene	mg/kg	110	D	4.4		.49		.19	J	.16	J
2,6-Dinitrotoluene	mg/kg	68	D	.62		.065	J	.093	J	.072	J
2-Chloronaphthalene	mg/kg	.42	U	.41	U	.41	U	.41	U	.4	U
2-Chlorophenol	mg/kg	.42	U	.41	U	.41	U	.41	U	.4	U
2-Methylnaphthalene	mg/kg	.42	U	.41	U	.41	U	.41	U	.4	U
2-Methylphenol	mg/kg	.42	U	.41	U	.41	U	.41	U	.4	U
2-Nitroaniline	mg/kg	2	U	2	U	2	U	2	U	1.9	U
2-Nitrophenol	mg/kg	.42	U	.41	U	.41	U	.41	U	.4	U
3,3'-Dichlorobenzidine	mg/kg	2	U	2	U	2	U	2	U	1.9	U
3-Nitroaniline	mg/kg	2	U	2	U	2	U	2	U	1.9	U
4,6-Dinitro-2-methylphenol	mg/kg	2	U	2	U	2	U	2	U	1.9	U
4-Bromophenyl phenyl ether	mg/kg	.42	U	.41	U	.41	U	.41	U	.4	U
4-Chloro-3-methylphenol	mg/kg	.42	U	.41	U	.41	U	.41	U	.4	U
4-Chloroaniline	mg/kg	.42	U	.41	U	.41	U	.41	U	.4	U
4-Chlorophenyl phenyl ether	mg/kg	.42	U	.41	U	.41	U	.41	U	.4	U
4-Methylphenol	mg/kg	.42	U	.41	U	.41	U	.41	U	.4	U
4-Nitroaniline	mg/kg	2	U	2	U	2	U	2	U	1.9	U
4-Nitrophenol	mg/kg	2	U	2	U	2	U	2	U	1.9	U
Acenaphthene	mg/kg	.42	U	.41	U	.41	U	.41	U	.4	U
Acenaphthylene	mg/kg	.42	U	.41	U	.41	U	.41	U	.075	J
Anthracene	mg/kg	.42	U	.41	U	.41	U	.029	J	.058	J

Sample Location:		TNTB-SO17		TNTB-SO18		TNTB-SO19		TNTB-SO20		TNTB-SO21	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10660		10670		10680		10690		10700	
Sample Date:		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1		0 - 1	
SEMIVOLATILES3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,2,4-Trichlorobenzene	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U
1,2-Dichlorobenzene	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U
1,3-Dichlorobenzene	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U
1,4-Dichlorobenzene	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U
2,4,5-Trichlorophenol	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U
2,4,6-Trichlorophenol	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U
2,4-Dichlorophenol	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U
2,4-Dimethylphenol	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U
2,4-Dinitrophenol	mg/kg	1.9	U	2.1	U	2.1	U	1.9	U	2	U
2,4-Dinitrotoluene	mg/kg	.18	J	.059	J	.44	U	.1	J	.082	J
2,6-Dinitrotoluene	mg/kg	.081	J	.43	U	.44	U	.4	U	.4	U
2-Chloronaphthalene	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U
2-Chlorophenol	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U
2-Methylnaphthalene	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U
2-Methylphenol	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U
2-Nitroaniline	mg/kg	1.9	U	2.1	U	2.1	U	1.9	U	2	U
2-Nitrophenol	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U
3,3'-Dichlorobenzidine	mg/kg	1.9	U	2.1	U	2.1	U	1.9	U	2	U
3-Nitroaniline	mg/kg	1.9	U	2.1	U	2.1	U	1.9	U	2	U
4,6-Dinitro-2-methylphenol	mg/kg	1.9	U	2.1	U	2.1	U	1.9	U	2	U
4-Bromophenyl phenyl ether	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U
4-Chloro-3-methylphenol	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U
4-Chloroaniline	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U
4-Chlorophenyl phenyl ether	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U
4-Methylphenol	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U
4-Nitroaniline	mg/kg	1.9	U	2.1	U	2.1	U	1.9	U	2	U
4-Nitrophenol	mg/kg	1.9	U	2.1	U	2.1	U	1.9	U	2	U
Acenaphthene	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U
Acenaphthylene	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U
Anthracene	mg/kg	.032	J	.43	U	.44	U	.4	U	.4	U

Sample Location:		TNTB-SO22		TNTB-SO23		TNTB-SO24		TNTB-SO25		TNTB-SO26	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10710		10720		10730		10740		10750	
Sample Date:		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1		0 - 1	
SEMIVOLATILES3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,2,4-Trichlorobenzene	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U
1,2-Dichlorobenzene	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U
1,3-Dichlorobenzene	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U
1,4-Dichlorobenzene	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U
2,4,5-Trichlorophenol	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U
2,4,6-Trichlorophenol	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U
2,4-Dichlorophenol	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U
2,4-Dimethylphenol	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U
2,4-Dinitrophenol	mg/kg	2	U	1.7	U	1.9	U	2	U	1.9	U
2,4-Dinitrotoluene	mg/kg	.41		.36	U	.23	J	.4	U	.4	U
2,6-Dinitrotoluene	mg/kg	.044	J	.36	U	.11	J	.4	U	.4	U
2-Chloronaphthalene	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U
2-Chlorophenol	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U
2-Methylnaphthalene	mg/kg	.4	U	.36	U	.053	J	.4	U	.4	U
2-Methylphenol	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U
2-Nitroaniline	mg/kg	2	U	1.7	U	1.9	U	2	U	1.9	U
2-Nitrophenol	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U
3,3'-Dichlorobenzidine	mg/kg	2	U	1.7	U	1.9	U	2	U	1.9	U
3-Nitroaniline	mg/kg	2	U	1.7	U	1.9	U	2	U	1.9	U
4,6-Dinitro-2-methylphenol	mg/kg	2	U	1.7	U	1.9	U	2	U	1.9	U
4-Bromophenyl phenyl ether	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U
4-Chloro-3-methylphenol	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U
4-Chloroaniline	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U
4-Chlorophenyl phenyl ether	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U
4-Methylphenol	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U
4-Nitroaniline	mg/kg	2	U	1.7	U	1.9	U	2	U	1.9	U
4-Nitrophenol	mg/kg	2	U	1.7	U	1.9	U	2	U	1.9	U
Acenaphthene	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U
Acenaphthylene	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U
Anthracene	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U

Sample Location:		TNTB-SO27		TNTB-SO28		TNTB-SO29		TNTB-SO30		TNTB-SO31	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10760		10770		10780		10790		10800	
Sample Date:		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98		12-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1		0 - 1	
SEMIVOLATILES3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,2,4-Trichlorobenzene	mg/kg	.41	U	2	U	.4	U	.41	U	.39	U
1,2-Dichlorobenzene	mg/kg	.41	U	2	U	.4	U	.41	U	.39	U
1,3-Dichlorobenzene	mg/kg	.41	U	2	U	.4	U	.41	U	.39	U
1,4-Dichlorobenzene	mg/kg	.41	U	2	U	.4	U	.41	U	.39	U
2,4,5-Trichlorophenol	mg/kg	.41	U	2	U	.4	U	.41	U	.39	U
2,4,6-Trichlorophenol	mg/kg	.41	U	2	U	.4	U	.41	U	.39	U
2,4-Dichlorophenol	mg/kg	.41	U	2	U	.4	U	.41	U	.39	U
2,4-Dimethylphenol	mg/kg	.41	U	2	U	.4	U	.41	U	.39	U
2,4-Dinitrophenol	mg/kg	2	U	9.6	U	1.9	U	2	U	1.9	U
2,4-Dinitrotoluene	mg/kg	.4	J	2	U	.079	J	.41	U	.11	J
2,6-Dinitrotoluene	mg/kg	.1	J	2	U	.4	U	.41	U	.39	U
2-Chloronaphthalene	mg/kg	.41	U	2	U	.4	U	.41	U	.39	U
2-Chlorophenol	mg/kg	.41	U	2	U	.4	U	.41	U	.39	U
2-Methylnaphthalene	mg/kg	.1	J	2	U	.4	U	.41	U	.068	J
2-Methylphenol	mg/kg	.41	U	2	U	.4	U	.41	U	.39	U
2-Nitroaniline	mg/kg	2	U	9.6	U	1.9	U	2	U	1.9	U
2-Nitrophenol	mg/kg	.41	U	2	U	.4	U	.41	U	.39	U
3,3'-Dichlorobenzidine	mg/kg	2	U	9.6	U	1.9	U	2	U	1.9	U
3-Nitroaniline	mg/kg	2	U	9.6	U	1.9	U	2	U	1.9	U
4,6-Dinitro-2-methylphenol	mg/kg	.062	J	9.6	U	1.9	U	2	U	1.9	U
4-Bromophenyl phenyl ether	mg/kg	.41	U	2	U	.4	U	.41	U	.39	U
4-Chloro-3-methylphenol	mg/kg	.41	U	2	U	.4	U	.41	U	.39	U
4-Chloroaniline	mg/kg	.41	U	2	U	.4	U	.41	U	.39	U
4-Chlorophenyl phenyl ether	mg/kg	.41	U	2	U	.4	U	.41	U	.39	U
4-Methylphenol	mg/kg	.41	U	2	U	.4	U	.41	U	.39	U
4-Nitroaniline	mg/kg	2	U	9.6	U	1.9	U	2	U	1.9	U
4-Nitrophenol	mg/kg	2	U	9.6	U	1.9	U	2	U	1.9	U
Acenaphthene	mg/kg	.41	U	2	U	.4	U	.41	U	.39	U
Acenaphthylene	mg/kg	.41	U	2	U	.4	U	.41	U	.39	U
Anthracene	mg/kg	.41	U	2	U	.4	U	.41	U	.027	J

Sample Location:		TNTB-SO32		TNTB-SO33		TNTB-SO34		TNTB-SO35		TNTB-SO36	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10810		10820		10830		10840		10850	
Sample Date:		12-NOV-98		12-NOV-98		12-NOV-98		11-NOV-98		12-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1		0 - 1	
SEMIVOLATILES3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,2,4-Trichlorobenzene	mg/kg	.39	U	.36	U	.37	U	.4	U	.39	U
1,2-Dichlorobenzene	mg/kg	.39	U	.36	U	.37	U	.4	U	.39	U
1,3-Dichlorobenzene	mg/kg	.39	U	.36	U	.37	U	.4	U	.39	U
1,4-Dichlorobenzene	mg/kg	.39	U	.36	U	.37	U	.4	U	.39	U
2,4,5-Trichlorophenol	mg/kg	.39	U	.36	U	.37	U	.4	U	.39	U
2,4,6-Trichlorophenol	mg/kg	.39	U	.36	U	.37	U	.4	U	.39	U
2,4-Dichlorophenol	mg/kg	.39	U	.36	U	.37	U	.4	U	.39	U
2,4-Dimethylphenol	mg/kg	.39	U	.36	U	.37	U	.4	U	.39	U
2,4-Dinitrophenol	mg/kg	1.9	U	1.8	U	1.8	U	1.9	U	1.9	U
2,4-Dinitrotoluene	mg/kg	.17	J	.36	U	.37	U	.4	U	.057	J
2,6-Dinitrotoluene	mg/kg	.39	U	.36	U	.37	U	.4	U	.39	U
2-Chloronaphthalene	mg/kg	.39	U	.36	U	.37	U	.4	U	.39	U
2-Chlorophenol	mg/kg	.39	U	.36	U	.37	U	.4	U	.39	U
2-Methylnaphthalene	mg/kg	.17	J	.36	U	.37	U	.4	U	.061	J
2-Methylphenol	mg/kg	.39	U	.36	U	.37	U	.4	U	.39	U
2-Nitroaniline	mg/kg	1.9	U	1.8	U	1.8	U	1.9	U	1.9	U
2-Nitrophenol	mg/kg	.39	U	.36	U	.37	U	.4	U	.39	U
3,3'-Dichlorobenzidine	mg/kg	1.9	U	1.8	U	1.8	U	1.9	U	1.9	U
3-Nitroaniline	mg/kg	1.9	U	1.8	U	1.8	U	1.9	U	1.9	U
4,6-Dinitro-2-methylphenol	mg/kg	1.9	U	1.8	U	1.8	U	1.9	U	1.9	U
4-Bromophenyl phenyl ether	mg/kg	.39	U	.36	U	.37	U	.4	U	.39	U
4-Chloro-3-methylphenol	mg/kg	.39	U	.36	U	.37	U	.4	U	.39	U
4-Chloroaniline	mg/kg	.39	U	.36	U	.37	U	.4	U	.39	U
4-Chlorophenyl phenyl ether	mg/kg	.39	U	.36	U	.37	U	.4	U	.39	U
4-Methylphenol	mg/kg	.39	U	.36	U	.37	U	.4	U	.39	U
4-Nitroaniline	mg/kg	1.9	U	1.8	U	1.8	U	1.9	U	1.9	U
4-Nitrophenol	mg/kg	1.9	U	1.8	U	1.8	U	1.9	U	1.9	U
Acenaphthene	mg/kg	.093	J	.36	U	.37	U	.4	U	.068	J
Acenaphthylene	mg/kg	.3	J	.36	U	.37	U	.4	U	.38	J
Anthracene	mg/kg	.92		.36	U	.37	U	.4	U	.56	

Report Date: 08/28/00

Sample Location:		TNTB-SO37		TNTB-SO38		TNTB-SO39		TNTB-SO40	
Associated Site:		TNTB		TNTB		TNTB		TNTB	
Sample No:		10860		10870		10880		10890	
Sample Date:		12-NOV-98		12-NOV-98		12-NOV-98		12-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1	
SEMIVOLATILES3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,2,4-Trichlorobenzene	mg/kg	.41	U	.4	U	.38	U	.39	U
1,2-Dichlorobenzene	mg/kg	.41	U	.4	U	.38	U	.39	U
1,3-Dichlorobenzene	mg/kg	.41	U	.4	U	.38	U	.39	U
1,4-Dichlorobenzene	mg/kg	.41	U	.4	U	.38	U	.39	U
2,4,5-Trichlorophenol	mg/kg	.41	U	.4	U	.38	U	.39	U
2,4,6-Trichlorophenol	mg/kg	.41	U	.4	U	.38	U	.39	U
2,4-Dichlorophenol	mg/kg	.41	U	.4	U	.38	U	.39	U
2,4-Dimethylphenol	mg/kg	.41	U	.4	U	.38	U	.39	U
2,4-Dinitrophenol	mg/kg	2	U	1.9	U	1.8	U	1.9	U
2,4-Dinitrotoluene	mg/kg	.53		.083	J	.38	U	.054	J
2,6-Dinitrotoluene	mg/kg	.16	J	.4	U	.38	U	.39	U
2-Chloronaphthalene	mg/kg	.41	U	.4	U	.38	U	.39	U
2-Chlorophenol	mg/kg	.41	U	.4	U	.38	U	.39	U
2-Methylnaphthalene	mg/kg	.41	U	.054	J	.38	U	.39	U
2-Methylphenol	mg/kg	.41	U	.4	U	.38	U	.39	U
2-Nitroaniline	mg/kg	2	U	1.9	U	1.8	U	1.9	U
2-Nitrophenol	mg/kg	.41	U	.4	U	.38	U	.39	U
3,3'-Dichlorobenzidine	mg/kg	2	U	1.9	U	1.8	U	1.9	U
3-Nitroaniline	mg/kg	2	U	1.9	U	1.8	U	1.9	U
4,6-Dinitro-2-methylphenol	mg/kg	2	U	1.9	U	1.8	U	1.9	U
4-Bromophenyl phenyl ether	mg/kg	.41	U	.4	U	.38	U	.39	U
4-Chloro-3-methylphenol	mg/kg	.41	U	.4	U	.38	U	.39	U
4-Chloroaniline	mg/kg	.41	U	.4	U	.38	U	.39	U
4-Chlorophenyl phenyl ether	mg/kg	.41	U	.4	U	.38	U	.39	U
4-Methylphenol	mg/kg	.41	U	.4	U	.38	U	.39	U
4-Nitroaniline	mg/kg	2	U	1.9	U	1.8	U	1.9	U
4-Nitrophenol	mg/kg	2	U	1.9	U	1.8	U	1.9	U
Acenaphthene	mg/kg	.41	U	.4	U	.38	U	.39	U
Acenaphthylene	mg/kg	.41	U	.4	U	.38	U	.39	U
Anthracene	mg/kg	.41	U	.4	U	.38	U	.39	U

Sample Location:		TNTB-SO01		TNTB-SO02		TNTB-SO03		TNTB-SO04		TNTB-SO05	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10500		10510		10520		10530		10540	
Sample Date:		09-NOV-98		09-NOV-98		09-NOV-98		09-NOV-98		09-NOV-98	
Depth:		.5 - 2		3.5 - 4		3 - 4		5 - 6		2.5 - 3.5	
SEMIVOLATILES3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Benzo(a)anthracene	mg/kg	.39	U	.37	U	.037	J	.44	U	.42	U
Benzo(a)pyrene	mg/kg	.39	U	.37	U	.033	J	.44	U	.42	U
Benzo(b)fluoranthene	mg/kg	.39	U	.37	U	.053	J	.44	U	.42	U
Benzo(ghi)perylene	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U
Benzo(k)fluoranthene	mg/kg	.39	U	.37	U	.055	J	.44	U	.42	U
Butyl benzyl phthalate	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U
Carbazole	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U
Chrysene	mg/kg	.39	U	.37	U	.11	J	.44	U	.42	U
Dibenz(a,h)anthracene	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U
Dibenzofuran	mg/kg	.39	U	.37	U	.045	J	.44	U	.42	U
Diethyl phthalate	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U
Dimethyl phthalate	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U
Fluoranthene	mg/kg	.39	U	.37	U	.13	J	.44	U	.42	U
Fluorene	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U
Hexachlorobenzene	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U
Hexachlorobutadiene	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U
Hexachlorocyclopentadiene	mg/kg	1.9	UJ	1.8	UJ	1.8	UJ	2.1	UJ	2	UJ
Hexachloroethane	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U
Indeno(1,2,3-cd)pyrene	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U
Isophorone	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U
Naphthalene	mg/kg	.39	U	.37	U	.28	J	.44	U	.42	U
Nitrobenzene	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U
Pentachlorophenol	mg/kg	1.9	U	1.8	U	1.8	U	2.1	U	2	U
Phenanthrene	mg/kg	.39	U	.048	J	.28	J	.44	U	.42	U
Phenol	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U
Pyrene	mg/kg	.39	U	.37	U	.12	J	.44	U	.42	U
bis(2-Chloroethoxy)methane	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U
bis(2-Chloroethyl)ether	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U
bis(2-Chloroisopropyl)ether	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U
bis(2-Ethylhexyl)phthalate	mg/kg	.39	U	1.4	B	.92	B	.44	U	.36	B

Sample Location:		TNTB-SO06		TNTB-SO07		TNTB-SO08		TNTB-SO09		TNTB-SO10	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10550		10560		10570		10580		10590	
Sample Date:		09-NOV-98		10-NOV-98		09-NOV-98		11-NOV-98		10-NOV-98	
Depth:		4 - 5		3 - 4		6 - 8		0 - 1		4 - 6	
SEMIVOLATILES3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Benzo(a)anthracene	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
Benzo(a)pyrene	mg/kg	.38	U	.36	U	.4	U	.028	J	.39	U
Benzo(b)fluoranthene	mg/kg	.041	J	.36	U	.4	U	.037	J	.39	U
Benzo(ghi)perylene	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
Benzo(k)fluoranthene	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
Butyl benzyl phthalate	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
Carbazole	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
Chrysene	mg/kg	.38	U	.36	U	.4	U	.042	J	.39	U
Dibenz(a,h)anthracene	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
Dibenzofuran	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
Diethyl phthalate	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
Dimethyl phthalate	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
Fluoranthene	mg/kg	.38	U	.36	U	.4	U	.051	J	.39	U
Fluorene	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
Hexachlorobenzene	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
Hexachlorobutadiene	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
Hexachlorocyclopentadiene	mg/kg	1.8	UJ	1.8	U	2	U	1.9	U	1.9	U
Hexachloroethane	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
Indeno(1,2,3-cd)pyrene	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
Isophorone	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
Naphthalene	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
Nitrobenzene	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
Pentachlorophenol	mg/kg	1.8	U	1.8	U	2	U	1.9	U	1.9	U
Phenanthrene	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
Phenol	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
Pyrene	mg/kg	.38	U	.36	U	.4	U	.04	J	.39	U
bis(2-Chloroethoxy)methane	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
bis(2-Chloroethyl)ether	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
bis(2-Chloroisopropyl)ether	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
bis(2-Ethylhexyl)phthalate	mg/kg	1.1	B	.088	B	1	B	.091	B	.57	B

Sample Location:		TNTB-SO11		TNTB-SO12		TNTB-SO14		TNTB-SO15		TNTB-SO16	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10600		10610		10630		10640		10650	
Sample Date:		10-NOV-98		10-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98	
Depth:		8 - 10		4 - 5		0 - 1		0 - 1		0 - 1	
SEMIVOLATILES3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Benzo(a)anthracene	mg/kg	.42	U	.41	U	.04	J	.1	J	.16	J
Benzo(a)pyrene	mg/kg	.42	U	.41	U	.056	J	.11	J	.21	J
Benzo(b)fluoranthene	mg/kg	.42	U	.41	U	.073	J	.14	J	.18	J
Benzo(ghi)perylene	mg/kg	.42	U	.41	U	.037	J	.076	J	.13	J
Benzo(k)fluoranthene	mg/kg	.42	U	.41	U	.074	J	.1	J	.25	J
Butyl benzyl phthalate	mg/kg	.42	U	.41	U	.41	U	.41	U	.4	U
Carbazole	mg/kg	.42	U	.41	U	.41	U	.41	U	.4	U
Chrysene	mg/kg	.42	U	.41	U	.076	J	.12	J	.19	J
Dibenz(a,h)anthracene	mg/kg	.42	U	.41	U	.41	U	.032	J	.068	J
Dibenzofuran	mg/kg	.42	U	.41	U	.41	U	.41	U	.4	U
Diethyl phthalate	mg/kg	.42	U	.41	U	.41	U	.41	U	.4	U
Dimethyl phthalate	mg/kg	.42	U	.41	U	.41	U	.41	U	.4	U
Fluoranthene	mg/kg	.42	U	.41	U	.11	J	.16	J	.24	J
Fluorene	mg/kg	.42	U	.41	U	.41	U	.41	U	.4	U
Hexachlorobenzene	mg/kg	.42	U	.41	U	.41	U	.41	U	.4	U
Hexachlorobutadiene	mg/kg	.42	U	.41	U	.41	U	.41	U	.4	U
Hexachlorocyclopentadiene	mg/kg	2	U	2	U	2	U	2	U	1.9	U
Hexachloroethane	mg/kg	.42	U	.41	U	.41	U	.41	U	.4	U
Indeno(1,2,3-cd)pyrene	mg/kg	.42	U	.41	U	.037	J	.076	J	.13	J
Isophorone	mg/kg	.42	U	.41	U	.41	U	.41	U	.4	U
Naphthalene	mg/kg	.42	U	.41	U	.41	U	.41	U	.4	U
Nitrobenzene	mg/kg	.42	U	.41	U	.41	U	.41	U	.4	U
Pentachlorophenol	mg/kg	2	U	2	U	2	U	2	U	1.9	U
Phenanthrene	mg/kg	.42	U	.41	U	.41	U	.083	J	.082	J
Phenol	mg/kg	.42	U	.41	U	.41	U	.41	U	.4	U
Pyrene	mg/kg	.42	U	.41	U	.084	J	.14	J	.21	J
bis(2-Chloroethoxy)methane	mg/kg	.42	U	.41	U	.41	U	.41	U	.4	U
bis(2-Chloroethyl)ether	mg/kg	.42	U	.41	U	.41	U	.41	U	.4	U
bis(2-Chloroisopropyl)ether	mg/kg	.42	U	.41	U	.41	U	.41	U	.4	U
bis(2-Ethylhexyl)phthalate	mg/kg	.58	B	.063	B	.085	B	.41	U	.4	U

Sample Location:		TNTB-SO17		TNTB-SO18		TNTB-SO19		TNTB-SO20		TNTB-SO21	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10660		10670		10680		10690		10700	
Sample Date:		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1		0 - 1	
SEMIVOLATILES3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Benzo(a)anthracene	mg/kg	.07	J	.056	J	.44	U	.4	U	.4	U
Benzo(a)pyrene	mg/kg	.081	J	.057	J	.44	U	.039	J	.035	J
Benzo(b)fluoranthene	mg/kg	.078	J	.063	J	.44	U	.039	J	.4	U
Benzo(ghi)perylene	mg/kg	.059	J	.43	U	.44	U	.4	U	.4	U
Benzo(k)fluoranthene	mg/kg	.11	J	.06	J	.44	U	.4	U	.4	U
Butyl benzyl phthalate	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U
Carbazole	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U
Chrysene	mg/kg	.093	J	.067	J	.44	U	.05	J	.046	J
Dibenz(a,h)anthracene	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U
Dibenzofuran	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U
Diethyl phthalate	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U
Dimethyl phthalate	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U
Fluoranthene	mg/kg	.11	J	.092	J	.44	U	.064	J	.062	J
Fluorene	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U
Hexachlorobenzene	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U
Hexachlorobutadiene	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U
Hexachlorocyclopentadiene	mg/kg	1.9	U	2.1	U	2.1	U	1.9	U	2	U
Hexachloroethane	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U
Indeno(1,2,3-cd)pyrene	mg/kg	.059	J	.43	U	.44	U	.4	U	.4	U
Isophorone	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U
Naphthalene	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U
Nitrobenzene	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U
Pentachlorophenol	mg/kg	1.9	U	2.1	U	2.1	U	1.9	U	2	U
Phenanthrene	mg/kg	.047	J	.046	J	.44	U	.4	U	.046	J
Phenol	mg/kg	.4	U	.43	U	.44	U	.4	U	.065	B
Pyrene	mg/kg	.097	J	.074	J	.44	U	.057	J	.054	J
bis(2-Chloroethoxy)methane	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U
bis(2-Chloroethyl)ether	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U
bis(2-Chloroisopropyl)ether	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U
bis(2-Ethylhexyl)phthalate	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U

Sample Location:		TNTB-SO22		TNTB-SO23		TNTB-SO24		TNTB-SO25		TNTB-SO26	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10710		10720		10730		10740		10750	
Sample Date:		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1		0 - 1	
SEMIVOLATILES3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Benzo(a)anthracene	mg/kg	.06	J	.36	U	.08	J	.4	U	.4	U
Benzo(a)pyrene	mg/kg	.068	J	.36	U	.085	J	.4	U	.4	U
Benzo(b)fluoranthene	mg/kg	.086	J	.36	U	.1	J	.4	U	.4	U
Benzo(ghi)perylene	mg/kg	.067	J	.36	U	.051	J	.4	U	.4	U
Benzo(k)fluoranthene	mg/kg	.093	J	.36	U	.11	J	.4	U	.4	U
Butyl benzyl phthalate	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U
Carbazole	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U
Chrysene	mg/kg	.093	J	.36	U	.12	J	.4	U	.4	U
Dibenz(a,h)anthracene	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U
Dibenzofuran	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U
Diethyl phthalate	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U
Dimethyl phthalate	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U
Fluoranthene	mg/kg	.16	J	.36	U	.16	J	.4	U	.046	J
Fluorene	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U
Hexachlorobenzene	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U
Hexachlorobutadiene	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U
Hexachlorocyclopentadiene	mg/kg	2	U	1.7	U	1.9	U	2	U	1.9	UJ
Hexachloroethane	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U
Indeno(1,2,3-cd)pyrene	mg/kg	.069	J	.36	U	.05	J	.4	U	.4	U
Isophorone	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U
Naphthalene	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U
Nitrobenzene	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U
Pentachlorophenol	mg/kg	2	U	1.7	U	1.9	U	2	U	1.9	U
Phenanthrene	mg/kg	.076	J	.36	U	.071	J	.4	U	.4	U
Phenol	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U
Pyrene	mg/kg	.11	J	.36	U	.13	J	.4	U	.4	U
bis(2-Chloroethoxy)methane	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U
bis(2-Chloroethyl)ether	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U
bis(2-Chloroisopropyl)ether	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U
bis(2-Ethylhexyl)phthalate	mg/kg	.4	U	.36	U	.087	B	.073	B	.4	U

Sample Location:		TNTB-SO27		TNTB-SO28		TNTB-SO29		TNTB-SO30		TNTB-SO31	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10760		10770		10780		10790		10800	
Sample Date:		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98		12-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1		0 - 1	
SEMIVOLATILES3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Benzo(a)anthracene	mg/kg	.04	J	2	U	.046	J	.044	J	.046	J
Benzo(a)pyrene	mg/kg	.045	J	2	U	.048	J	.064	J	.068	J
Benzo(b)fluoranthene	mg/kg	.07	J	2	U	.057	J	.062	J	.075	J
Benzo(ghi)perylene	mg/kg	.41	U	2	U	.034	J	.41	U	.051	J
Benzo(k)fluoranthene	mg/kg	.062	J	2	U	.4	U	.055	J	.093	J
Butyl benzyl phthalate	mg/kg	.41	U	2	U	.4	U	.41	U	.39	U
Carbazole	mg/kg	.41	U	2	U	.4	U	.41	U	.39	U
Chrysene	mg/kg	.091	J	2	U	.058	J	.051	J	.087	J
Dibenz(a,h)anthracene	mg/kg	.41	U	2	U	.4	U	.41	U	.39	U
Dibenzofuran	mg/kg	.41	U	2	U	.4	U	.41	U	.39	U
Diethyl phthalate	mg/kg	.41	U	2	U	.4	U	.41	U	.39	U
Dimethyl phthalate	mg/kg	.41	U	2	U	.4	U	.41	U	.39	U
Fluoranthene	mg/kg	.11	J	2	U	.096	J	.049	J	.11	J
Fluorene	mg/kg	.41	U	2	U	.4	U	.41	U	.39	U
Hexachlorobenzene	mg/kg	.41	U	2	U	.4	U	.41	U	.39	U
Hexachlorobutadiene	mg/kg	.41	U	2	U	.4	U	.41	U	.39	U
Hexachlorocyclopentadiene	mg/kg	2	UJ	9.6	U	1.9	U	2	U	1.9	U
Hexachloroethane	mg/kg	.41	U	2	U	.4	U	.41	U	.39	U
Indeno(1,2,3-cd)pyrene	mg/kg	.41	U	2	U	.4	U	.41	U	.053	J
Isophorone	mg/kg	.41	U	2	U	.4	U	.41	U	.39	U
Naphthalene	mg/kg	.41	U	2	U	.4	U	.41	U	.041	J
Nitrobenzene	mg/kg	.41	U	2	U	.4	U	.41	U	.39	U
Pentachlorophenol	mg/kg	2	U	9.6	U	1.9	U	2	U	1.9	U
Phenanthrene	mg/kg	.19	J	2	U	.066	J	.41	U	.083	J
Phenol	mg/kg	.41	U	2	U	.4	U	.41	U	.39	U
Pyrene	mg/kg	.11	J	2	U	.064	J	.047	J	.088	J
bis(2-Chloroethoxy)methane	mg/kg	.41	U	2	U	.4	U	.41	U	.39	U
bis(2-Chloroethyl)ether	mg/kg	.41	U	2	U	.4	U	.41	U	.39	U
bis(2-Chloroisopropyl)ether	mg/kg	.41	U	2	U	.4	U	.41	U	.39	U
bis(2-Ethylhexyl)phthalate	mg/kg	.092	B	2	U	.073	B	.078	B	.39	U

Sample Location:		TNTB-SO32		TNTB-SO33		TNTB-SO34		TNTB-SO35		TNTB-SO36	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10810		10820		10830		10840		10850	
Sample Date:		12-NOV-98		12-NOV-98		12-NOV-98		11-NOV-98		12-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1		0 - 1	
SEMIVOLATILES3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Benzo(a)anthracene	mg/kg	2.4		.36	U	.37	U	.4	U	1.6	
Benzo(a)pyrene	mg/kg	2		.36	U	.37	U	.037	J	1.7	
Benzo(b)fluoranthene	mg/kg	1.8		.36	U	.37	U	.039	J	1.8	
Benzo(ghi)perylene	mg/kg	.88		.36	U	.37	U	.4	U	.88	
Benzo(k)fluoranthene	mg/kg	2		.36	U	.37	U	.4	U	1.5	
Butyl benzyl phthalate	mg/kg	.39	U	.36	U	.37	U	.4	U	.39	U
Carbazole	mg/kg	.2	J	.36	U	.37	U	.4	U	.25	J
Chrysene	mg/kg	2.4		.36	U	.37	U	.4	U	1.8	
Dibenz(a,h)anthracene	mg/kg	.55		.36	U	.37	U	.4	U	.48	
Dibenzofuran	mg/kg	.18	J	.36	U	.37	U	.4	U	.13	J
Diethyl phthalate	mg/kg	.39	U	.36	U	.37	U	.4	U	.39	U
Dimethyl phthalate	mg/kg	.39	U	.36	U	.37	U	.4	U	.39	U
Fluoranthene	mg/kg	5		.36	U	.039	J	.045	J	3.9	
Fluorene	mg/kg	.36	J	.36	U	.37	U	.4	U	.17	J
Hexachlorobenzene	mg/kg	.39	U	.36	U	.37	U	.4	U	.39	U
Hexachlorobutadiene	mg/kg	.39	U	.36	U	.37	U	.4	U	.39	U
Hexachlorocyclopentadiene	mg/kg	1.9	U	1.8	U	1.8	U	1.9	U	1.9	U
Hexachloroethane	mg/kg	.39	U	.36	U	.37	U	.4	U	.39	U
Indeno(1,2,3-cd)pyrene	mg/kg	1		.36	U	.37	U	.4	U	.96	
Isophorone	mg/kg	.39	U	.36	U	.37	U	.4	U	.39	U
Naphthalene	mg/kg	.073	J	.36	U	.37	U	.4	U	.05	J
Nitrobenzene	mg/kg	.39	U	.36	U	.37	U	.4	U	.39	U
Pentachlorophenol	mg/kg	1.9	U	1.8	U	1.8	U	1.9	U	1.9	U
Phenanthrene	mg/kg	3		.36	U	.37	U	.4	U	2.3	
Phenol	mg/kg	.39	U	.36	U	.37	U	.4	U	.39	U
Pyrene	mg/kg	3.6		.36	U	.37	U	.037	J	2.7	
bis(2-Chloroethoxy)methane	mg/kg	.39	U	.36	U	.37	U	.4	U	.39	U
bis(2-Chloroethyl)ether	mg/kg	.39	U	.36	U	.37	U	.4	U	.39	U
bis(2-Chloroisopropyl)ether	mg/kg	.39	U	.36	U	.37	U	.4	U	.39	U
bis(2-Ethylhexyl)phthalate	mg/kg	.39	U	.36	U	.37	U	.077	B	.74	B

Sample Location:		TNTB-SO37		TNTB-SO38		TNTB-SO39		TNTB-SO40	
Associated Site:		TNTB		TNTB		TNTB		TNTB	
Sample No:		10860		10870		10880		10890	
Sample Date:		12-NOV-98		12-NOV-98		12-NOV-98		12-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1	
SEMIVOLATILES3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Benzo(a)anthracene	mg/kg	.05	J	.049	J	.05	J	.39	U
Benzo(a)pyrene	mg/kg	.055	J	.077	J	.055	J	.39	U
Benzo(b)fluoranthene	mg/kg	.061	J	.1	J	.044	J	.39	U
Benzo(ghi)perylene	mg/kg	.037	J	.068	J	.38	U	.39	U
Benzo(k)fluoranthene	mg/kg	.058	J	.087	J	.055	J	.39	U
Butyl benzyl phthalate	mg/kg	.41	U	.4	U	.38	U	.39	U
Carbazole	mg/kg	.41	U	.4	U	.38	U	.39	U
Chrysene	mg/kg	.07	J	.091	J	.054	J	.39	U
Dibenz(a,h)anthracene	mg/kg	.41	U	.4	U	.38	U	.39	U
Dibenzofuran	mg/kg	.41	U	.4	U	.38	U	.39	U
Diethyl phthalate	mg/kg	.41	U	.4	U	.38	U	.39	U
Dimethyl phthalate	mg/kg	.41	U	.4	U	.38	U	.39	U
Fluoranthene	mg/kg	.097	J	.11	J	.1	J	.39	U
Fluorene	mg/kg	.41	U	.4	U	.38	U	.39	U
Hexachlorobenzene	mg/kg	.41	U	.4	U	.38	U	.39	U
Hexachlorobutadiene	mg/kg	.41	U	.4	U	.38	U	.39	U
Hexachlorocyclopentadiene	mg/kg	2	U	1.9	U	1.8	U	1.9	U
Hexachloroethane	mg/kg	.41	U	.4	U	.38	U	.39	U
Indeno(1,2,3-cd)pyrene	mg/kg	.037	J	.062	J	.38	U	.39	U
Isophorone	mg/kg	.41	U	.4	U	.38	U	.39	U
Naphthalene	mg/kg	.41	U	.4	U	.38	U	.39	U
Nitrobenzene	mg/kg	.41	U	.4	U	.38	U	.39	U
Pentachlorophenol	mg/kg	2	U	1.9	U	1.8	U	1.9	U
Phenanthrene	mg/kg	.045	J	.083	J	.38	U	.39	U
Phenol	mg/kg	.41	U	.4	U	.38	U	.39	U
Pyrene	mg/kg	.071	J	.086	J	.071	J	.39	U
bis(2-Chloroethoxy)methane	mg/kg	.41	U	.4	U	.38	U	.39	U
bis(2-Chloroethyl)ether	mg/kg	.41	U	.4	U	.38	U	.39	U
bis(2-Chloroisopropyl)ether	mg/kg	.41	U	.4	U	.38	U	.39	U
bis(2-Ethylhexyl)phthalate	mg/kg	.41	U	.4	U	.38	U	.39	U

Sample Location:		TNTB-SO01		TNTB-SO02		TNTB-SO03		TNTB-SO04		TNTB-SO05	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10500		10510		10520		10530		10540	
Sample Date:		09-NOV-98		09-NOV-98		09-NOV-98		09-NOV-98		09-NOV-98	
Depth:		.5 - 2		3.5 - 4		3 - 4		5 - 6		2.5 - 3.5	
SEMIVOLATILES3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
di-n-Butyl phthalate	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U
di-n-Octyl phthalate	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U
n-Nitroso-di-n-propylamine	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U
n-Nitrosodiphenylamine	mg/kg	.39	U	.37	U	.38	U	.44	U	.42	U

Sample Location:		TNTB-SO06		TNTB-SO07		TNTB-SO08		TNTB-SO09		TNTB-SO10	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10550		10560		10570		10580		10590	
Sample Date:		09-NOV-98		10-NOV-98		09-NOV-98		11-NOV-98		10-NOV-98	
Depth:		4 - 5		3 - 4		6 - 8		0 - 1		4 - 6	
SEMIVOLATILES3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
di-n-Butyl phthalate	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
di-n-Octyl phthalate	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
n-Nitroso-di-n-propylamine	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U
n-Nitrosodiphenylamine	mg/kg	.38	U	.36	U	.4	U	.39	U	.39	U

Sample Location:		TNTB-SO11		TNTB-SO12		TNTB-SO14		TNTB-SO15		TNTB-SO16	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10600		10610		10630		10640		10650	
Sample Date:		10-NOV-98		10-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98	
Depth:		8 - 10		4 - 5		0 - 1		0 - 1		0 - 1	
SEMIVOLATILES3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
di-n-Butyl phthalate	mg/kg	.42	U	.41	U	.41	U	.41	U	.4	U
di-n-Octyl phthalate	mg/kg	.42	U	.41	U	.41	U	.41	U	.4	U
n-Nitroso-di-n-propylamine	mg/kg	.42	U	.41	U	.41	U	.41	U	.4	U
n-Nitrosodiphenylamine	mg/kg	.42	U	.41	U	.41	U	.41	U	.4	U

Sample Location:		TNTB-SO17		TNTB-SO18		TNTB-SO19		TNTB-SO20		TNTB-SO21	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10660		10670		10680		10690		10700	
Sample Date:		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1		0 - 1	
SEMIVOLATILES3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
di-n-Butyl phthalate	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U
di-n-Octyl phthalate	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U
n-Nitroso-di-n-propylamine	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U
n-Nitrosodiphenylamine	mg/kg	.4	U	.43	U	.44	U	.4	U	.4	U

Sample Location:		TNTB-SO22		TNTB-SO23		TNTB-SO24		TNTB-SO25		TNTB-SO26	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10710		10720		10730		10740		10750	
Sample Date:		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1		0 - 1	
SEMIVOLATILES3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
di-n-Butyl phthalate	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U
di-n-Octyl phthalate	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U
n-Nitroso-di-n-propylamine	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U
n-Nitrosodiphenylamine	mg/kg	.4	U	.36	U	.39	U	.4	U	.4	U

Sample Location:		TNTB-SO27		TNTB-SO28		TNTB-SO29		TNTB-SO30		TNTB-SO31	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10760		10770		10780		10790		10800	
Sample Date:		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98		12-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1		0 - 1	
SEMIVOLATILES3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
di-n-Butyl phthalate	mg/kg	.41	U	2	U	.4	U	.41	U	.39	U
di-n-Octyl phthalate	mg/kg	.41	U	2	U	.4	U	.41	U	.39	U
n-Nitroso-di-n-propylamine	mg/kg	.41	U	2	U	.4	U	.41	U	.39	U
n-Nitrosodiphenylamine	mg/kg	.41	U	2	U	.4	U	.41	U	.39	U

Sample Location:		TNTB-SO32		TNTB-SO33		TNTB-SO34		TNTB-SO35		TNTB-SO36	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10810		10820		10830		10840		10850	
Sample Date:		12-NOV-98		12-NOV-98		12-NOV-98		11-NOV-98		12-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1		0 - 1	
SEMIVOLATILES3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
di-n-Butyl phthalate	mg/kg	.39	U	.36	U	.37	U	.4	U	.39	U
di-n-Octyl phthalate	mg/kg	.39	U	.36	U	.37	U	.4	U	.39	U
n-Nitroso-di-n-propylamine	mg/kg	.39	U	.36	U	.37	U	.4	U	.39	U
n-Nitrosodiphenylamine	mg/kg	.39	U	.36	U	.37	U	.4	U	.39	U

Sample Location:		TNTB-SO37		TNTB-SO38		TNTB-SO39		TNTB-SO40	
Associated Site:		TNTB		TNTB		TNTB		TNTB	
Sample No:		10860		10870		10880		10890	
Sample Date:		12-NOV-98		12-NOV-98		12-NOV-98		12-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1	
SEMIVOLATILES3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
di-n-Butyl phthalate	mg/kg	.41	U	.4	U	.38	U	.39	U
di-n-Octyl phthalate	mg/kg	.41	U	.4	U	.38	U	.39	U
n-Nitroso-di-n-propylamine	mg/kg	.41	U	.4	U	.38	U	.39	U
n-Nitrosodiphenylamine	mg/kg	.41	U	.4	U	.38	U	.39	U

Sample Location:		TNTB-SO01		TNTB-SO02		TNTB-SO03		TNTB-SO04		TNTB-SO05	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10500		10510		10520		10530		10540	
Sample Date:		09-NOV-98		09-NOV-98		09-NOV-98		09-NOV-98		09-NOV-98	
Depth:		.5 - 2		3.5 - 4		3 - 4		5 - 6		2.5 - 3.5	
PCB3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aroclor 1016	mg/kg	.039	U	.074	U	.19	U	.044	U	.042	U
Aroclor 1221	mg/kg	.039	U	.074	U	1.3	U	.044	U	.042	U
Aroclor 1232	mg/kg	.039	U	.074	U	.19	U	.044	U	.042	U
Aroclor 1242	mg/kg	.039	U	.074	U	.19	U	.044	U	.042	U
Aroclor 1248	mg/kg	.039	U	.074	U	.19	U	.044	U	.042	U
Aroclor 1254	mg/kg	.039	U	.14	NJ	1.1	U	.063	N	.042	U
Aroclor 1260	mg/kg	.039	U	.093	U	1.3	N	.044	U	.042	U

Sample Location:		TNTB-SO06		TNTB-SO07		TNTB-SO08		TNTB-SO09		TNTB-SO10	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10550		10560		10570		10580		10590	
Sample Date:		09-NOV-98		10-NOV-98		09-NOV-98		11-NOV-98		10-NOV-98	
Depth:		4 - 5		3 - 4		6 - 8		0 - 1		4 - 6	
PCB3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aroclor 1016	mg/kg	.38	U	.72	U	.04	U	.039	U	.039	U
Aroclor 1221	mg/kg	.38	U	.72	U	.22	U	.039	U	.039	U
Aroclor 1232	mg/kg	.38	U	.72	U	.04	U	.039	U	.039	U
Aroclor 1242	mg/kg	.38	U	.72	U	.04	U	.039	U	.039	U
Aroclor 1248	mg/kg	.38	U	.72	U	.04	U	.039	U	.039	U
Aroclor 1254	mg/kg	1.4	U	2.5	U	.063	U	.32	N	.039	U
Aroclor 1260	mg/kg	2.8	NJ	4.6	N	.11	N	.24	U	.039	U

Sample Location:		TNTB-SO11		TNTB-SO12		TNTB-SO14		TNTB-SO15		TNTB-SO16	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10600		10610		10630		10640		10650	
Sample Date:		10-NOV-98		10-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98	
Depth:		8 - 10		4 - 5		0 - 1		0 - 1		0 - 1	
PCB3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aroclor 1016	mg/kg	.042	U	.041	U	.041	U	.081	U	.04	U
Aroclor 1221	mg/kg	.042	U	.041	U	.041	U	.081	U	.04	U
Aroclor 1232	mg/kg	.042	U	.041	U	.041	U	.081	U	.04	U
Aroclor 1242	mg/kg	.042	U	.041	U	.041	U	.081	U	.04	U
Aroclor 1248	mg/kg	.042	U	.041	U	.041	U	.081	U	.04	U
Aroclor 1254	mg/kg	.042	U	.041	U	.21	U	.53	N	.12	N
Aroclor 1260	mg/kg	.042	U	.041	U	.23	N	.26	U	.08	U

Sample Location:		TNTB-SO17		TNTB-SO18		TNTB-SO19		TNTB-SO20		TNTB-SO21	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10660		10670		10680		10690		10700	
Sample Date:		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1		0 - 1	
PCB3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aroclor 1016	mg/kg	.04	U	.043	U	.044	U	.04	U	.065	U
Aroclor 1221	mg/kg	.04	U	.043	U	.044	U	.04	U	.04	U
Aroclor 1232	mg/kg	.04	U	.043	U	.044	U	.04	U	.04	U
Aroclor 1242	mg/kg	.04	U	.043	U	.044	U	.04	U	.04	U
Aroclor 1248	mg/kg	.04	U	.043	U	.044	U	.04	U	.04	U
Aroclor 1254	mg/kg	.048	U	.045	U	.075	U	.15	U	.25	U
Aroclor 1260	mg/kg	.099	N	.05	N	.11	N	.16	N	.27	N

Sample Location:		TNTB-SO22		TNTB-SO23		TNTB-SO24		TNTB-SO25		TNTB-SO26	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10710		10720		10730		10740		10750	
Sample Date:		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1		0 - 1	
PCB3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aroclor 1016	mg/kg	.04	U	.036	U	3.9	U	.04	U	.04	U
Aroclor 1221	mg/kg	.04	U	.038	U	3.9	U	.04	U	.04	U
Aroclor 1232	mg/kg	.04	U	.036	U	3.9	U	.04	U	.04	U
Aroclor 1242	mg/kg	.04	U	.036	U	3.9	U	.04	U	.04	U
Aroclor 1248	mg/kg	.04	U	.036	U	3.9	U	.04	U	.04	U
Aroclor 1254	mg/kg	.051	U	.036	U	7.2	U	.04	U	.04	U
Aroclor 1260	mg/kg	.1	N	.14	N	15	N	.089	N	.048	N

Sample Location:		TNTB-SO27		TNTB-SO28		TNTB-SO29		TNTB-SO30		TNTB-SO31	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10760		10770		10780		10790		10800	
Sample Date:		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98		12-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1		0 - 1	
PCB3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aroclor 1016	mg/kg	.041	U	.04	U	.04	U	.041	U	.046	U
Aroclor 1221	mg/kg	.058	U	.04	U	.04	U	.041	U	.039	U
Aroclor 1232	mg/kg	.041	U	.04	U	.04	U	.041	U	.039	U
Aroclor 1242	mg/kg	.041	U	.04	U	.04	U	.041	U	.039	U
Aroclor 1248	mg/kg	.041	U	.04	U	.04	U	.041	U	.039	U
Aroclor 1254	mg/kg	.21	N	.24	N	.19	N	.041	U	.054	U
Aroclor 1260	mg/kg	.096	U	.16	U	.12	U	.041	U	.19	N

Sample Location:		TNTB-SO32		TNTB-SO33		TNTB-SO34		TNTB-SO35		TNTB-SO36	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10810		10820		10830		10840		10850	
Sample Date:		12-NOV-98		12-NOV-98		12-NOV-98		11-NOV-98		12-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1		0 - 1	
PCB3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aroclor 1016	mg/kg	.15	U	.11	U	.037	U	.04	U	.039	U
Aroclor 1221	mg/kg	.15	U	.11	U	.037	U	.04	U	.039	U
Aroclor 1232	mg/kg	.15	U	.11	U	.037	U	.04	U	.039	U
Aroclor 1242	mg/kg	.15	U	.11	U	.037	U	.04	U	.039	U
Aroclor 1248	mg/kg	.15	U	.11	U	.037	U	.04	U	.039	U
Aroclor 1254	mg/kg	.25	U	.11	U	.037	U	.04	U	.039	U
Aroclor 1260	mg/kg	.99	N	.54	N	.037	U	.041	NJ	.041	N

Sample Location:		TNTB-SO37		TNTB-SO38		TNTB-SO39		TNTB-SO40	
Associated Site:		TNTB		TNTB		TNTB		TNTB	
Sample No:		10860		10870		10880		10890	
Sample Date:		12-NOV-98		12-NOV-98		12-NOV-98		12-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1	
PCB3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aroclor 1016	mg/kg	.041	U	.2	U	.038	U	.039	U
Aroclor 1221	mg/kg	.041	U	.2	U	.038	U	.039	U
Aroclor 1232	mg/kg	.041	U	.2	U	.038	U	.039	U
Aroclor 1242	mg/kg	.041	U	.2	U	.038	U	.039	U
Aroclor 1248	mg/kg	.041	U	.2	U	.038	U	.039	U
Aroclor 1254	mg/kg	.13	U	.28	U	.038	U	.039	U
Aroclor 1260	mg/kg	.45	N	1.1	N	.038	U	.039	U

Sample Location:		TNTB-SO01		TNTB-SO02		TNTB-SO03		TNTB-SO04		TNTB-SO05	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10500		10510		10520		10530		10540	
Sample Date:		09-NOV-98		09-NOV-98		09-NOV-98		09-NOV-98		09-NOV-98	
Depth:		.5 - 2		3.5 - 4		3 - 4		5 - 6		2.5 - 3.5	
METALS3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	9350		5560		6120		8080		7600	
Antimony	mg/kg	7.1	UJ	6.7	UJ	6.9	UJ	8.0	UJ	7.7	UJ
Arsenic	mg/kg	23.8	J	8.9	J	20.5	J	15.4	J	18.1	J
Barium	mg/kg	496		51.8		58.3		103		207	
Beryllium	mg/kg	1.8		0.57		0.84		1.0		1.2	
Cadmium	mg/kg	0.59	U	0.56	U	0.57	U	0.67	U	0.64	U
Calcium	mg/kg	1670		4020		3370		3790		4060	
Chromium	mg/kg	17.4		9.0		24.9		13.6		13.6	
Cobalt	mg/kg	54.1		8.7		16.1		11.7		9.7	
Copper	mg/kg	58.9		27.3		46.0		39.3		60.1	
Iron	mg/kg	80000		14100		33000		27900		37600	
Lead	mg/kg	19.1	J	26.1	J	80.7	J	16.1	J	20.5	J
Magnesium	mg/kg	831		1730		2000		1290		1420	
Manganese	mg/kg	3110		116		241		169		340	
Mercury	mg/kg	0.043		0.037	U	0.054		0.044	U	0.080	
Nickel	mg/kg	48.5		21.9		46.4		37.2		55.5	
Potassium	mg/kg	594	U	752		1390		785		1150	
Selenium	mg/kg	3.9	J	0.90	J	2.0	J	1.7	J	2.2	J
Silver	mg/kg	1.2	U	1.1	U	1.1	U	1.3	U	1.3	U
Sodium	mg/kg	594	U	559	U	571	U	668	U	639	U
Thallium	mg/kg	1.8	B	1.1	UJ	1.2	B	1.3	UJ	1.5	B
Vanadium	mg/kg	5.9	UJ	8.6	B	5.7	UJ	6.7	UJ	6.4	UJ
Zinc	mg/kg	42.8		57.0		285		97.8		99.1	

Sample Location:		TNTB-SO06		TNTB-SO07		TNTB-SO08		TNTB-SO09		TNTB-SO10	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10550		10560		10570		10580		10590	
Sample Date:		09-NOV-98		10-NOV-98		09-NOV-98		11-NOV-98		10-NOV-98	
Depth:		4 - 5		3 - 4		6 - 8		0 - 1		4 - 6	
METALS3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	2990		4440		5060		5110	J	5210	
Antimony	mg/kg	6.9	UJ	6.6	UJ	7.4	UJ	7.1	UJ	7.2	UJ
Arsenic	mg/kg	9.9	J	8.7	J	22.3	J	11.5		22.2	J
Barium	mg/kg	40.8		56.4		38.9		64.8	J	67.9	
Beryllium	mg/kg	0.57	U	0.55	U	0.88		0.63		0.73	
Cadmium	mg/kg	0.57	U	1.1		0.61	U	0.64		0.60	U
Calcium	mg/kg	2140		3150		2080		2950	J	1070	
Chromium	mg/kg	6.2		6.9		11.3		20.3	J	9.8	
Cobalt	mg/kg	5.7	U	5.5	U	9.5		14.8		9.4	
Copper	mg/kg	19.7		16.9		66.7		28.9	J	46.1	
Iron	mg/kg	12500		13000		30800		20600	J	34000	
Lead	mg/kg	61.4	J	53.5	J	17.3	J	53.0	J	17.6	J
Magnesium	mg/kg	655		721		1260		1000	J	724	
Manganese	mg/kg	87.5		264		195		373	J	207	
Mercury	mg/kg	0.038	U	0.036	U	0.044		0.044		0.059	
Nickel	mg/kg	8.8		11.9		40.5		27.1		23.4	
Potassium	mg/kg	690		677		1200		843		1110	
Selenium	mg/kg	0.78	J	0.64	J	1.6	J	1.0		1.6	J
Silver	mg/kg	1.1	U	1.1	U	1.2	U	1.2	U	1.2	U
Sodium	mg/kg	573	U	548	U	613	U	592	U	597	U
Thallium	mg/kg	1.1	UJ	1.1	UJ	1.3	B	1.2	U	1.5	B
Vanadium	mg/kg	6.6	B	5.6	B	6.1	UJ	5.9	UJ	6.0	UJ
Zinc	mg/kg	42.9		272		54.0		241	J	68.8	

Sample Location:		TNTB-SO11		TNTB-SO12		TNTB-SO14		TNTB-SO15		TNTB-SO16	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10600		10610		10630		10640		10650	
Sample Date:		10-NOV-98		10-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98	
Depth:		8 - 10		4 - 5		0 - 1		0 - 1		0 - 1	
METALS3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	4650		5070		7150	J	5840		5000	
Antimony	mg/kg	7.5	UJ	7.4	UJ	7.5	UJ	7.4	UJ	7.3	UJ
Arsenic	mg/kg	25.3	J	35.6	J	13.2		11.7		8.9	
Barium	mg/kg	85.1		64.9		112	J	51.8		36.4	
Beryllium	mg/kg	0.67		0.71		0.86		0.62	U	0.61	U
Cadmium	mg/kg	0.63	U	0.62	U	0.63	U	0.62	U	0.61	U
Calcium	mg/kg	8110		922		5610	J	3260		2620	
Chromium	mg/kg	10.2		11.3		12.5	J	11.3		8.3	
Cobalt	mg/kg	9.0		8.1		11.8		11.2		9.7	
Copper	mg/kg	40.4		46.7		47.8	J	32.0		24.4	
Iron	mg/kg	37900		40400		23600	J	20200		15100	
Lead	mg/kg	20.0	J	22.9	J	67.7	J	41.9		30.2	
Magnesium	mg/kg	1460		1020		1550	J	1760		909	
Manganese	mg/kg	460		136		378	J	150		152	
Mercury	mg/kg	0.059		0.081		0.082		0.080		0.073	
Nickel	mg/kg	25.4		27.4		31.3		26.9		19.8	
Potassium	mg/kg	1170		1300		1130		1220		898	
Selenium	mg/kg	1.8	J	1.8	J	1.3		1.6		1.0	
Silver	mg/kg	1.3	U	1.2	U	1.3	U	1.2	U	1.2	U
Sodium	mg/kg	629	U	617	U	628	U	615	U	605	U
Thallium	mg/kg	1.4	B	1.8	B	1.3	U	1.2	U	1.2	U
Vanadium	mg/kg	6.3	UJ	6.2	UJ	6.8	B	6.2	U	6.1	U
Zinc	mg/kg	40.6		44.6		146	J	241	J	49.9	J

Sample Location:		TNTB-SO17		TNTB-SO18		TNTB-SO19		TNTB-SO20		TNTB-SO21	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10660		10670		10680		10690		10700	
Sample Date:		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1		0 - 1	
METALS3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	5770		7170		8400		7290		6760	
Antimony	mg/kg	7.2	UJ	7.9	UJ	7.9	UJ	7.2	UJ	7.3	UJ
Arsenic	mg/kg	11.1		12.3		8.8		18.1		15.8	
Barium	mg/kg	52.7		56.1		82.7		73.4		66.6	
Beryllium	mg/kg	0.61		0.77		0.82		0.73		0.78	
Cadmium	mg/kg	0.60	U	0.66	U	0.66	U	0.60	U	0.61	U
Calcium	mg/kg	10900		3410		2790		3600		3370	
Chromium	mg/kg	12.4		11.8		11.8		13.0		13.4	
Cobalt	mg/kg	11.8		9.4		10		10.7		11.2	
Copper	mg/kg	37.7		35.6		40.8		36.2		35.1	
Iron	mg/kg	18800		22400		17800		25500		26100	
Lead	mg/kg	54.8		19.8		15.3		37.1		26.0	
Magnesium	mg/kg	2550		891		873		1300		1060	
Manganese	mg/kg	176		85.7		69.6		196		274	
Mercury	mg/kg	0.11		0.056		0.057		0.069		0.077	
Nickel	mg/kg	26.5		20.0		24.7		27.1		23.8	
Potassium	mg/kg	1090		1080		750		1170		1120	
Selenium	mg/kg	1.3		1.6		1.2		1.3		1.3	
Silver	mg/kg	1.2	U	1.3	U	1.3	U	1.2	U	1.2	U
Sodium	mg/kg	600	U	656	U	662	U	600	U	611	U
Thallium	mg/kg	1.2	U	1.3	U	1.3	U	1.2	U	1.2	U
Vanadium	mg/kg	6.0	U	11.1		13.0		6.0	U	6.1	U
Zinc	mg/kg	82.5	J	31.1	J	25.2	J	52.7	J	61.4	J

Sample Location:		TNTB-SO22		TNTB-SO23		TNTB-SO24		TNTB-SO25		TNTB-SO26	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10710		10720		10730		10740		10750	
Sample Date:		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1		0 - 1	
METALS3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	6540		3050		3960	J	6300	J	5240	J
Antimony	mg/kg	7.3	UJ	6.5	UJ	35.0	UJ	7.4	UJ	7.3	UJ
Arsenic	mg/kg	12.4		2.8		7.4		12.0		9.1	
Barium	mg/kg	69.0		21.8	U	47.6	J	76.8	J	39.6	J
Beryllium	mg/kg	0.75		0.54	U	0.58	U	0.80		0.61	U
Cadmium	mg/kg	0.61	U	0.54	U	2.9	U	0.61	U	0.61	U
Calcium	mg/kg	4000		14200		90900	J	21000	J	31000	J
Chromium	mg/kg	20.5		6.0		12.1	J	12.4	J	8.5	J
Cobalt	mg/kg	10.9		5.4	U	5.9		11.7		7.4	
Copper	mg/kg	38.6		8.3		34.3	J	43.9	J	23.5	J
Iron	mg/kg	21500		7790		13400	J	26600	J	15600	J
Lead	mg/kg	32.0		29.5		245	J	126	J	33.4	J
Magnesium	mg/kg	1160		1570		9190	J	2090	J	4170	J
Manganese	mg/kg	284		171		286	J	352	J	154	J
Mercury	mg/kg	0.062		0.036	U	0.13		0.069		0.049	
Nickel	mg/kg	23.6		8.0		13.9		32.6		17.9	
Potassium	mg/kg	1140		544	U	763		735		831	
Selenium	mg/kg	1.2		0.54	U	0.58	U	1.1		0.97	
Silver	mg/kg	1.2	U	1.1	U	1.2	U	1.2	U	1.2	U
Sodium	mg/kg	612	U	544	U	584	U	613	U	608	U
Thallium	mg/kg	1.2	U	1.1	U	1.2	U	1.2	U	1.2	U
Vanadium	mg/kg	6.5	B	6.5	B	11.6	J	6.1	UJ	8.7	
Zinc	mg/kg	116	J	79.1	J	156	J	170	J	53.3	J

Sample Location:		TNTB-SO27		TNTB-SO28		TNTB-SO29		TNTB-SO30		TNTB-SO31	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10760		10770		10780		10790		10800	
Sample Date:		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98		12-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1		0 - 1	
METALS3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	6570	J	4910	J	5530	J	5750	J	5740	
Antimony	mg/kg	7.4	UJ	7.2	UJ	7.3	UJ	7.4	UJ	7.2	UJ
Arsenic	mg/kg	22.1		9.2		9.6		9.3		20.3	
Barium	mg/kg	100	J	76.5	J	73.3	J	46.2	J	74.5	
Beryllium	mg/kg	0.87		0.60	U	0.63		0.62	U	0.85	
Cadmium	mg/kg	0.63		0.60	U	0.61	U	0.62	U	1.3	
Calcium	mg/kg	3610	J	2860	J	3350	J	7030	J	4100	
Chromium	mg/kg	12.9	J	19.1	J	17.3	J	9.5	J	11.3	
Cobalt	mg/kg	15.5		15.9		10.7		8.4		14.9	
Copper	mg/kg	48.3	J	25.4	J	33.3	J	21.7	J	47.9	
Iron	mg/kg	32800	J	18900	J	19900	J	17900	J	19300	
Lead	mg/kg	30.5	J	40.5	J	35.6	J	36.6	J	77.6	
Magnesium	mg/kg	1130	J	1010	J	1050	J	1540	J	1020	
Manganese	mg/kg	311	J	504	J	330	J	116	J	357	
Mercury	mg/kg	0.061		0.040	U	0.048		0.045		0.083	
Nickel	mg/kg	42.6		23.6		24.5		19.4		56.3	
Potassium	mg/kg	1450		920		835		785		747	
Selenium	mg/kg	1.7		0.95		0.89		1.1		1.2	
Silver	mg/kg	1.2	U	1.2	U	1.2	U	1.2	U	1.2	U
Sodium	mg/kg	616	U	600	U	605	U	618	U	598	U
Thallium	mg/kg	1.4		1.2	U	1.2	U	1.2	U	1.2	U
Vanadium	mg/kg	6.2	UJ	6.0	UJ	6.1	UJ	6.2	UJ	8.2	
Zinc	mg/kg	91.8	J	164	J	164	J	63.7	J	235	J

Sample Location:		TNTB-SO32		TNTB-SO33		TNTB-SO34		TNTB-SO35		TNTB-SO36	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10810		10820		10830		10840		10850	
Sample Date:		12-NOV-98		12-NOV-98		12-NOV-98		11-NOV-98		12-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1		0 - 1	
METALS3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	5410		4180		3720		4680	J	5280	
Antimony	mg/kg	7.0	UJ	6.6	UJ	6.7	UJ	7.2	UJ	7.2	UJ
Arsenic	mg/kg	8.0		1.7		4.0		8.5		15.8	
Barium	mg/kg	45.5		46.3		24.1		39.0	J	53.3	
Beryllium	mg/kg	0.69		0.55	U	0.56	U	0.60	U	0.60	U
Cadmium	mg/kg	1.1		0.55	U	0.56	U	0.60	U	0.60	U
Calcium	mg/kg	6020		1200		1830		1770	J	8480	
Chromium	mg/kg	10		6.4		6.6		8.9	J	10.7	
Cobalt	mg/kg	15.7		5.5	U	5.6	U	7.7		10.7	
Copper	mg/kg	445		7.6		6.9		19.9	J	28.5	
Iron	mg/kg	14500		7340		9030		14300	J	21000	
Lead	mg/kg	153		41.6		9.7		32.3	J	24.8	
Magnesium	mg/kg	1410		660		897		796	J	1850	
Manganese	mg/kg	203		235		185		202	J	291	
Mercury	mg/kg	0.047		0.036	U	0.037	U	0.042		0.053	
Nickel	mg/kg	40.7		9.1		11.4		14.0		17.1	
Potassium	mg/kg	907		551	U	560	U	765		1160	
Selenium	mg/kg	1.0		0.55	U	0.56	U	0.64		1.3	
Silver	mg/kg	1.2	U	1.1	U	1.1	U	1.2	U	1.2	U
Sodium	mg/kg	587	U	551	U	560	U	602	U	597	U
Thallium	mg/kg	1.2	U	1.1	U	1.1	U	1.2	U	1.2	U
Vanadium	mg/kg	5.9	U	5.5	B	6.8	B	6.0	B	6.0	U
Zinc	mg/kg	282	J	46.1	J	33.7	J	42.7	J	50.1	J

Sample Location:		TNTB-SO37		TNTB-SO38		TNTB-SO39		TNTB-SO40	
Associated Site:		TNTB		TNTB		TNTB		TNTB	
Sample No:		10860		10870		10880		10890	
Sample Date:		12-NOV-98		12-NOV-98		12-NOV-98		12-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1	
METALS3	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	6160		5720		4170		3170	
Antimony	mg/kg	7.4	UJ	7.3	UJ	6.9	UJ	7.1	UJ
Arsenic	mg/kg	12.8		12.5		4.0		29.4	
Barium	mg/kg	90.8		77.0		43.4		60.2	
Beryllium	mg/kg	0.79		0.62		0.58	U	0.59	U
Cadmium	mg/kg	0.62	U	0.61	U	0.58	U	0.59	U
Calcium	mg/kg	4760		4640		1430		807	
Chromium	mg/kg	12.1		12.7		6.2		8.1	
Cobalt	mg/kg	10.0		8.8		5.9		6.2	
Copper	mg/kg	34.7		28.2		8.8		35.2	
Iron	mg/kg	19900		20200		9750		30500	
Lead	mg/kg	58.4		47.4		35.7		35.0	
Magnesium	mg/kg	1050		1220		741		595	U
Manganese	mg/kg	205		240		219		24.0	
Mercury	mg/kg	0.085		0.065		0.038		0.056	
Nickel	mg/kg	23.2		20.9		12.3		6.5	
Potassium	mg/kg	1340		1450		577	U	1930	
Selenium	mg/kg	1.2		1.1		0.64		2.4	
Silver	mg/kg	1.2	U	1.2	U	1.2	U	1.2	U
Sodium	mg/kg	617	U	608	U	577	U	595	U
Thallium	mg/kg	1.2	U	1.2	U	1.2	U	1.4	
Vanadium	mg/kg	7.9	B	6.1	U	5.8	U	5.9	U
Zinc	mg/kg	75.5	J	75.9	J	27.1	J	17.7	J

Sample Location:		TNTB-SO01		TNTB-SO02		TNTB-SO03		TNTB-SO04		TNTB-SO05	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10500		10510		10520		10530		10540	
Sample Date:		09-NOV-98		09-NOV-98		09-NOV-98		09-NOV-98		09-NOV-98	
Depth:		.5 - 2		3.5 - 4		3 - 4		5 - 6		2.5 - 3.5	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	0.25	U	0.25	U	25	U	0.25	U	2.5	U
1,3-Dinitrobenzene	mg/kg	0.25	U	0.25	U	25	U	0.25	U	2.5	U
2,4,6-Trinitrotoluene	mg/kg	0.25	U	0.27		620		4.8		44	
2,4-Dinitrotoluene	mg/kg	0.25	U	1.6		27		1.4		2.5	U
2,6-Dinitrotoluene	mg/kg	0.25	U	0.49		25	U	0.25	U	2.5	U
2-Amino-4,6-dinitrotoluene	mg/kg	0.25	U	0.25	U	93		1.0		12	
2-Nitrotoluene	mg/kg	0.25	U	0.25	U	25	U	0.25	U	2.5	U
3-Nitrotoluene	mg/kg	0.25	U	0.25	U	25	U	0.25	U	2.5	U
4-Amino-2,6-dinitrotoluene	mg/kg	0.25	U	0.25	U	170	U	1.7		15	
4-Nitrotoluene	mg/kg	0.25	U	0.25	U	25	U	0.25	U	2.5	U
HMX	mg/kg	0.50	U	0.50	U	50	U	0.50	U	5.0	U
Nitrobenzene	mg/kg	0.25	U	0.25	U	25	U	0.25	U	2.5	U
RDX	mg/kg	0.50	U	0.50	U	50	U	0.50	U	5.0	U
Tetryl	mg/kg	0.65	U	0.65	U	65	U	0.65	U	6.5	U

Sample Location:		TNTB-SO06		TNTB-SO07		TNTB-SO08		TNTB-SO09		TNTB-SO10	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10550		10560		10570		10580		10590	
Sample Date:		09-NOV-98		10-NOV-98		09-NOV-98		11-NOV-98		10-NOV-98	
Depth:		4 - 5		3 - 4		6 - 8		0 - 1		4 - 6	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	62	U	0.25	U	0.50	U	5.0	U	0.25	U
1,3-Dinitrobenzene	mg/kg	62	U	0.25	U	0.50	U	5.0	U	0.25	U
2,4,6-Trinitrotoluene	mg/kg	2200	J	5.8	J	11		92		1.1	
2,4-Dinitrotoluene	mg/kg	62	U	1.9	J	2.1		5.0	U	0.25	U
2,6-Dinitrotoluene	mg/kg	62	U	0.25	U	1.0		5.0	U	0.25	U
2-Amino-4,6-dinitrotoluene	mg/kg	62	U	5.1	J	2.3		5.0	U	0.25	U
2-Nitrotoluene	mg/kg	62	U	0.25	U	0.50	U	5.0	U	0.25	U
3-Nitrotoluene	mg/kg	62	U	0.25	U	0.50	U	5.0	U	0.25	U
4-Amino-2,6-dinitrotoluene	mg/kg	400	U	5.1	J	3.8		16	U	0.25	U
4-Nitrotoluene	mg/kg	62	U	0.25	U	0.50	U	5.0	U	0.25	U
HMX	mg/kg	120	U	0.50	U	1.0	U	10	U	0.50	U
Nitrobenzene	mg/kg	62	U	0.25	U	0.50	U	5.0	U	0.25	U
RDX	mg/kg	120	U	0.50	U	1.0	U	10	U	0.50	U
Tetryl	mg/kg	160	U	0.65	U	1.3	U	13	U	0.65	U

Sample Location:		TNTB-SO11		TNTB-SO12		TNTB-SO13		TNTB-SO14		TNTB-SO15	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10600		10610		10620		10630		10640	
Sample Date:		10-NOV-98		10-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98	
Depth:		8 - 10		4 - 5		0 - 1		0 - 1		0 - 1	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	18	U	2.5	U	250	U	25	U	0.25	U
1,3-Dinitrobenzene	mg/kg	12	U	2.5	U	250	U	25	U	0.25	U
2,4,6-Trinitrotoluene	mg/kg	24		39		6900		490	J	4.6	
2,4-Dinitrotoluene	mg/kg	240		2.6		250	U	25	U	0.39	
2,6-Dinitrotoluene	mg/kg	180		2.5	U	250	U	25	U	1.0	U
2-Amino-4,6-dinitrotoluene	mg/kg	70		4.0		250	U	25	U	4.2	
2-Nitrotoluene	mg/kg	82		2.5	U	250	U	25	U	0.25	U
3-Nitrotoluene	mg/kg	12	U	2.5	U	250	U	25	U	0.25	U
4-Amino-2,6-dinitrotoluene	mg/kg	45		11		2400	U	77	U	4.2	
4-Nitrotoluene	mg/kg	67		2.5	U	250	U	25	U	0.25	U
HMX	mg/kg	25	U	5.0	U	500	U	50	U	0.50	U
Nitrobenzene	mg/kg	12	U	2.5	U	250	U	25	U	0.25	U
RDX	mg/kg	25	U	5.0	U	500	U	50	U	0.50	U
Tetryl	mg/kg	32	U	6.5	U	650	U	65	U	0.65	U

Sample Location:		TNTB-SO16		TNTB-SO17		TNTB-SO18		TNTB-SO19		TNTB-SO20	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10650		10660		10670		10680		10690	
Sample Date:		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1		0 - 1	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	0.25	U	0.25	U	0.25	U	0.25	U	0.25	U
1,3-Dinitrobenzene	mg/kg	0.25	U	0.25	U	0.25	U	0.25	U	0.25	U
2,4,6-Trinitrotoluene	mg/kg	4.3		3.8		2.9		0.25	U	0.59	
2,4-Dinitrotoluene	mg/kg	0.25	U	0.76		0.25	U	0.25	U	0.25	U
2,6-Dinitrotoluene	mg/kg	0.25	U	0.25	U	0.25	U	0.25	U	0.25	U
2-Amino-4,6-dinitrotoluene	mg/kg	4.4		3.6		3.8		0.25	U	0.78	
2-Nitrotoluene	mg/kg	0.25	U	0.25	U	0.25	U	0.25	U	0.25	U
3-Nitrotoluene	mg/kg	0.25	U	0.25	U	0.25	U	0.25	U	0.25	U
4-Amino-2,6-dinitrotoluene	mg/kg	3.5		3.0		2.0		0.25	U	0.60	
4-Nitrotoluene	mg/kg	0.25	U	0.25	U	0.25	U	0.25	U	0.25	U
HMX	mg/kg	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U
Nitrobenzene	mg/kg	0.25	U	0.25	U	0.25	U	0.25	U	0.25	U
RDX	mg/kg	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U
Tetryl	mg/kg	0.65	U	0.65	U	0.65	U	0.65	U	0.65	U

Sample Location:		TNTB-SO21		TNTB-SO22		TNTB-SO23		TNTB-SO24		TNTB-SO25	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10700		10710		10720		10730		10740	
Sample Date:		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1		0 - 1	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	0.25	U	0.25	U	0.25	U	0.50	U	0.25	U
1,3-Dinitrobenzene	mg/kg	0.25	U	0.25	U	0.25	U	0.50	U	0.25	U
2,4,6-Trinitrotoluene	mg/kg	0.31		2.5		0.68		14		0.26	
2,4-Dinitrotoluene	mg/kg	0.25	U	0.25	U	0.25	U	0.50	U	0.25	U
2,6-Dinitrotoluene	mg/kg	0.25	U	0.25	U	0.25	U	0.50	U	0.25	U
2-Amino-4,6-dinitrotoluene	mg/kg	0.30		2.6		0.25	U	4.6		1.7	
2-Nitrotoluene	mg/kg	0.25	U	0.25	U	0.25	U	0.50	U	0.25	U
3-Nitrotoluene	mg/kg	0.25	U	0.25	U	0.25	U	0.50	U	0.25	U
4-Amino-2,6-dinitrotoluene	mg/kg	0.25	U	2.0		0.35		5.9		1.1	
4-Nitrotoluene	mg/kg	0.25	U	0.25	U	0.25	U	0.50	U	0.25	U
HMX	mg/kg	0.50	U	0.50	U	0.50	U	1.0	U	0.50	U
Nitrobenzene	mg/kg	0.25	U	0.25	U	0.25	U	0.50	U	0.25	U
RDX	mg/kg	0.50	U	0.50	U	0.50	U	1.0	U	0.50	U
Tetryl	mg/kg	0.65	U	0.65	U	0.65	U	1.3	U	0.65	U

Sample Location:		TNTB-SO26		TNTB-SO27		TNTB-SO28		TNTB-SO29		TNTB-SO30	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10750		10760		10770		10780		10790	
Sample Date:		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1		0 - 1	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	0.25	U	0.25	U	0.25	U	0.25	U	0.25	U
1,3-Dinitrobenzene	mg/kg	0.25	U	0.25	U	0.25	U	0.25	U	0.25	U
2,4,6-Trinitrotoluene	mg/kg	0.43		4.0		1.1		1.0		0.56	
2,4-Dinitrotoluene	mg/kg	0.25	U	0.25	U	0.25	U	0.25	U	0.25	U
2,6-Dinitrotoluene	mg/kg	0.25	U	0.25	U	0.25	U	0.25	U	0.25	U
2-Amino-4,6-dinitrotoluene	mg/kg	0.25	U	7.6		1.3		1.5		0.25	U
2-Nitrotoluene	mg/kg	0.25	U	0.25	U	0.25	U	0.25	U	0.25	U
3-Nitrotoluene	mg/kg	0.25	U	0.25	U	0.25	U	0.25	U	0.25	U
4-Amino-2,6-dinitrotoluene	mg/kg	0.25	U	5.4		0.99		1.1		0.34	
4-Nitrotoluene	mg/kg	0.25	U	0.25	U	0.25	U	0.25	U	0.25	U
HMX	mg/kg	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U
Nitrobenzene	mg/kg	0.25	U	0.25	U	0.25	U	0.25	U	0.25	U
RDX	mg/kg	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U
Tetryl	mg/kg	0.65	U	0.65	U	0.65	U	0.65	U	0.65	U

Sample Location:		TNTB-SO31		TNTB-SO32		TNTB-SO33		TNTB-SO34		TNTB-SO35	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10800		10810		10820		10830		10840	
Sample Date:		12-NOV-98		12-NOV-98		12-NOV-98		12-NOV-98		11-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1		0 - 1	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	1.2	U	0.25	U	0.25	U	0.25	U	0.25	U
1,3-Dinitrobenzene	mg/kg	1.2	U	0.25	U	0.25	U	0.25	U	0.25	U
2,4,6-Trinitrotoluene	mg/kg	22		7.6		0.25	U	0.25	U	7.6	J
2,4-Dinitrotoluene	mg/kg	1.2	U	0.38		0.25	U	0.25	U	1.6	J
2,6-Dinitrotoluene	mg/kg	1.2	U	0.25	U	0.25	U	0.25	U	0.28	J
2-Amino-4,6-dinitrotoluene	mg/kg	4.7		3.7		0.25	U	0.25	U	0.48	
2-Nitrotoluene	mg/kg	1.2	U	0.25	U	0.25	U	0.25	U	0.25	U
3-Nitrotoluene	mg/kg	1.2	U	0.25	U	0.25	U	0.25	U	0.25	U
4-Amino-2,6-dinitrotoluene	mg/kg	8.8		4.0		0.25	U	0.25	U	1.3	U
4-Nitrotoluene	mg/kg	1.2	U	0.25	U	0.25	U	0.25	U	0.25	U
HMX	mg/kg	2.5	U	0.50	U	0.50	U	0.50	U	0.50	U
Nitrobenzene	mg/kg	1.2	U	0.25	U	0.25	U	0.25	U	0.25	U
RDX	mg/kg	2.5	U	0.50	U	0.50	U	0.50	U	0.50	U
Tetryl	mg/kg	3.2	U	0.65	U	0.65	U	0.65	U	0.65	U

Sample Location:		TNTB-SO36		TNTB-SO37		TNTB-SO38		TNTB-SO39		TNTB-SO40	
Associated Site:		TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:		10850		10860		10870		10880		10890	
Sample Date:		12-NOV-98		12-NOV-98		12-NOV-98		12-NOV-98		12-NOV-98	
Depth:		0 - 1		0 - 1		0 - 1		0 - 1		0 - 1	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	0.25	U	0.25	U	0.25	U	0.25	U	0.25	U
1,3-Dinitrobenzene	mg/kg	0.25	U	0.25	U	0.25	U	0.25	U	0.25	U
2,4,6-Trinitrotoluene	mg/kg	0.40		4.3		0.78		0.25	U	0.25	U
2,4-Dinitrotoluene	mg/kg	0.25	U	2.3		0.34		0.25	U	0.26	
2,6-Dinitrotoluene	mg/kg	0.25	U	0.83		0.25	U	0.25	U	0.25	U
2-Amino-4,6-dinitrotoluene	mg/kg	0.25	U	1.7		0.25	U	0.25	U	0.25	U
2-Nitrotoluene	mg/kg	0.25	U	0.25	U	0.25	U	0.25	U	0.25	U
3-Nitrotoluene	mg/kg	0.25	U	0.25	U	0.25	U	0.25	U	0.25	U
4-Amino-2,6-dinitrotoluene	mg/kg	0.25	U	2.5		0.35		0.25	U	0.25	U
4-Nitrotoluene	mg/kg	0.25	U	0.25	U	0.25	U	0.25	U	0.25	U
HMX	mg/kg	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U
Nitrobenzene	mg/kg	0.25	U	0.25	U	0.25	U	0.25	U	0.25	U
RDX	mg/kg	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U
Tetryl	mg/kg	0.65	U	0.65	U	0.65	U	0.65	U	0.65	U

Plum Brook Ordnance Works

TNT Area B

Data Summary Report

Soils

Report Date: 08/28/00

Sample Location:			TNTB-SO01		TNTB-SO02		TNTB-SO03		TNTB-SO04		TNTB-SO05	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10505		10515		10525		10535		10545	
Sample Date:			09-NOV-98		09-NOV-98		09-NOV-98		09-NOV-98		09-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	18	UJD	0.18	UJ	18	UJD
2,4,6-Trinitrotoluene		mg/kg	0.03	J	0.06	J	100	D	0.82		56	D
2,4-Dinitrotoluene		mg/kg	4	U	4	U	400	UD	4	U	400	UD
2,6-Dinitrotoluene		mg/kg	4	U	4	U	400	UD	4	U	400	UD
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	11	JD	0.06	J	18	UD
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	18	UJD	0.18	UJ	18	UJD

Plum Brook Ordnance Works

TNT Area B

Data Summary Report

Soils

Report Date: 08/28/00

Sample Location:			TNTB-SO06		TNTB-SO07		TNTB-SO08		TNTB-SO09		TNTB-SO10	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10555		10565		10575		10585		10595	
Sample Date:			09-NOV-98		10-NOV-98		09-NOV-98		11-NOV-98		10-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	220	UJD	1.2	UJD	0.18	UJ	18	UJD	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	650	D	3.0	D	0.17	U	36	D	0.36	
2,4-Dinitrotoluene		mg/kg	5000	UD	27	UD	4	U	400	UD	4	U
2,6-Dinitrotoluene		mg/kg	5000	UD	27	UD	4	U	400	UD	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	220	UD	1.2	JD	0.18	U	18	UD	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	220	UJD	1.2	UJD	0.18	UJ	18	UJD	0.18	UJ

Plum Brook Ordnance Works

TNT Area B

Data Summary Report

Soils

Report Date: 08/28/00

Sample Location:			TNTB-SO11		TNTB-SO12		TNTB-SO13		TNTB-SO14		TNTB-SO15	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10605		10615		10625		10635		10645	
Sample Date:			10-NOV-98		10-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	18	UJD	18	UJD	1800	UJD	180	UJD	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	43	D	11	D	5200	D	450	D	0.78	
2,4-Dinitrotoluene		mg/kg	400	UD	400	UD	40000	UD	400	UD	4	U
2,6-Dinitrotoluene		mg/kg	400	UD	400	UD	40000	UD	4000	UD	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	12	JD	18	UD	1800	UD	180	UD	0.29	
4-Amino-2,6-dinitrotoluene		mg/kg	18	UJD	18	UJD	1800	UJD	180	UJD	0.18	UJ

Sample Location:			TNTB-SO16		TNTB-SO17		TNTB-SO18		TNTB-SO19		TNTB-SO20	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10655		10665		10675		10685		10695	
Sample Date:			11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.80		0.59		0.24		0.08	J	0.35	
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.27		0.19		0.04	J	0.18	U	0.16	J
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SO21		TNTB-SO22		TNTB-SO23		TNTB-SO24		TNTB-SO25	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10705		10715		10725		10735		10745	
Sample Date:			11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	18	UJD	18	UJD	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.09	J	0.53		33		8.1	D	0.32	
2,4-Dinitrotoluene		mg/kg	4	U	4	U	400	UD	400	UD	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	400	UD	400	UD	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.05	J	0.13	J	18	UD	18	UD	0.56	
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	18	UJD	18	UJD	0.18	UJ

Report Date: 08/28/00

Sample Location:			TNTB-SO26		TNTB-SO27		TNTB-SO28		TNTB-SO29		TNTB-SO30	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10755		10765		10775		10785		10795	
Sample Date:			11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98		11-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	6	UJD	1.8	UJD	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.22		5.6	D	2.2	D	0.74		0.03	J
2,4-Dinitrotoluene		mg/kg	4	U	130	UD	40	UD	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	130	UD	40	UD	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	4.9	JD	3.2	D	0.38		0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	6	UJD	1.8	UJD	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SO31		TNTB-SO32		TNTB-SO33		TNTB-SO34		TNTB-SO35	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10805		10815		10825		10835		10845	
Sample Date:			12-NOV-98		12-NOV-98		12-NOV-98		12-NOV-98		11-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	9	UJD	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	26	D	1.1		0.17	U	0.17	U	0.10	J
2,4-Dinitrotoluene		mg/kg	200	UD	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	200	UD	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	9	UD	0.22		0.18	U	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	9	UJD	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SO36		TNTB-SO37		TNTB-SO38		TNTB-SO39		TNTB-SO40	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10855		10865		10875		10885		10895	
Sample Date:			12-NOV-98		12-NOV-98		12-NOV-98		12-NOV-98		12-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.27		0.30		0.17	U	0.17	U	0.17	U
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.14	J	0.18	U	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS001		TNTB-SS002		TNTB-SS003		TNTB-SS004		TNTB-SS005	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10000		10001		10002		10003		10004	
Sample Date:			21-OCT-98		21-OCT-98		21-OCT-98		21-OCT-98		22-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.11	J	0.17	U	0.17	U	0.17	U
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18	U	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS006		TNTB-SS007		TNTB-SS008		TNTB-SS009		TNTB-SS010	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10005		10006		10007		10008		10009	
Sample Date:			22-OCT-98		22-OCT-98		22-OCT-98		22-OCT-98		22-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.17	U	0.01	J	0.17	U	0.17	U
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.13	J	0.02	J	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Report Date: 08/28/00

Sample Location:			TNTB-SS011		TNTB-SS012		TNTB-SS013		TNTB-SS014		TNTB-SS015	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10010		10011		10012		10013		10014	
Sample Date:			22-OCT-98		22-OCT-98		22-OCT-98		22-OCT-98		22-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.17	U	0.01	J	0.17	U	0.17	U
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18	U	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS016		TNTB-SS017		TNTB-SS018		TNTB-SS019		TNTB-SS020	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10015		10016		10017		10018		10019	
Sample Date:			22-OCT-98		22-OCT-98		22-OCT-98		22-OCT-98		22-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.01	J	0.01	J	0.17	U	0.83	
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.25		0.18	U	0.18	U	0.12	J
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS021		TNTB-SS022		TNTB-SS023		TNTB-SS024		TNTB-SS025	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10020		10021		10022		10023		10024	
Sample Date:			22-OCT-98		22-OCT-98		22-OCT-98		22-OCT-98		22-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.82		0.07	J	0.17	U	0.17	U	0.01	J
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.13	J	0.18	U	0.18	U	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS026		TNTB-SS027		TNTB-SS028		TNTB-SS029		TNTB-SS030	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10025		10026		10027		10028		10029	
Sample Date:			22-OCT-98		22-OCT-98		22-OCT-98		22-OCT-98		22-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.14	J	0.17	U	0.17	U	0.17	U
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18	U	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Report Date: 08/28/00

Sample Location:			TNTB-SS031		TNTB-SS032		TNTB-SS033		TNTB-SS034		TNTB-SS035	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10030		10031		10032		10033		10034	
Sample Date:			22-OCT-98		22-OCT-98		22-OCT-98		22-OCT-98		22-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.17	U	0.17	U	0.17	U	0.05	J
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18	U	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS037		TNTB-SS038		TNTB-SS039		TNTB-SS040		TNTB-SS042	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10036		10037		10038		10039		10041	
Sample Date:			22-OCT-98		22-OCT-98		22-OCT-98		22-OCT-98		22-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.9	UJD	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	4.7	D	0.31		0.63		0.39		0.20	
2,4-Dinitrotoluene		mg/kg	20	UD	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	20	UD	100	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	2.00	UD	0.09	J	0.15	J	0.17	J	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.9	UJD	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS043		TNTB-SS044		TNTB-SS045		TNTB-SS046		TNTB-SS047	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10042		10043		10044		10045		10046	
Sample Date:			22-OCT-98		22-OCT-98		22-OCT-98		27-OCT-98		27-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.06	J	0.17	U	0.10	J	0.45	
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	UJ	0.18	U	0.09	J	0.07	J
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS048		TNTB-SS049		TNTB-SS050		TNTB-SS051		TNTB-SS052	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10047		10048		10049		10050		10051	
Sample Date:			27-OCT-98		27-OCT-98		27-OCT-98		27-OCT-98		27-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.83		0.55		0.53		0.11	J	0.61	
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.44		0.18	U	0.18	U	0.18	U	0.01	J
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS053		TNTB-SS054		TNTB-SS055		TNTB-SS056		TNTB-SS057	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10052		10053		10054		10055		10056	
Sample Date:			27-OCT-98		27-OCT-98		27-OCT-98		27-OCT-98		27-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.51		0.46		0.01	J	0.93	
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.10	J	0.04	J	0.18	U	0.60	
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS058		TNTB-SS059		TNTB-SS060		TNTB-SS061		TNTB-SS062	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10057		10058		10059		10060		10061	
Sample Date:			27-OCT-98		23-OCT-98		23-OCT-98		23-OCT-98		23-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.76		0.11	J	0.18		0.14	J	0.50	
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.03	J	0.18	U	0.01	J	0.18	U	0.02	J
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS063		TNTB-SS064		TNTB-SS065		TNTB-SS066		TNTB-SS067	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10062		10063		10064		10065		10066	
Sample Date:			23-OCT-98		23-OCT-98		25-OCT-98		25-OCT-98		25-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.43		0.18		0.20		0.27		0.72	
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.06	J	0.18	U	0.20		0.70		0.64	
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS068		TNTB-SS069		TNTB-SS070		TNTB-SS071		TNTB-SS072	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10067		10068		10069		10070		10071	
Sample Date:			25-OCT-98		25-OCT-98		25-OCT-98		25-OCT-98		25-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.01	J	0.17	U	0.48		0.17	U
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18	U	0.28		0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS073		TNTB-SS074		TNTB-SS075		TNTB-SS076		TNTB-SS077	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10072		10073		10074		10075		10076	
Sample Date:			25-OCT-98		26-OCT-98		26-OCT-98		26-OCT-98		26-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.08	J	0.17	U	0.07	J	0.01	J
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18	U	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Report Date: 08/28/00

Sample Location:			TNTB-SS078		TNTB-SS079		TNTB-SS080		TNTB-SS081		TNTB-SS082	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10077		10078		10079		10080		10081	
Sample Date:			26-OCT-98		26-OCT-98		26-OCT-98		23-OCT-98		23-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.02	J	0.01	J	0.11	J	0.02	J	0.01	J
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.04	J	0.21		0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS083		TNTB-SS084		TNTB-SS085		TNTB-SS086		TNTB-SS087	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10082		10083		10084		10085		10086	
Sample Date:			23-OCT-98		23-OCT-98		23-OCT-98		23-OCT-98		23-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.01	J	0.01	J	0.17	U	0.01	J	0.87	
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18	U	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS088		TNTB-SS089		TNTB-SS090		TNTB-SS091		TNTB-SS092	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10087		10088		10089		10090		10091	
Sample Date:			23-OCT-98		23-OCT-98		23-OCT-98		27-OCT-98		27-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.57		0.43		0.01	J	0.18		0.89	
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	0.3	J	6.2	J
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18	U	0.03	J	0.01	J
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS093		TNTB-SS094		TNTB-SS095		TNTB-SS096		TNTB-SS097	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10092		10093		10094		10095		10096	
Sample Date:			27-OCT-98		27-OCT-98		27-OCT-98		23-OCT-98		23-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.30		1.2		0.54		0.39		0.17	U
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	2.6	J	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.01	J	0.18	U	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS098		TNTB-SS099		TNTB-SS100		TNTB-SS101		TNTB-SS102	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10097		10098		10099		10100		10101	
Sample Date:			23-OCT-98		23-OCT-98		23-OCT-98		23-OCT-98		23-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.01	J	0.17	U	0.17	U	0.17	U	0.25	
2,4-Dinitrotoluene		mg/kg	4.3	J	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18	U	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS103		TNTB-SS104		TNTB-SS105		TNTB-SS106		TNTB-SS107	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10102		10103		10104		10105		10106	
Sample Date:			23-OCT-98		23-OCT-98		23-OCT-98		23-OCT-98		26-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.17	U	0.01	J	0.01	J	0.17	U
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18	U	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS108		TNTB-SS109		TNTB-SS110		TNTB-SS111		TNTB-SS112	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10107		10108		10109		10110		10111	
Sample Date:			26-OCT-98		26-OCT-98		26-OCT-98		26-OCT-98		26-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	9.7	J	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18	U	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS113		TNTB-SS114		TNTB-SS115		TNTB-SS116		TNTB-SS117	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10112		10113		10114		10115		10116	
Sample Date:			26-OCT-98		26-OCT-98		26-OCT-98		26-OCT-98		26-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U
2,4-Dinitrotoluene		mg/kg	4	U	23	J	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18	U	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS118		TNTB-SS119		TNTB-SS120		TNTB-SS121		TNTB-SS122	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10117		10118		10119		10120		10121	
Sample Date:			26-OCT-98		26-OCT-98		26-OCT-98		26-OCT-98		26-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.17	U	0.17	U	0.17	U	0.15	J
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18	U	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS123		TNTB-SS124		TNTB-SS125		TNTB-SS126		TNTB-SS127	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10122		10123		10124		10125		10126	
Sample Date:			26-OCT-98		26-OCT-98		26-OCT-98		26-OCT-98		23-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.01	J	0.17	U	0.17	U	0.17	U	0.09	J
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18	U	0.18	U	0.01	J
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS128		TNTB-SS129		TNTB-SS130		TNTB-SS131		TNTB-SS132	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10127		10128		10129		10130		10131	
Sample Date:			23-OCT-98		23-OCT-98		23-OCT-98		23-OCT-98		23-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.17	U	0.01	J	0.17	U	0.17	U
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18	U	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS133		TNTB-SS134		TNTB-SS135		TNTB-SS136		TNTB-SS137	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10132		10133		10134		10135		10136	
Sample Date:			23-OCT-98		23-OCT-98		23-OCT-98		23-OCT-98		25-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18	U	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS138		TNTB-SS139		TNTB-SS140		TNTB-SS141		TNTB-SS142	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10137		10138		10139		10140		10141	
Sample Date:			25-OCT-98		25-OCT-98		25-OCT-98		25-OCT-98		25-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.05	J	0.17	U	0.17	U	0.17	U
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.01	J	0.18	U	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS143		TNTB-SS144		TNTB-SS145		TNTB-SS146		TNTB-SS147	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10142		10143		10144		10145		10146	
Sample Date:			25-OCT-98		25-OCT-98		25-OCT-98		25-OCT-98		25-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18	U	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS148		TNTB-SS149		TNTB-SS150		TNTB-SS151		TNTB-SS152	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10147		10148		10149		10150		10151	
Sample Date:			25-OCT-98		25-OCT-98		25-OCT-98		25-OCT-98		25-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.17	U	0.17	U	0.01	J	0.17	U
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18	U	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS153		TNTB-SS154		TNTB-SS155		TNTB-SS156		TNTB-SS157	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10152		10153		10154		10155		10156	
Sample Date:			25-OCT-98		25-OCT-98		25-OCT-98		25-OCT-98		25-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17		0.20		0.20		0.17	U	0.17	U
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18	U	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS158		TNTB-SS159		TNTB-SS160		TNTB-SS161		TNTB-SS162	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10157		10158		10159		10160		10161	
Sample Date:			25-OCT-98		25-OCT-98		25-OCT-98		25-OCT-98		25-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.17	U	0.17	U	0.15	J	0.32	
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18	U	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS163		TNTB-SS164		TNTB-SS165		TNTB-SS166		TNTB-SS167	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10162		10163		10164		10165		10166	
Sample Date:			25-OCT-98		25-OCT-98		25-OCT-98		25-OCT-98		25-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18	U	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS168		TNTB-SS169		TNTB-SS170		TNTB-SS171		TNTB-SS172	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10167		10168		10169		10170		10171	
Sample Date:			25-OCT-98		25-OCT-98		25-OCT-98		27-OCT-98		27-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.17	U	0.17	U	0.01	J	0.17	U
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18	U	0.09	J	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS173		TNTB-SS174		TNTB-SS175		TNTB-SS176		TNTB-SS177	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10172		10173		10174		10175		10176	
Sample Date:			27-OCT-98		27-OCT-98		27-OCT-98		27-OCT-98		27-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	45	UJD	0.18	UJ	22.5	UJD	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.10	J	250	D	0.72		3.7	D	0.13	J
2,4-Dinitrotoluene		mg/kg	4	U	1000	UD	4	U	500	UD	4	U
2,6-Dinitrotoluene		mg/kg	4	U	1000	UD	4	U	500	UD	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.36		45	UD	0.19		2.40	JD	0.18	
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	45	UJD	0.18	UJ	22.5	UJD	0.18	UJ

Sample Location:			TNTB-SS178		TNTB-SS179		TNTB-SS180		TNTB-SS181		TNTB-SS182	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10177		10178		10179		10180		10181	
Sample Date:			27-OCT-98		27-OCT-98		27-OCT-98		27-OCT-98		27-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.28		0.17	U	0.65		0.17	U	0.76	
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.17	J	0.18	U	0.16	J	0.18	U	0.18	UJ
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS183		TNTB-SS184		TNTB-SS185		TNTB-SS186		TNTB-SS187	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10182		10183		10184		10185		10186	
Sample Date:			26-OCT-98		26-OCT-98		26-OCT-98		26-OCT-98		26-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.01	J	0.17	U	0.01	J	0.17	U	0.17	U
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18	U	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS188		TNTB-SS189		TNTB-SS190		TNTB-SS191		TNTB-SS192	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10187		10188		10189		10190		10191	
Sample Date:			26-OCT-98		26-OCT-98		27-OCT-98		27-OCT-98		29-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.17	U	0.17	U	0.17	U	0.01	J
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18	U	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS193		TNTB-SS194		TNTB-SS195		TNTB-SS196		TNTB-SS197	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10192		10193		10194		10195		10196	
Sample Date:			29-OCT-98		29-OCT-98		29-OCT-98		29-OCT-98		29-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.01	J	0.07	J	0.68		0.04	J
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.03	J	0.18	U	0.10	J	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS198		TNTB-SS199		TNTB-SS200		TNTB-SS204		TNTB-SS205	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10197		10198		10199		10203		10204	
Sample Date:			29-OCT-98		29-OCT-98		02-NOV-98		30-OCT-98		30-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.06	J	0.31		0.17	U	0.30		0.81	
2,4-Dinitrotoluene		mg/kg	4	U	7.0	J	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	UJ	0.18	U	0.03	J	0.27	
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS206		TNTB-SS207		TNTB-SS208		TNTB-SS209		TNTB-SS210	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10205		10206		10207		10208		10209	
Sample Date:			30-OCT-98		30-OCT-98		30-OCT-98		30-OCT-98		30-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.6	UJD	18	UJD	0.18	UJ	360	UJD
2,4,6-Trinitrotoluene		mg/kg	0.89		1.4	D	23	D	0.17	U	1200	D
2,4-Dinitrotoluene		mg/kg	4	U	12	UD	400	UD	4	U	8000	UD
2,6-Dinitrotoluene		mg/kg	4	U	12	UD	400	UD	4	U	8000	UD
2-Amino-4,6-dinitrotoluene		mg/kg	0.12	J	1.6	D	18	UD	0.18	U	360	UD
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.6	UJD	18	UJD	0.18	UJ	360	UJD

Sample Location:			TNTB-SS211		TNTB-SS212		TNTB-SS213		TNTB-SS215		TNTB-SS216	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10210		10211		10212		10214		10215	
Sample Date:			30-OCT-98		30-OCT-98		30-OCT-98		30-OCT-98		30-OCT-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	1800	UJD	360	UJD	0.6	UJD	0.36	UJD	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	2800	D	470	D	1.4	D	0.50	D	0.73	
2,4-Dinitrotoluene		mg/kg	40000	UD	8000	UD	13.3	UD	8	UD	4	U
2,6-Dinitrotoluene		mg/kg	40000	UD	8000	UD	13.3	UD	8	UD	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	1800	UD	360	UD	0.51	JD	0.11	JD	0.01	J
4-Amino-2,6-dinitrotoluene		mg/kg	1800	UJD	360	UJD	0.6	UJD	0.36	UJD	0.18	UJ

Sample Location:			TNTB-SS217		TNTB-SS218		TNTB-SS219		TNTB-SS220		TNTB-SS221	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10216		10217		10218		10219		10220	
Sample Date:			30-OCT-98		02-NOV-98		02-NOV-98		02-NOV-98		02-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.65		0.17	U	0.47		0.19		0.03	J
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.15	J	0.18	U	0.01	J	0.01	J	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS222		TNTB-SS223		TNTB-SS224		TNTB-SS225		TNTB-SS226	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10221		10222		10223		10224		10225	
Sample Date:			02-NOV-98		02-NOV-98		02-NOV-98		02-NOV-98		02-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	6	UJD	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	13	D	0.11	J	0.06	J	0.16	J	0.01	UJ
2,4-Dinitrotoluene		mg/kg	133	UD	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	133	UD	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	3.1	JD	0.08	J	0.18	U	0.18	U	0.31	
4-Amino-2,6-dinitrotoluene		mg/kg	6	UJD	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS227		TNTB-SS228		TNTB-SS229		TNTB-SS230		TNTB-SS231	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10226		10227		10228		10229		10230	
Sample Date:			02-NOV-98		02-NOV-98		02-NOV-98		02-NOV-98		02-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.17	U	0.17	U	0.22		0.21	
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18	U	0.06	J	0.09	J
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS232		TNTB-SS233		TNTB-SS234		TNTB-SS235		TNTB-SS236	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10231		10232		10233		10234		10235	
Sample Date:			02-NOV-98		02-NOV-98		02-NOV-98		02-NOV-98		02-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.9	UJD	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.13	J	0.17	U	0.02	J	2.3	D	0.47	
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	20	UD	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	20	UD	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18	U	0.79	JD	0.24	
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.9	UJD	0.18	UJ

Sample Location:			TNTB-SS237		TNTB-SS238		TNTB-SS239		TNTB-SS240		TNTB-SS241	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10236		10237		10238		10239		10240	
Sample Date:			02-NOV-98		02-NOV-98		02-NOV-98		02-NOV-98		02-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	3	UJD	0.18	UJ	3.6	UJD	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	3.4	D	0.48		6.1	D	0.17	U	0.08	J
2,4-Dinitrotoluene		mg/kg	67	UD	4	U	80	UD	4	U	4	U
2,6-Dinitrotoluene		mg/kg	67	UD	4	U	80	UD	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	1.4	JD	0.13	J	1.1	JD	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	3	UJD	0.18	UJ	3.6	UJD	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS242		TNTB-SS243		TNTB-SS244		TNTB-SS245		TNTB-SS246	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10241		10242		10243		10244		10245	
Sample Date:			02-NOV-98		02-NOV-98		02-NOV-98		02-NOV-98		02-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.47		0.01	J	0.17	U	0.07	J	0.39	
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18	U	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS247		TNTB-SS248		TNTB-SS249		TNTB-SS250		TNTB-SS251	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10246		10247		10248		10249		10250	
Sample Date:			02-NOV-98		02-NOV-98		02-NOV-98		02-NOV-98		03-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.01	J	0.18		0.01	J	0.40		0.17	U
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4.2	J	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18	U	0.10	J	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS252		TNTB-SS253		TNTB-SS254		TNTB-SS255		TNTB-SS256	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10251		10252		10253		10254		10255	
Sample Date:			03-NOV-98		03-NOV-98		03-NOV-98		03-NOV-98		03-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18	U	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS257		TNTB-SS258		TNTB-SS259		TNTB-SS260		TNTB-SS261	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10256		10257		10258		10259		10260	
Sample Date:			03-NOV-98		03-NOV-98		03-NOV-98		03-NOV-98		03-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.13	J	0.17	U	0.17	U	0.17	U
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18	U	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS262		TNTB-SS263		TNTB-SS264		TNTB-SS265		TNTB-SS266	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10261		10262		10263		10264		10265	
Sample Date:			03-NOV-98		03-NOV-98		03-NOV-98		03-NOV-98		03-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	18	UJD	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	66	D	0.62		0.17	U	0.06	J	0.66	
2,4-Dinitrotoluene		mg/kg	400	UD	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	400	UD	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	18	UD	0.23		0.18	U	0.18	U	0.06	J
4-Amino-2,6-dinitrotoluene		mg/kg	18	UJD	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS267		TNTB-SS268		TNTB-SS269		TNTB-SS270		TNTB-SS271	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10266		10267		10268		10269		10270	
Sample Date:			03-NOV-98		03-NOV-98		03-NOV-98		03-NOV-98		03-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.77	J	0.17	U	0.01	J	0.17	U
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.05	J	0.18	U	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS272		TNTB-SS273		TNTB-SS274		TNTB-SS275		TNTB-SS276	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10271		10272		10273		10274		10275	
Sample Date:			03-NOV-98		03-NOV-98		03-NOV-98		03-NOV-98		03-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18	U	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS277		TNTB-SS278		TNTB-SS279		TNTB-SS280		TNTB-SS281	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10276		10277		10278		10279		10280	
Sample Date:			03-NOV-98		04-NOV-98		04-NOV-98		04-NOV-98		04-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.23		0.21		0.17	U	0.36	
2,4-Dinitrotoluene		mg/kg	4	U	7.6	J	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18	U	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS282		TNTB-SS283		TNTB-SS284		TNTB-SS285		TNTB-SS286	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10281		10282		10283		10284		10285	
Sample Date:			04-NOV-98		04-NOV-98		04-NOV-98		06-NOV-98		06-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.46		0.45		0.22		0.17	U	0.17	U
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.34	J	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS287		TNTB-SS288		TNTB-SS289		TNTB-SS290		TNTB-SS291	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10286		10287		10288		10289		10290	
Sample Date:			06-NOV-98		06-NOV-98		06-NOV-98		06-NOV-98		06-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	6	UJD	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.10	J	0.02	J	14	D	0.17	U
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	130	UD	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	130	UD	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18	U	6	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	6	UJD	0.18	UJ

Sample Location:			TNTB-SS292		TNTB-SS293		TNTB-SS294		TNTB-SS295		TNTB-SS296	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10291		10292		10293		10294		10295	
Sample Date:			06-NOV-98		06-NOV-98		06-NOV-98		08-NOV-98		08-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	1.8	UJD	18	UJD	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	3.9	D	19	D	0.72		0.20		0.12	J
2,4-Dinitrotoluene		mg/kg	40	UD	400	UD	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	40	UD	400	UD	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	2.0		18	UD	0.21		0.21		0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	1.8	UJD	18	UJD	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS297		TNTB-SS298		TNTB-SS299		TNTB-SS300		TNTB-SS301	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10296		10297		10298		10299		10300	
Sample Date:			08-NOV-98		08-NOV-98		08-NOV-98		08-NOV-98		08-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.17	U	0.17	U	0.28		0.17	U
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18	U	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS302		TNTB-SS303		TNTB-SS304		TNTB-SS305		TNTB-SS306	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10301		10302		10303		10304		10305	
Sample Date:			08-NOV-98		08-NOV-98		08-NOV-98		08-NOV-98		08-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	8.2		4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18	U	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS307		TNTB-SS308		TNTB-SS309		TNTB-SS310		TNTB-SS311	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10306		10307		10308		10309		10310	
Sample Date:			08-NOV-98		08-NOV-98		08-NOV-98		08-NOV-98		08-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	180	UJD
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.17	U	0.55		0.06	J	720	D
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4000	UD
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4000	UD
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.07	J	0.18	U	180	UD
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	180	UJD

Sample Location:			TNTB-SS312		TNTB-SS313		TNTB-SS314		TNTB-SS315		TNTB-SS316	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10311		10312		10313		10314		10315	
Sample Date:			08-NOV-98		08-NOV-98		08-NOV-98		08-NOV-98		08-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.26	J	0.23		0.86		0.60		0.17	U
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	J	0.18	U	0.35		0.27		0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS317		TNTB-SS318		TNTB-SS319		TNTB-SS320		TNTB-SS321	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10316		10317		10318		10319		10320	
Sample Date:			08-NOV-98		08-NOV-98		09-NOV-98		09-NOV-98		09-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.15	J	0.03	J	0.17	U	0.47		0.09	J
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18	U	0.08	J	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS322		TNTB-SS323		TNTB-SS324		TNTB-SS325		TNTB-SS326	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10321		10322		10323		10324		10325	
Sample Date:			09-NOV-98		09-NOV-98		09-NOV-98		09-NOV-98		09-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.15	J	0.17	U	0.01	J	0.20		0.56	
2,4-Dinitrotoluene		mg/kg	4	U	4	U	1.3	J	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.01	J	0.18	U	0.09	J
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS327		TNTB-SS328		TNTB-SS329		TNTB-SS330		TNTB-SS331	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10326		10327		10328		10329		10330	
Sample Date:			09-NOV-98		09-NOV-98		09-NOV-98		09-NOV-98		09-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	1.8	UJD	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.05	J	0.40		0.25		3.5	D	0.16	J
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	40	UD	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	40	UD	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.01	J	0.18	U	1.8	UD	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	1.8	UJD	0.18	UJ

Sample Location:			TNTB-SS332		TNTB-SS333		TNTB-SS334		TNTB-SS335		TNTB-SS336	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10331		10332		10333		10334		10335	
Sample Date:			09-NOV-98		09-NOV-98		09-NOV-98		09-NOV-98		10-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.28		0.78		0.27		0.84	
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18		0.01	J	0.27	
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS337		TNTB-SS362		TNTB-SS362		TNTB-SS365		TNTB-SS366	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10336		10360		10361		10364		10365	
Sample Date:			10-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.36		0.17	U	0.28		0.17	U	0.17	U
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.02	J	0.18	U	0.18	U	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS368		TNTB-SS368		TNTB-SS369		TNTB-SS369		TNTB-SS370	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10367		10368		10369		10370		10371	
Sample Date:			06-NOV-98		06-NOV-98		06-NOV-98		06-NOV-98		06-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.17	UJ	0.17	U	0.17	U	0.52	
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.01	J	0.18	U	0.18	U	0.38	
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS370		TNTB-SS371		TNTB-SS372		TNTB-SS373		TNTB-SS373	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10372		10373		10374		10375		10376	
Sample Date:			06-NOV-98		06-NOV-98		06-NOV-98		06-NOV-98		06-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	18	UJD	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	25		0.07	J	0.17	U	0.17	U	0.17	U
2,4-Dinitrotoluene		mg/kg	400	UD	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	400	UD	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	18	U	0.18		0.18	U	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	18	UJD	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS374		TNTB-SS375		TNTB-SS375		TNTB-SS376		TNTB-SS376	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10377		10378		10379		10380		10381	
Sample Date:			06-NOV-98		06-NOV-98		06-NOV-98		06-NOV-98		06-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	1800	UJD	18	UJD	18	UJD	1.2	UJD
2,4,6-Trinitrotoluene		mg/kg	0.50		6100	D	76	D	110	D	2.7	D
2,4-Dinitrotoluene		mg/kg	4	U	4000	UD	400	UD	400	UD	27	UD
2,6-Dinitrotoluene		mg/kg	4	U	40000	UD	400	UD	400	UD	27	UD
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	1800	UD	18	UD	17	JD	1.2	UD
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	1800	UJD	18	UJD	18	UJD	1.2	UJD

Sample Location:			TNTB-SS377		TNTB-SS378		TNTB-SS379		TNTB-SS379		TNTB-SS380	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10382		10383		10384		10385		10386	
Sample Date:			06-NOV-98		08-NOV-98		08-NOV-98		08-NOV-98		08-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	6	UJD	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.07	J	18	D	0.17	U	0.15	J
2,4-Dinitrotoluene		mg/kg	4	U	4	U	130	UD	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	130	UD	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.49		6	UD	0.18	U	0.08	J
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	6	UJD	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS380		TNTB-SS381		TNTB-SS381		TNTB-SS382		TNTB-SS382	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10387		10388		10389		10390		10391	
Sample Date:			08-NOV-98		08-NOV-98		08-NOV-98		08-NOV-98		08-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.50		0.17	U	0.17	U	0.17	U	0.17	U
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.12	J	0.18	U	0.02	J	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS383		TNTB-SS383		TNTB-SS384		TNTB-SS384		TNTB-SS385	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10392		10393		10394		10395		10396	
Sample Date:			08-NOV-98		08-NOV-98		08-NOV-98		08-NOV-98		08-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.17	U	0.17	U	0.84		0.17	U
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18	U	0.06	J	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS386		TNTB-SS387		TNTB-SS387		TNTB-SS388		TNTB-SS389	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10397		10398		10399		10400		10401	
Sample Date:			08-NOV-98		08-NOV-98		08-NOV-98		08-NOV-98		08-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	3.6	UJD	0.45	UJD
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.17	U	0.17	U	5.2	D	1.6	D
2,4-Dinitrotoluene		mg/kg	4	U	17.3	J	4	U	80	UD	10	UD
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	80	UD	10	UD
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18	U	3.6	UJD	0.45	UD
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	3.6	UJD	0.45	UJD

Sample Location:			TNTB-SS389		TNTB-SS390		TNTB-SS391		TNTB-SS392		TNTB-SS392	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10402		10403		10404		10405		10406	
Sample Date:			08-NOV-98		08-NOV-98		08-NOV-98		08-NOV-98		08-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	18	UJD	3.6	UJD	0.45	UJD	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	46	D	19	D	2.4	D	0.37		0.64	
2,4-Dinitrotoluene		mg/kg	254.5	D	80	UD	10	UD	4	U	4	U
2,6-Dinitrotoluene		mg/kg	400	UD	80	UD	10	UD	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	42	D	2.4	JD	0.45	UD	0.37		0.04	J
4-Amino-2,6-dinitrotoluene		mg/kg	18	UJD	3.6	UJD	0.45	UJD	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS393		TNTB-SS393		TNTB-SS394		TNTB-SS394		TNTB-SS395	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10407		10408		10409		10410		10411	
Sample Date:			10-NOV-98		10-NOV-98		10-NOV-98		10-NOV-98		10-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	6	UJD	0.18	UJ	18	UJD	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	18	D	0.17	U	27	D	0.17	U	0.15	J
2,4-Dinitrotoluene		mg/kg	130	UD	4	U	400	UD	4	U	4	U
2,6-Dinitrotoluene		mg/kg	130	UD	4	U	400	UD	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	3.07	JD	0.18	U	18	UD	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	6	UJD	0.18	UJ	18	UJD	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS395		TNTB-SS396		TNTB-SS396		TNTB-SS397		TNTB-SS397	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10412		10413		10414		10415		10416	
Sample Date:			10-NOV-98		10-NOV-98		10-NOV-98		10-NOV-98		10-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.14	J	0.17	U	0.02	J	0.21	
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.12	J	0.18	U	0.03	J	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS398		TNTB-SS398		TNTB-SS399		TNTB-SS399		TNTB-SS400	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10417		10418		10419		10420		10421	
Sample Date:			10-NOV-98		10-NOV-98		10-NOV-98		10-NOV-98		10-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.28		0.29		0.17	U	0.17	U	0.17	U
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.39		0.53		0.18	U	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

Sample Location:			TNTB-SS400		TNTB-SS401		TNTB-SS401		TNTB-SS402		TNTB-SS402	
Associated Site:			TNTB		TNTB		TNTB		TNTB		TNTB	
Sample No:			10422		10423		10424		10425		10426	
Sample Date:			10-NOV-98		10-NOV-98		10-NOV-98		10-NOV-98		10-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr	Result	Lab Qlfr
1,3,5-Trinitrobenzene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
2,4,6-Trinitrotoluene		mg/kg	0.17	U	0.05	J	0.17	U	0.17	U	0.17	U
2,4-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2,6-Dinitrotoluene		mg/kg	4	U	4	U	4	U	4	U	4	U
2-Amino-4,6-dinitrotoluene		mg/kg	0.18	U	0.18	U	0.18	U	0.18	U	0.18	U
4-Amino-2,6-dinitrotoluene		mg/kg	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ

APPENDIX B

CALCULATION OF RESIDENTIAL SOIL PRELIMINARY REMEDIATION GOAL (PRG) CONCENTRATIONS FOR CHEMICALS WITHOUT VALUES TABULATED BY EPA REGION 9

Residential soil preliminary remedial goals (PRG) are not available in the U.S. Environmental Protection Agency (EPA) (1998) Region IX PRG tables for all of the chemicals identified in soil. PRGs can be derived using the EPA (1998) Region IX methodology and chemical-specific variable values (such as toxicity values) from approved sources. The chemicals, their chemical-specific values and their documentation, and the derived PRGs are provided below.

Chemical	RfDo (mg/kg-day)	RfDi (mg/kg-day	PEF	VFs	PRG (mg/kd-day)
2-Amino-4,6-DNT	6E-5[a]	6E-5[b]	1.32E+9[c]	NA[d]	3.3E+0 nc
4-Amino-2,6-DNT	6E-5[a]	6E-5[b]	1.32E+9[c]	NA[d]	3.3E+0 nc
Thallium	6.5E-5[e]	NA[f]	1.32E+9[c]	NA[d]	4.9E+0 nc
4,6-Dinitro-2-methylphenol	1E-4[g]	1E-4[b]	1.32E+9[c]	NA[d]	5.5E+0 nc
Benzo(g,h,i)perlyene	3E-2[h]	3E-2[b]	1.32E+9[c]	NA[d]	1.5E+3 nc
Phenanthrene	3E-2[h]	3E-2[b]	1.32E+9[c]	NA[d]	1.5E+3 nc
2-Methylnaphthalene	2E-2[i]	2E-2[b]	1.32E+9[c]	NA[d]	1.1E+3 nc
Acenaphthylene	6E-2[j]	6E-2[b]	1.32E+9[c]	NA[d]	2.6E+3 nc

RfDo = oral reference dose; RfDi = inhalation reference dose; PEF = particulate emission factor; VFs = volatilization-from-soil factor; PRG = preliminary remediation goal calculated by the EPA (1998) methodology; NA = not applicable; nc = based on a noncancer hazard index of 1.0.

[a] U.S. Environmental Protection Agency (EPA), 1993, ***Risk Assessment Issue Paper for: Derivation of Oral RfD for 2-Amino-4,6-Dinitrotoluene (CASRN 35572-78-2) and 4-Amino-2,6-Dinitrotoluene (CASRN 19406-51-0) By Analogy to 2,4,6-Trinitrotoluene, Systemic Toxicity Assessment***, National Center for Environmental Assessment, Cincinnati, OH, 23 February.

[b] U.S. Environmental Protection Agency (EPA), 1998, ***Region IX Preliminary Remediation Goals,*** U.S. EPA Region IX, San Francisco, California, May 1.

[c] Default from EPA (1998).

[d] VFs is evaluated only for readily volatile organic compounds; the compound of interest is assumed to be semivolatile or a non-volatile metal.

[e] The RfDo for thallium was estimated by adjusting the verified RfDo for thallium sulfate by the difference in molecular weight, assuming that the toxicity of thallium sulfate is mediated entirely by the thallium moiety and that the sulfate moiety is nontoxic (sulfate is endogenous to the mammalian body).

[f] The RfDo is not adopted as the RfDi for inorganic chemicals when chemical-specific values are not available (EPA, 1998).

[g] U.S. Environmental Protection Agency (EPA), 1995, ***Risk Assessment Issue Paper for: Provisional RfD for 4,6-Dinitro-o-cresol (also known as 4,6-dinitro-2-methylphenol) (CASRN 534-52-1)***, National Center for Environmental Assessment, Cincinnati, OH, 13 June.

[h] The verified RfDo for pyrene was used as a surrogate RfDo for this chemical.

[I] The verified RfDo for naphthalene was used as a surrogate RfDo for this chemical.

[j] The verified RfDo for acenaphthene was used as a surrogate RfDo for this chemical.

APPENDIX C

WILCOXON RANK SUM TEST FOR COMPARISON OF BACKGROUND CONCENTRATIONS OF METALS WITH CONCENTRATIONS MEASURED IN SURFACE SOIL AND COMBINED SURFACE AND SUBSURFACE SOIL

Table C-1

Wilcoxon Rank Sum Test of Site-Related and Background Soil Concentrations at the Former Plum Brook Ordnance Works Sandusky, Ohio

Copper in Surface Soil

Background		Site Related		Total Values	
Ranked Concentration (ppm)	Rank Order[a]	Ranked Concentration (ppm)	Rank Order[a]	Ranked Concentration (ppm)	Rank Order
1.45	1	6.9	3	1.45	1
3.9	2	7.6	4	3.9	2
14.4	7	8.3	5	6.9	3
25.3	12	8.8	6	7.6	4
30.1	17	19.9	8	8.3	5
56.2	33.0	21.7	9	8.8	6
		23.5	10	14.4	7
		24.4	11	19.9	8
		25.4	13	21.7	9
		28.2	14	23.5	10
		28.5	15	24.4	11
		28.9	16	25.3	12
		32	18	25.4	13
		33.3	19	28.2	14
		34.3	20	28.5	15
		34.7	21	28.9	16
		35.1	22	30.1	17
		35.2	23	32	18
		35.6	24	33.3	19
		36.2	25	34.3	20
		37.7	26	34.7	21
		38.6	27	35.1	22
		40.8	28	35.2	23
		43.9	29	35.6	24
		47.8	30	36.2	25
		47.9	31	37.7	26
		48.3	32	38.6	27
		445	34	40.8	28
Sum of Background Ranks (Bi)	72	Sum of Site-Related Ranks (Ci)	523	43.9	29
No. of Background Values (nBi)	6	No. of Site-Related Values (nCi)	28	47.8	30
No. of Total Values (N)	34	W	117	47.9	31
No. of Groups With Tie Values (g)	0	EW	84	48.3	32
No. of Ties in Group One (tone)	NA	SDW	22.13594	56.2	33
No. of Ties in Group Two (ttwo)	NA	Z	1.46820	445	34
No. of Ties in Group Three (tthree)	NA	Z95	1.645		
No. of Ties in Group Four (tfour)	NA	**Not Significantly Above Background with 95% confidence**			
No. of Ties in Group Five (tfive)	NA				
No. of Ties in Group Six (tsix)	NA				
No. of Ties in Group Seven (tseven)	NA				

a Tied values are ranked with the average rank order
Shading indicates background sample
NA Not applicable

Table C-2

Wilcoxon Rank Sum Test of
Site-Related and Background Soil Concentrations at the
Former Plum Brook Ordnance Works
Sandusky, Ohio

Copper in Surface and Subsurface Soil

Background		Site Related		Total Values	
Ranked Concentration (ppm)	Rank Order[a]	Ranked Concentration (ppm)	Rank Order	Ranked Concentration (ppm)	Rank Order
1.1	1.5	6.9	11	1.1	1
1.1	1.5	7.6	13	1.1	2
1.45	3	8.3	14	1.45	3
2.3	4	8.8	15	2.3	4
3.6	5	16.9	19	3.6	5
3.9	6	19.7	24	3.9	6
4	7	19.9	25	4	7
4.8	8	21.7	26	4.8	8
5.2	9	23.5	27	5.2	9
6.7	10	24.4	28	6.7	10
7.5	12	25.4	30	6.9	11
10	16	27.3	31	7.5	12
14	17	28.2	32	7.6	13
14.4	18	28.5	33	8.3	14
17	20	28.9	34	8.8	15
18.6	21	32	37	10	16
19.1	22	33.3	38	14	17
19.2	23	34.3	41	14.4	18
25.3	29	34.7	42	16.9	19
30.1	35	35.1	44	17	20
30.7	36	35.2	45	18.6	21
34	39.5	35.6	46	19.1	22
34	39.5	36.2	47	19.2	23
35	43	37.7	48	19.7	24
43.4	53	38.6	49	19.9	25
56.2	61	39.3	50	21.7	26
		40.4	51	23.5	27
		40.8	52	24.4	28
		43.9	54	25.3	29
		46	55	25.4	30
		46.1	56	27.3	31
		46.7	57	28.2	32
		47.8	58	28.5	33
		47.9	59	28.9	34
		48.3	60	30.1	35
		58.9	62	30.7	36
		60.1	63	32	37
		66.7	64	33.3	38
		445	65	34	39
Sum of Background Ranks (Bi)	540	Sum of Site-Related Ranks (Ci)	1605	34	40
No. of Background Values (nBi)	26	No. of Site-Related Values (nCi)	39	34.3	41
No. of Total Values (N)	65	W	825	34.7	42
No. of Groups With Tie Values (g)	2	EW	507	35	43
No. of Ties in Group One (tone)	2	SDW	74.67768	35.1	44
No. of Ties in Group Two (ttwo)	2	Z	4.25160	35.2	45
		Z95	1.645	35.6	46
				36.2	47
				37.7	48
				38.6	49
				39.3	50
				40.4	51
				40.8	52
				43.4	53
				43.9	54
				46	55
				46.1	56
				46.7	57
				47.8	58
				47.9	59
				48.3	60
				56.2	61
				58.9	62
				60.1	63
				66.7	64
				445	65

Significantly Above Background with 95% confidence

a Tied values are ranked with the average rank order
Shading indicates background sample

Table C-3

Wilcoxon Rank Sum Test of Site-Related and Background Soil Concentrations at the Former Plumb Brook Ordnance Works Sandusky, Ohio

Iron in Surface and Subsurface Soil

Background		Site Related		Total Values	
Ranked Concentration (ppm)	Rank Order[a]	Ranked Concentration (ppm)	Rank Order	Ranked Concentration (ppm)	Rank Order
5880	1	7340	4	5880	1
6610	2	7790	5	6610	2
7300	3	9030	6	7300	3
15000	14	9750	7	7340	4
17700	17	12500	8	7790	5
26700	35	13000	9	9030	6
29500	37	13400	10	9750	7
32200	40	14100	11	12500	8
34200	44	14300	12	13000	9
35000	45	14500	13	13400	10
37400	46	15100	15	14100	11
234000	51	15600	16	14300	12
		17800	18	14500	13
		17900	19	15000	14
		18800	20	15100	15
		18900	21	15600	16
		19300	22	17700	17
		19900	23	17800	18
		19900	24	17900	19
		20200	25	18800	20
		20200	26	18900	21
		20600	27	19300	22
		21000	28	19900	23
		21500	29	19900	24
		22400	30	20200	25
		23600	31	20200	26
		25500	32	20600	27
		26100	33	21000	28
		26600	34	21500	29
		27900	36	22400	30
		30500	38	23600	31
		30800	39	25500	32
		32800	41	26100	33
		33000	42	26600	34
		34000	43	25700	35
		37600	47	27900	36
		37900	48	29500	37
		40400	49	30500	38
		80000	50	30800	39
Sum of Background Ranks (Bi)	335	Sum of Site-Related Ranks (Ci)	991	32200	40
No. of Background Values (nBi)	12	No. of Site-Related Values (nCi)	39	32800	41
No. of Total Values (N)	51	W	211	33000	42
No. of Groups With Tie Values (g)	2	EW	234	34000	43
No. of Ties in Group One (tone)	2	SDW	45.03128	34200	44
No. of Ties in Group Two (ttwo)	2	Z	-0.52188	35000	45
		Z95	1.645	37400	46
				37600	47
				37900	48
				40400	49
				80000	50
				234000	51

Not Significantly Above Background with 95% confidence

a Tied values are ranked with the average rank order
Shading indicates background sample

Table C-4

Wilcoxon Rank Sum Test of Site-Related and Background Soil Concentrations at the Former Plum Brook Ordnance Works Sandusky, Ohio

Thallium in Surface Soil

Background		Site Related		Total Values	
Ranked Concentration (ppm)	Rank Order[a]	Ranked Concentration (ppm)	Rank Order[a]	Ranked Concentration (ppm)	Rank Order
0.55	3	0.55	3	0.55	1
0.55	3	0.55	3	0.55	2
0.6	16.5	0.55	3	0.55	3
0.6	16.5	0.6	16.5	0.55	4
0.65	30	0.6	16.5	0.55	5
1.3	32	0.6	16.5	0.6	6
		0.6	16.5	0.6	7
		0.6	16.5	0.6	8
		0.6	16.5	0.6	9
		0.6	16.5	0.6	10
		0.6	16.5	0.6	11
		0.6	16.5	0.6	12
		0.6	16.5	0.6	13
		0.6	16.5	0.6	14
		0.6	16.5	0.6	15
		0.6	16.5	0.6	16
		0.6	16.5	0.6	17
		0.6	16.5	0.6	18
		0.6	16.5	0.6	19
		0.6	16.5	0.6	20
		0.6	16.5	0.6	21
		0.6	16.5	0.6	22
		0.6	16.5	0.6	23
		0.65	30	0.6	24
		0.65	30	0.6	25
		0.65	30	0.6	26
		1.4	33.5	0.6	27
		1.4	33.5	0.65	28
				0.65	29
				0.65	30
				0.65	31
				1.3	32
				1.4	33
				1.4	34

Sum of Background Ranks (Bi)	101	Sum of Site-Related Ranks (Ci)	496
No. of Background Values (nBi)	6	No. of Site-Related Values (nCi)	28
No. of Total Values (N)	34	W	90
No. of Groups With Tie Values (g)	4	EW	84
No. of Ties in Group One (tone)	5	SDW	18.85577
No. of Ties in Group Two (ttwo)	22	Z	0.29169
No. of Ties in Group Three (tthree)	3	Z95	1.645
No. of Ties in Group Four (tfour)	2		
No. of Ties in Group Five (tfive)	0		
No. of Ties in Group Six (tsix)	0		
No. of Ties in Group Seven (tseven)	0		

Not Significantly Above Background with 95% confidence

a Tied values are ranked with the average rank order
Shading indicates background sample
NA Not applicable

Table C-5

Wilcoxon Rank Sum Test of
Site-Related and Background Soil Concentrations at the
Former Plum Brook Ordnance Works
Sandusky, Ohio

Thallium in Surface and Subsurface Soil

Background		Site Related		Total Values	
Ranked Concentration (ppm)	Rank Order [a]	Ranked Concentration (ppm)	Rank Order	Ranked Concentration (ppm)	Rank Order
0.55	4.5	0.55	4.5	0.55	1
0.55	4.5	0.55	4.5	0.55	2
0.6	21.5	0.55	4.5	0.55	3
0.6	21.5	0.55	4.5	0.55	4
0.6	21.5	0.55	4.5	0.55	5
0.6	21.5	0.55	4.5	0.55	6
0.6	21.5	0.6	21.5	0.55	7
0.6	21.5	0.6	21.5	0.55	8
0.65	37	0.6	21.5	0.6	9
1.2	40	0.6	21.5	0.6	10
1.3	41	0.6	21.5	0.6	11
2.7	44.5	0.6	21.5	0.6	12
2.7	44.5	0.6	21.5	0.6	13
2.75	46	0.6	21.5	0.6	14
2.8	48	0.6	21.5	0.6	15
2.8	48	0.6	21.5	0.6	16
2.8	48	0.6	21.5	0.6	17
2.85	51.5	0.6	21.5	0.6	18
2.85	51.5	0.6	21.5	0.6	19
2.85	51.5	0.6	21.5	0.6	20
2.85	51.5	0.6	21.5	0.6	21
2.9	54	0.6	21.5	0.6	22
2.95	55	0.6	21.5	0.6	23
3	56	0.6	21.5	0.6	24
3.05	57	0.6	21.5	0.6	25
		0.6	21.5	0.6	26
		0.65	37	0.6	27
		0.65	37	0.6	28
		0.65	37	0.6	29
		0.65	37	0.6	30
		1.4	42.5	0.6	31
		1.4	42.5	0.6	32
				0.6	33
				0.6	34
				0.65	35
				0.65	36
				0.65	37
				0.65	38
				0.65	39
				1.2	40
				1.3	41
				1.4	42
				1.4	43
				2.7	44
				2.7	45
				2.75	46
				2.8	47
				2.8	48
				2.8	49
				2.85	50
				2.85	51
				2.85	52
				2.85	53
				2.9	54
				2.95	55
				3	56
				3.05	57

Sum of Background Ranks (Bi)	963
No. of Background Values (nBi)	25
No. of Total Values (N)	57
No. of Groups With Tie Values (g)	7
No. of Ties in Group One (tone)	8
No. of Ties in Group Two (ttwo)	28
No. of Ties in Group Three (tthree)	5
No. of Ties in Group Four (tfour)	2
No. of Ties in Group Five (tfive)	2
No. of Ties in Group Six (tsix)	3
No. of Ties in Group Seven (tseven)	4

Sum of Site-Related Ranks (Ci)	690
No. of Site-Related Values (nCi)	32
W	162
EW	400
SDW	59.03463
Z	-4.04000
Z95	1.645

Not Significantly Above Background with 95% confidence

a Tied values are ranked with the average rank order
Shading indicates background sample

APPENDIX D

TOXICOLOGICAL PROFILES
FOR THE CHEMICALS OF POTENTIAL CONCERN

APPENDIX D
TOXICOLOGICAL PROFILES
FOR THE CHEMICALS OF POTENTIAL CONCERN

D.1.0 Introduction

Toxicological profiles are brief descriptions of the nature of the adverse effects associated with the COPCs selected for evaluation because their concentrations in one or more environmental media exceed a very conservatively derived risk-based screening concentration. It is important to note that a discussion of adverse effects without a discussion of dose is incomplete and potentially misleading, because virtually any chemical may be toxic at some dose, and many chemicals (e.g., nutritionally required minerals, vitamins, amino acids, etc.) enhance human health at some low dose. An ever growing and compelling body of evidence suggests that many environmental contaminants also enhance health at low doses (Hart, R.W. and L.T. Frame, 1996, "Toxicological Defense Mechanisms and How They May Affect the Nature of Dose-Response Relationships," ***Biological Effects of Low Level Exposure Newsletter***, 5[1]: 1-16).

When sufficient data are available, the U.S. Environmental Protection Agency (EPA) Integrated Risk Information System (IRIS) presents the EPA's Reference Dose (RfD)/Reference Concentration (RfC) Work Group-verified chronic toxicity values for threshold, or noncancer, effects, and the Carcinogen Risk Assessment Verification Endeavor Work Group-verified toxicity values for cancer risk. The toxicity values for noncancer effects include an RfD expressed in milligrams per kilogram per day (mg/kg-day) for chronic oral exposure, and a RfC, in milligrams per cubic meter (mg/m^3), for chronic inhalation exposure. The inhalation RfC in units of mg/m^3 may be converted to an equivalent inhalation RfD by assuming continuous chronic exposure of humans with a body weight of 70 kg and an inhalation rate of 20 m^3/day. In other words, the RfC expressed as mg/m^3 is multiplied by the inhalation rate of 20 m^3/day, and the result is divided by the body weight of 70 kg to yield an inhalation RfD expressed as mg/kg-day.

RfDs and RfCs are usually derived from empirical benchmark doses (BMD) or concentrations called no-observed-effect levels (NOEL) or no-observed-adverse-effect levels (NOAEL) from animal toxicity or human epidemiologic studies. If the data do not permit identifying a NOEL or NOAEL, a lowest-observed-adverse-effect level (LOAEL) or lowest-effect level (LEL) may be used. A frank-effect level (FEL), e.g., mortality, shortened life span or serious neurologic or behavioral disturbances, is generally considered an inappropriate benchmark from which to

develop an RfD or RfC. Some more recent derivations employ a BMD that is a statistically estimated dose for humans at which some low proportion of the population may experience some minimally adverse effect. A BMD at which 10 percent of the population may be expected to respond is expressed as BMD_{10}. The RfD or RfC is derived by dividing the benchmark level (e.g., NOAEL or BMD_{10}) by a series of uncertainty and modifying factors, collectively designated the uncertainty factor (UF).

For cancer effects, IRIS presents an EPA cancer weight-of-evidence group classification that reflects qualitatively the likelihood that the chemical is carcinogenic to humans. IRIS also presents a slope factor (SF) for oral exposure, expressed as the risk per mg/kg-day ingested dose, and a unit risk factor (URF) for inhalation exposure, expressed as the risk per $\mu g/m^3$ in ambient air. These quantitative estimates are generally provided for chemicals in EPA weight-of-evidence Groups A, B, and C if the data are adequate. The SF or URF is usually estimated as an upper bound on the slope of the dose- or concentration-response curve from animal toxicity or human epidemiologic studies. The inhalation URF in units of risk per micrograms per cubic meter ($\mu g/m^3$) may be converted to an equivalent inhalation SF in units of risk per mg/kg-day by assuming continuous lifetime exposure of humans with a body weight to 70 kg and an inhalation rate of 20 m^3/day. In other words, the URF expressed as risk per $\mu g/m^3$ is divided by the inhalation rate of 20 m^3/day, and multiplied by the assumed body weight of 70 kg and a conversion factor of 1,000 $\mu g/mg$.

Toxicity values are not estimated for acute toxicity and acute exposure is not evaluated in the RA. Nonetheless, the levels associated with acute lethality and data regarding the effects associated with acute exposure to levels higher than ordinarily observed in chronic environmental exposure provide additional perspective regarding the toxicity of the chemical. Therefore, this information is generally included in the profiles. Lethality data for laboratory animals are generally expressed as the oral dose associated with lethality of 50 percent of a test group (LD_{50}) or the concentration in air associated with lethality of 50 percent of a test group (LC_{50}).

The toxicity profiles also provide the documentation for the gastrointestinal (GI) absorption factor (GAF), which is used to develop the dermal RfD and SF. They also provide documentation for the dermal absorption factor (ABS), which describes the extent of dermal uptake from soil, and the permeability coefficient, which describes the rate of dermal uptake from water.

Aluminum

Aluminum is a naturally occurring metal used in a wide variety of metal applications, including packaging, kitchen utensils, auto bodies and components, airplanes and building components (Elinder and Sjogren, 1986). It is also used in cosmetics, food additives, and some pharmaceuticals and cosmetics.

Dietary intake accounts for the majority of human exposure to aluminum (Elinder and Sjogren, 1986); pharmaceuticals and medical procedures (e.g., dialysis treatment for kidney failure) are important sources of exposure for some individuals. A recent review (EPA, 1994) summarizes GI uptake in animals treated with single oral doses of aluminum chloride ranging from less than one percent (rabbits) to 27 percent (rats). The data indicate that dose and the animal species may be more important than chemical form in determining the extent of GI absorption. Human GI absorption data range from 0.1 to 0.3 percent, but the chemical form and dose were not reported. These observations suggest that GI absorption by rodents may exceed absorption by rabbits or humans. The toxicokinetic study selected for derivation of the GAF should approximate, as closely as possible, the conditions of the critical study (the study upon which the toxicity value is based). The provisional oral RfD is based on a study in mice with aluminum lactate in the diet. The toxicokinetic study most adequately reflecting the conditions of the key study (rodents, oral exposure, soluble form of aluminum) is the study that identified GI absorption of 27 percent in rats. Therefore, the absorption factor of 0.27 observed in rats is chosen as the GAF for this evaluation. Data were not located regarding the extent of dermal absorption of aluminum from soil. The Ohio Environmental Protection Agency (OEPA) (1998) default soil absorption factor ABS for metals of 0.01 is chosen for this evaluation.

Aluminum is relatively nontoxic via oral exposure to physiologically normal humans, but recently concern has arisen regarding neurological effects, including Alzheimer's disease and similar forms of dementia (EPA, 1994). Much of this concern stems from studies with large oral doses of soluble aluminum salts (e.g., aluminum hydroxide) and from medical procedures that bypass the GI absorption barrier. A review of several animal studies with many different forms of aluminum identified the developing infant as potentially the most sensitive member of the human population. A provisional chronic oral RfD of 1E+0 mg/kg-day was derived from a LOAEL of 100 mg/kg-day for minimal and equivocal neurological effects in the offspring of mice. The nervous system is the target organ for oral exposure to aluminum. The mice were fed diets fortified with aluminum lactate throughout gestation and lactation. An uncertainty factor of 100 was used. Confidence in the oral RfD is low.

Occupational exposure to aluminum metal dust and aluminum oxide is associated with pulmonary fibrosis and related respiratory effects such as cough, emphysema, pneumonia and decreased pulmonary function (American Conference of Governmental Industrial Hygienists [ACGIH], 1991; EPA, 1997). The toxicity of occupational exposure to dusts of aluminum pyro powders is somewhat higher, and occupational exposure to salts such as the sulfate and chloride may yield hydrolysis to the corresponding acids. Pulmonary effects were also observed in animals exposed to powders and dusts of metallic aluminum and various aluminum compounds.

Results of testing Canadian gold and uranium miners prophylactically treated with aluminum oxide powders to prevent silicosis associated aluminum exposure with impaired cognitive performance (EPA, 1997). The likelihood of cognitive impairment was directly related to the duration of exposure. Neurological performance was also impaired in aluminum foundry workers exposed to fumes and aluminum dust (4.6 to 11.5 mg aluminum/m^3) for a mean of 12 years. Other studies also implicate aluminum as a cause of neurological impairment and neurophysical effects in exposed smelter workers and aluminum welders. A provisional inhalation RfC is based on the LOAEL of 4.6 mg aluminum/m^3 in the study of foundry workers described above. The lower end of the exposure concentration adjusted for intermittent exposure is 1.64 mg/m^3. Application of an uncertainty factor of 300 yields an RfC of 5E-3 mg/m^3, which is equivalent to an inhalation RfD of 1.4E-3 mg/kg-day. Confidence in the inhalation RfC is medium. The nervous system is the target organ for inhalation exposure to aluminum.

Data were not located regarding the carcinogenicity of exposure to aluminum.

References for Aluminum

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U.S. Environmental Protection Agency (EPA), 1994, ***Risk Assessment Issue Paper for: Derivation of a Provisional Oral RfD for Aluminum (CASRN 7429-90-5)***, National Center for Environmental Assessment, Cincinnati, Ohio, June 20.

U.S. Environmental Protection Agency (EPA), 1997, ***Risk Assessment Issue Paper for: Derivation of Provisional Inhalation RfC for Aluminum (CASRN 7429-90-5)***, National Center for Environmental Assessment, Cincinnati, Ohio, June 20.

Arsenic

Arsenic is a natural element that occurs in both inorganic and organic forms (Agency for Toxic Substances and Disease Registry [ATSDR], 1989). Inorganic arsenic is more toxic than organic forms. Important releases to the atmosphere occur from nonferrous smelting operations, particularly in other countries. Major uses in the U.S. include its incorporation into wood preservatives and other agricultural chemicals.

Several studies confirm that soluble inorganic arsenic compounds and organic arsenic compounds are nearly completely (greater than 90 percent) absorbed from the GI tract in both animals and humans (Ishinishi et al., 1986). The absorption efficiency of insoluble inorganic arsenic compounds depends on particle size and stomach pH. Data regarding the dermal uptake of arsenic were not located. The GAF of 0.95 (EPA, 1993) and default ABS of 0.01 (OEPA, 1998) were chosen for this evaluation.

A lethal dose of arsenic trioxide in humans is 70 to 180 mg (≈50-140 mg arsenic [Ishinishi et al., 1986]). Acute oral exposure of humans to high doses of arsenic produces liver swelling, skin lesions, disturbed heart function and neurological effects. The only noncancer effects in humans clearly attributable to chronic oral exposure to arsenic are dermal hyperpigmentation and keratosis, as revealed by studies of several hundred Chinese exposed to naturally occurring arsenic in well water (EPA, 1999). Similar effects were observed in persons exposed to high levels of arsenic in water in Utah and the northern part of Mexico. Occupational (predominantly inhalation) exposure is also associated with neurological deficits, anemia, and cardiovascular effects (Ishinishi et al., 1986), but concomitant exposure to other chemicals cannot be ruled out. EPA (1999) verified an RfD of 3E-4 mg/kg-day for chronic oral exposure, based on a NOAEL of 8E-4 mg/kg-day for skin lesions from the Chinese data. An uncertainty factor of 3 was applied. Confidence in the RfD is medium. The principal target organs for arsenic appear to be the skin, nervous system and cardiovascular system. Inorganic arsenic may be an essential nutrient, exerting beneficial effects on growth, health and feed conversion efficiency (Underwood, 1977). The data are not sufficient for estimation of an inhalation RfC.

Inorganic arsenic is clearly a carcinogen in humans. Inhalation exposure is associated with increased risk of lung cancer in persons employed as smelter workers, in arsenical pesticide applicators, and in a population residing near a pesticide manufacturing plant (EPA, 1999). Oral exposure to high levels in well water is associated with increased risk of skin cancer (EPA, 1999). Extensive animal testing with various forms of arsenic given by many routes of exposure to several species, however, has not demonstrated the carcinogenicity of arsenic. EPA (1999) classified inorganic arsenic in cancer weight-of-evidence Group A (human carcinogen), and recommended an oral SF of 1.5E+0 per mg/kg-day, based on the incidence of skin cancer in the Chinese study. EPA (1999) noted that the uncertainties associated with the oral unit risk are considerably less than those for most carcinogens, so that the unit risk might be reduced an order of magnitude. An inhalation URF of 4E-3 per $\mu g/m^3$, equivalent to an inhalation SF of 1.5E+1 per mg/kg-day, was derived for inorganic arsenic from the incidence of lung cancer in occupationally exposed men.

References for Arsenic

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U.S. Environmental Protection Agency (EPA), 1993, "Oral and Dermal Absorption Factors for Multiple Chemicals (Fernald Environmental Management Project O.U. #4/Fernald, Ohio)," Memorandum from Joan Dollarhide, Environmental Criteria and Assessment Office, to Pat VanLeeuwen, Region V, dated July 21.

U.S. Environmental Protection Agency (EPA), 1999, Integrated Risk Information System (IRIS), On-line, Environmental Criteria and Assessment Office, Cincinnati, Ohio.

Chromium

Chromium is used largely in the metallurgical, refractory, and chemical industries (ATSDR, 1989). The largest amount is used in the metallurgical industry in various steels and nonferrous alloys. The second largest use is by the chemical industry in such products as pigments, metal finishing, leather tanning, and wood treatment.

A review of several studies suggests that 0.4 to 11 percent of orally administered chromium is absorbed by the GI tract of humans and animals, but valence and chemical form and nutritional status (fed vs. fasting) appear to influence efficiency of absorption (ATSDR, 1989). The average absorption efficiency of 5 percent reported by Jones and Owen (1989) for chromium VI is selected as the GAF for this evaluation. Quantitative data regarding dermal absorption of chromium were not located; therefore, the default ABS of 0.01 (OEPA, 1998) is adopted.

Chromium (III) is an essential nutrient involved in maintenance of normal fat, cholesterol and glucose metabolism (ATSDR, 1989). Acute ingestion of chromium (VI) compounds can induce kidney effects, but adverse effects have not been observed in humans or animals chronically exposed to low levels. EPA (1999) verified an RfD for chronic oral exposure to chromium (VI) of 3E-3 mg/kg-day based on a NOEL of 25 mg/L (2.5 mg/kg body weight/day) in the drinking water of rats exposed for one year. An uncertainty factor of 1000 was applied. Confidence in the oral RfD is low. EPA (1999) verified an RfD of 1.5E+0 mg/kg-day for chronic oral exposure to chromium (III) by applying an uncertainty factor of 1000 to a NOEL of 1800 g/kg (1.468 mg/kg body weight/day) as an average total ingested dose in a dietary study in which rats were given 600 feedings of chromic oxide baked into bread. No other dose levels were tested. Confidence in the RfD is low. No target organ was identified for the toxicity of oral exposure to chromium (VI) or chromium (III).

The oral RfD for chromium (VI) is 500-fold lower than the oral RfD for chromium (III). No adverse effects, however, were observed for ingestion exposure to either chromium (VI) or chromium (III). The difference in the oral RfDs, therefore, arises solely from the available data, and does not reflect differences in the chronic toxicity of ingestion exposure to low levels of chromium (VI) and chromium (III). Recent investigations reveal that ingested chromium (VI) is rapidly and virtually completely reduced to chromium (III) before reaching the blood stream (Kerger et al., 1997; Finley et al., 1997). Since there is no evidence of differences in toxicity, and since chromium (VI) is readily converted to chromium (III), the verified oral RfD of 1.5E+0 mg/kg-day for chromium (III) is used for oral exposure to total chromium.

Inhalation (occupational) exposure to chromium may induce respiratory symptoms, changes in lung function and irritation, erosion or perforation of the nasal septum, depending in part on the exposure level (EPA, 1993). No adverse effects were observed in workers exposed to 1E-3 mg/m^3 for 0.2 to 23.6 years (average 2.5 years). EPA (1998a, 1999) reviewed several human and animal studies, and determined that effects observed from inhalation exposure to chromium (VI) are not relevant to exposure to chromium (III). EPA (1998) concluded that chromium (VI) is the only species of concern for inhalation exposure to chromium.

EPA (1999) developed separate chronic inhalation RfC values for human exposure to chromic acid mists and dissolved chromium (VI) aerosols, and for exposure to chromium (VI) particulates. A verified inhalation RfC of 8E-6 mg/m^3 for chromic acid mists and dissolved chromium (VI) aerosols is based on an adjusted LOAEL of 7.14E-4 mg/m^3 associated with atrophy of the nasal septum in occupationally exposed humans. An uncertainty factor of 90 was used. Confidence in the inhalation RfC is low. The upper respiratory tract is considered the target organ for inhalation exposure to chromic acid mists and dissolved chromium (VI) aerosols. The RfC is equivalent to an inhalation RfD of 2.3E-6 mg/kg-day.

Inhalation exposure to chromium (VI) particulates is associated with pneumocyte toxicity; i.e., with effects on the lungs themselves. EPA (1999) derived an RfC of 1E-4 mg/m^3 for chronic inhalation exposure to chromium (VI) particulates from an adjusted benchmark concentration of 3.4E-2 mg/m^3 associated with altered enzyme activity in bronchioalveolar lavage fluid from rats exposed to sodium dichromate dust intermittently for up to 90 days. An uncertainty factor of 300 was used. Confidence in the RfC is medium. The RfC is equivalent to a chronic inhalation RfD of 2.9E-5 mg/kg-day. The lung is considered to be the target organ for chronic inhalation exposure to chromium (VI) particulates.

EPA (1998b) notes that exposure to chromic acid mists and dissolved chromium (VI) aerosols is likely to be restricted to occupational settings and that most environmental exposures would involve exposure to chromium (VI) particulates. The inhalation RfC for chromium particulates of 1E-4 mg/m^3 equivalent to an inhalation RfD of 2.9E-5 mg/kg-day will be used in this evaluation.

Chromium (VI) is classified in cancer weight-of-evidence Group A based on the consistent finding of lung cancer in epidemiologic studies of occupationally exposed workers in chromate production and the chrome pigment industry (EPA, 1998). There is no evidence that oral

exposure to chromium (VI) induces cancer. An inhalation URF of 1.2E-2 per $\mu g/m^3$ (equivalent to an inhalation SF of 4.2E+1 per mg/kg-day was based on increased risk of lung cancer deaths in chromate production workers.

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U.S. Environmental Protection Agency (EPA), 1998a, ***Combustion Technical Assistance Center (CTAC) Request No. 70: Chromium Values***, National Center for Environmental Assessment, Cincinnati, Ohio, September 22.

U.S. Environmental Protection Agency (EPA), 1998b, ***Combustion Technical Assistance Center (CTAC) Request No. 77: Information Regarding Chromium (III) and (VI) for Site-Specific Risk Assessment***, National Center for Environmental Assessment, Cincinnati, Ohio, October 5.

U.S. Environmental Protection Agency (EPA), 1999, ***Integrated Risk Information System (IRIS)***, National Center for Environmental Assessment, Cincinnati, Ohio, on line.

Copper

Copper is a naturally occurring metal used in its metallic form primarily in electrical applications, and in various alloys, including brass, bronze, gun metal and Monel metal (ATSDR, 1990).

A toxicokinetic study with single oral doses of radioactive copper in humans measured uptake from the GI tract ranging from 15 to 97 percent (average of 60 percent) of the administered dose (ATSDR, 1990). For the purposes of this evaluation the GAF of 0.6 is used (EPA, 1992). Data regarding the dermal uptake of copper were not located. The OEPA (1998) default ABS of 0.01 is chosen for this evaluation.

Copper is a nutritionally required trace element that is incorporated into several enzymes and other macromolecules in the body (ATSDR, 1990). Normal homeostatic mechanisms prevent systemic absorption of toxic amounts except in severe overload, such as ingestion of large quantities of copper sulfate in a suicide attempt. The only known syndrome of chronic copper toxicity in humans is a heritable autosomal recessive trait known as Wilson's disease. In this disease, the normal homeostatic mechanisms fail and toxic levels of copper accumulate in the liver and kidney, resulting in liver and kidney disease and hemolytic anemia. EPA (1994) reviewed subchronic oral toxicity data in rats and pigs that identify the liver as the primary target organ. EPA (1994) determined that the data were insufficient for development of a chronic oral RfD, but identified 4E-2 to 7E-2 mg/kg-day as "guidance" for oral exposure to copper. The lower limit of this range, 4E-2 mg/kg-day, is adopted in place of a chronic oral RfD for the purposes of this evaluation. Target organs for the chronic oral toxicity of copper include the liver, kidney and erythrocyte.

Inhalation (occupational) exposure to copper fume is associated with irritation of the upper respiratory tract, altered taste sensation, nausea and metal fume fever (ACGIH, 1991). Symptoms similar to metal fume fever are reported for occupational exposure to metallic copper dust. Inhalation of dusts and mists of copper salts may induce nasal and pharyngeal irritation, possibly with nasal septal perforation. The inhalation data are inadequate for development of an inhalation RfC or RfD.

EPA (1999) classified copper in cancer weight-of-evidence Group D (not classifiable as to carcinogenicity to humans). Quantitative cancer risk estimates are not derived for Group D chemicals.

References for Copper

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U.S. Environmental Protection Agency (EPA), 1999, Integrated Risk Information System (IRIS), On-line, Environmental Criteria and Assessment Office, Cincinnati, Ohio.

Iron

Iron is a very abundant, ubiquitous, naturally occurring mineral element that constitutes approximately 5 percent of the earth's crust (Spivey Fox and Rader, 1988). Its primary use is in making steels and other metals that have a wide range of application. Less than 1 percent of iron is used to make iron compounds that have application in dyes and pigments, water treatment, organic chemical synthesis, and medicinal preparations.

Estimates of GI absorption efficiency in humans range from 2 to 20 percent in normal humans, and 20 to 60 percent in humans with iron-deficiency anemia (Elinder, 1986). Iron from animal sources is absorbed more readily (10 to 25 percent) than iron from vegetables and grains (1 to 10 percent). High levels of other trace elements decrease the extent of GI uptake of iron. For this evaluation, the GAF of 10 percent (0.1) is chosen as an estimate of average for normal humans. The OEPA (1998) default soil absorption factor ABS for metals of 0.01 is chosen for this evaluation.

Iron is a nutritionally required trace element that forms an integral part of hemoglobin, myoglobin and several enzymes (Spivey Fox and Rader, 1988). Acute ingestion of large quantities (e.g., children may ingest several ferrous sulfate tablets with candy-like coating) results in severe GI irritation and, in some cases, liver damage (Elinder, 1986). Chronic iron toxicity is seldom observed in humans with normal homeostatic control of iron absorption (EPA, 1993). A

noteworthy exception is the occurrence of hepatic hemosiderosis and fibrosis in Bantus who regularly consumed Kaffir beer, an acid beer brewed in iron vessels. EPA (1993) derived a chronic oral RfD of 3E-1 mg/kg-day based on average iron intakes obtained from a nutritional dietary survey. An uncertainty factor of 1 was applied. Confidence in the RfD is medium. Based on other data reviewed by EPA (1993), it appears that the liver is an important target organ for oral toxicity, but hemosiderosis also occurs in the heart, pancreas, and endocrine glands.

The appropriateness of the oral RfD for iron is controversial, especially for use with exposure to iron in soil. The oral RfD reflects estimates of iron intakes based on nutritional surveys, but identifies neither a NOAEL nor LOAEL for iron ingestion. In other words, it is entirely possible that a much higher level of dietary iron intake would be innocuous, although this possibility is not evaluated in the oral RfD documentation.

In addition, it is likely that the forms of iron present in the plant and animal products that comprise the diets evaluated in the nutritional survey are more bioavailable than those present in soil, sediment, or other non-aqueous environmental media. There are only two known instances of toxicity to iron following oral exposure. One involves acute ingestion of large quantities of soluble forms formulated to enhance bioavailability for their medicinal effects. The other is the occurrence of hemosiderosis in Bantu consuming Kaffir beer. It has been established, however, that the iron in the beer is present in a soluble form that is as bioavailable as the iron in ferric chloride. Presumably, high bioavailability is important in development of toxicity to ingested iron. Iron in soil would be subject to binding to other minerals (matrix effect), and the presence of other minerals would reduce the extent to which iron ingested in soil is absorbed.

Inhalation (occupational) exposure to iron oxide fumes may lead to radiographic densities in the lungs without demonstrable clinical effects (ACGIH, 1991). Inhalation of dusts or mists of ferric salts may irritate the respiratory tract. Inhalation data are insufficient for derivation of an inhalation RfC or RfD.

Data regarding the potential carcinogenicity of iron were not located.

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U.S. Environmental Protection Agency (EPA), 1995, ***Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment (Interim)***, Waste Management Division, Office of Health Assessment, EPA Region 4, Atlanta, Georgia, November.

Lead

Lead is a naturally occurring metal used in the manufacture of batteries, ammunition, and other metal products (ATSDR, 1988).

Studies in humans indicate that an average of 10 percent of ingested lead is absorbed, but estimates as high as 40 percent were obtained in some individuals (Tsuchiya, 1986). Nutritional factors have a marked effect on GI absorption efficiency. Children absorb ingested lead more efficiently than adults; absorption efficiencies up to 53 percent were recorded for children three months to eight years of age. Similar results were obtained for laboratory animals; absorption efficiencies of 5 to 10 percent were obtained for adults and equal to or greater than 50 percent were obtained for young animals. Data were not located regarding dermal uptake of lead from soil. For purposes of this evaluation, the GAF of 0.1 (EPA, 1993) and the default ABS of 0.01 (OEPA, 1998) were chosen.

The noncancer toxicity of lead to humans has been well characterized through decades of medical observation and scientific research (EPA, 1999). The principal effects of acute oral exposure are gastrointestinal colic with diffuse paroxysmal abdominal pain (probably due to vagal irritation), anemia, and, in severe cases, acute encephalopathy, particularly in children (Tsuchiya, 1986). The primary effects of long-term exposure are neurological and hematological. Limited occupational data indicate that long-term exposure to lead may induce kidney

damage. The principal target organs of lead toxicity are the nervous system and the erythrocyte. Some of the effects on the blood, particularly changes in levels of certain blood enzymes, and subtle neurobehavioral changes in children, appear to occur at levels so low as to be considered nonthreshold effects. In part for this reason the EPA (1990, 1999) considered inappropriate the derivation of an RfD for chronic oral exposure.

The Integrated Exposure, Uptake Biokinetic Model (IEUBK) Version 0.99D (EPA, 1994) is generally used to evaluate lead in children, the most sensitive receptor. The IEUBK model integrates lead uptake from inhalation, drinking water, diet, soil and dust ingestion, and ingestion of incidental sources such as chips of lead-based paint, and estimates blood lead concentrations over the first 7 years of a child's life. Generally, it is considered that childhood blood lead levels below 10 micrograms per deciliter (µg/dL) reflect minimal likelihood of adverse effects from exposure to lead.

EPA (1999) classified lead in cancer weight-of-evidence Group B2 (probable human carcinogen), based on inadequate evidence in humans and sufficient animal evidence. The human data consist of several epidemiologic occupational studies that yield confusing results. All the studies lacked quantitative exposure date and failed to control for smoking and concomitant exposure to other possibly carcinogenic metals. Rat and mouse bioassays showed statistically significant increases in renal tumors following dietary and subcutaneous exposure to several soluble lead salts. Various lead compounds were observed to induce chromosomal alterations in vivo and in vitro, sister chromatid exchange in exposed workers and cell transformation in Syrian hamster embryo cells, to enhance simian adenovirus induction, and to alter molecular processes that regulate gene expression. EPA (1999) declined to estimate risk for oral exposure to lead because many factors (e.g., age, general health, nutritional status, existing body burden, and duration of exposure) influence the bioavailability of ingested lead, introducing a great deal of uncertainty into any estimate of risk.

References for Lead

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U.S. Environmental Protection Agency (EPA), 1999, Integrated Risk Information System (IRIS), On-line, Environmental Criteria and Assessment Office, Cincinnati, Ohio.

Manganese

Manganese is a naturally occurring metal used in the manufacture of steel and other metallurgical processes, batteries, and various manganese-containing chemicals (Keen and Leach, 1988).

Keen and Leach (1988) reported that approximately 3 percent of dietary manganese is absorbed, regardless of the amount present in the diet. This value was selected as the GAF. The ABS of 0.01 is an OEPA (1998) default for metals for which empirical data are lacking.

Manganese is nutritionally required in humans for normal growth and health (EPA, 1999). Humans exposed to approximately 0.8 mg manganese/kg-day in drinking water exhibited lethargy, mental disturbances (1/16 committed suicide) and other neurologic effects. The elderly appeared to be more sensitive than children. Oral treatment of laboratory rodents induces biochemical changes in the brain, but rodents do not exhibit the neurological signs exhibited by humans. Occupational exposure to high concentrations in air induce a generally typical spectrum of neurological effects, and increased incidence of pneumonia (ACGIH, 1991).

EPA (1999) derived an oral RfD for manganese of 1.4E-1 mg/kg-day from a NOAEL of 1.4E-1 mg/kg-day for neurologic effects from human dietary studies and an uncertainty factor of 1. Confidence in the RfD is medium. EPA (1998) recommends that a modifying factor of 3 should be used to adjust the RfD for use when oral exposure involves non-dietary ingestion. The oral

RfD resulting from application of the modifying factor, 4.7E-2 mg/kg-day, will be used for this evaluation. The nervous system is the target organ for chronic oral exposure to manganese.

EPA (1999) presents a verified chronic inhalation RfC of 5E-5 mg/m^3 (equivalent to an inhalation RfD of 1.4E-5 mg/kg-day) based on a LOAEL for neurological effects in occupationally exposed humans and an uncertainty factor of 1,000. Confidence in the RfC is medium. The nervous system is the target organ for inhalation exposure to manganese.

EPA (1999) classified manganese in cancer weight-of-evidence Group D (not classifiable as to carcinogenicity to humans).

References for Manganese

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Thallium

Thallium is a naturally occurring metal widely used in the semiconductor industry (ATSDR, 1992). Thallium compounds are used in a variety of applications, including pharmaceuticals, semiconductors, photoelectric cells, optical systems, ore separation, glass production, and as an oxidizing agent in organic synthesis. An important former use of thallium and its compounds (before 1972) was in pesticide formulations for the control of insects and rodents.

Thallium is efficiently absorbed from the GI tract; human and animal studies with radioactive thallium nitrate suggest that absorption approaches 100 percent (ATSDR, 1992). The GAF of 1.0 is used for this evaluation. Data were not located regarding dermal uptake of thallium; the OEPA (1998) default ABS of 0.01 will be used for this evaluation.

Thallium is highly toxic. Acute oral exposure to thallium and its compounds may cause death preceded by neurological disturbances and effects on the lungs, heart and liver (ATSDR, 1992). Formerly, thallium was used medicinally to induce alopecia in cases of ringworm of the scalp, sometimes with disastrous results. The critical effect of chronic oral exposure to low levels of thallium compounds in animals and humans is alopecia (ACGIH, 1992; EPA, 1999). EPA (1999) developed chronic oral RfDs for several thallium salts (thallium acetate, thallium carbonate, thallium chloride, thallium nitrate, and thallium sulfate) based on a study with thallium sulfate. The oral RfD for thallium sulfate of 8E-5 mg/kg-day was based on a NOAEL of 0.25 mg/kg-day in rats treated by gavage with thallium sulfate for 90 days. No adverse effects were seen in this study. Effects on the testis and kidney were observed in rats exposed to higher dose rates. An uncertainty factor of 3000 was used. Confidence in the RfD is low. Other studies suggest that the skin (alopecia) may be the critical target organ for oral exposure to thallium. The chronic oral RfD for thallium sulfate of 8E-5, when adjusted for differences in molecular weight, is equivalent to an oral RfD for thallium of 6.5E-5 mg/kg-day. This adjustment is based on the assumption that the toxicity of thallium sulfate is due entirely to thallium, rather than to the sulfate moiety. Effects on the testis and kidney are observed in rats exposed to higher dose rates.

Inhalation exposure data are very limited. An occupational study suggests that neurological effects may develop following prolonged inhalation exposure (ATSDR, 1992). The nervous system appears to be more sensitive than the skin as a target organ for inhalation exposure. The data are inadequate for estimation of an inhalation RfC or RfD.

Several thallium compounds (thallium oxide, thallium acetate, thallium carbonate, thallium chloride, thallium nitrate, thallium sulfate) are classified as cancer weight-of-evidence Group D substances (not classifiable as to carcinogenicity to humans) (EPA, 1999). No weight-of-evidence classification was located for thallium alone, but the Group D classification can be applied to thallium. Quantitative cancer risk estimates are not derived for Group D chemicals.

References for Thallium

Agency for Toxic Substances and Disease Registry, (ATSDR), 1992, ***Toxicological Profile for Thallium***, U.S. Public Health Service, Atlanta, Georgia.

Ohio Environmental Protection Agency (OEPA), 1998, ***U.S. NASA Plum Brook, Erie County, Ohio LD #: 332-0552, Risk Assessment Work Plans***, letter from R. E. Nabors, Site Coordinator, to L. S. Ingram, Department of the Army, 22 June.

U.S. Environmental Protection Agency (EPA), 1999, ***Integrated Risk Information System (IRIS)***, On-line, Environmental Criteria and Assessment Office, Cincinnati, Ohio.

Nitroaromatic Chemicals

Aminodinitrotoluenes

The aminodinitrotoluene (ADNT) are present in environmental media presumably as break-down products of 2,4,6-trinitrotoluene (TNT) (ATSDR, 1993).

Data regarding the extent of GI absorption of the ADNTs were not located in the available literature. ATSDR (1993) summarized the results of toxicokinetic studies in which a single oral dose of radiolabeled TNT was given to rats, mice, dogs, and rabbits, and radiolabel was quantified in various body compartments 24 hours after dosing. The appearance of red pigment in the urine of the rats and mice indicated that absorption is rapid. Urinary recovery accounted for approximately 60 percent of the dose in rats, mice, and dogs, and 74 percent of the dose in rabbits. The extent of urinary recovery may serve as a conservative estimate of the extent of GI absorption. Assuming that the ADNTs may be absorbed to the same extent as TNT, the GAF for TNT of 0.6 is also adopted for the ADNTs.

Data regarding the extent of dermal uptake of the ADNTs from soil were not located. The OEPA (1998) default ABS of 0.1 for organic compounds is adopted for this evaluation.

Data regarding the acute toxicity of oral exposure to the ADNTs are limited to LD_{50} values. Oral LD_{50} values in rats and mice are summarized below (EPA, 1993a):

Oral LD_{50} Values in Rats (mg/kg)		
Chemical	Males	Females
TNT	1010	820
2-Amino-4,6-DNT	2240	1394
4-Amino-2,6-DNT	1360	959
Oral LD_{50} Values in Mice (mg/kg)		
TNT	1009	1014
2-Amino-4,6-DNT	1522	1722
4-Amino-2,6-DNT	1342	1495

The data suggest that the acute toxicity of the ADNTs is not greater than TNT.

Data were not located regarding the chronic oral toxicity of the ADNTs. EPA (1993a) evaluated the toxicity of TNT and the 2,4-DNT, and concluded that TNT is the more appropriate surrogate for the ADNTs. A verified oral RfD for TNT of 5E-4 mg/kg-day is based on a LOAEL for liver effects of 0.5 mg/kg-day in a 26-week feeding study in dogs (EPA, 1999). An uncertainty factor of 1000 was applied. EPA (1993a) estimated a LOAEL for the ADNTs of 0.58 mg/kg-day by adjusting the TNT LOAEL of 0.5 mg/kg-day by the difference in molecular weight (MW) (i.e., MW of TNT divided by MW of ADNT). Application of an uncertainty factor of 10,000 yields a provisional RfD for chronic oral exposure of the ADNTs of 5.8E-5 mg/kg-day, which is rounded to 6E-5 mg/kg-day. The liver is assumed to be the target organ for prolonged oral exposure to the ADNTs. Confidence in the provisional oral RfD is low.

EPA (1993b) classified the ADNTs in EPA cancer weight-of-evidence Group D, not classifiable as to carcinogenicity in humans, to reflect a total lack of human or animal data.

References for Aminodinitrotoluenes

Agency for Toxic Substances and Disease Registry (ATSDR), 1993, ***Toxicological Profile for 2,4,6-Trinitrotoluene***, Draft for Public Comment, U.S. Department of Health and Human Services, May.

Ohio Environmental Protection Agency (OEPA), 1998, ***U.S. NASA Plum Brook, Erie County, Ohio LD #: 332-0552, Risk Assessment Work Plans***, letter from R.E. Nabors, Site Coordinator, to L.S. Ingram, Department of the Army, June 22.

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Dinitrotoluene

The dinitrotoluene (DNT) isomers that are the subject of this evaluation are limited to 2,4- and 2,6-DNT. The DNTs are used predominantly as intermediates in the production of polyurethanes (ATSDR, 1989). Another use is as a gelatinizing and waterproofing agent in the production of explosives. The DNTs may appear in environmental media as breakdown products of TNT.

The rapid disappearance of radioactivity from the small intestine of rats following oral administration of radiolabeled 2,4- or 2,6-DNT suggests that absorption from the GI tract is rapid and essentially complete (ATSDR, 1989; EPA, 1992). Species differences in the excretion of DNT, however, confound quantification of the extent of GI absorption. Fecal excretion and the GI tract (tissue + contents) accounted for 9.2 to 17.3 percent of the dose of radioactivity 24 hours after administration of radiolabeled 2,4-DNT to rats, rabbits, dogs, and monkeys, and 83.1 to 85 percent in mice in the same study (EPA, 1992). Biliary excretion is more important in mice than in the other species tested. Data from the rats, rabbits, dogs, and monkeys suggest that a GAF of 0.9 may be reasonable, which is adopted for this evaluation. Data regarding dermal uptake from soil were not located; therefore, the OEPA (1998) default ABS of 0.1 is chosen.

Acute oral exposure to 2,4-DNT induces methemoglobinemia; dogs appear to more sensitive than rats, which are more sensitive than mice (ATSDR, 1989). Oral LD_{50} values include 270 mg/kg for rats and 1,630 mg/kg for mice. The lethality of oral exposure to 2,6-DNT appears to be somewhat less dependent on species. Oral LD_{50} values for rats (665 mg/kg) and mice (714 mg/kg) are similar. Dogs, however, appear to be more sensitive than rodents in subchronic studies.

A verified chronic oral RfD or 2E-3 mg/kg-day for 2,4-DNT is based on neurotoxicity, hematologic effects and biliary tract hyperplasia in dogs given capsules containing 2,4-DNT for 2 years (EPA, 1999). Progressive paralysis, accompanied by degenerative lesions in the central nervous system, were observed in dogs treated with 10 mg/kg-day. Hematologic effects, including methemoglobinemia and its sequelae, were observed in dogs treated with 1.5 mg/kg-day, which is the LOAEL for this study. No adverse effects were observed in dogs treated with 0.2 mg/kg-day. Application of an uncertainty factor of 100 to the NOAEL of 0.2 mg/kg-day yields an RfD of 2E-3 mg/kg-day. Confidence in the RfD is high. The nervous system, erythrocyte and liver appears to be the target organs for prolonged oral exposure, at least in dogs.

A provisional oral RfD of 1E-3 mg/kg-day for 2,6-DNT is based on a 13-week dietary study with 2,6-DNT in dogs (EPA, 1997). The NOAEL in this study was 4 mg/kg-day, somewhat higher than the LOAEL for 2,4-DNT. An uncertainty factor of 3,000 was applied. The nervous system, erythrocyte, liver and kidney appear to be the target organs for prolonged oral exposure to 2,6-DNT. The oral data in dogs suggest that the 2,6-isomer is somewhat less toxic than the 2,4-isomer for prolonged oral exposure. The oral RfD for the 2,6-isomer, however, is less than the oral RfD for the 2,4-isomer. This apparent contradiction is an artifact of the lesser quality data base for 2,6-DNT and, consequently, the higher uncertainty factor used to derive the RfD for the 2,6-isomer.

Occupational studies indicate that acute exposure to DNT causes methemoglobinemia, which produces headache, irritability, dizziness, weakness, nausea, vomiting, dyspnea, drowsiness, unconsciousness and, in extreme cases, death (ACGIH, 1991). Occupational exposure may lead to increased risk of ischemic heart disease, possibly arising from decreased oxygen-carrying capacity of the blood. The data are insufficient to develop inhalation RfCs for the DNT isomers.

EPA (1999) classified the 2,4-/2,6-DNT mixture in EPA cancer weight-of-evidence Group B2 (probably human carcinogen) on the basis of multiple tumor types in male and female rats and renal tumors in male mice in several dietary studies. Occupational data provide no evidence of carcinogenicity, but the studies reviewed lack the power to reveal small differences in cancer risk (ACGIH, 1991). EPA (1999) verified an oral SF of 6.8E-1 per mg/kg-day for exposure to the 2,4-/2,6-DNT mixture based on an increased incidence of a variety of tumors in female rats. The test material contained about 98 percent 2,4-DNT and 2 percent 2,6-DNT. Other studies suggest that much of the carcinogenicity of the mixture is the result of the 2,6-isomer. The B2 classification and the oral SF of 6.8E-1 per mg/kg-day are used in this evaluation for either isomer and the 2,4-/2,6-DNT mixture. The data are insufficient for development of potency factors for inhalation exposure.

References for Dinitrotoluenes

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Nitrotoluenes

Nitrotoluene consists of three isomers: o-nitrotoluene (1-methyl-2-nitrobenzene), m-nitrotoluene (1-methyl-3-nitrobenzene) and p-nitrotoluene (1-methyl-4-nitrobenzene) (Lewis, 1997). The nitrotoluenes, particularly the o- and p-isomers, are used as intermediates in the synthesis of other organic chemicals, particularly rubber and agricultural chemicals, dyes and pigments. The nitrotoluenes meet the specifications of volatile organic compounds, since all isomers have Henry's law constants greater than 1E+5 atmosphere-m^3/mole (Montgomery, 1996) and molecular weights less than 200 g/mole.

Data regarding the extent of GI absorption of the nitrotoluenes were not located in the available literature. Lacking empirical data, the default GAF of 1 (OEPA, 1999) is selected for these chemicals. Data regarding the dermal uptake of the nitrotoluenes from soil were not located in the available literature; the OEPA (1998) default ABS of 0.1 is selected for this evaluation.

Data regarding the acute toxicity of oral exposure to the nitrotoluenes were not located. A 13-week dietary study with the three nitrotoluene isomers in rats and mice indicated that effects were most notable with o-nitrotoluene (ACGIH, 1991). Effects included biochemical evidence of altered liver function, and splenic and renal lesions. EPA (1997) derived a provisional RfD of 1E-2 mg/kg-day for chronic oral exposure to all three nitrotoluene isomers from data for o-nitro-

toluene. In the key study, rats were treated by gavage for 6 months. The LOAEL was 200 mg/kg-day associated with lesions in the spleen, which is considered the target organ for chronic oral exposure to the nitrotoluenes. An uncertainty factor of 10,000 was applied to the LOAEL. The derivation of the provisional RfD is unclear, because dividing the LOAEL of 200 mg/kg-day by an uncertainty factor of 10,000 would be expected to yield an RfD of 2E-2 mg/kg-day, not 1E-2 mg/kg-day as reported by EPA (1997).

Data regarding the toxicity of inhalation exposure to the nitrotoluenes were not located in the available literature. The data are inadequate for developing an inhalation RfC.

Data regarding the potential carcinogenicity of the nitrotoluenes were not located in the available literature.

References for Nitrotoluenes

American Conference of Governmental Industrial Hygienists (ACGIH), 1991, ***Documentation of the Threshold Limit Values and Biological Exposure Indices***, Sixth Edition, ACGIH, Cincinnati, Ohio, pp. 1131-1133.

Lewis, R. J., Sr., 1997, ***Hawley's Condensed Chemical Dictionary***, Thirteenth Edition, John Wiley & Sons, Inc., New York, pp. 800-801.

Montgomery, J. H., 1996, ***Groundwater Chemicals Desk Reference***, Second Edition, Lewis Publishers, New York, pp. 790-795.

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U.S. Environmental Protection Agency (EPA), 1997, ***Health Effects Assessment Summary Tables, FY 1997 Update***, Office of Solid Waste and Emergency Response, Washington, DC, 9200.6-303(97-1), EPA 540/R-97-036, PB97-921199.

2,4,6-Trinitrotoluene (TNT)

TNT is classified as a high explosive and is used as a military explosive in bombs and grenades (ATSDR, 1993). It has found wide use in filling shells and airborne detonation bombs because it can withstand the shock of ejection from a gun barrel but can be exploded on impact with a detonator mechanism. It is used as a pure compound or combined with other explosive chemicals for military application. Small amounts are used in industrial explosives. Minor applications include use as a chemical intermediate in the manufacture of dyestuffs and photographic chemicals.

Pharmacokinetic data are limited to studies of oral administration of radiolabeled compound to several species followed by collection and measurement of radioactivity in urine, gastrointestinal tract (including contents) and feces (ATSDR, 1993). Total recovery from these compartments ranged from 92 to 104 percent, suggesting little metabolism to radioactive metabolites that were exhaled. The percent of the dose recovered in the urine is adopted as a minimal estimate of GI absorption, because the extent of biliary excretion and enterohepatic recirculation has not been investigated. Urinary recovery averaged 60 percent in rats, mice and dogs, and approximately 74 percent in rabbits. The 60 percent recovery in the urine of dogs is selected as the GAF for this evaluation.

Studies indicate that TNT is rapidly absorbed through the skin of occupationally exposed humans, but quantitative data were not located (ATSDR, 1993). Dermal absorption ranged from 17 to 68 percent of a single dose of radioactivity in studies using laboratory animals exposed for 24 hours to radiolabeled compound. Absorption appeared to be more complete in rabbits and mice than in rats and dogs, suggesting that species differences are significant. Data were not located regarding the dermal uptake of TNT from soil, which would account for the matrix effect, or the ability of soil to bind the chemical and retard its dermal uptake. In the absence of quantitative data, the default ABS of 0.1 recommended by OEPA (1998) is adopted for this evaluation.

Information regarding the inhalation toxicity of TNT are limited to occupational studies, which probably also included dermal exposure, generally associated with the manufacture of explosives for World War I and World War II (ATSDR, 1993). Effects attributed to occupational exposure include deaths from liver disease and aplastic anemia, anemia, dermatitis, and cataracts. The data are insufficient to derive an RfC for inhalation exposure to TNT.

The critical effect of prolonged oral exposure of animals to TNT is liver damage (EPA, 1999). Dogs appear to be more sensitive than rats or mice. A verified RfD for chronic oral exposure of 5E-4 mg/kg-day was derived from a LOAEL of 0.5 mg/kg-day in a 26-week feeding study in dogs. An uncertainty factor of 1,000 was applied. Confidence in the oral RfD is medium. The liver is the target organ for chronic oral exposure to TNT.

TNT is classified in EPA weight-of-evidence Group C (possible human carcinogen) on the basis of positive mutagenicity studies and dietary studies that showed an increased incidence of urinary bladder tumors in rats (EPA, 1999). Human data are inadequate. An oral SF of 3E-2 per mg/kg-day is based on the incidence of bladder tumors in female rats in a 24-month dietary study. The data are inadequate for potency estimation for inhalation exposure.

References for 2,4,6-Trinitrotoluene

Agency for Toxic Substances and Disease Registry, (ATSDR), 1993, ***Toxicological Profile for 2,4,6-Trinitrotoluene***, Draft for Public Comment, U.S. Public Health Service, Atlanta, Georgia.

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Pesticides and Polychlorinated Biphenyls

Polychlorinated Biphenyls

The polychlorinated biphenyls (PCB) manufactured and used in the U.S. are called aroclors (ATSDR, 1993). The aroclors are mixtures of several PCB congeners and related compounds. Aroclors were used as dielectric and heat exchange agents in several open and closed systems, but since the middle 1970s, use has been restricted largely to electrical transformers and capacitors.

The PCBs are among the compounds that bioaccumulate in food chain pathways and are of special concern for biomagnification from sediment in benthic fish. EPA (1995) reported a

biota-to-sediment-accumulation factor for total PCBs of 1.85 for trout in the Great Lakes ecosystem.

Toxicokinetic data from laboratory animals suggests that the efficiency of GI absorption is roughly inversely related to the degree of chlorination (ATSDR, 1993). The GI absorption of mono- to hexachlorinated biphenyls exceeds 90 percent. Dichlorobiphenyl GI absorption efficiency is approximately 95 percent, but the absorption efficiency of octachlorobiphenyl approximates only 75 percent. GI absorption efficiency of Aroclor-1254 approximates 85.4 percent in ferrets and greater than 90 percent in monkeys. These data generally support the GAF of 0.9, which is adopted for all aroclors in this evaluation. However, an oral-to-dermal absorption factor of 1 is used for the cancer evaluation to be consistent with the application of the cancer SF recommended by EPA (1999).

The PCBs appear to be readily absorbed by the skin when applied as neat compound or mixed with a suitable vehicle (ATSDR, 1993), but efficiency falls off when soil is the medium of exchange. The EPA (1992) recommended ABS of 0.06 for PCBs is used in this evaluation.

The acute oral toxicity of the PCBs is low to moderate, as indicated by LD_{50} values in laboratory animals ranging from 750 mg/kg (mink) to 4,250 mg/kg (rats) (ATSDR, 1993). Death appears to be due to respiratory depression and dehydration from diarrhea.

The best known incident involving oral exposure by humans is the "Yusho" incident in Japan, in which persistent chloracne, gastrointestinal irritation and central nervous symptoms followed ingestion of cooking oil contaminated with PCBs (Gaffey, 1983). Further investigation, however, revealed that concentrations of polychlorinated dibenzofurans (PCDF) and polychlorinated quaterphenyls in the cooking oil were similar to those of PCBs, which confounds the interpretation of the results of this study.

Prolonged oral exposure of laboratory animals leads to liver damage, signs of chloracne, immunological effects, and neurological impairment, particularly of the young. A verified oral RfD for Aroclor-1254 of 2E-5 mg/kg-day for chronic oral exposure is based on a LOAEL of 5E-3 mg/kg-day associated with chloracne and related signs and immunological effects in monkeys treated with the test material in gelatin capsules for over five years (EPA, 1999). An uncertainty

factor of 300 was applied. Confidence in the RfD is medium. The immune system is considered the target organ for prolonged oral exposure to Aroclor-1254. A verified oral RfD for Aroclor-1016 of 7E-5 mg/kg-day is based on a NOAEL of 7E-3 mg/kg-day in a long-term perinatal and neurobehavioral toxicity study in monkeys. An uncertainty factor of 100 was applied to the NOAEL. The LOAEL (2.8E-2 mg/kg-day) was associated with low birth weights. The fetus is considered the sensitive target tissue for prolonged oral exposure to Aroclor-1016. Confidence in the oral RfD is medium.

Occupational exposure to PCBs, which involved both inhalation and dermal exposure, was associated with upper respiratory tract and ocular irritation, loss of appetite, liver enlargement and increased serum concentrations of liver enzymes, skin irritation, rashes and chloracne, and, in heavily exposed female workers, decreased birth weight (ATSDR, 1993). Concurrent exposure to PCB contaminants, such as PCDFs, confound the interpretation of the occupational exposure studies. Rats, mice, rabbits and guinea pigs intermittently exposed to Aroclor-1254 vapors exhibit moderate liver degeneration, decreased body weight gain and slight renal tubular degeneration. The accuracy of the reported exposure concentration is in doubt. Neither verified nor provisional chronic inhalation RfC values are available.

EPA (1998) classified PCBs in cancer weight-of-evidence Group B2 (probable human carcinogen) based on adequate evidence for liver tumors in laboratory animals and inadequate data in humans. EPA (1998) established a tiered approach for estimating the cancer potency of exposure to the PCBs. For the high risk tier, A SF of 2.0E+0 per mg/kg-day is proposed as an upper-bound for exposure to PCBs via ingestion in the food chain, ingestion of soil or sediment, inhalation of dust or aerosol, or dermal contact with soil or sediment if an absorption factor is applied. In addition, the SF of 2.0E+0 per mg/kg-day is used for any congeners considered to be persistent or acting in a dioxin-like manner, and for any early life exposures. The high risk tier SF for central tendency (CT) analyses is 1.0E+0 per mg/kg-day. EPA (1998) proposed an upper-bound SF of 4.0E-1 per mg/kg-day for the low risk tier, which includes ingestion of water-soluble congeners, inhalation of evaporated congeners, and dermal exposure if no absorption factor is applied. A SF of 3E-1 per mg/kg-day is recommended for the low risk CT evaluation. The SF of 2.0E+0 per mg/kg-day is used for all exposure scenarios and exposure routes in this evaluation because analytical data that demonstrate the absence of dioxin-like or persistent congeners are not available, and the exposure of children and youth is plausible.

References for PCBs

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Semivolatile Organic Compounds

Dinitrocresols (Dinitromethylphenols). Several dinitrocresol isomers are possible; however, the isomer most frequently encountered in environmental media is 4,6-dinitro-2-methylphenol (4,6-dinitro-o-cresol, or DNOC) (ATSDR, 1993). DNOC is used as an insecticide and a herbicide effective against broadleaf weeds. 2,6-Dinitro-p-cresol is used in the synthesis of fungicides, dyes and pharmaceuticals. It has been used in the past as an aid to weight loss because of its mechanism of action, which is to uncouple oxidative phosphorylation and increase basal metabolic rate. DNOC is released to the atmosphere primarily during its use as a pesticide.

Toxicokinetic studies that DNOC is incompletely absorbed from the GI tract (ATSDR, 1993). Urinary excretion data, and concentrations in the blood and tissues following oral dosing suggests that approximately 50 percent of the oral dose is absorbed. The GAF of 0.5 is selected as a conservative estimate for this evaluation. Data were not located regarding the dermal uptake of DNOC from soil, which would account for the matrix effect, or the ability of soil to bind the chemical and retard its dermal uptake. In the absence of quantitative data, the default ABS of 0.1 recommended by OEPA (1998) is adopted for this evaluation.

Oral LD_{50} values for DNOC include 16.4 mg/kg for mice and 25-40 mg/kg for rats (ATSDR, 1993). Death is associated with dyspnea, lung congestion and elevated body temperature due to uncoupling of oxidative phosphorylation. Prolonged oral exposure is associated with elevated basal metabolic rate, weight loss, altered pituitary and thyroid function, sweating, lassitude, headache, and cataract formation in humans. Decreased growth rate, decreased organ weights and stomach irritation are observed in laboratory animals subjected to prolonged exposure. The animal data, however, are inadequate to develop an oral RfD (EPA, 1995). A review of the human data, particularly use of DNOC in humans as weight-loss aid, identifies 0.35 mg/kg-day as a LOAEL associated with sweating and fatigue. Application of an uncertainty factor of 3,000 yields a provisional oral RfD of 1E-4 mg/kg-day. Cellular respiration is considered the target for prolonged oral exposure to DNOC. Lacking more definitive information, the provisional oral RfD of 1E-4 for DNOC is applied to all dinitrocresols.

Data regarding the carcinogenicity of the dinitrocresols were not located.

References for Dinitrocresols

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Polyaromatic Hydrocarbons

The polyaromatic hydrocarbons (PAH) regularly observed in environmental media include acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)-fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, carbazole, chrysene, dibenzo(a,h)-anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene. PAHs are the products of incomplete combustion of fossil fuels or other organic matter, hence include both natural and anthropogenic sources (ATSDR, 1993). The PAHs are ubiquitous, reflecting natural

combustion, the widespread practice of fossil fuel combustion, and wide dissemination via wind currents.

Toxicokinetic studies of several PAHs summarized by ATSDR (1993) provide limited quantitative information regarding the extent of GI absorption. Qualitatively, these studies indicate that absorption is incomplete. A study of benzo(a)pyrene in rats suggested that GI absorption ranges from 38 to 58 percent. The GAF of 0.5 (Jones and Owen, 1989), near the midpoint of the range from the rat study, is selected for benzo(a)pyrene and the other PAHs for which quantitative data are not available. A study in rats reported absorption efficiency for anthracene ranging from 53 to 74 percent; 0.7 is selected as the GAF for this evaluation. GI absorption of pyrene, chrysene and dibenzo(a,h)anthracene was described as high; a GAF of 0.8 is assumed for these compounds.

Empirical data with pure compound dissolved or suspended in vehicles suggest that dermal uptake of benzo(a)pyrene is extensive (ATSDR, 1993), but data regarding absorption from soil were not located. Lacking suitable empirical data for dermal exposure, the OEPA (1998) default ABS of 0.1 is chosen for the PAHs.

Data regarding the toxicity of acute oral exposure to the PAHs are generally scarce. Prolonged exposure is associated with a number of renal, hematologic and other effects, depending on the compound to which exposed. Subchronic (90 day) gavage treatment of mice with acenaphthene is associated with histopathologic evidence of liver hypertrophy. A verified RfD of 6E-2 mg/kg-day for chronic oral exposure was derived from the NOAEL of 175 mg/kg-day and an uncertainty factor of 3,000 (EPA, 1999). The LOAEL in this study was 350 mg/kg-day. Confidence in the RfD is low.

A verified RfD of 3E-1 mg/kg-day for chronic oral exposure to anthracene was derived from a NOEL of 1,000 mg/kg-day, the highest dose tested, in a 90-day gavage study in mice (EPA, 1999). An uncertainty factor of 3,000 was applied. Confidence in the RfD is low. The data are inadequate to identify a target organ for anthracene.

Subchronic exposure to fluoranthene induces liver and kidney effects in orally treated mice (EPA, 1999). A verified RfD of 4E-2 mg/kg-day for chronic oral exposure was derived from a

NOAEL of 125 mg/kg-day in a 13-week gavage study. The LOAEL was 250 mg/kg-day in this study. An uncertainty factor of 3,000 was applied. Confidence in the oral RfD is low. The kidney may be slightly more sensitive than the liver, and is chosen as the target organ for fluoranthene.

Subchronic exposure to fluorene induces hemolytic anemia in orally treated mice (EPA, 1999). A verified RfD of 4E-2 mg/kg-day for chronic oral exposure was derived from a NOAEL of 125 mg/kg-day in a 13-week gavage study. The LOAEL was 250 mg/kg-day in this study. An uncertainty factor of 3,000 was applied. Confidence in the oral RfD is low. The erythrocyte is the target organ for fluorene.

Subchronic exposure to pyrene induces mild renal tubular degeneration and reduced kidney weight in orally treated mice (EPA, 1999). A verified RfD of 3E-2 mg/kg-day for chronic oral exposure was derived from a NOAEL of 75 mg/kg-day in a 13-week gavage study. The LOAEL was 125 mg/kg-day in this study. An uncertainty factor of 3,000 was applied. Confidence in the oral RfD is low. The kidney is chosen as the target organ for chronic oral exposure to pyrene.

Data regarding the effects of chronic or subchronic exposure to acenaphthylene were not located in the available literature. Acenaphthene is adopted as a reasonable surrogate for acenaphthylene based on structural similarity. Therefore, the oral RfD of 6E-2 mg/kg-day for acenaphthene is adopted as the oral RfD for chronic exposure to acenaphthylene. The target organ for acenaphthylene is assumed to be the liver.

Data regarding the effects of chronic or subchronic exposure to benzo(g,h,i)perylene were not located in the available literature. Pyrene is adopted as a reasonable surrogate for benzo(g,h,i)-perylene based on structural similarity. Therefore, the oral RfD of 3E-2 mg/kg-day for pyrene is adopted as the oral RfD for chronic exposure to benzo(g,h,i)perylene. The target organ for benzo(g,h,i)perylene is assumed to be the kidney.

Relevant data regarding chronic or subchronic exposure to phenanthrene were not located. Lacking chemical-specific data, the verified oral RfD of 3E-1 mg/kg-day for anthracene is adopted as a reasonable surrogate based on similarity in chemical structure. A target organ was not identified for anthracene.

Acenaphthylene, anthracene, benzo(g,h,i)perylene, fluoranthene, fluorene, phenanthrene and pyrene are classified in EPA cancer weight-of-evidence Group D (not classifiable as to carcinogenicity to humans) because of a lack of human data and inadequate animal data (EPA, 1999). Data regarding the carcinogenicity of acenaphthene were not located. Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, carbazole, chrysene, dibenzo(a,h)-anthracene, and indeno(1,2,3-cd)pyrene are classified in EPA weight-of-evidence Group B2 (probable human carcinogens) (EPA, 1999; 1997). Benzo(a)pyrene is the most extensively studied member of the class, inducing tumors in tissues at the point of contact of virtually all laboratory species tested by all routes of exposure. Although epidemiology studies suggested that complex mixtures that contain PAHs (coal tar, soots, coke oven emissions, cigarette smoke) are carcinogenic to humans, the carcinogenicity cannot be attributed to PAHs alone because of the presence of other potentially carcinogenic substances in these mixtures (ATSDR, 1993). In addition, recent investigations showed that the PAH fraction of roofing tar, cigarette smoke and coke oven emissions accounted for only 0.1 to 8 percent of the total mutagenic activity in Salmonella of the unfractionated complex mixture (Lewtas, 1988). Aromatic amines, nitrogen heterocyclic compounds, highly oxygenated quinones, diones, and nitrooxygenated compounds, none of which would be expected to arise from in vivo metabolism of PAHs, probably accounts for the majority of the mutagenicity of coke oven emissions and cigarette smoke. Furthermore, coal tar, which contains a mixture of many PAHs, has a long history of use in the clinical treatment of a variety of skin disorders in humans (ATSDR, 1993).

Because of the lack of human cancer data, assignment of individual PAHs to EPA cancer weight-of-evidence groups is based largely on the results of animal studies with large doses of purified compound (EPA, 1999). Frequently, unnatural routes of exposure, including implants of the test chemical in beeswax and trioctanoin in the lungs of female rats, intratracheal instillation, and subcutaneous or intraperitoneal injection, were used.

EPA (1999) verified a SF for oral exposure to benzo(a)pyrene of 7.3E+0 per mg/kg-day, based on several dietary studies in mice and rats. Recent reevaluations of the carcinogenicity and mutagenicity of the Group B2 PAHs suggest that there are large differences between individual PAHs in cancer potency (Krewski et al., 1989). Based on the available cancer and mutagenicity data, and assuming that there is a constant relative potency between different carcinogens across different bioassay systems and that the PAHs under consideration have similar dose-response

curves, EPA (1993) adopted relative potency values for several PAHs. These values and the corresponding oral SFs, based on a relative potency for benzo(a)pyrene of 1.0, are presented below.

Relative Potencies and Slope Factors for PAHs			
PAH	Relative Potency	Oral Slope Factor (/mg/kg-day)	Inhalation Slope Factor (mg/kg-day)
Benzo[a]pyrene	1.0	7.3E+0	3.1E+0
Benzo[a]anthracene	0.1	7.3E-1	3.1E-1
Benzo[b]fluoranthene	0.1	7.3E-1	3.1E-1
Benzo[k]fluoranthene	0.01	7.3E-2	3.1E-2
Chrysene	0.001	7.3E-3	3.1E-3
Dibenzo[a,h]anthracene	1.0	7.3E+0	3.1E+0
Indeno[1,2,3-cd]pyrene	0.1	7.3E-1	3.1E-1

Although the EPA has not verified SFs for Group B2 PAHs other than benzo(a)pyrene, the SFs above represent reasonable estimates based on the data available. The relative potency approach employed here meets criteria considered to be desirable for this type of analysis (Lewtas, 1988). For example, the chemicals compared have similar chemical structures and would be expected to have similar toxicokinetic fate in mammalian systems. In addition, the available data suggest that the Group B2 PAHs have a similar mechanism of action, inducing frameshift mutations in Salmonella and tumor initiation in the mouse skin painting assay. Similar noncancer effects (minor changes in the blood, liver, kidneys) of the Group D PAHs support the hypothesis of a common mechanism of toxicity. Finally, the same endpoints of toxicity, i.e., potency in various cancer assays, and related data, were used to derive the relative potency values (Krewski et al., 1989). The oral SF for benzo(a)pyrene of 7.3E+0 per mg/kg-day, and the SFs presented above for the other Group B2 PAHs are adopted for the purposes of this evaluation.

A recent EPA (1994) evaluation of the inhalation cancer data suggests adoption of an inhalation SF for benzo(a)pyrene of 3.1E+0 per mg/kg-day, based on the incidence of upper respiratory and

digestive tract tumors in hamsters. Applying the relative potency estimates presented above yield the inhalation SFs for the other Group B2 PAHs presented above.

Carbazole was not investigated in the relative potency investigations described above. EPA (1997) presents a provisional oral SF of 2E-2 per mg/kg-day based on the incidence of liver tumors in a 96-week dietary study in mice. The location of primary tumors distal to the point of contact (the GI tract) suggests a mechanism of toxicity different from benzo(a)pyrene and the other Group B2 PAHs discussed above. The data are inadequate for estimation of an inhalation SF for carbazole.

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