Appendix A-1

Part A Application Figures:

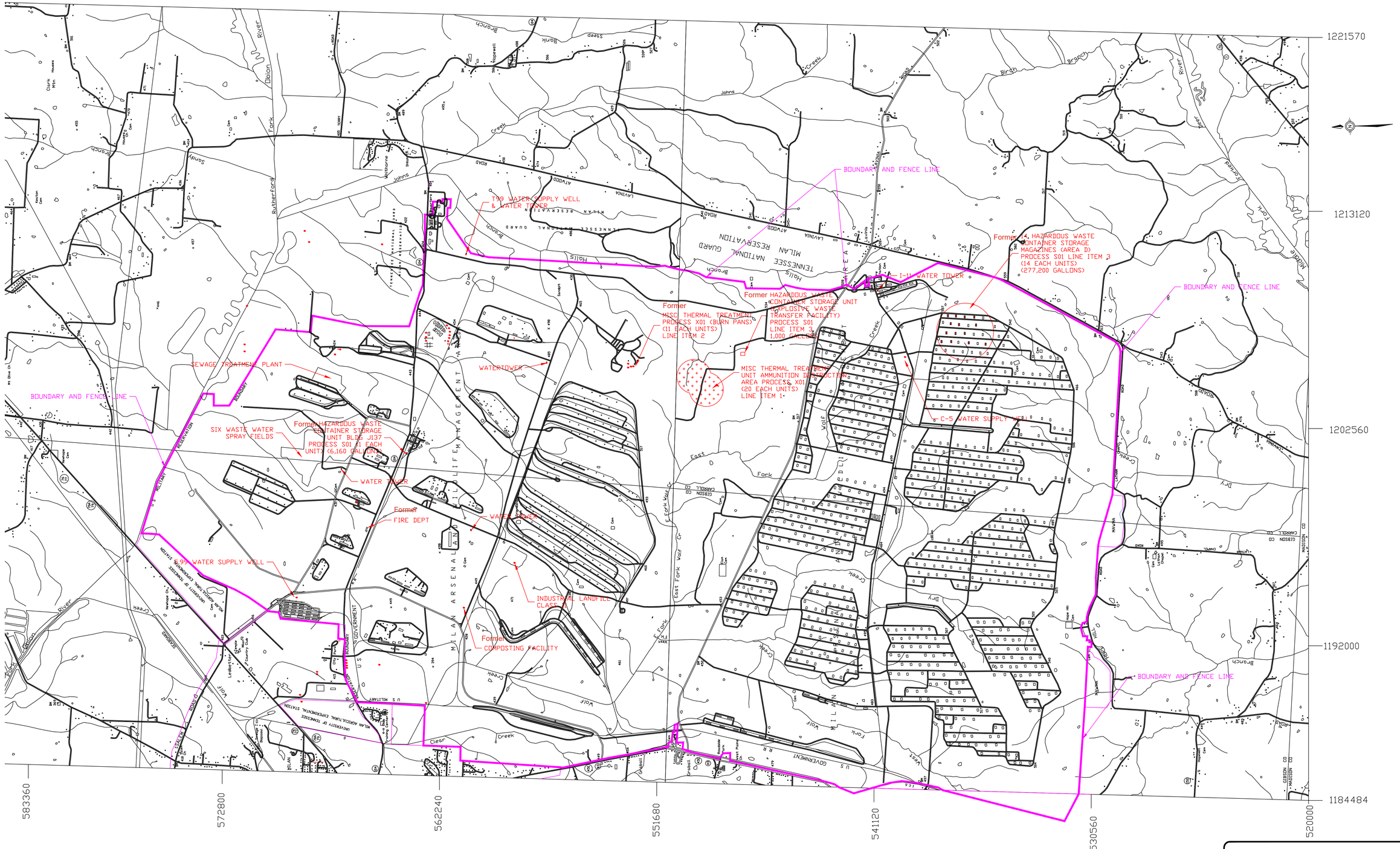
A-1 ADA Location Map (Fig. B-1)
A-2 Facility Drawing (Fig. B-2)
A-3 MLAAP Area of Past Storage, Treatment or Disposal Operations (Fig. B-3)
A-4 USGS Sitewide Topographic Map (Fig. B-5)
A-5a ADA Topographic Map with 1,000 ft. Boundary (Imagery & Wind Rose) (Fig. B-7a)
A-5b ADA Topographic Map (Wind Rose) (Fig. B-7b)

Figure B-1 (A-1)
Ammunition Destruction Area (ADA)
Location Map

N

Legend

- TNARNG Volunteer Training Site Boundary (Property Added Aug. 2022)
- TNARNG Volunteer Training Site Boundary (Prior to Aug 2022)
- MLAAP Installation Boundary post 9Aug2022
- Ammunition Destruction Area
- Ammunition Destruction 1000 Ft Buffer
- Former Shooting Pit Locations
- Roads
- Railroad



SOURCE:
AMERICAN ORDNANCE
MILAN ARMY AMMUNITION PLANT
MILAN, TENNESSEE
DRAWING: MAAP-C, FACILITY PART A-2

FIGURE B-2 (A-2)
FACILITY DRAWING
MILAN ARMY AMMUNITION PLANT
MILAN, TENNESSEE

REQUESTED BY: KIM SASS	
DRAWN BY: BRONSON	
DWG DATE: 01/17/11 rev. 10.2025	
DWG NO: 4452_B011	

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SOURCE:
AMERICAN ORDNANCE
MILAN ARMY AMMUNITION PLANT
MILAN, TENNESSEE
DRAWING: MAAP-C, FACILITY PART A-3

FIGURE B-3(A-3)
MLAAP AREA OF PAST STORAGE, TREATMENT OR DISPOSAL OPERATIONS
MILAN ARMY AMMUNITION PLANT
MILAN, TENNESSEE

REQUESTED BY:	KIM SASS
DRAWN BY:	BRONSON
DWG DATE:	01/18/11 Rev. 10.2025
DWG NO:	4452_B003

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Facility Roadways
Drainage Ditch
Streams
Operable Unit Boundary
PropertyBoundary
1,000 Ft Buffer

N

0 1,000 2,000 4,000 Feet

USGS Topographic Map: National Geographic TOPO! - ArcGIS Online

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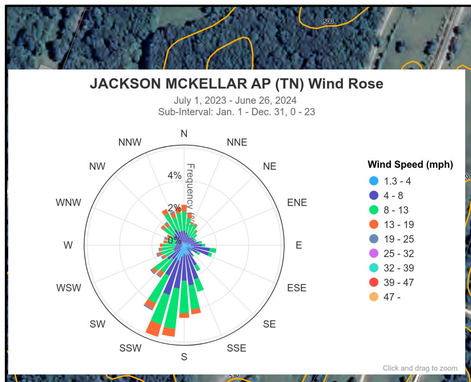
Figure B-5 (A-4)
USGS Topographic Map
Milan Army Ammunition Plant
Milan, Tennessee

7/23/2008 D:\projects\milan\Milan AAP\Map\property_topo.mxd



SECURITY FENCE GATE LOCATION

1,000 FOOT BOUNDARY

1,000 FOOT BOUNDARY

EAST SHOOTING FIELD

Former Shooting Range/Qui Building (Rm3)

WEST SHOOTING FIELD

SILT BASIN

SILT BASIN

SILT BASIN

SILT BASIN

SECURITY FENCE GATE LOCATION

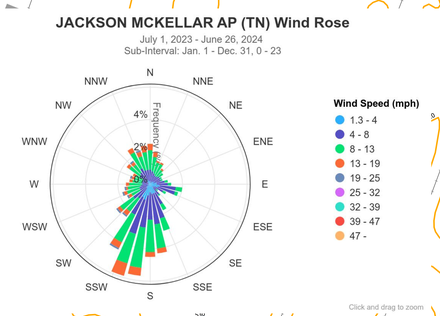
Notes:
1. There are no 100-year flood plains within the extent of this map.

0 230 460 920 1,380 Feet

Legend
- Elevation Contour
- National Hydrography Dataset
- TNARNG Volunteer Training Site Boundary (Property Added Aug. 2022)
- Former Shooting Pit Locations
- Ammunition Destruction Area RCRA Fence
- Ammunition Destruction Area 1000 Ft Buffer

Drawn by: B. Corrigan
June 26, 2024

Figure B-7a (A-5a)
Ammunition Destruction Area
Topographic with 1,000 Ft. Boundary with Imagery



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SECURITY FENCE GATE LOCATION

1,000 FOOT BOUNDARY

1,000 FOOT BOUNDARY

EAST SHOOTING FIELD

Former Shooting Barricade Building W-53

WEST SHOOTING FIELD

SILT BASIN

SILT BASIN

SILT BASIN

SECURITY FENCE GATE LOCATION

Notes:
1. There are no 100-year flood plains within the extent of this map.

0 230 460 920 1,380 Feet

Figure B-7b (A-5b)
Ammunition Destruction Area
Topographic with 1,000 Ft. Boundary

Legend
- Elevation Contour
- National Hydrography Dataset
- TNARNG Volunteer Training Site Boundary (Property Added Aug, 2022)
- Former Shooting Pit Locations
- Ammunition Destruction Area RCRA Fence
- Ammunition Destruction Area 1000 Ft Buffer

Drawn by: B. Corrigan
June 26, 2024

Appendix B-1

All Figures:

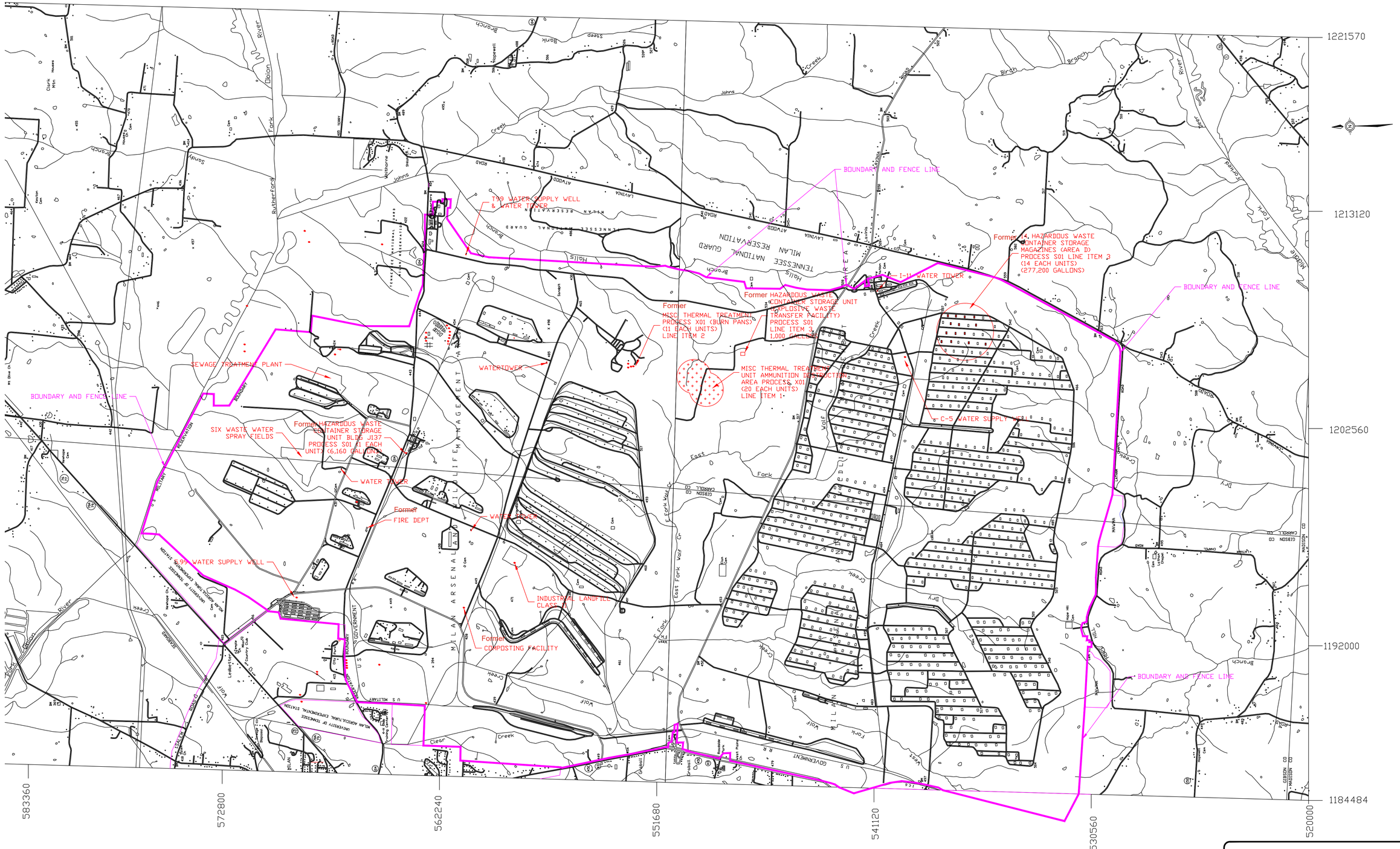
B-1 ADA Location Map (Fig. A-1)
B-2 Facility Drawing (Fig. A-2)
B-3 MLAAP Area of Past Storage, Treatment or Disposal Operations (Fig. A-3)
B-4 OD Unit (ADA) Layout
B-5 USGS Sitewide Topographic Map (Fig. A-4)
B-6 General Site Layout Drainage
B-7a ADA Topographic Map with 1,000 ft. Boundary (Imagery & Wind Rose) (Fig. A-5a)
B-7b ADA Topographic Map (Wind Rose) (Fig. A-5b)
B-8 Waste Management Area Topographic Map with Groundwater Point of Compliance
B-9 Simulated Study Area Groundwater Flow Map (Fig. C-3)
B-10 Fall 2024 Groundwater Flow at RCRA Waste Management Area Map (Fig. C-4)
B-11a ADA and Former BG Area TNT Plume Map (Fig. C-1)
B-11b ADA and Former BG Area Topographic Map with TNT Plume
B-12a ADA and Former BG Area RDX Plume Map (Fig. C-2)
B-12b ADA and Former BG Area Topographic Map with RDX Plume
B-13a MLAAP Floodplain Location Map
B-13b FEMA National Flood Hazard Layer Map
B-14 OD Unit- ICUZ Noise Zone Map (Fig. D-1)
B-15 Map of Air Blast Receptors (Fig. D-2)
B-16 Evacuation Route (Fig. G-1)
B-17 OU Site Location Map (Fig. I-1)
B-18 OU MLAAP Site Map (Fig. I-2)
B-19 Horizontal Distribution of RDX in Site-Wide Groundwater- RASR Year 9 (Fig. I-3)
B-20 Horizontal Distribution of TNT in Site-Wide Groundwater- RASR Year 9 (Fig. I-4)
B-21 Cross-Section Location Map and Groundwater Flow Direction (Fig. I-5)
B-22 OU5 and Line C Groundwater Potentiometric Surface Map (Fig. I-6)
B-23 OU5 and Line C RDX Concentrations in Groundwater (Fig. I-7)
B-24 OU5 and Line C TNT Concentrations in Groundwater (Fig. I-8)
B-25 Cross-Section J-J' RDX Plume Through OU5 (Fig. I-9)
B-26 Estimated Areas Remaining Above the Interim Goals at the End of Date for Active Remediation (Year 15, 2030) (Fig. I-10)

Figure B-1 (A-1)
Ammunition Destruction Area (ADA)
Location Map

N

Legend

- TNARNG Volunteer Training Site Boundary (Property Added Aug. 2022)
- TNARNG Volunteer Training Site Boundary (Prior to Aug 2022)
- MLAAP Installation Boundary post 9Aug2022
- Ammunition Destruction Area
- Ammunition Destruction 1000 Ft Buffer
- Former Shooting Pit Locations
- Roads
- Railroad



SOURCE:
AMERICAN ORDNANCE
MILAN ARMY AMMUNITION PLANT
MILAN, TENNESSEE
DRAWING: MAAP-C, FACILITY PART A-2

FIGURE B-2 (A-2)
FACILITY DRAWING
MILAN ARMY AMMUNITION PLANT
MILAN, TENNESSEE

REQUESTED BY: KIM SASS	
DRAWN BY: BRONSON	
DWG DATE: 01/17/11 rev. 10.2025	
DWG NO: 4452_B011	

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SOURCE:
AMERICAN ORDNANCE
MILAN ARMY AMMUNITION PLANT
MILAN, TENNESSEE
DRAWING: MAAP-C, FACILITY PART A-3

FIGURE B-3(A-3)
MLAAP AREA OF PAST STORAGE, TREATMENT OR DISPOSAL OPERATIONS
MILAN ARMY AMMUNITION PLANT
MILAN, TENNESSEE

REQUESTED BY:	KIM SASS
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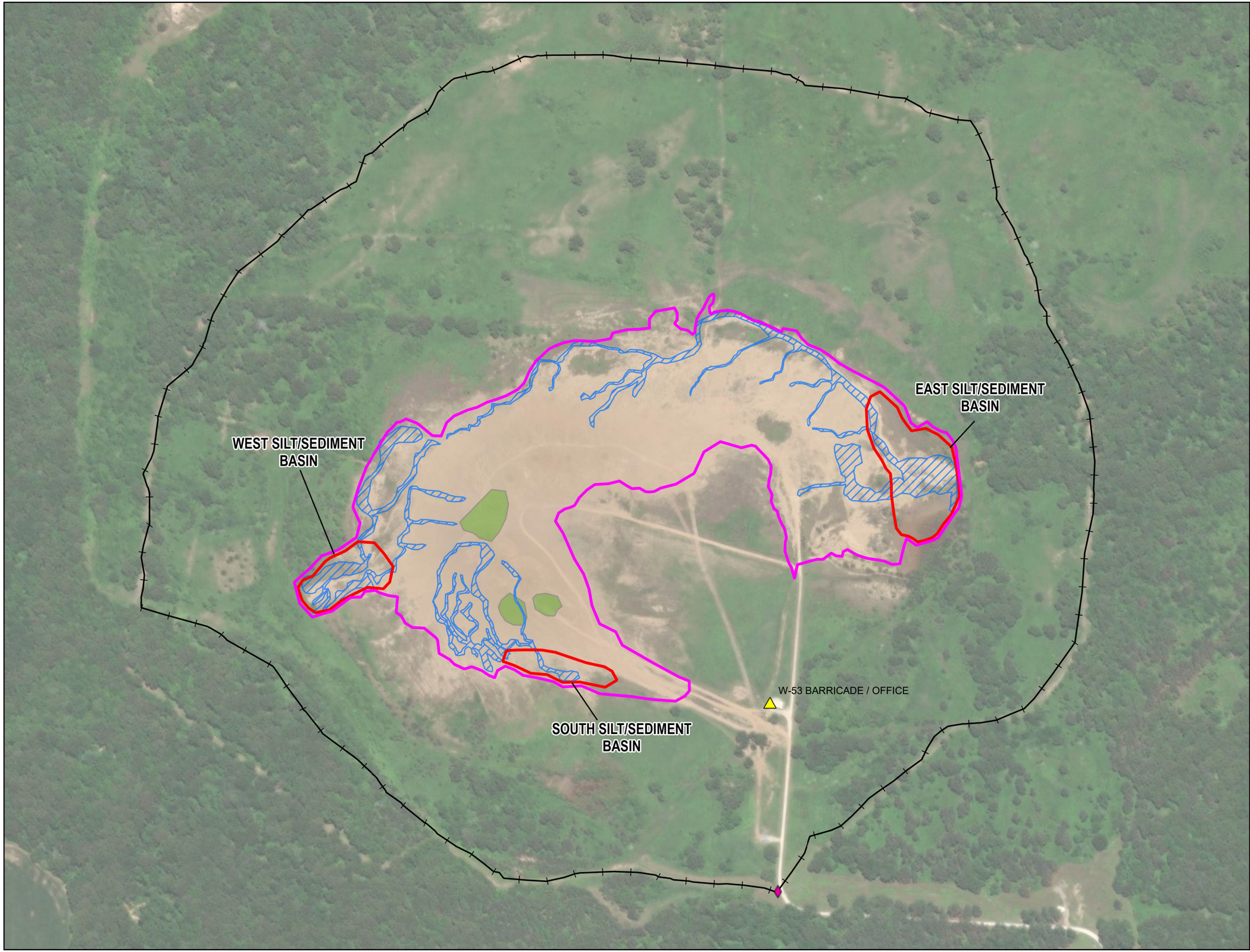

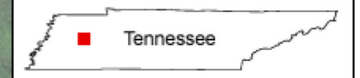

LEGEND

- ENTRANCE GATE
- FORMER OFFICE BUILDING
- PROPOSED GRADING LIMITS (OD UNIT LOCATION)
- FENCE BOUNDARY (217-ACRE PORTION OF ADA)
- DRAINAGE TO SEDIMENT BASINS
- SOIL MOUNDS
- GENERAL SILT/SEDIMENT BASIN LOCATION
- GENERAL LOCATIONS OF FIRING PITS (20 Ea.), PROCESS X01

N

0 350 700

SCALE IN FEET

SOURCE: World Imagery; Esri

FIGURE B-4

OD UNIT (ADA) LAYOUT

MILAN, GIBSON COUNTY, TENNESSEE

Rev. 10.2025

DATE	PROJECT NO	SCALE
JANUARY 2025	00934.257.971.0011	AS SHOWN

FILE: G:\Federal\Milan\pro\Milan\Milan-Copy.aprx 10:51 AM 1/10/2025 letartes

Facility Roadways
Drainage Ditch
Streams
Operable Unit Boundary
PropertyBoundary
1,000 Ft Buffer

N

0 1,000 2,000 4,000 Feet

USGS Topographic Map: National Geographic TOPO! - ArcGIS Online

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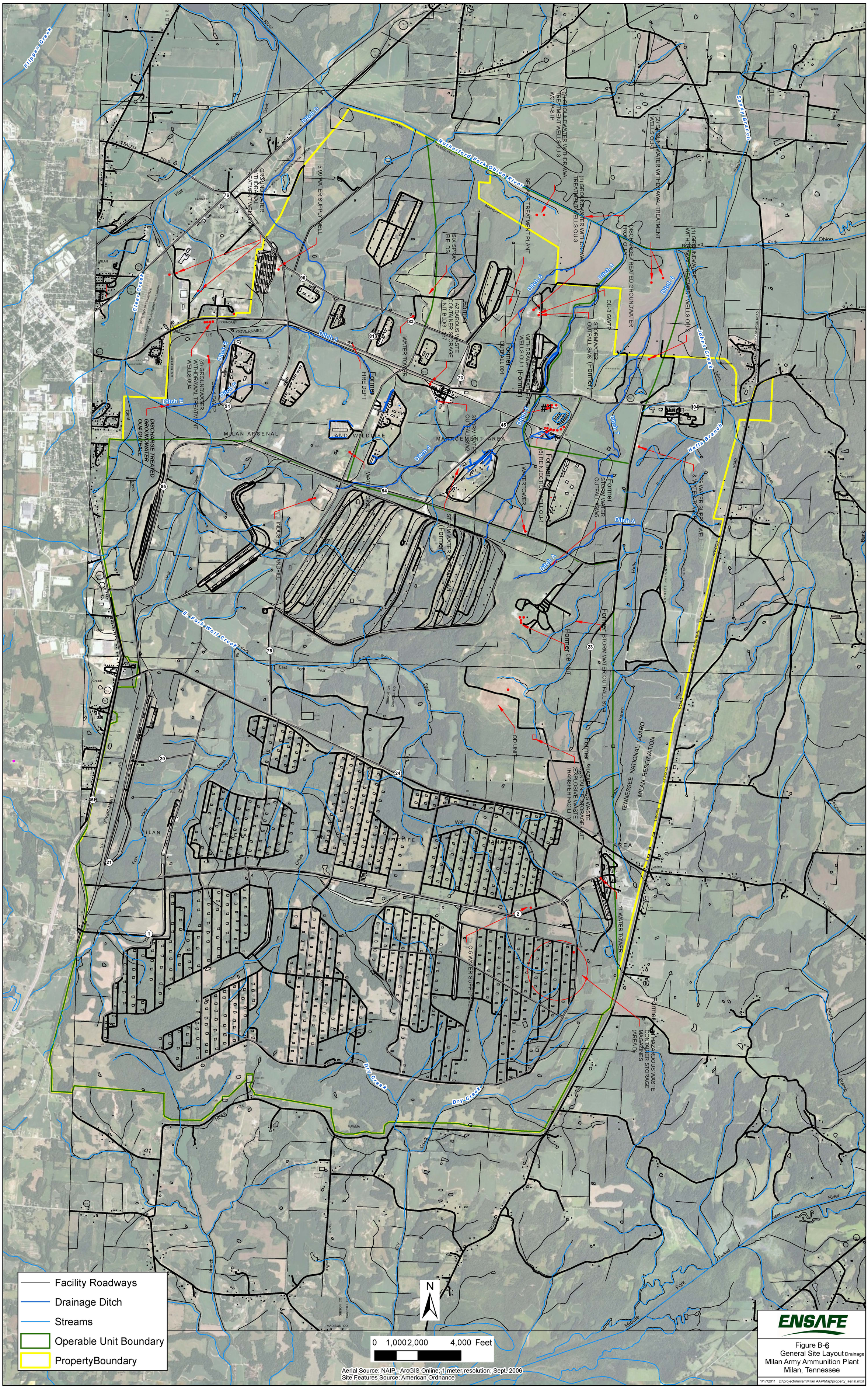
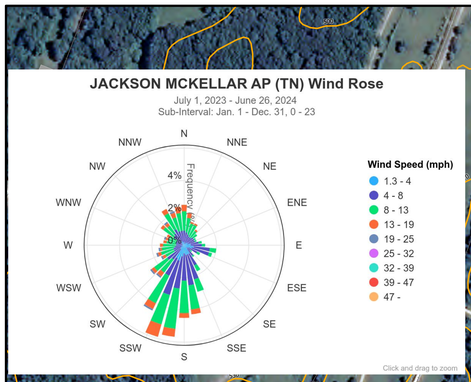
Figure B-5 (A-4)
USGS Topographic Map
Milan Army Ammunition Plant
Milan, Tennessee

7/23/2008 D:\projects\milan\Milan AAP\Map\property_topo.mxd


Flippen Creek
Clear Creek
Wolf Creek
Sandy Branch
Johns Creek
Halls Branch
Ditch D
Ditch E
Ditch 2
Ditch 3
Ditch 4
Ditch 5
Ditch 6
Ditch 7
Ditch A
E. Fork Wolf Creek
Dry Creek
Rutherford Fork Obion River
SALEM ROAD
SEABOARD
U.S. MILITARY RESERVATION
BOUNDARY
GOVERNMENT
MILAN ARSENAL
AND WILDLIFE MANAGEMENT AREA
UNIVERSITY OF TENNESSEE MILAN AGRICULTURAL EXPERIMENTAL STATION
TENNESSEE NATIONAL GUARD MILAN RESERVATION
5.99 WATER SUPPLY WELL
GROUNDWATER WITHDRAWAL TREATMENT WELLS OU4
(4) GROUNDWATER WITHDRAWAL TREATMENT WELLS OU4
OU-4 GWTP
DISCHARGE TREATED GROUNDWATER OU4 OUTFALL
(2) GROUNDWATER WITHDRAWAL TREATMENT WELLS OU-3 WCCP-STP
(1) GROUNDWATER WITHDRAWAL TREATMENT WELLS OU-3
SEWAGE TREATMENT PLANT
SIX SPRAY FIELDS
DISCHARGE TREATED GROUNDWATER FROM OU-3
(2) GROUNDWATER WITHDRAWAL TREATMENT WELLS OU-3
(1) GROUNDWATER WITHDRAWAL TREATMENT WELLS OU-3
OU-3 GWTP
STORMWATER OUTFALL SW8 (Former)
Former HAZARDOUS WASTE CONTAINER STORAGE UNIT BLDG J-37
Former OUTFALL 001
GROUNDWATER WITHDRAWAL TREATMENT WELLS OU-1 (Former)
WATER TOWER
Former FIRE DEPT
STORM WATER OUTFALL SW2
(6) REINJECTION WELL OU-1
Former STORM WATER OUTFALL SW5
Former STORM WATER OUTFALL SW4
Former OB UNIT
Former HAZARDOUS WASTE CONTAINER STORAGE UNIT (EXPLOSIVE WASTE TRANSFER FACILITY)
INDUSTRIAL LANDFILL
Former STORM WATER OUTFALL SW7
C-5 WATER SUPPLY WELL
I-11 WATER TOWER
Former HAZARDOUS WASTE CONTAINER STORAGE MAGAZINES (AREA D)
5.99 WATER SUPPLY WELL & WATER TOWER
Facility Roadways
Drainage Ditch
Streams
Operable Unit Boundary
PropertyBoundary
N
0 1,000 2,000 4,000 Feet
Aerial Source: NAIP - ArcGIS Online; 1 meter resolution; Sept. 2006
Site Features Source: American Ordnance
ENSAFE
Figure B-6
General Site Layout Drainage
Milan Army Ammunition Plant
Milan, Tennessee
1/17/2011 D:\projects\milan\Milan AAP\Map\property_aerial.mxd



SECURITY FENCE GATE LOCATION

1,000 FOOT BOUNDARY

1,000 FOOT BOUNDARY

EAST SHOOTING FIELD

Former Shooting Range/Qui Building (Rm3)

WEST SHOOTING FIELD

SILT BASIN

SILT BASIN

SILT BASIN

SILT BASIN

SECURITY FENCE GATE LOCATION

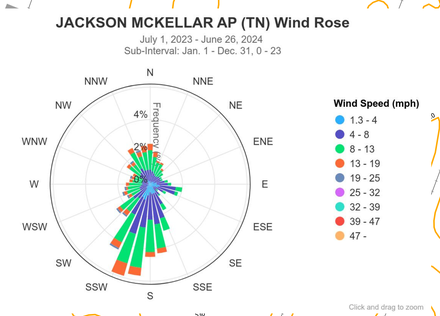
Notes:
1. There are no 100-year flood plains within the extent of this map.

0 230 460 920 1,380 Feet

Legend
- Elevation Contour
- National Hydrography Dataset
- TNARNG Volunteer Training Site Boundary (Property Added Aug. 2022)
- Former Shooting Pit Locations
- Ammunition Destruction Area RCRA Fence
- Ammunition Destruction Area 1000 Ft Buffer

Drawn by: B. Corrigan
June 26, 2024

Figure B-7a (A-5a)
Ammunition Destruction Area
Topographic with 1,000 Ft. Boundary with Imagery



N

SECURITY FENCE GATE LOCATION

1,000 FOOT BOUNDARY

1,000 FOOT BOUNDARY

EAST SHOOTING FIELD

Former Shooting Barricade Building W-53

WEST SHOOTING FIELD

SILT BASIN

SILT BASIN

SILT BASIN

SECURITY FENCE GATE LOCATION

Notes:
1. There are no 100-year flood plains within the extent of this map.

0 230 460 920 1,380 Feet

Figure B-7b (A-5b)
Ammunition Destruction Area
Topographic with 1,000 Ft. Boundary

Legend
- Elevation Contour
- National Hydrography Dataset
- TNARNG Volunteer Training Site Boundary (Property Added Aug, 2022)
- Former Shooting Pit Locations
- Ammunition Destruction Area RCRA Fence
- Ammunition Destruction Area 1000 Ft Buffer

Drawn by: B. Corrigan
June 26, 2024

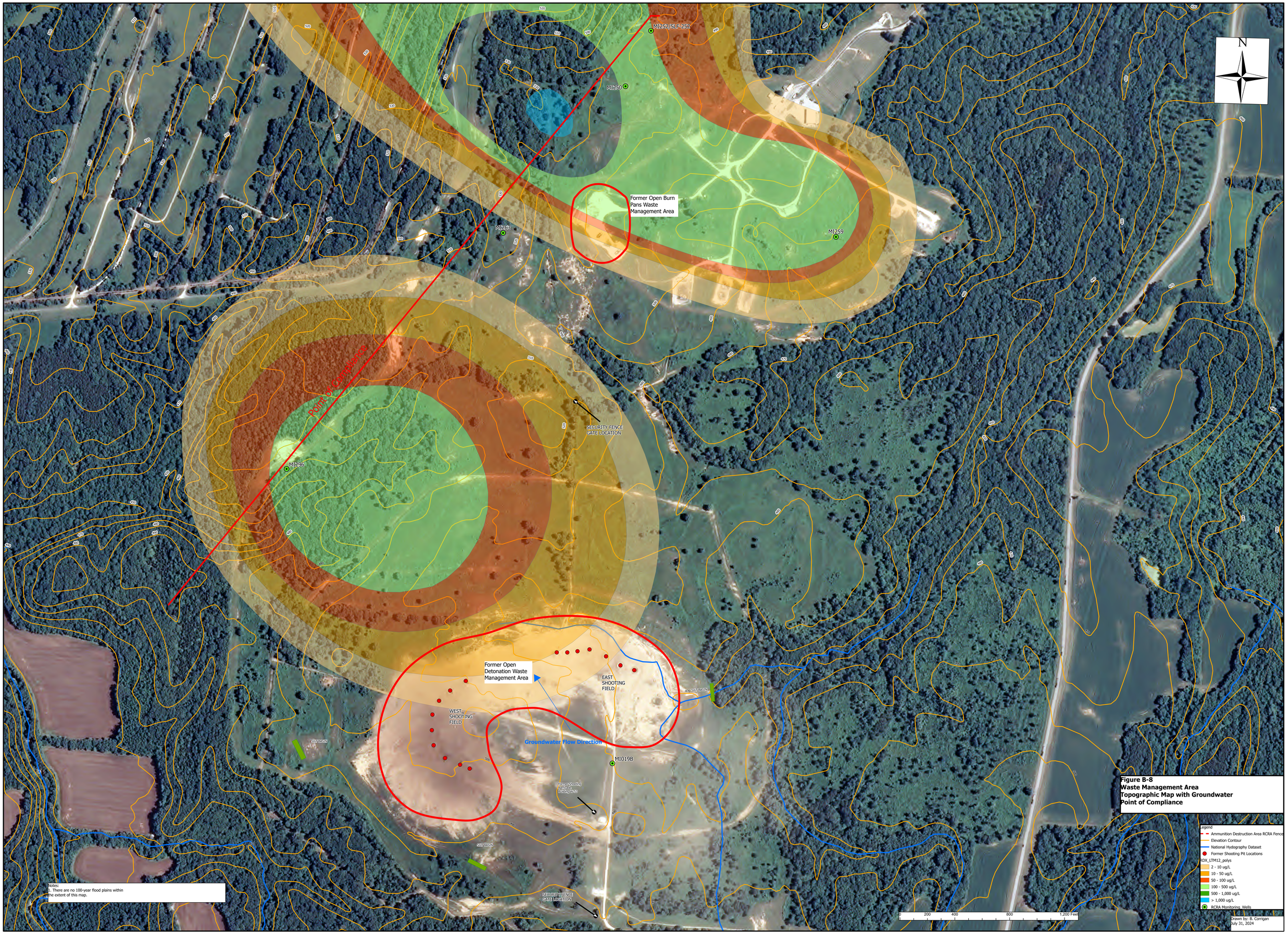
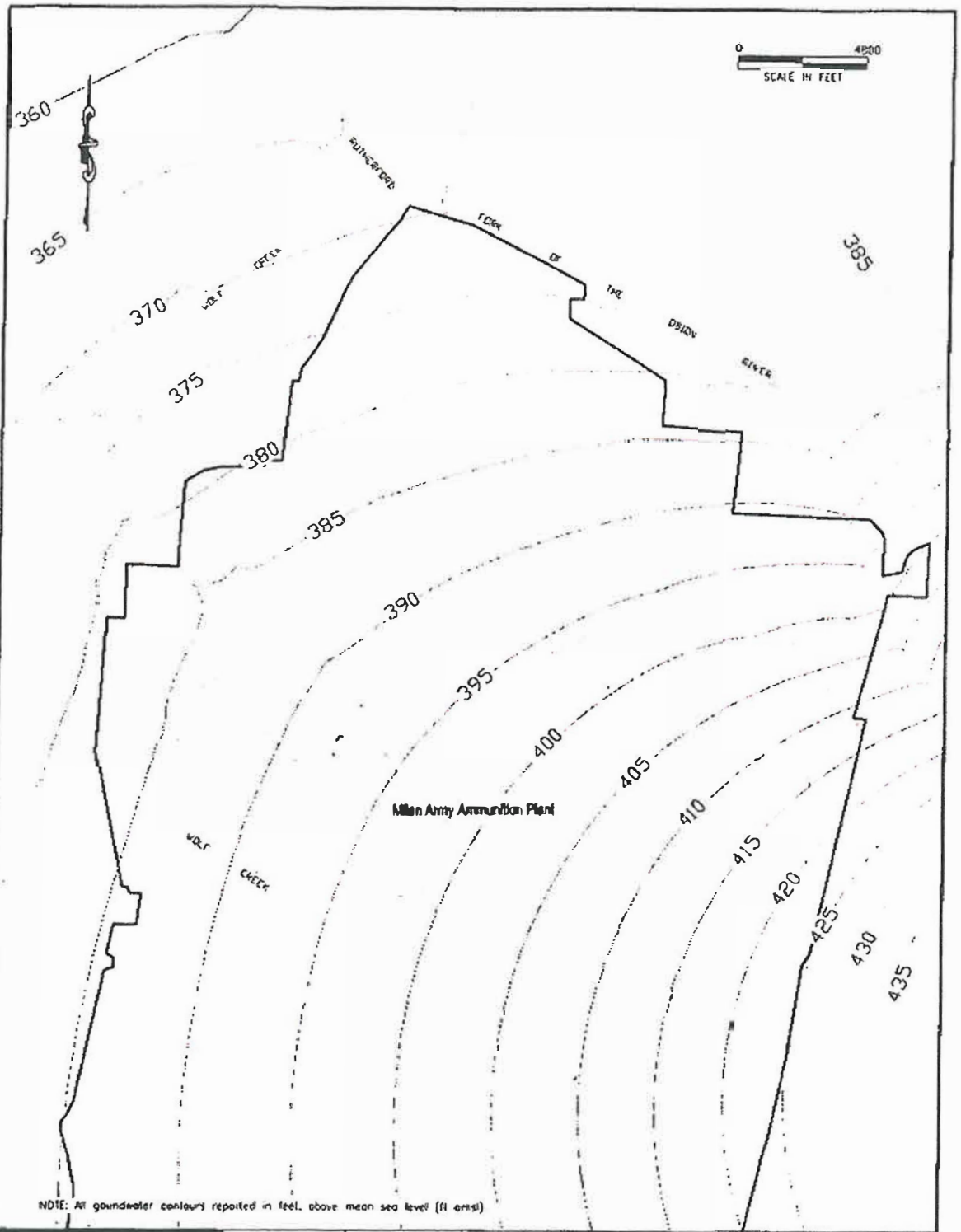
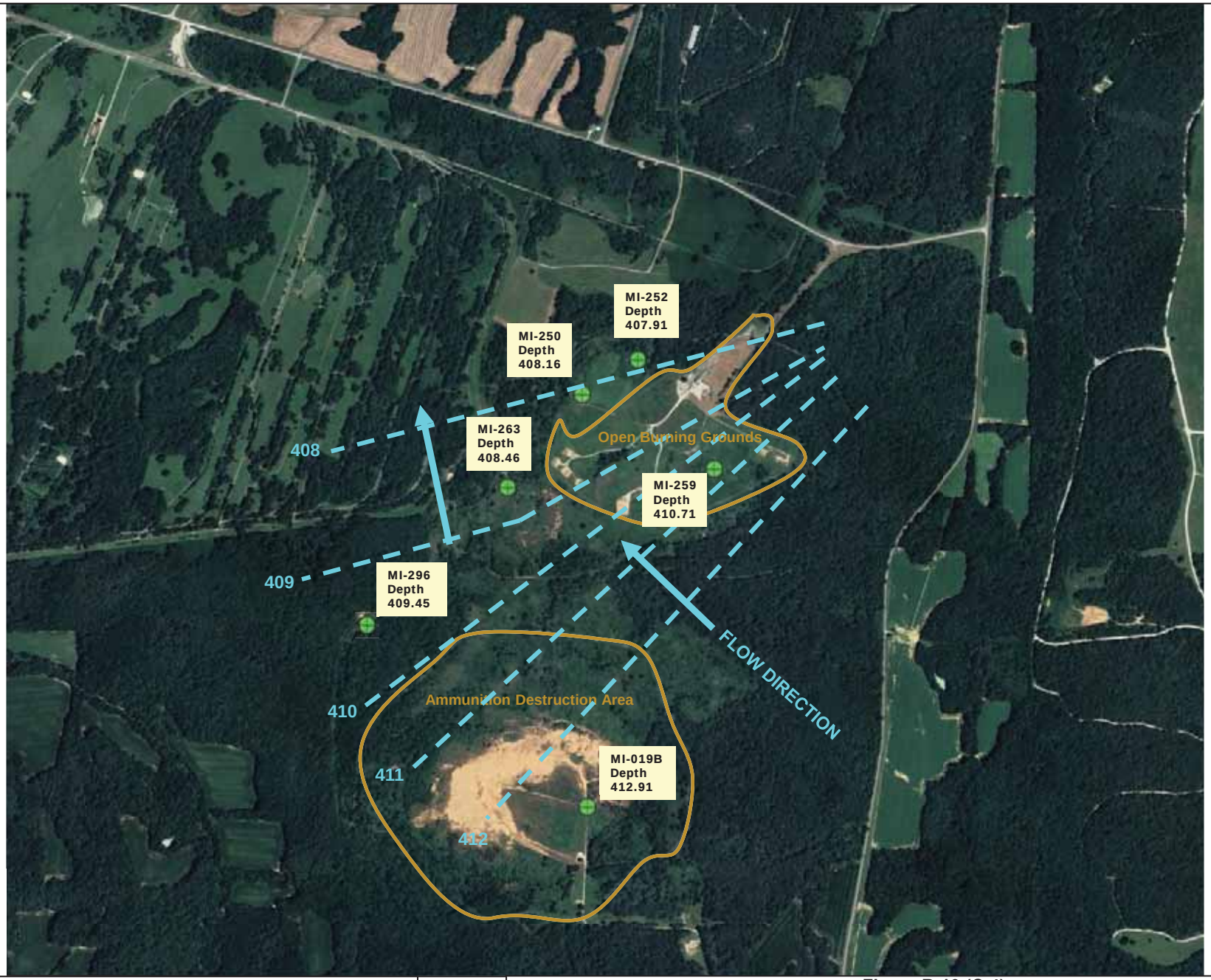


Figure B-8
Waste Management Area
Topographic Map with Groundwater
Point of Compliance



ARCADIS

Figure B-9 (C-3)
Simulated Study Area Groundwater Flow Map
Model Layer 1
Milan Army Ammunition Plant



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Consulting Engineers & Scientists • A Division of Fisher & Arnold, Inc.
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Figure B-10 (C-4)
FALL 2024 GROUNDWATER FLOW AT RCRA WMA
MAP 2024 AMERICAN ORDINANCE LLC
2280 HWY 104 WEST, SUITE 2, MILAN, TN 38358-3177

DATE: 01/2025 Rev. 10/2025	SOURCE: SATELLITE IMAGERY		FIGURE
Drawn By: KTS	SCALE :NTS	JOB NO. AMERORDN.0007EN	

N

Burning Ground Plume

0 495 990 1,980 2,970 Feet

Figure B-11a (C-1)
Ammunition Destruction Area
TNT Plume Map

MLAAP Installation Boundary post 9Aug2022
TNARNG Volunteer Training Site Boundary (Prior to Aug 2022)
Ammunition Destruction Area
TNT_LTM12_polys
NAME
2.8 - 10 ug/L
10 - 50 ug/L
50 - 100 ug/L
100 - 500 ug/L
500 - 1000 ug/L
1,000 - 4,000 ug/L
> 4,000 ug/L
Monitoring_Wells
Former Shooting Pit Locations

Drawn by: B. Corrigan
June 27, 2024

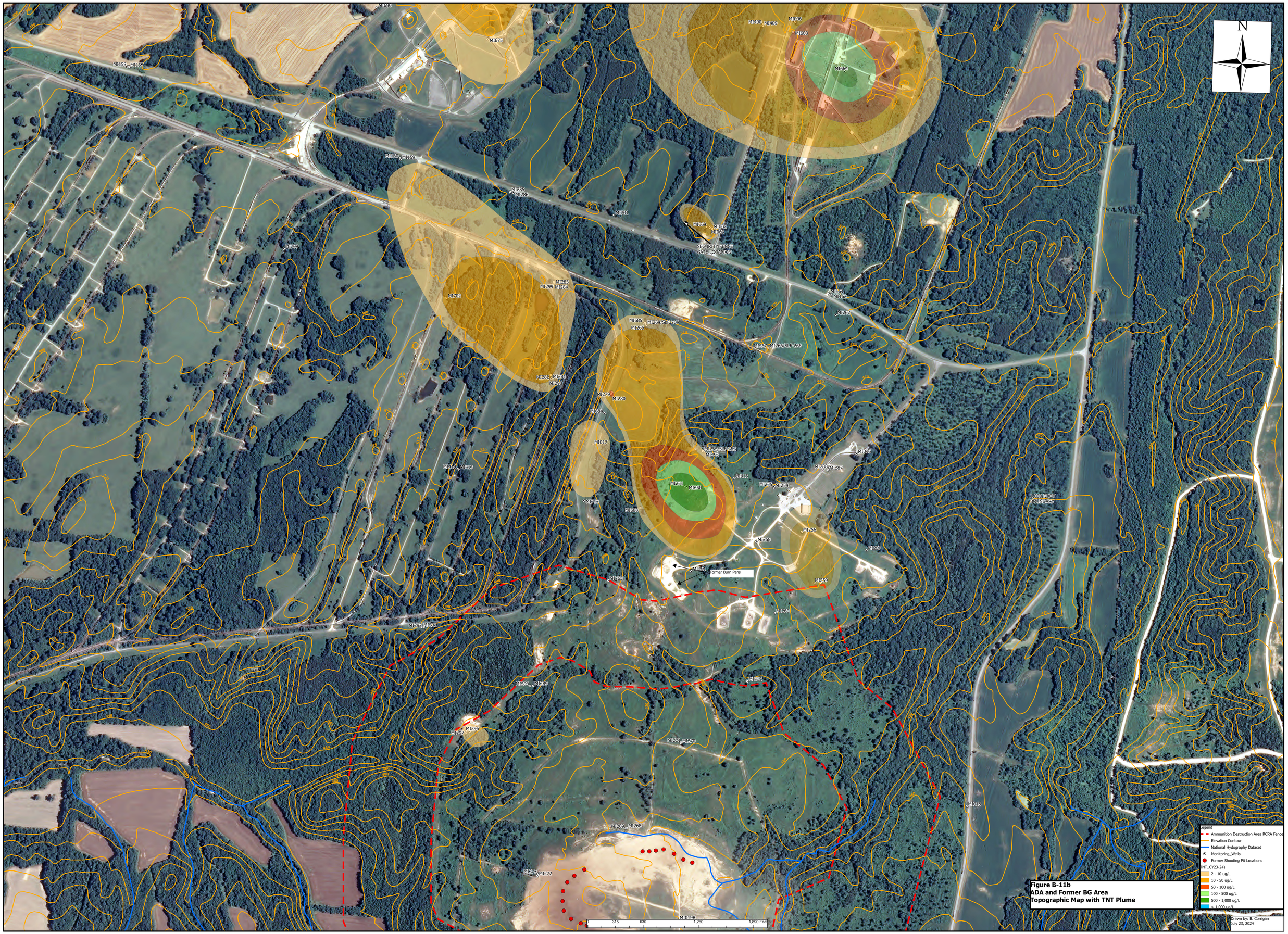


Figure B-11b
ADA and Former BG Area
Topographic Map with TNT Plume

N

Burning Ground Plume

ADA Plume

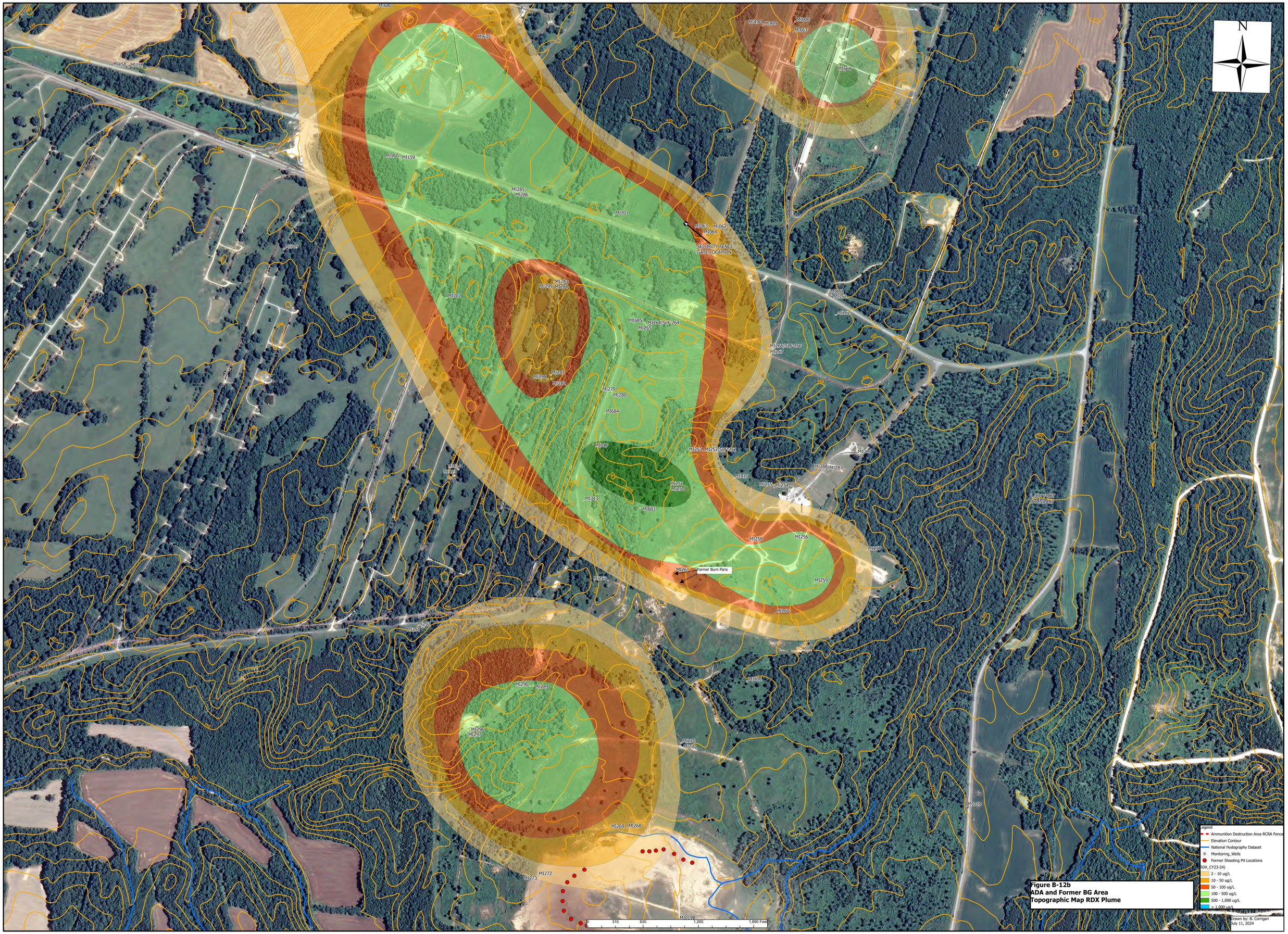
0 495 990 1,980 2,970 Feet

Figure B-12a (C-2)
ADA and Former BG Area
RDX Plume Map

Legend
- TNARNG Volunteer Training Site Boundary (Property Added Aug. 2022)
- MLAAP Installation Boundary post 9Aug2022
- TNARNG Volunteer Training Site Boundary (Prior to Aug 2022)
- Ammunition Destruction Area

RDX Concentrations
- 2 - 10 ug/L
- 10 - 50 ug/L
- 50 - 100 ug/L
- 100 - 500 ug/L
- 500 - 1,000 ug/L
- > 1,000 ug/L
- Monitoring_Wells
- Former Shooting Pit Locations

Drawn by: B. Corrigan
June 27, 2024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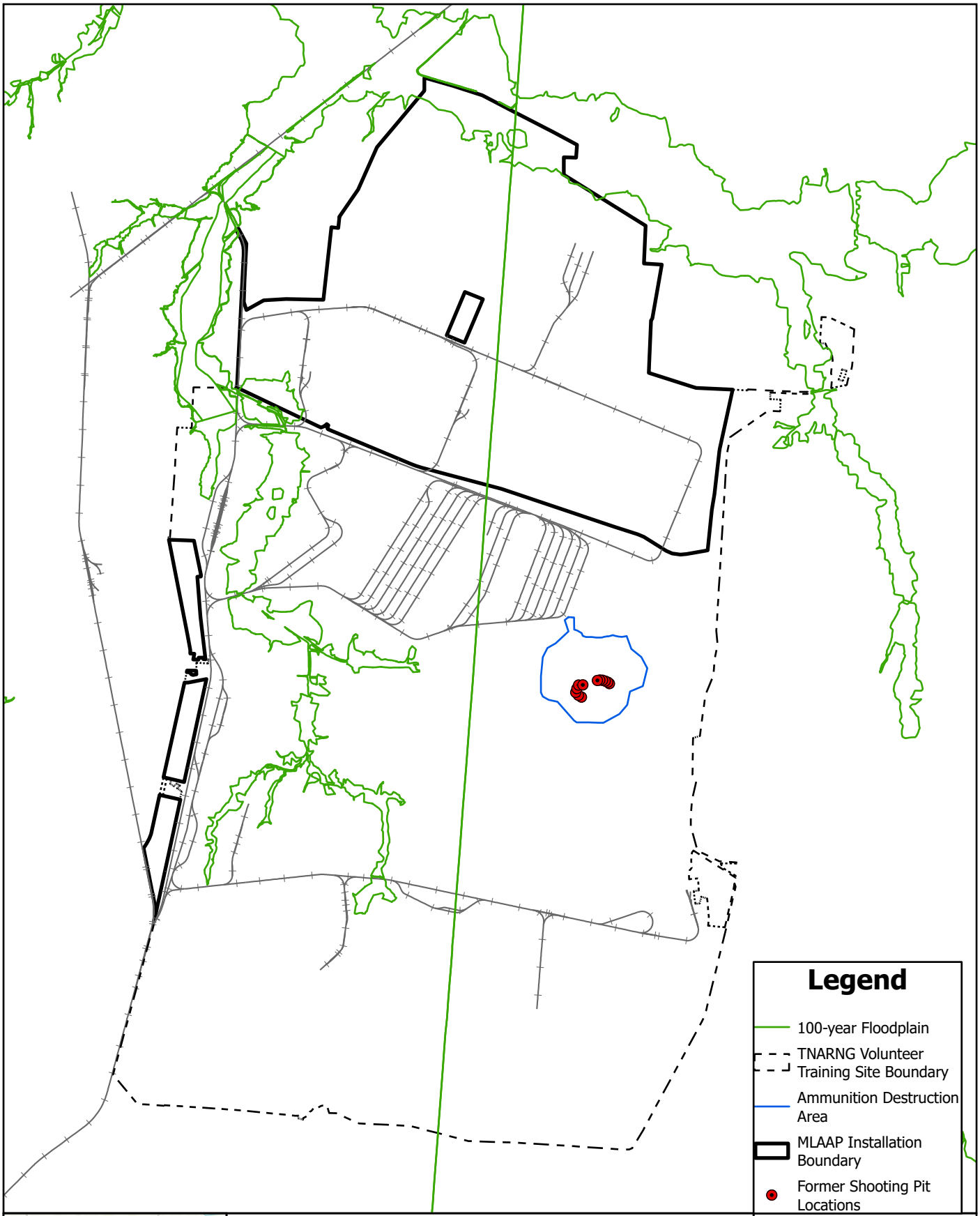


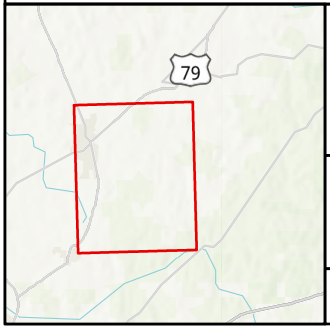


Figure B-13a
MLAAP Floodplain Location Map

Esri, CGIAR, USGS, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

2025

Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet

N

0 0.5 1 Mi

0 1 2 Km

National Flood Hazard Layer FIRMette

Figure B-13b

FEMA

88°41'23"W 35°52'34"N

88°40'45"W 35°52'5"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance / Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

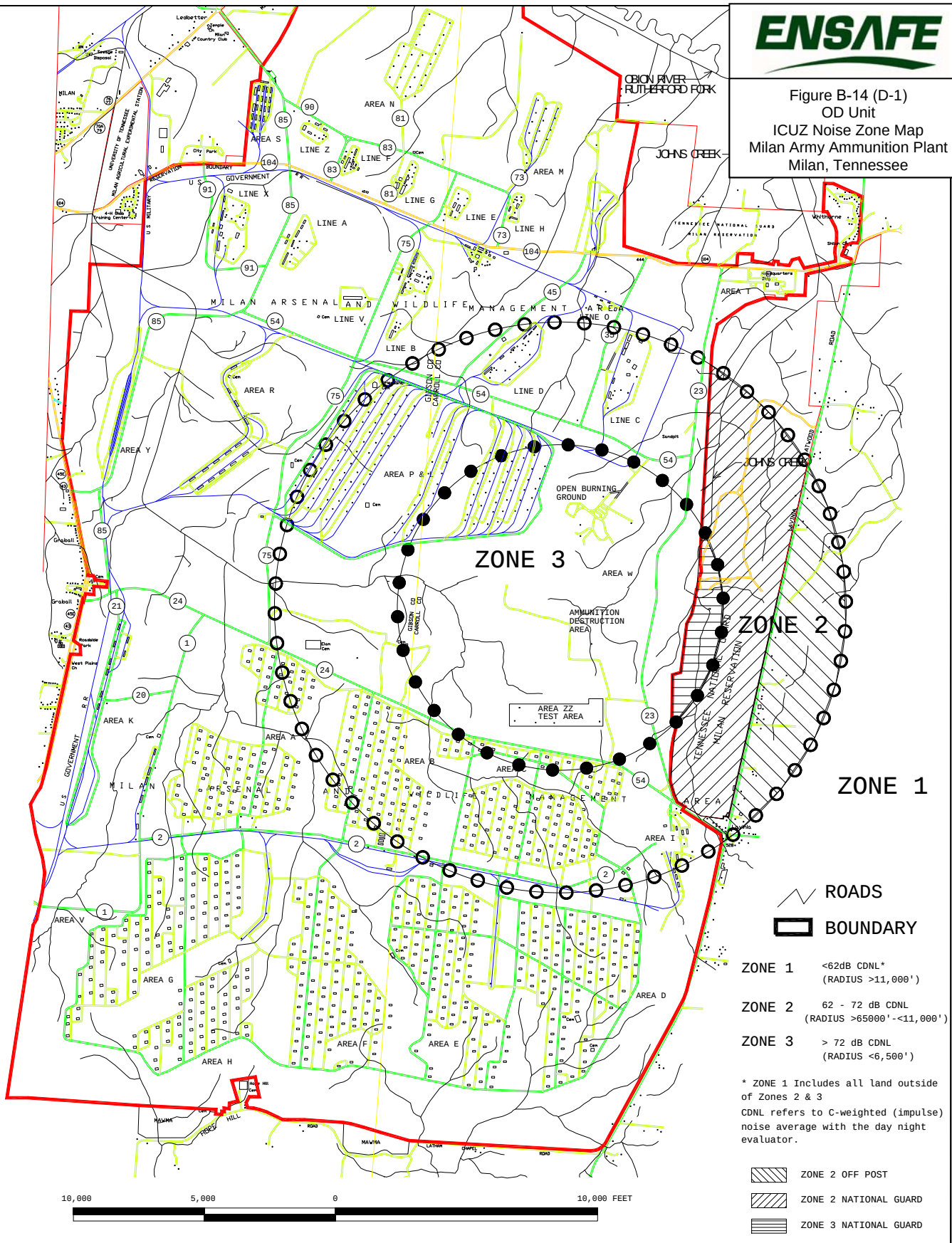
This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 6/20/2024 at 4:15 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

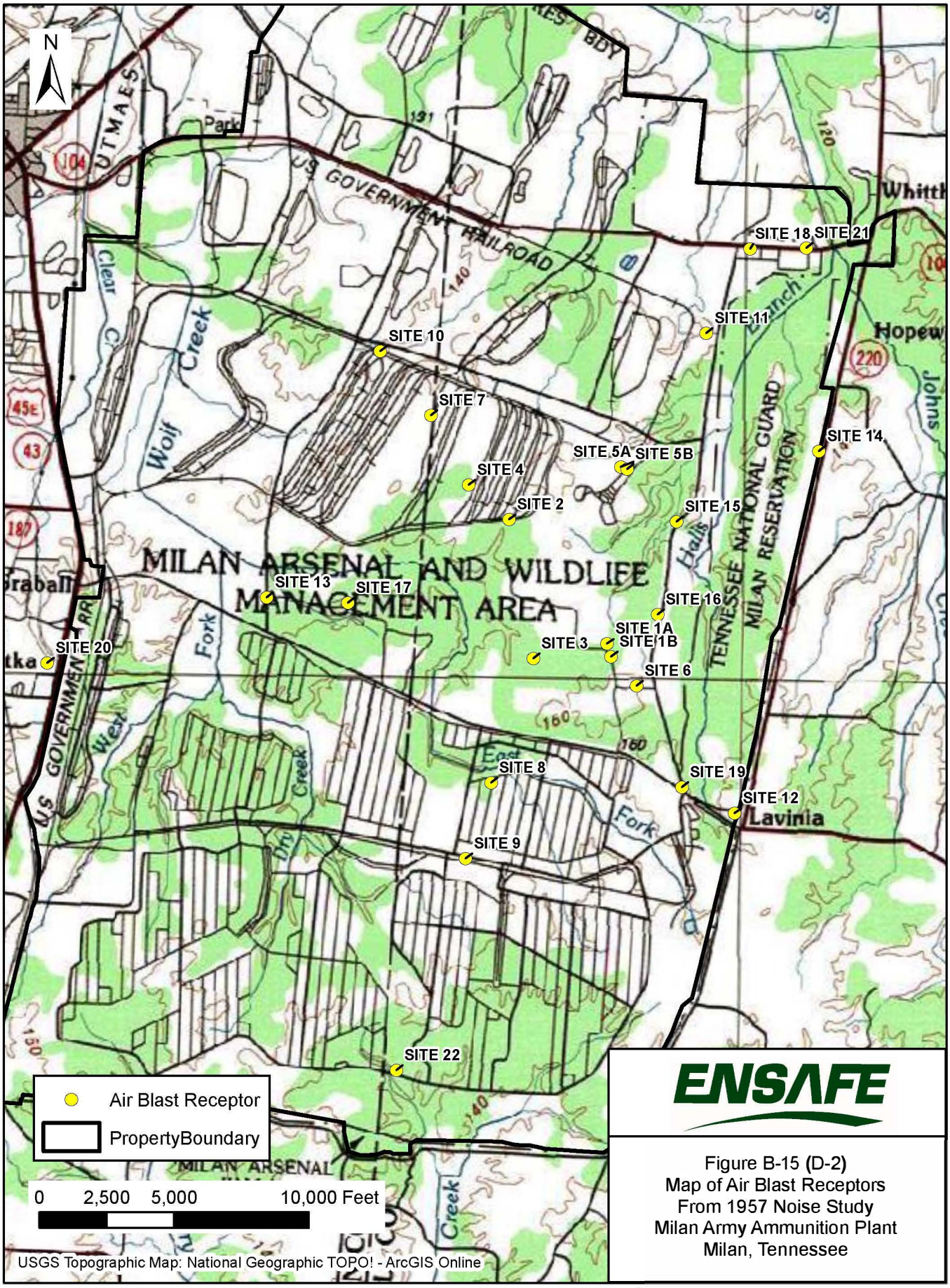
ENSAFE

Figure B-14 (D-1)
OD Unit
ICUZ Noise Zone Map
Milan Army Ammunition Plant
Milan, Tennessee



DRAWN BY: DJB
DATE: 7-03
PLANT: MILAN
LINE:
BLDG. NO.:
DWG. LIST:
SCALE: GRAPHIC

American Ordnance
TITLE: MILAN ARMY AMMUNITION PLANT NOISE CONTOURS MAP
DRAWING NUMBER: MAAP - C - 1150 - 1
SUPERSEDES:
SUPERSEDED BY:



ENSAFE

Figure B-15 (D-2)
Map of Air Blast Receptors
From 1957 Noise Study
Milan Army Ammunition Plant
Milan, Tennessee

7/31/2008 D:\projects\milan\Milan AAP\Map\air_blast_receptors.mxd

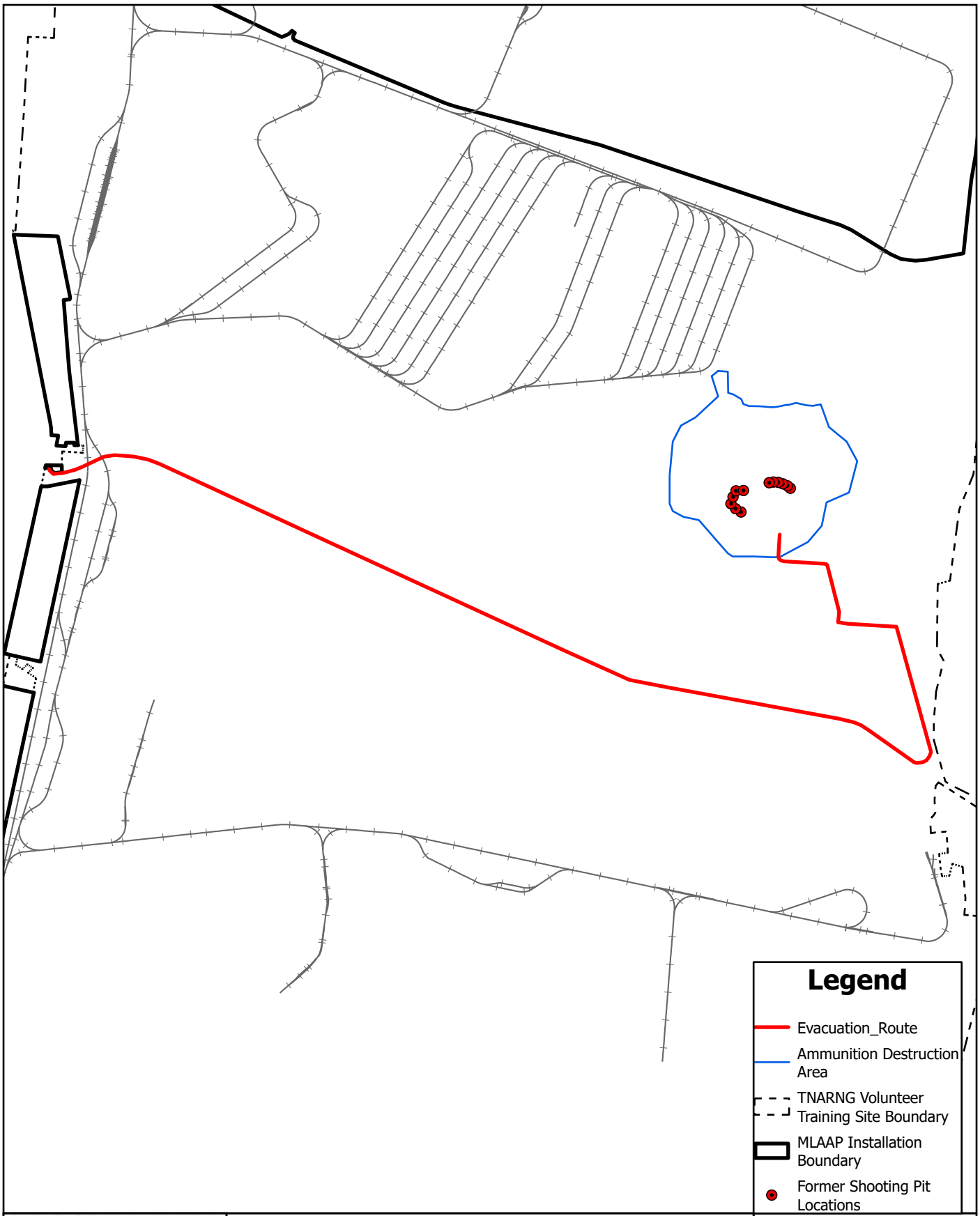


Figure B-16 (G-1)
Evacuation Map

Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, Sources: Esri, Maxar, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap, and the GIS user community

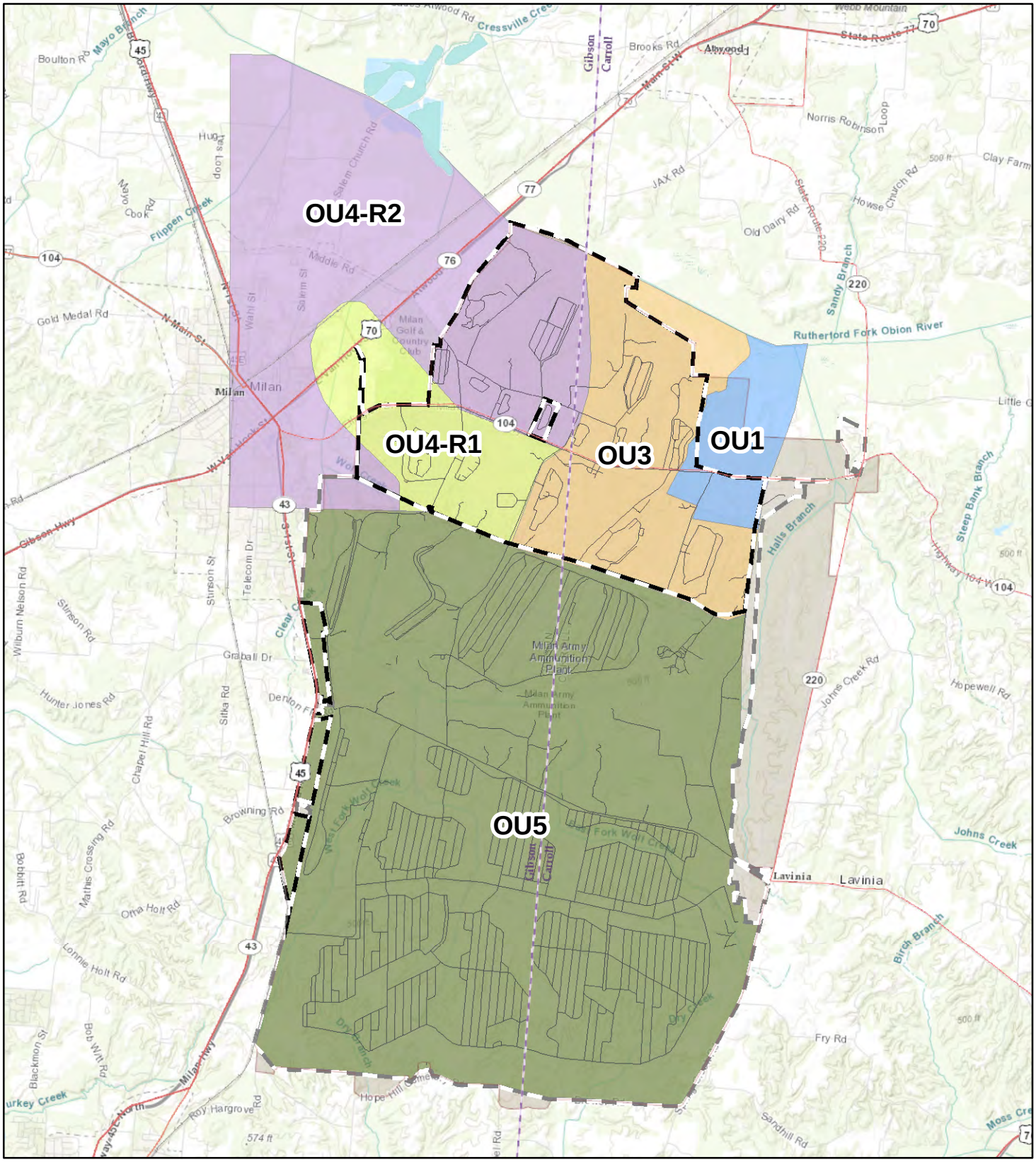
2025

Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet

N

0 0.33 0.65 Mi

0 0.5 1 Km



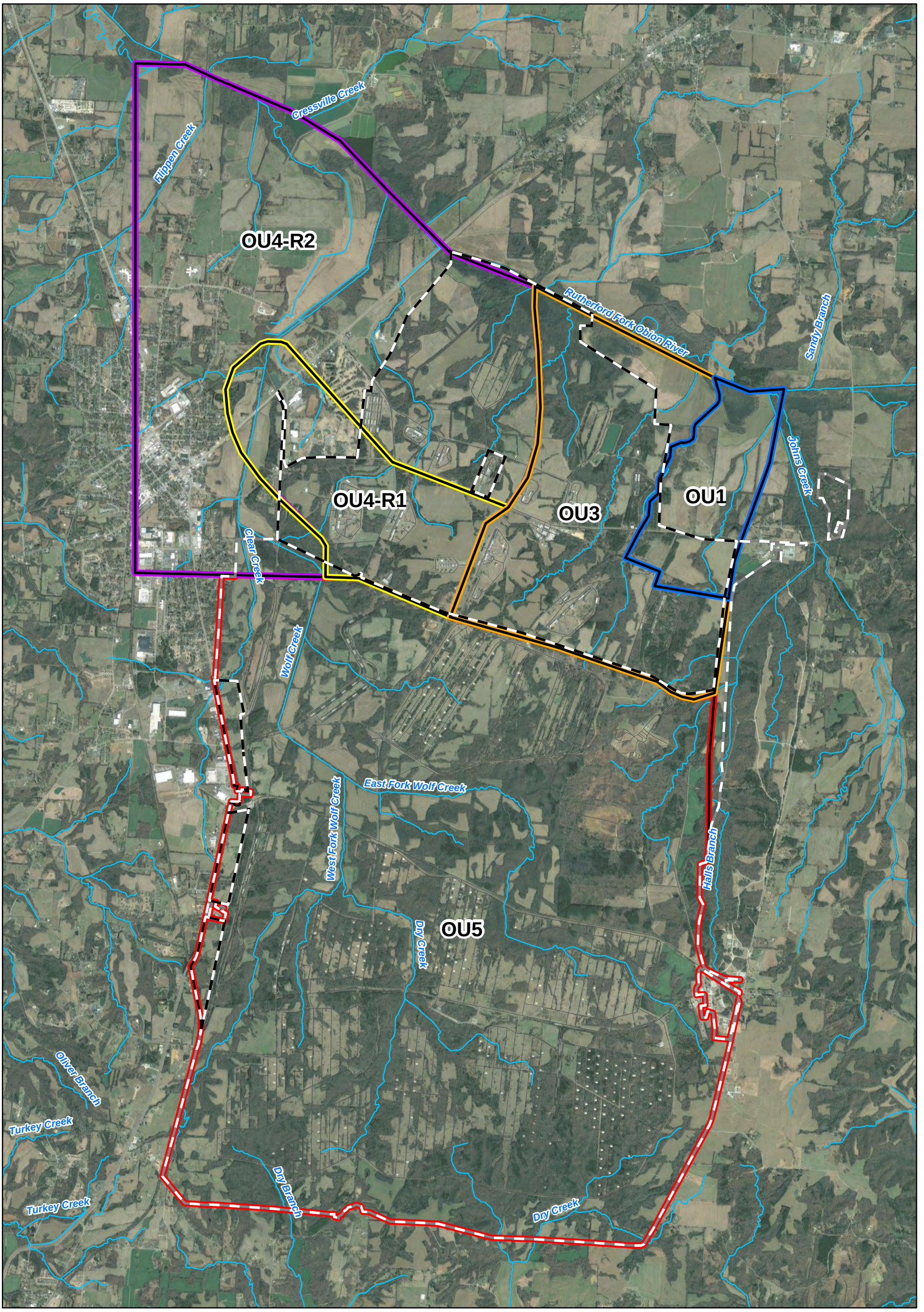
MILAN ARMY AMMUNITION PLANT
MILAN, TENNESSEE

OU Site Location Map

Environmental Chemical Corporation

FIGURE
B-17 (I-1)

ECC GIS Server E:\Projects\MLAAP\MapDocuments\RASR\Year14\Fig1-1_SiteLocationMap.mxd June 2023 Map Size: A



Legend

- Installation Boundary
- Parcel transferred to TNARNG
- Stream/River
- Road

Groundwater Operable Unit Boundaries

- OU1
- OU3
- OU4-R1
- OU4-R2
- OU5

N

0 0.5 1

Miles

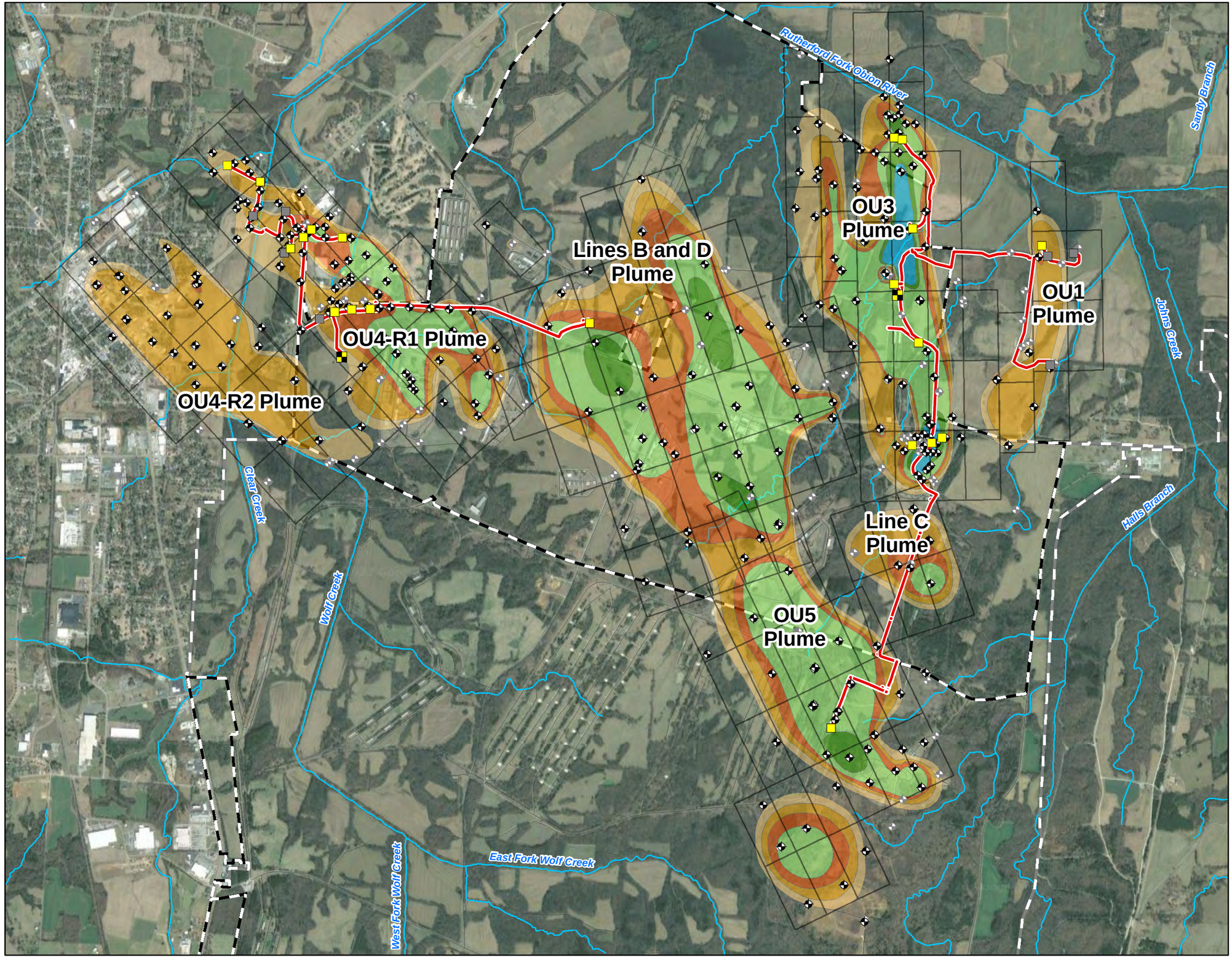
MILAN ARMY AMMUNITION PLANT
MILAN, TENNESSEE

OU MLAAP Site Map

Environmental Chemical Corporation

FIGURE
B-18 (I-2)

ECC GIS Server E:\Projects\MLAAP\MapDocuments\RASR\Year14\Fig1-2_MLAAP_SiteMap.mxd June 2023 Map Size: B



Legend

- Groundwater Treatment Plants (GWTPs)
- Monitoring Well Data Used for Plume Configuration
- Monitoring Well
- Active Extraction Well
- Inactive Extraction Well
- Existing Extraction Piping
- GMA Grid

RDX Concentrations (2022-2023)

- 2 - 10 µg/L
- 10 - 50 µg/L
- 50 - 100 µg/L
- 100 - 500 µg/L
- 500 - 1,000 µg/L
- > 1,000 µg/L
- Installation Boundary
- Parcel transferred to TNARNG
- Stream/River
- Road

N

0 0.5 1

Miles

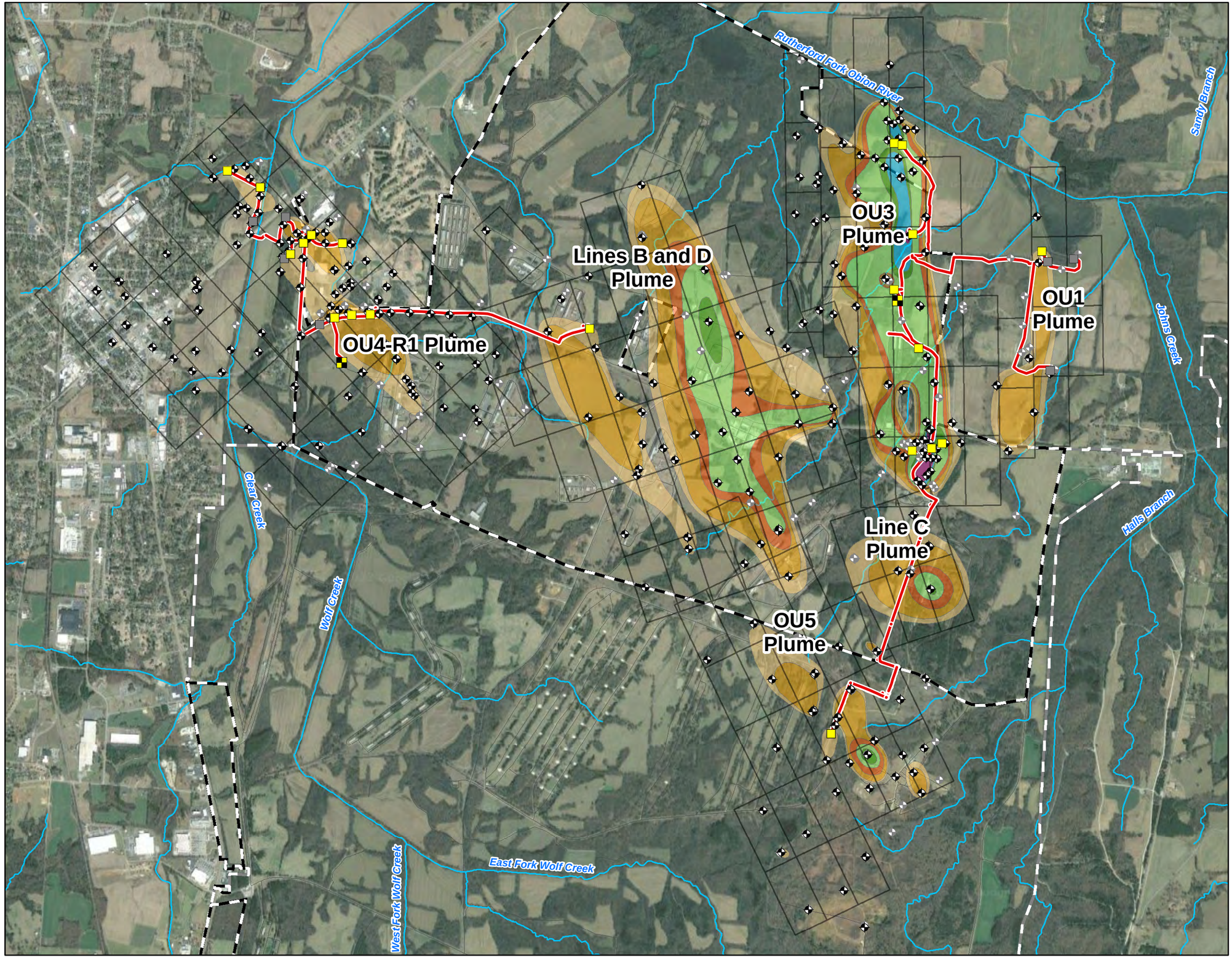
MILAN ARMY AMMUNITION PLANT
MILAN, TENNESSEE

Horizontal Distribution of RDX in Site-Wide Groundwater - RASR Year 9

Environmental Chemical Corporation

FIGURE
B-19 (I-3)

ECC GIS Server E:\Projects\MLAAP\MapDocuments\RASR\Year14\Fig6-01_RASR09_RDXplume.mxd June 2023 Map Size: B



Legend

- Groundwater Treatment Plants (GWTPs)
- Monitoring Well Data Used for Plume Configuration
- Monitoring Well
- Active Extraction Well
- Inactive Extraction Well
- Existing Extraction Piping
- GMA Grid

TNT Concentrations (2022-2023)

- 2 - 10 µg/L
- 10 - 50 µg/L
- 50 - 100 µg/L
- 100 - 500 µg/L
- 500 - 1000 µg/L
- 1,000 - 2,000 µg/L
- > 2,000 µg/L
- Installation Boundary
- Parcel transferred to TNARNG
- Stream/River
- Road

N

0 0.5 1

Miles

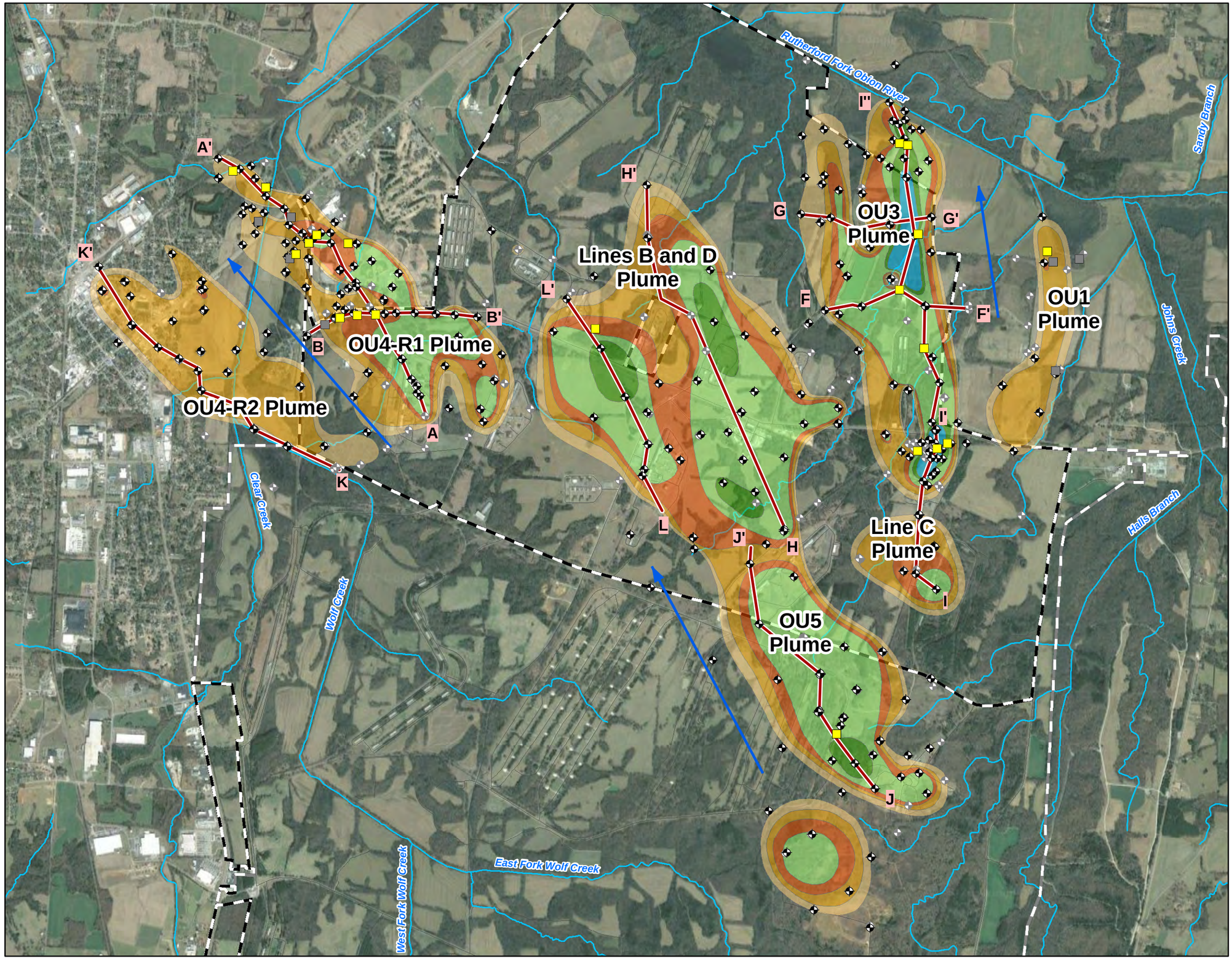
MILAN ARMY AMMUNITION PLANT
MILAN, TENNESSEE

Horizontal Distribution of TNT in Site-Wide Groundwater - RASR Year 9

Environmental Chemical Corporation

FIGURE
B-20 (I-4)

ECC GIS Server E:\Projects\MLAAP\MapDocuments\RASR\Year14\Fig6-02_RASR09_TNTplume.mxd June 2023 Map Size: B



Legend

- Monitoring Well Data Used for Plume Configuration
- Monitoring Well
- Active Extraction Well
- Inactive Extraction Well
- Cross-section
- Approximate Groundwater Flow Direction

RDX Concentrations (2022-2023)

- 2 - 10 µg/L
- 10 - 50 µg/L
- 50 - 100 µg/L
- 100 - 500 µg/L
- 500 - 1,000 µg/L
- > 1,000 µg/L
- Installation Boundary
- Parcel transferred to TNARNG
- Stream/River
- Road

N

0 0.5 1

Miles

MILAN ARMY AMMUNITION PLANT
MILAN, TENNESSEE

Cross-section Location Map and Groundwater Flow Direction

Environmental Chemical Corporation

FIGURE
B-21 (I-5)

ECC GIS Server E:\Projects\MLAAP\MapDocuments\RASR\Year14\Fig6-03_RASR09_CrossSectionLine.mxd June 2023 Map Size: B

Line C Plume

OU5 Plume

MI486 398.70
MI387 400.27
MI680 399.16
MI065 400.13
MI663 401.70
MI490 401.33
MI675 400.22
MI664 402.60
MI159 401.70
MI286 402.85
MI701 403.87
MI063 404.75
MI709 402.11
MI702 403.76
MI299 404.55
MI264 406.62
MI162 407.27
MI281 406.00
MI266 408.48
MI280 406.95
MI684 407.14
EXT-111
MI252 409.53
MI287 410.35
MI017 407.20
MI254 410.63
MI413 406.34
MI250 410.00
MI713 408.36
MI683 409.77
MI256 411.43
MI257 412.09
MI261 411.16
MI263 410.19
MI259 412.28
MI291 408.70
MI260 412.60
MI289 411.10
MI271 413.40
MI296 411.25
MI269 414.39
MI272 414.53
MI019 416.35

399'
400'
401'
402'
403'
404'
405'
406'
407'
408'
409'
410'
411'
412'
413'
414'
415'
416'

East Fork Wolf Creek

Legend

- Monitoring Well with Potentiometric Surface Elevation (ft-amsl)
- Active Extraction Well
- Approximate Groundwater Flow Direction
- Potentiometric Surface Elevation Contour (ft-amsl)
- Installation Boundary

RDX Concentrations (2022-2023)

- 2 - 10 µg/L
- 10 - 50 µg/L
- 50 - 100 µg/L
- 100 - 500 µg/L
- 500 - 1,000 µg/L
- > 1,000 µg/L

- Stream/River

N

0 500 1,000
Feet

Notes:
ft-amsl - feet above mean sea level
1. Monitoring wells were gauged at OU5 and Line C in Quarter 1 2023.
2. Potentiometric surface elevations in parentheses not used for contouring.
3. Because of effects from well efficiency, water levels collected from active extraction wells were not used for contouring.

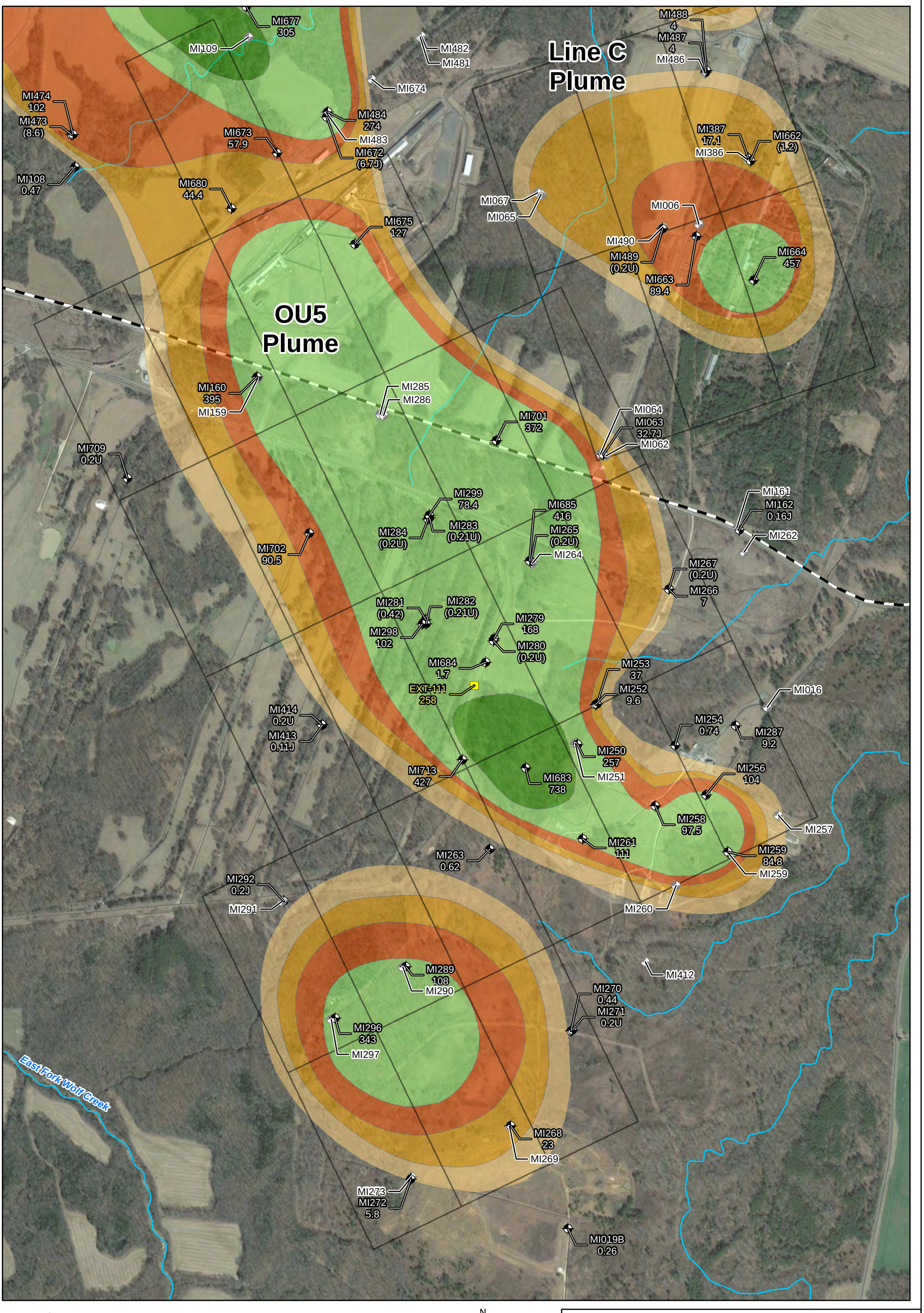
MILAN ARMY AMMUNITION PLANT
MILAN, TENNESSEE

OU5 and Line C Groundwater Potentiometric Surface Map

Environmental Chemical Corporation

FIGURE
B-22 (I-6)

ECC GIS Server E:\Projects\MLAAP\MapDocuments\RASR\Year14\Fig6-18_RASR09_OU5LineC_GW.mxd June 2023 Map Size: B



Legend

- Monitoring Well Data Used for Plume Configuration
- Monitoring Well
- Active Extraction Well
- Inactive Extraction Well
- Installation Boundary
- GMA Grid

RDX Concentrations (2022-2023)

- 2 - 10 µg/L
- 10 - 50 µg/L
- 50 - 100 µg/L
- 100 - 500 µg/L
- 500 - 1,000 µg/L
- > 1,000 µg/L

- Stream/River
- Road

N

0 500 1,000

Feet

Notes:

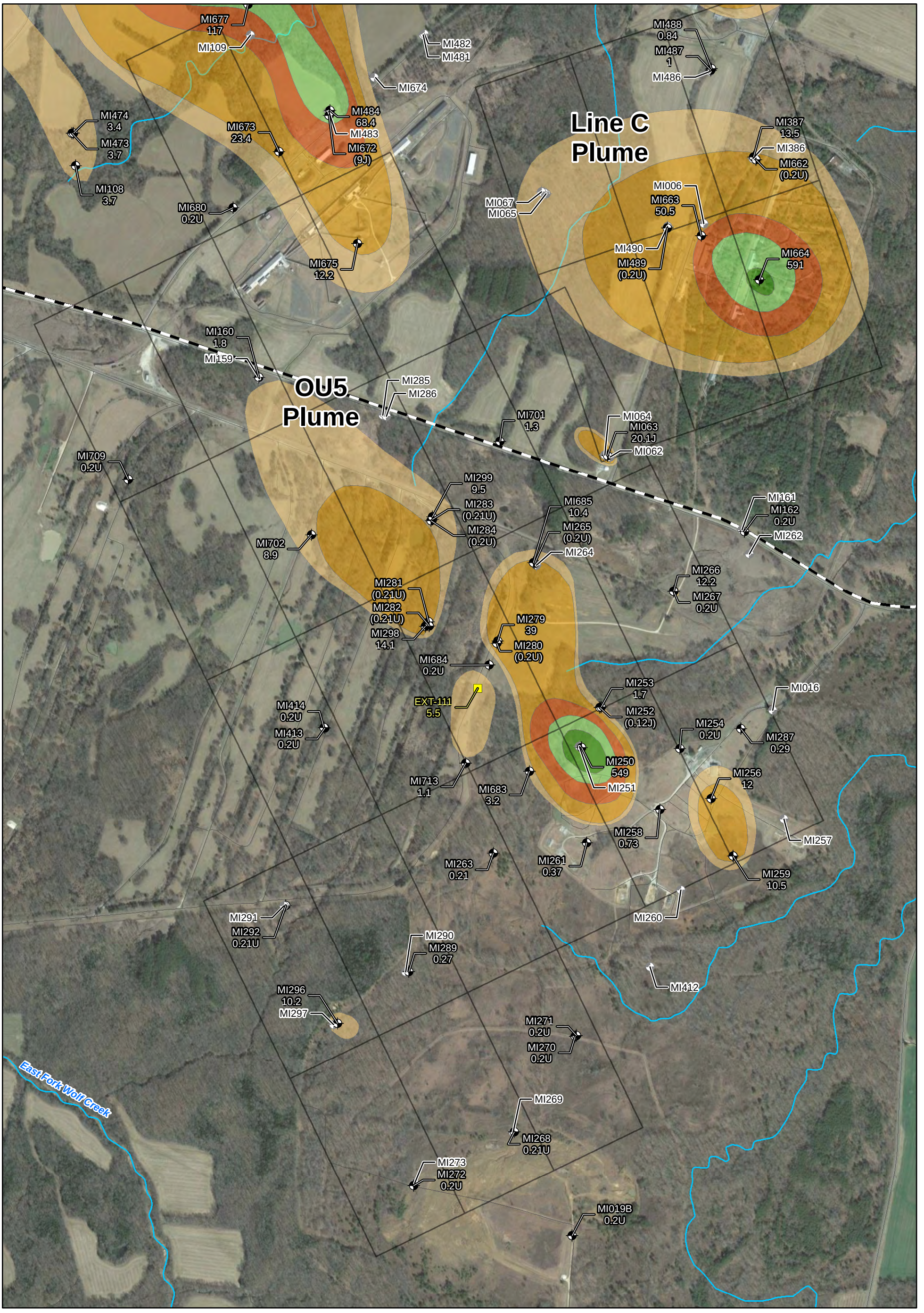
1. Monitoring wells were sampled at OU5 and Line C in Quarter 1 2023.
2. Posted results in µg/L
3. RDX results in parentheses not used for plume contouring

MILAN ARMY AMMUNITION PLANT
MILAN, TENNESSEE

OU5 and Line C
RDX Concentrations in Groundwater

Environmental Chemical Corporation

FIGURE
B-23 (I-7)



Legend

- Monitoring Well Data Used for Plume Configuration
- Monitoring Well
- Active Extraction Well
- Inactive Extraction Well
- Installation Boundary
- GMA Grid

TNT Concentrations (2022-2023)

- 2 - 10 µg/L
- 10 - 50 µg/L
- 50 - 100 µg/L
- 100 - 500 µg/L
- 500 - 1000 µg/L
- 1,000 - 2,000 µg/L
- > 2,000 µg/L

- Stream/River
- Road

N

0 500 1,000

Feet

Notes:
1. Monitoring wells were sampled at OU5 and Line C in Quarter 1 2023.
2. Posted results in µg/L
3. TNT results in parentheses not used for plume contouring

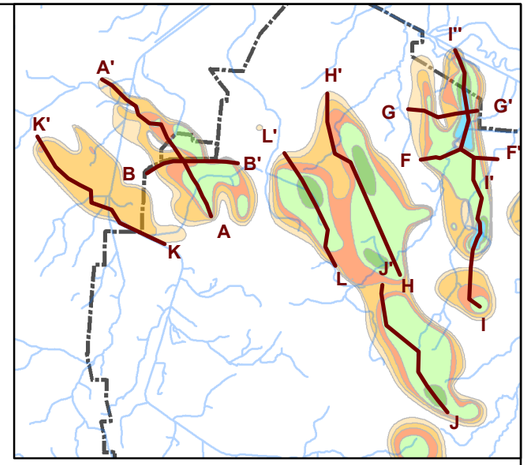
MILAN ARMY AMMUNITION PLANT
MILAN, TENNESSEE

OU5 and Line C
TNT Concentrations in Groundwater

Environmental Chemical Corporation

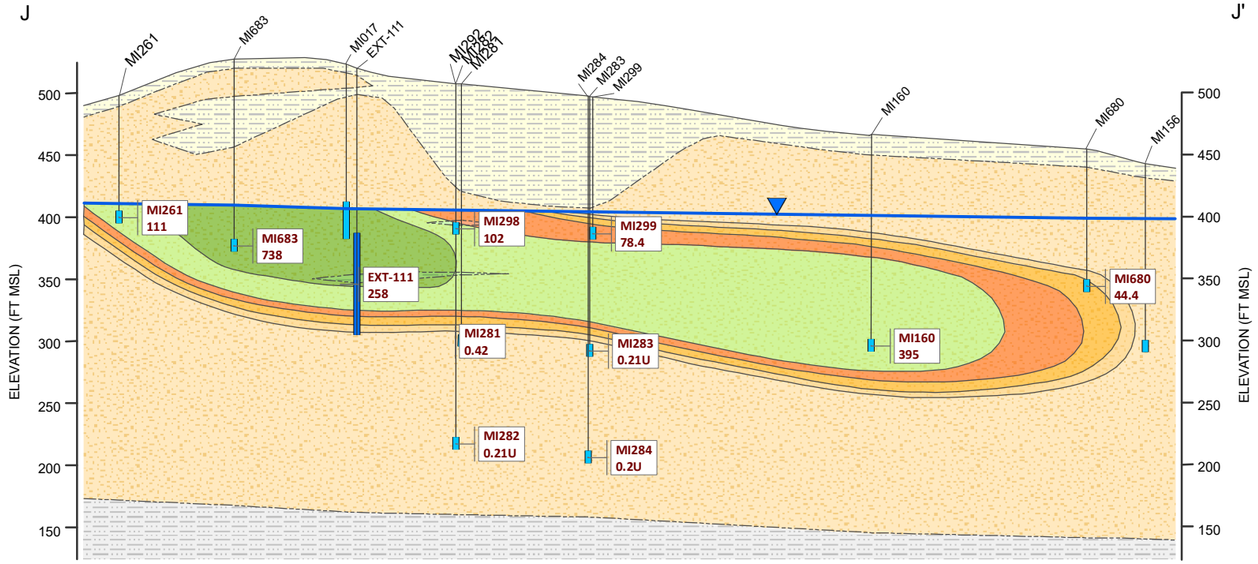
FIGURE
B-24 (I-8)

ECC GIS Server E:\Projects\MLAAP\MapDocuments\RASR\Year14\Fig6-20_RASR09_OU5LineC_TNT.mxd June 2023 Map Size: B



SOUTH
J

NORTH
J'



Legend

- Water Table
- Extraction Well Screen
- Monitoring Well Screen

RASR Year 9 RDX Concentrations (2022-2023)

- 2 - 10 µg/L
- 10 - 50 µg/L
- 50 - 100 µg/L
- 100 - 500 µg/L
- 500 - 1,000 µg/L
- > 1,000 µg/L

Stratigraphy

- Silt, Clay and Sand
- Sand
- Silt and/or Clay

Notes:
1. Posted RDX concentrations in ug/L.
2. If no concentration label, then well was not sampled in RASR Year 9.

J = estimated value

N

0 1,000 2,000

Feet

VERTICAL EXAGGERATION = 10X

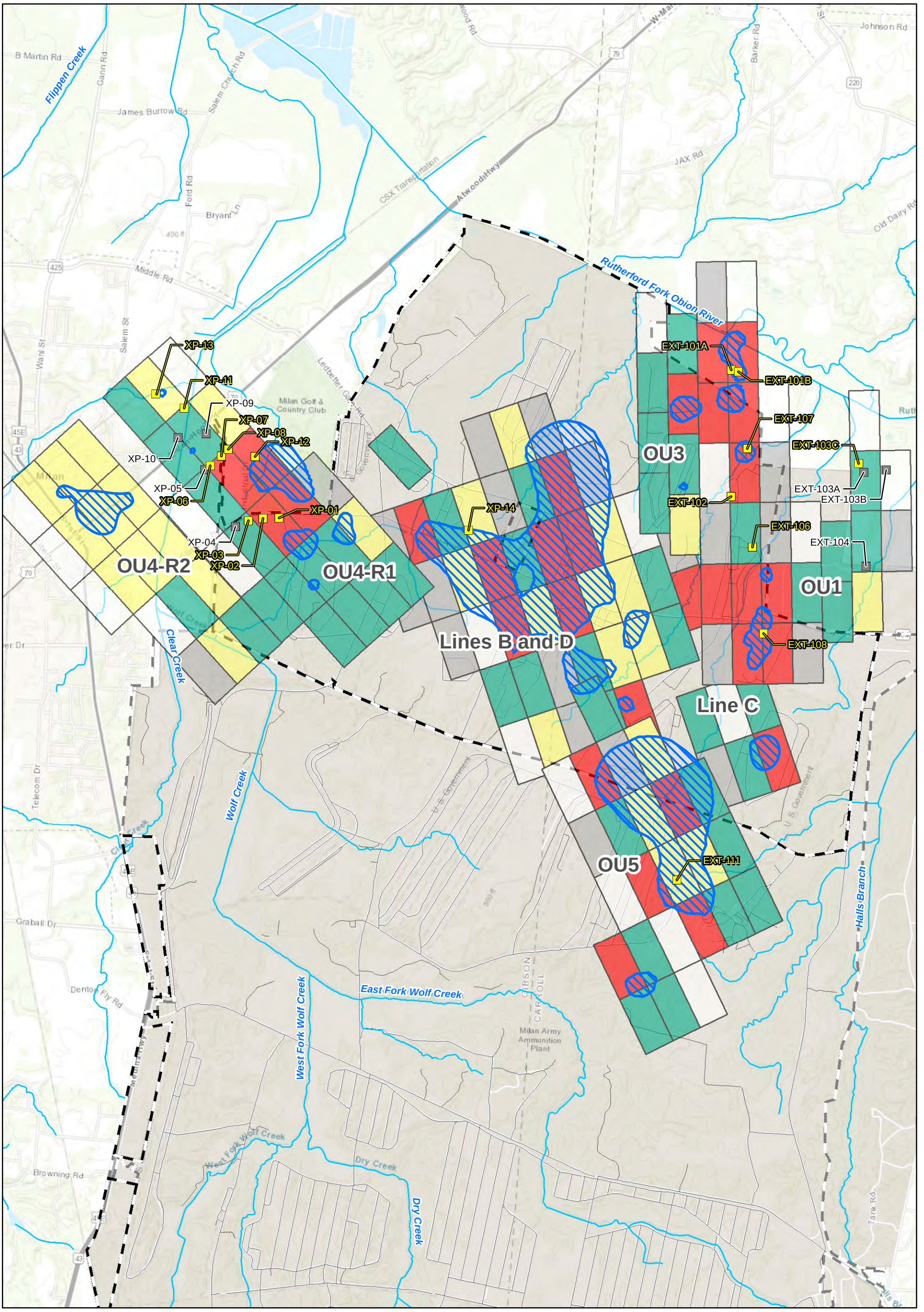
MILAN ARMY AMMUNITION PLANT
MILAN, TENNESSEE

Cross-Section J-J'
RDX Plume
Through OU5

Environmental Chemical Corporation

FIGURE
B-25 (I-9)

ECC GIS Server F:\Projects\MLAAP\MapDocuments\RASR\Year8\Fig6-01_Year8_RDXplume.mxd July 2017 Map Size: B



Legend

- Active Extraction Well
- Inactive Extraction Well
- Projected Areas above the Interim Goal (95 µg/L) in 2030
- Installation Boundary
- Parcel transferred to TNARNG
- Stream/River

GMA Grid

Priority

- First
- Second
- Third
- Fourth
- No Monitoring Wells in the Program

N

0 1,500 3,000

Feet

MILAN ARMY AMMUNITION PLANT
MILAN, TENNESSEE

Estimated Areas Remaining above the Interim Goals at the End Date for Active Remediation (Year 15, 2030)

Environmental Chemical Corporation

FIGURE
B-26 (I-10)

ECC GIS Server E:\Projects\MLAAP\MapDocuments\RASR\Year14\Fig7-07_RASR09_Remedy_Estimate2030.mxd September 2023 Map Size: B

Appendix B-2
Past Waste Management Practices

Appendix B-2
Past Waste Management Practices

The MLAAP site has been in operation almost continually for over 65 years with major investigation efforts being conducted plant-wide to determine past disposal practices and locations through numerous studies and investigations.

The southern area includes Area ZZ (Test Area), Area W, and a closed sanitary landfill. No open burning activities are performed at the Test Area. However, duds or misfired ammunition were open-detonated aboveground at the Test Area upon approval of the Army Safety Office. Area W contains the current ADA and former Burning Ground (BG). The ADA contains the open detonation units and the former EWTF. The BG contains the former open burning units. These areas have been used for treatment of solid and hazardous waste for many years. The following is a summary of what is currently known of past waste handling and disposal practices at MLAAP.

A) One or two disposal trenches active from the mid 1960's to the mid 1970's run east to west with the easternmost end being located approximately 400 feet west-northwest of the W-2 BG Building. At either end of the trenches, is a spoil pile from the excavation of the trenches. These trenches were used primarily for the disposal of explosive-contaminated shells and ash resulting from open burning of bulk explosives. Several potentially live munitions were found at the surface of this area.

B) Two areas northwest of the current PEP burn pan at burning ground were used for the surface burning of bulk PEP and shells from 1942 until 1983. The larger open surface burning area (approximately 500 feet by 750 feet) is on the road encompassing the area where the burn pans are currently located. The smaller area (approximately 250 feet by 175 feet) is on the north side of the road encompassing the area where the primer firing and flashing area is currently located.

C) The old Ammunition Destruction Area southwest of the current burn pans, encompassing an area of approximately 500 feet by 700 feet, was used from 1942 to 1947. In 1984, the area was leveled by a bulldozer, tilled, and sodded to enhance drainage in the area. During this operation, several shells of white phosphorous were exposed and burned out. White phosphorous was burned primarily on the hill located to the east of the drainage ditch that runs through the old ADA.

D) An area east of the old ADA, near the BG (Approximately 750 feet by 500 feet) was used for bulk explosive/propellant burning on the ground surface. After the burns were completed, the burned area would be raked and scraped with the ashes being disposed of in the trenches indicated as "A" above and the metal sent to salvage yard. Inadvertent burial of inert and possible live ordnance occurred in this area during its use from the early 1950's to the mid 1970's.

E) An area used for the disposal of ash and 20/40 mm projectiles from which the tracer had been burned out. This area was located primarily in the first 1,000 feet of the drainage ditch that runs from just south of building W-10 toward the east then to the southeast. The projectiles were inert when received by BG personnel and only needed to have the tracer burned out. The ash resulted from the surface burning of bulk explosive/propellant.

F) An area consisting of three parallel trenches were utilized from the mid 1970's until 1983 when the easternmost trench was removed and backfilled. These trenches ran north-south with each trench approximately 300 feet long, 15 feet wide and 15 feet deep. The center of the westernmost trench is approximately just under the disposal of ash, contaminated casings, and other material that were burned with wooden pallets and explosive contaminated cardboard boxes before being covered with soil.

G) An Area consisting of 4-6 trenches was used for the disposal of bulk liquid paints from the late 1950's to the mid-1970's. The trenches ran in a northeast-southwest pattern and are about 600 feet east of the explosive contaminated waste burning area.

H) An area where three pallets of live 40-Millimeter (MM) ordnance were stacked and set on fire with wood behind a soil berm or barricade. The barricade is still visible in this area. There is evidence that potentially live 40-MM ordnance was inadvertently buried at the site by the ensuing explosion and potentially live 40-MM ordnance, and inert 40-MM projectiles were found in and around the barricade area during the site inspection.

I) A 200-foot by 750-foot area in a relatively flat area across the road (east) from Building W-2 was used for the open surface burning of bulk explosive/ propellant and for the flashing of metal during the period from the mid-1940's to the late 1950's. This area runs northeast to southwest from the front gate (Building W-1A) to near the former weather balloon shelter.

J) A low lying area of about 150 feet by 300 feet where explosive contaminated paper was burned in pits from the early 1940's until the late 1960's. The majority of the burning and pits were located between Track 60 and Route No. 54, and some burning was done on the south side of Track 60 and west side of the drainage ditch. Mounds of ash that were removed from the burning pits are still onsite.

K) A diesel-fired incinerator situated on a concrete pad was loaded near Track 60. The incinerator was used to burn tracers from 40-MM projectiles and flash other contaminated metals. The burned projectiles were loaded from the incinerator into a wheelbarrow and onto flat cars. This practice began in the mid-1940's and was discontinued in the early 1960's; the concrete pad has since been demolished.

L) A natural depression where mud/sludge from the "O" Line ponds was disposed. The depression is at the west end of the trenches outlined in A above. The disposal area appears to be in about a 40-foot diameter circle in the lowest point of the depression. Dates and amounts of disposal are unknown.

M) Line was used for demilitarization, disassembly, rework, and LAP operations. The demil operation included an explosive washout process. The washout water, containing explosives, was captured and allowed to settle in a series of settling ponds. Explosives were periodically removed and the explosive-contaminated water was discharged to a nearby ditch. These use of the ponds was discontinued in the late 1970's and replaced with Industrial Wastewater Treatment Facilities (IWTF), utilizing settling in concrete sumps, filtration, and carbon absorption for treatment. The O-Line ponds were dredged, lined (with the spoils placed on the liner), and capped. Subsequently, groundwater monitoring determined that groundwater in the vicinity of O-Line was contaminated with explosives.

N) A small area where spent activated carbon from the IWTF had been dumped and subsequently removed and disposed. The approximate dimensions of the area are 10 feet by 20 feet and the area is on the east side of the old ADA road, about 150 feet north of the old ADA boundary. The carbon was excavated from the area and properly disposed of offsite in 1983.

O) Location of burial site of an explosive pouring machine (mechanical cow) that has been partially decontaminated at the BG. The machine is buried at a depth of approximately five feet.

P) An area that was used to dispose of approximately 50,000 pounds of Ammonium Nitrate. The chemical was in 100-pound, double-layer sacks, and buried in two pits approximately 300 feet east/southeast of the current explosive-contaminated burn area, almost to the fire break. The larger pit ran in a northwest-southeast direction, and its approximate dimensions were 75 feet long by 13 feet wide by 15 feet deep. The smaller pit was adjacent to the larger pit to the southeast. This disposal took place around 1955.

Q) This 125-foot area was designed as the "Old Hopper Area" where waste munitions, casings, and other metal components were flashed in hoppers and on tables from the mid-1940's to the mid 1970's. This area is currently the location of the uncontaminated waste burn area. The ash from this operation was disposed of in a "trench" and the inert 40-MM casings and projectiles were sent to the salvage yard.

R) A 200-foot by 500-foot area used during the mid-1940's to the early 1950's for destruction of ordnance containing white phosphorous. Remnants of this ordnance have been discovered.

S) Area located 150 feet south of Disposal Area "S" used as a surface burning/flashing area for laboratory waste and ordnance items.

T) Area known as the new ADA which has been in use since the abandonment, in 1947, of the old ADA (area outlined in C above). The area known as the firing area is now inactive and has been graded and sodded as was area C above. The remaining sections of the new ADA are still actively used for ammunition destruction. The entire area has approximate dimensions of 750 feet by 1,250 feet.

U) A small area used for the flashing of potentially contaminated materials, located to the east of the "Old Hopper Area" (Area R above). Dimensions and dates of operations for this area are unknown.

V) A small area used for flashing fuel tanks, light poles, etc. The dimensions and dates of operation for this area are unknown.

W) A 200-foot by 300-foot area that appears to have been used for ammunition destruction during the late 1960's and early 1970's. The area also includes a metal components flashing area for which the dimensions and dates of operation are unknown.

X) A 200-foot square area used for the flashing of explosive-contaminated materials from the mid 1950's to the present (explosive contaminated burn pans). The general area also in which three burn pans were located from the early 1960's to the mid-1970's. Each pan was located on a 30 foot by 60 foot cleared area.

Other Waste Generating and Management Areas (Current and Closed)

A) The closed landfill, SNL 09-101-0144, located south of of MLAAP Route No. 54, was operated from 1974 to 1999. A permitted extension was added in 1984. The landfill covers an area of approximately 37 acres, of which over 36 acres are filled and covered. The landfill used trenches for disposal of solid waste with daily cover of six inches of soil. The landfill was used for disposal of all MLAAP's solid waste, i.e. industrial waste, including metal cans, plastics, paper, rubbish, glass, cafeteria waste, etc. The landfill unit was also used for disposal of Special Solid Waste, including non-hazardous ash from the burning grounds, dried sewage sludge from the sewage treatment plants, dried paints and paint filters, and dried laundry sludge. Other wastes have included asphalt, kerosene, diesel fuel, and oil or grease from the cafeterias.

B) Closed landfill located north of Highway 104. Solid waste from MLAAP operations and processes that were not open burned were disposed of in this landfill. The date waste was first placed in this landfill is unknown, but it is believed that this landfill was first used during the construction of the facility. The landfill was closed and capped when the landfill outlined in A above was placed in operation (1974-75).

C) LAP Lines A, B, C, D, E, F, G, H, I, K, O, X and Z. Solid waste generated from these production lines have been placed in the solid waste landfill, SNL 09-101-0144, or burned for volume reduction. Currently, the class II industrial landfill, IDL-27-101-0085, is used for disposal of non-hazardous waste from production lines and special solid waste for which approval has been obtained. Cardboard, office paper, printer toner cartridges, plastics, and other recyclable materials are recycled.

Prior to the construction of the IWTF for treatment of explosive-contaminated wastewater, these wastewaters were discharged to the ground surface after passing through a series of

small settling sumps. This has resulted in contamination of ditches and soils at the production lines, along with contamination of creeks and some of MLAAP's water supply wells.

Hazardous wastes generated before Resource Conservation Recovery Act (RCRA) regulations were promulgated, were treated and disposed as outlined in A - Y above. Current hazardous waste generated is handled as required under RCRA and TDEC, DSWM regulations.

D) Support Areas A, B, C, D, E, F, I, J, K, L, M, N, P, Q, R, S, T, Y and ZZ. These support areas were used for storage of raw materials, intermediate products, final product (munitions), administrative support, crafts (plumbing, electrical, machine work, carpentry), laboratory and testing (both material and munitions), sewage treatment, steam generation, maintenance, and other support activities. Solid waste generated from these support areas have been placed in the solid waste landfill, SNL 09-101-0144, or burned for volume reduction. Currently, the class II industrial landfill, IDL-27-101-0085, is used for disposal of non-hazardous waste from production lines and special solid waste for which approval has been obtained. Cardboard, office paper, printer toner cartridges, plastics, and other recyclable materials are recycled. Hazardous wastes generated before RCRA regulations were promulgated, were treated and disposed as outlined in A — Y above.

Polychlorinated Biphenyls (PCB) equipment was sent offsite to be reconditioned and if determined to be non-serviceable, was scrapped at the service location. No oils have been disposed of onsite, except those lost during leaks prior to 1980. Currently, PCB contaminated transformers and/or electrical equipment are disposed of offsite at a permitted facility.

Used oil generated at MLAAP was burned in at the coal-fired boiler plant (K-10) from the early 1960's until 2002. Prior to the early 1960's, it is believed that used oil from the vehicle and maintenance shop was burned either at K-10 or the BG. Some isolated incidents of disposal of used oils, asphalt, fuel oil, and kerosene are known to have occurred at the present MLAAP solid waste landfill and other locations. These disposals were believed to have been limited to quantities of less than 100 gallons.

Pallets and boxes treated with the wood preservative, Pentachlorophenol (PCP), were burned at the BG until the mid-1980's or sold as scrap through MLAAP's Salvage Yard.

Since the mid-1980's these materials have been disposed of through DOD disposal contactors.

E) Area V, Sunny Slope. Sunny Slope was used during and for a short time after World War II for demilitarization of large munitions (including shells and bombs). These munitions items were opened and then burned out on an elevated rack. Currently the area is used for a target range for MLAAP Security personnel, and an onsite storage magazine was used by the former MLAAP Fire Department for training. Drilling at the site has indicated the presence of explosives in perched groundwater.

F) Transite Asbestos Materials are known to have been disposed of in at least five locations. These disposal sites include the closed landfill, the closed construction debris landfill, the current class II industrial landfill (with special waste asbestos provision) and two locations south of Areas P and L. The areas have been marked and labeled to alert personnel entering the area with signs that read "WARNING — Non-Friable Asbestos Containing Material Disposed of at This Location."

G) In 1984, sandblasting to remove paint and allow repainting of five elevated water towers at MLAAP led to each water tower ground surface being contaminated with leachable lead at levels greater that the Toxicity Characteristic Leaching Procedure (TCLP) allowable limit of 5.0 micrograms per liter (mg\L). In March 1994, an interim action was initiated which consisted of excavating soils under and around the towers. Excavated soils were transported to an offsite permitted facility for treatment and/or disposal.

H) The Salvage Yard along Highway 104 near Area J has been in use since the early operation of MLAAP. The salvage yard sold and continues to sell scrap/reclaimed metals, wood pallets, boxes, plastics, and used or scrap material and equipment to the public.

Appendix C-1
Waste Analysis Plan

Waste Analysis Plan

The Milan Army Ammunition Plant (MLAAP) is a Government-Owned, Contractor-Operated (GOCO) military industrial installation. The MLAAP facility was constructed and operations started between January 1941 and January 1942. MLAAP's general mission has been the manufacture, storage, and shipment of explosive ordnance, including both large and small-caliber military ammunition. MLAAP is assigned the following general responsibilities:

- Operation and maintenance of active facilities in support of current operations
- General maintenance and caretaker status of facilities
- Continuation of environmental cleanup and liabilities
- Continue closure activities as the facility undergoes divestiture
- Support service for tenants

Facility and Processes that Generate Hazardous Waste

Hazardous wastes generated at all MLAAP include waste propellants, explosives, pyrotechnics (PEP; waste munitions and munitions components. MLAAP also generates non-explosive contaminated waste solvents, and non-explosive contaminated paint-related waste in addition to lab packs and other miscellaneous hazardous waste. A list of wastes currently registered with the Tennessee Department of Environment and Conservation (TDEC) is listed in Table 1.2-1.

Hazardous wastes are generated at MLAAP as a result of the following:

1. Operation and maintenance of active facilities in support of current operations
2. General maintenance and caretaker status of facilities
3. Continuation of environmental cleanup and liabilities
4. Continue closure activities as the facility undergoes divestiture

All non-reactive (explosive) hazardous waste generated at MLAAP is shipped offsite to a permitted treatment and/or disposal facility.

Hazardous Waste Received from Offsite Sources

Hazardous waste is no longer received at MLAAP from off-site.

Table 1.2-1
Hazardous Wastes Currently Registered with TDEC

TDEC Wastestream Number	Waste Name	EPA Waste Codes	Treatment Location	Onsite Treatment Area
No. 1	Explosive Sludge	K044	Onsite	Area W Ammunition Destruction Area
No. 2	Spent Carbon	K045	*Offsite	Treated at Area W Ammunition Destruction Area only if failed Card Gap/DDT Test
No. 3	Non-listed Reactive	D003, D030	Onsite	Area W Burning Pans or Ammunition Destruction Area
No. 7	Ash	D004, D005, D006, D007, D008	Offsite	Area W Burning Pans
No. 8	Explosive/Solvent Contaminated Rags	D001, F005, F003	Offsite	NA
No. 9	Pinkwater	K047	Onsite	Permit Exempt Totally Enclosed Treatment Units with discharge to CWA permitted system.
No. 10	Mixed Thinner Waste	D001, D007, D008, F003, F005	Offsite	NA
No. 11	Paint Sludge and Thinner	D001, F003, F005	Offsite	NA
No. 38	Waste Fluorescent Bulbs	D009	Offsite	NA
No. 40	Waste Lab Pack (Laboratory Chemicals)	LABP	Offsite	NA
No. 43	Waste Corrosives and Metals	D002, D006, D007, D008, D009	Offsite	NA
No 44	Water Soluble Oil	D004, D006, D007, D008	Offsite	NA
No. 45	Waste Toluene Diisocyanate	U223	Offsite	NA
No. 47	Waste Laboratory Solvents	D001, F003, F005	Offsite	NA
No 50	Waste Lead Foil & Cloth Bags	D008	Offsite	NA
No. 51	Waste Fixer Solution from X-Ray	D011	Onsite	Permit Exempt Totally Enclosed Treatment Units with discharge to CWA permitted system.
No. 54	Waste Paint & Adhesive	D001, F003, F005	Offsite	NA
No. 58	Waste Adhesive/Cement	D001, F003, F005	Offsite	NA
No. 59	Waste Chlorinated Laboratory Solvents	F002, D028, D039, U080	Offsite	NA
No. 61	Waste Ash from OB that fails reactivity Test.	D003	Onsite	Area W Burning Ground
No. 62	Waste Bituminous Compound	D001	Offsite	NA
No. 63	Waste Thinner from Stores	D001, D035, F003, F005, U154	Offsite	NA
No. 64	Waste Ink, Out of Specification or Excess	D001, F003, F005	Offsite	NA
No. 65	Waste Dispersant with Lead	D008	Offsite	NA
No. 66	Waste Lab Pack, Chlorinated Solvent	U080	Offsite	NA
No. 67	Polysulfide, cured	D008	Offsite	NA
No. 68	Richmold	D001	Offsite	NA
No. 69	Gasoline Spill Residue	D001	Offsite	NA

Table 1.2-1 Hazardous Wastes Currently Registered with TDEC				
TDEC Wastestream Number	**Waste Name**	**EPA Waste Codes**	**Treatment Location**	**Onsite Treatment Area**
No. 70	Cosomoline	D001	Offsite	NA
No. 71	Gasoline Spill Residue, Contaminated Vermiculite	D001	Offsite	NA
No. 72	Ethanol	D001, F003, F005	Offsite	NA
No. 73	Red Varnish	D001	Offsite	NA
No. 74	Varsol	D001	Offsite	NA
No. 75	Isopropyl Alcohol	D001	Offsite	NA
No. 76	Waste Toluene	U220, D001	Offsite	NA
No. 81	Flammable Liquid, Corrosive	D001, D002	Offsite	NA
No. 82	Waste Paint Chips and Debris	D008, D006	Offsite	NA
No. 83	PQ-56 Antimicrobial Preservative	D002	Offsite	NA
No. 84	Portable Toilet Chemical	D001	Offsite	NA
No. 85	Calcium Hypochlorite	D001	Offsite	NA

Identification/EPA Classification and Quantities of Hazardous Wastes Managed

The chemical characterization of the wastes generated and/or received by MLAAP is described in Table 1.2-2. The table also provides a description of the various waste streams generated at MLAAP and typical Land Disposal Requirements (LDR) Treatment Standards. Treatment standards are subject to change in some instances when regulatory or analytical data changes.

Waste streams treated in Area “W” Open Detonation (OD) Unit at MLAAP only treat EPA listed or characteristic reactive (D003) wastes. These wastes can be grouped into three (3) categories: Propellants, Explosives, or Pyrotechnics (PEP). These are generally described as follows:

- Propellants include single based propellants, chiefly nitrocellulose, double based propellants, usually nitrocellulose and nitroglycerine and triple based or complex typically consisting of nitrocellulose, nitroglycerine and one or more additional nitrated compounds such as dinitrotoluene and/or nitroaguanidine. These propellants may contain stabilizers to reduce the risk of self-ignition, along with other additives to enhance serviceability, such as flash suppressants.

- Explosive compounds at MLAAP consist of three basic types. Each type of bulk explosive or munition varies in type and quantity of explosive. Explosives processed are: cyclotetramethylene tetranitramine (HMX); cyclotrimethylene trinitramine (RDX); and trinitrotoluene (TNT) or blends of these explosives. Additionally, military munitions treated at MLAAP may include ammonium nitrate mixes, insensitive munitions, tetryl and/or primary explosives such as lead azide or lead styphnate.

- Pyrotechnics that may be at MLAAP are small tracers, incendiaries containing explosive with metals such as aluminum, magnesium and/or iron, and some types of aircraft countermeasure flares and illumination rounds.

Waste streams treated by OB/OD include the following listed in Table 1.2.2.

Table 1.2-2

TDEC Wastestream Number	EPA ID Number	Treatment Area/Type
No. 3 – Non-Listed Reactive	D003	ADA

Because the content of these waste streams vary greatly, some discussion of each waste stream and the basis for treatment is provided in the following discussion.

Waste Stream No. 3 Non-listed Reactive

Non-listed reactive waste generated, stored, and treated at MLAAP are EPA D003 hazardous waste. These items may include waste military munitions, rejected munitions and components, partial and completed rounds, fuzes, primers, tracers, and PEP. These items are D003 because they are capable of detonation or explosive reaction if subjected to a strong initiating source or if heated under confinement or because they are capable of detonation or explosive decomposition or reaction at standard temperature and pressure.

Non-listed reactive wastes are collected in containers of various types and consolidated prior to miscellaneous thermal treatment. The only reactive wastes to be treated at MLAAP is already at the Open Detonation Unit. No wastes outside the OD unit will be treated at the ADA. Any non-listed reactive waste generated elsewhere at MLAAP will be shipped offsite for treatment and disposal.

Whether it is a bulk explosive or an item containing an explosive compound, waste munitions are usually contained in fiber containers. These containers may be the original shipping containers or similar containers that are structurally sound. Other containers that may be utilized are metal ammunition boxes. Some waste munitions such as primers will be stored under water or oil in small plastic containers (usually < 1quart) with a screw on lid. The waste munitions (and components) are generally DOT Class 1 explosives (49 CFR 173.50) and are therefore reactive, Tennessee Rule 0400-12-01-.02. They do not require any analysis requirements for explosive characteristics.

Waste containers used to contain and transport waste reactives are removed prior to treatment or are treated with the waste munitions, such as complete ammunition rounds, or munitions components. Containers that are considered RCRA “Empty” are either chemically neutralized if explosive residue is present, shipped offsite for disposal, shipped directly to MLAAP Property Department Salvage Yard at Area J.

Table 1.2-3
Waste streams and Treatment Standards

ame	Generation Area	Process Generating the Waste	Basis for Classification	EPA Waste Codes	Hazardous Properties of Waste	LDR NWW	LDR WW	LDR Treatment Standard (mg/L)
active	• Production Lines Demo Operations • OD Unit Cleanup Operations	Demolition of former production lines and OD unit cleanup operations will generate this reactive waste stream. The waste munitions (and components) are generally DOT Class 1 explosives and are therefore reactive, TN Rule 0400-12-01-.02. They do not require any analysis requirements.	Process Knowledge (SDS, MIDAS, Army Manuals) and/or testing	D003, *D030	Reactive	X		DEACT and meet 268.48 standards (*When D030 is present 0.14 and meet 268.48 standards.)
	• Former OBG Waste Management Unit	No Longer Generated- Ash from treatment of explosive contaminated non-hazardous waste or from explosive waste or from flashing explosive contaminated equipment. The burning of explosive and explosive contaminated waste may generate a residual ash which is an EP-Toxic hazardous waste.	Testing	D004, D005, D006, D007, D008	Toxic	X		Arsenic 5.0 Barium 21 Cadmium 0.11 Chromium 0.60 Lead 0.75 Meet 268.48 Standards
and	• Installation Maintenance Activities	Paint residue from painting of structures and/or equipment and related paint cleanup process.	Process Knowledge and/or Testing	D001, D007, D008, F003, F005	Ignitable, Toxic	X		Acetone 160 Methanol 5.6 MEK 36 Toluene 10 Xylenes 30 Lead 0.75 Chromium 0.060
Oils	• Installation Maintenance Activities	Automotive oils from maintenance heavily contaminated with heavy metals.	Testing	D006, D007, D008	Toxic	X		Cadmium 0.11 Chromium 0.60 Lead 0.75 Meet 268.48 Standards
scent	• Production Lines LAP Operations	This waste stream is generated from the crushing of florescent lighting (tubes) within MLAAP. The intact bulb is sent from many plant locations to the Open Burning Grounds where it is sent through a crushing unit designed for destruction of these florescent tubes. The waste is collected in drums and has a filter to prevent dust escaping to the atmosphere. As the drum becomes filled, it is managed as a hazardous waste and moved to J-137 permitted storage or Area D permitted storage magazine.	Testing	D009	Toxic	X		Mercury 0.025 and meet 268 standards

Table 1.2-3
Waste streams and Treatment Standards

ame	Generation Area	Process Generating the Waste	Basis for Classification	EPA Waste Codes	Hazardous Properties of Waste	LDR NWW	LDR WW	LDR Treatment Standard (mg/L)
ack	• Production Support Operations	Expired or out of shelf life chemicals & reagents from laboratory or from stock control.	Process Knowledge and/or Testing	LABP (D001, D002, D005, D0035, U080, U122)	Toxic, Ignitable	X		Various
ment	• Production Lines LAP Operations	Out of specification or unused adhesive and cement.	Process Knowledge and/or Testing	D001	Ignitable	X		CMBST
	• Production Lines LAP Operations	Out of specification or excess material.	Process Knowledge and Testing	D001	Ignitable	X		CMBST
m	• Installation Maintenance Activities	Out of specification or excess material. Spills.	Process Knowledge and Testing	D002	Corrosive	X		DEACT and meet 268.48 standards
Chips	• Installation Maintenance Activities	Paint chips and debris removed from buildings during cleaning, remodeling, and/or demolition. The debris is typically contaminated with lead and chromium.	Testing	D005,D006, D007, D008, D009	Toxic	X		Barium 21 TCLP Cadmium 0.11 TCLP Chromium 0.60 TCLP Lead 0.75 TCLP and meet 268.48 standards
d Wood	• Installation Maintenance Activities	Wood and debris removed from buildings during cleaning, remodeling, and/or demolition. The debris is typically contaminated with Arsenic	Process Knowledge and Testing	D004	Toxic	X		Arsenic 5.0 and meet 268.48 standards
ols	• Installation Maintenance Activities	Out of specification or excess material. Maintenance activities	Process Knowledge and Testing	D001	Ignitable	X		CMBST

DESCRIPTION OF HAZARDOUS WASTE MANAGEMENT UNITS

There are twenty (20) hazardous waste treatment units (for explosive waste) at MLAAP.

The 20 hazardous waste treatment units are located in Area W at the Ammunition Destruction Area (ADA) that contains up to twenty (20) demolition pits. Only the ADA is used for the miscellaneous thermal treatment of explosive hazardous waste (waste munitions). At the ADA, treatment consists of open detonation where the munitions are buried underground prior to detonation. In addition, detonation of dropped or dangerous rounds is conducted aboveground where safety issues will not allow for the burial of the items.

Safety and Environmental criteria for ADA operations are communicated to employees by environmental permits, Standing Operating Procedures (SOP's), and work instructions.

Area W Ammunition Destruction Area

The ADA (containing X01 units) is located directly south of the former BG area. OD is conducted at the ADA in both above and below ground configurations. The materials treated are bulk military high explosives, completed large caliber and small caliber military ammunition, dropped and/or potentially dangerous rounds, and other military munitions components containing explosives. This area has one (1) igloo-type permanent steel reinforced concrete structure covered with earth, which is used as a protective site for employees during treatment operations. It contains separate rooms used for supply storage.

A brief description of the processes for the miscellaneous thermal treatment at the ADA is as follows:

Waste military munitions, due to the variety of shapes and mission requirements, must often be configured to allow thermal treatment. Trained and experienced workers at the ADA configure and consolidate waste within the ADA.

The OD unit is approximately a 40 acre area containing fourteen to twenty earthen pits, located in two adjacent shooting fields for below ground treatment. The Firing Barricade is located between the shooting fields. Each pit is approximately twenty feet in diameter and ten to fifteen feet in depth (shaped as an inverted cone) and located approximately 120 feet apart.

The amount of materials (explosive waste) treated at this unit depends on the type and configuration of the military munitions. Typical below ground detonation is limited to 350 to 500 pounds or less net explosive weight (NEW) per pit. The material to be treated belowground is placed in open pits and covered with soils before detonation. There may be 10 to 20 "shots" conducted per 10-hour shift. A maximum of 10,000 pounds of waste military munitions as net explosive weight (NEW) may be treated below ground daily. Depending on weather conditions this process may be operated year round.

Above ground open detonation is conducted as well. The amount of waste military munitions and the configuration are limited to a maximum, total explosive weight of 15 pounds (except during an emergency that may threaten human health and/or the environment). This operation is often conducted to treat "potentially armed and/or dangerous rounds" or to open "questionable containers" such as a container from industrial stocks that has been deemed dangerous due to stability of the munition.

The OD unit is constructed of native soils found at the MLAAP facility. Ancillary equipment associated with the OD unit consists of an earthen covered steel reinforced concrete structure used as a firing control/observation post and material storage area. Also used at the ADA is various earth moving equipment, typically remotely operated bulldozers and track hoes.

Waste Transfer and Pick-Up

As closure activities will be conducted at the ADA, no waste will be transferred to the ADA for treatment. The only waste to be treated at the ADA is already within the ADA as explosive contaminated debris and munitions components.

Procedures for Ignitable, Reactive, and Incompatible Wastes

MLAAP has a rigorous program to provide information concerning a wastes hazardous characteristics or incompatibility prior to treatment. MLAAP explosive waste streams are classified according to DoD regulations for compatibility. Incompatible wastes will not be stored or treated together. Table 1.2-4 illustrates typical wastes and compatibility issues that identified for safe storage and movement of hazardous wastes at MLAAP.

Ignitable wastes are identified by reference to vendor SDS's, Sax's Dangerous Properties of Industrial Materials, NFPA's Fire Protection Guide on Hazardous Materials, and AMC-R-385-100 which is the Army's Safety Manual. Not all wastes stored at MLAAP are compatible, hence, requirements for segregation of incompatible wastes are applicable. All storage is conducted in compliance with AMC-R-385-100 and all rules governing the storage of incompatible waste in Tennessee.

Table 1.2-4
Typical Compatibility Controls

Wastestream Name	Incompatible Characteristic	Method
Laboratory Acid	Corrosive to steel	Store in plastic drums.
Bulk Explosives	Subject to friction	Store in fiber containers
Dropped or Dangerous Munitions	Dangerous to move	Place in container filled with sand and move with barricaded truck.

In addition, wastes may be subject to a compatibility evaluation. This evaluation uses the procedures delineated in the EPA document entitled "Design and Development of a Hazardous Waste Reactivity Testing Protocol, February 1984, EPA 600/2-84-057". These test procedures are used to classify wastes based on gross chemical composition for designation according to specific reactivity groups.

Waste munitions are typically stored in fiber, wood and/or metal containers. These containers are the units used for shipment and usage in the field. Bulk propellants and explosives are stored in fiber boxes and drums, non-sparking metal containers and lined wooden boxes. Waste munitions, with no open explosives are considered to be in a container. The munition body is considered the container. For example, some explosive wastes may not be stored together.

COMPATIBILITY OF WASTE AND CONTAINER

Laboratory acid and metals waste is collected in plastic containers that are resistant to the corrosive acids. All solvent waste, including waste mixed thinners and waste paint-related material are stored in 55-gallon steel drums or 5-gallon steel cans.

PROCEDURES TO ENSURE COMPLIANCE WITH LDR REQUIREMENTS

Solid wastes generated at MLAAP may be listed or characteristic hazardous waste and may be treated onsite or offsite. In accordance with Tennessee Rule 0400-12-01-.10, wastes may need to be analyzed to determine whether the waste meets the applicable LDR treatment standard. Analytical data or information from knowledge of the waste is used to determine if the waste is restricted under Tennessee Rule 0400-12-01-.10. If generator knowledge is used, all supporting data is maintained in the operating record. Testing will be conducted only to certify that the waste meets LDR treatment standards. If it is known that the wastes do not meet applicable LDR treatment standards based on process knowledge, no testing is necessary. Each waste for which a treatment standard has been set will be evaluated for the applicable parameters in Tennessee Rule 0400-12-01-.10. All analytical results completed in support of the LDR requirements will be retained in the facility operating record.

Waste resulting from facility operations that exceed applicable LDR treatment standards and are not permitted to be treated onsite will be sent to an off site permitted treatment facility. LDR notifications will be supplied with the shipment of waste with the information required by Tennessee Rule 0400-12-01-.10(g). In addition to the LDR notification, any additional data for the waste stream (waste profile, analytical data) will be provided to the designated treatment facility.

ADDITIONAL REQUIREMENTS FOR WASTE SHIPPED OFFSITE FOR DISPOSAL

Further analyses may be required for a waste to be accepted for offsite disposal. Laboratory arrangements must include data needed for completion of a Waste Analysis Profile and, at a minimum, must include sufficient information to generate the proper DOT shipping name, designation of reportable quantities of hazardous substances, and any other data required by the disposal company. Sufficient analytical data must be obtained to properly complete a shipping manifest for all offsite shipments of hazardous waste.

All wastes that are determined through analysis to meet treatment standards as specified in Tennessee Rule 0400-12-01-.01 will be land disposed in a permitted facility without further treatment. An LDR certification, including all analytical records to support the certification will be prepared and accompany the shipment of waste to the receiving facility.

SELECTING WASTE ANALYSIS PARAMETERS

Waste analysis parameters are selected to ensure proper waste management.

Based on MLAAP's extensive knowledge of raw materials, former process materials, physical/chemical processes of MLAAP former activities, and analytical results as necessary, parameters were selected to ensure complete characterization of solid wastes. To ensure complete characterization of listed waste for compliance with the LDR regulations, knowledge of the process, and where necessary, testing has been used to determine if the hazardous waste exhibit any of the four characteristics of Tennessee Rule 0400-12-01-.02.

Samples will be collected as necessary to meet the following objectives:

- To ensure the safety of the personnel at the site
- Identification of incompatible/inappropriate wastes
- Determine proper waste characterization;
- Determine land disposal requirements; and
- Verification of treatment.

Waste Analysis Requirements for Military Munitions Waste Generated Offsite

Sampling for laboratory analysis of military munitions will not be required in most cases. Military munitions are manufactured to exacting standards, with all components and chemical compositions of materials well identified at the point of manufacture and assembly. The composition of all materials, including those that would become hazardous waste, must meet Military Specification (Mil-Spec) as must the assembly of completed munitions.

In the event information is not available to correctly characterize and classify the munitions waste, samples will be collected and analyzed in accordance with Table 1.2-5.

Sampling Preservation and Storage

Most chemical samples from MLAAP are high concentration waste samples that do not require preservation. Low concentration samples or any samples where the concentration is not known will be preserved in accordance with SW-846 requirements. In addition, sample containers will be selected according to the waste compatibility.

Table 1.2-5 Waste Sample Analysis Requirements				
TDEC Wastestream Number	**Waste Name**	**Minimum Sample Parameter(s)**	**Analytical Method**	**Comments**
No. 3	Non-listed Reactive	Explosives, Reactivity	EPA 8330A, ASTM	The chemical composition of waste munitions and munition components is known and the munitions are also known to be reactive. **In most cases no laboratory analyses are needed to determine physical or chemical characteristics**. Before sampling and analysis is performed, every avenue available to determine the waste composition will be exhausted. In many cases, due to the nature of the waste, sampling and analysis may not be possible. In this case the generator site will be contacted for possible return of the waste munitions.
No. 7	Ash	Explosives, RCRA Metals, Card Gap/DDT, Paint Filter	EPA 8330A, EPA 6010C, EPA 7470A, ASTM, EPA 9095B	
No. 11	Paint Sludge and Thinner	Flashpoint Volatiles RCRA Metals	EPA 1010 EPA 8260B EPA 6010C	Waste is usually defined from the SDS's that are on file for the products added to the container.
No. 12	Spent Motor Oils	Flashpoint, RCRA Metals	EPA 1010, EPA 6010C	
No. 38	Waste Fluorescent Bulbs	RCRA Metals	EPA 6010C	
No. 40	Waste Lab Pack (Laboratory Chemicals)	Various Reagents, etc.	NA	Determined by Content. Many wastes are defined from the SDS's that are on file for the products added to the container.
No. 58	Waste Adhesive/Cement	Flashpoint, BTU's/lb, Volatiles	EPA 1010, EPA 8260	Waste is usually defined from the SDS's that are on file for the products added to the container.
No. 74	Varsol	Flashpoint, BTU's/lb	EPA 1010	Waste is usually defined from the SDS's that are on file for the products added to the container.
No. 77	Waste Sodium Hydroxide	pH	EPA 9040B	Waste is usually defined from the SDS's that are on file for the products added to the container.
No. 81	Waste Paint Chips and Debris	Explosives RCRA Metals	EPA 8330A EPA 6010C	
No. 88	Arsenic Contaminated Wood	Explosives RCRA Metals	EPA 8330A EPA 6010C	
No. 89	Waste Aerosols Flammable	Flashpoint, BTU's/lb	EPA 1010	Waste is usually defined from the SDS's that are on file for the products added to the container.

Sampling Methods

Selection of the analytical testing methods for the wastes generated at MLAAP was based upon the physical state of the wastes, analytes of interest, and information requirements. Selected sample parameters are the minimum analytes necessary to analyze for that particular waste stream in order to properly manage the waste. Table 1.2-6 lists waste streams at MLAAP and strategies to ensure these objectives are met.

The sampling methods used at MLAAP are consistent with those referenced in Tennessee Rule 0400-12-01-.02.

Trained and experienced site personnel perform sampling of all wastes at MLAAP. Sampling personnel have a minimum of 24-Hour TSD training and are proficient in the use of PPE and sampling equipment.

All sampling containers are purchased new or received pre-cleaned from the onsite laboratory or subcontract laboratory.

Samples, if required, for analysis of mixed solvent waste, waste paint related material, waste oils and waste laboratory solvents in 55-gallon drums are collected from the 55-gallon waste container using a clean glass tube that will reach the bottom of the drum. Sample collected is deposited in either a 40 ml VOA vial or a clean glass jar with Teflon lined lid. After sample collection, the glass tube is carefully broken and remains in the waste container.

All samples, upon collection are labeled and, as required, packed and transported between 0-4ºC to the laboratory. Chain of custody (CoC) protocol is followed. Sample containers must carry the waste or sample name, sample location, sample date and time of collection, the analysis requested, the method of preservation and the sampler's name.

Sample Equipment Decontamination Methods

Reusable sampling equipment is cleaned in the field or by MLAAP's EHS Department.
Sample equipment cleaning also includes decontamination in three (3) separate consecutive cleaning tubs as follows:

1. The equipment is washed with a phosphate-free detergent and nylon brush;
2. The equipment is washed with distilled water and a nylon brush; and
3. Step two is repeated.

Table 1.2-6 Waste Sample Strategies and Frequencies							
TDEC Wastestream Number	**Waste Name**	**Sample Preservation**	**Sample Container**	**Holding Time**	**Sample Type**	**Sample Equipment**	**Sample Frequency**
No. 3	Non-listed Reactive	ICE (0-4 Degrees C)	Fiber	14 days	Grab	Scoop	As required where process knowledge is not sufficient
No. 7	Ash	ICE (0-4 Degrees C)	Plastic	14 days	Grab	Scoop	Every Batch
No. 11	Paint Sludge and Thinner	ICE (0-4 Degrees C)	Glass	14 days	Grab	coliwasa	As required where process knowledge is not sufficient
No. 12	Spent Motor Oils	ICE (0-4 Degrees C)	Glass	14 days	Grab	coliwasa	As required where process knowledge is not sufficient
No. 38	Waste Fluorescent Bulbs	ICE (0-4 Degrees C)	Plastic	28 days	Grab	Trier, scoop, tiered thief	Every batch of crushed bulbs
No. 40	Waste Lab Pack (Laboratory Chemicals)	ICE (0-4 Degrees C)	Glass, Plastic	14 days	Grab	coliwasa	As required where process knowledge is not sufficient
No. 58	Waste Adhesive/Cement	ICE (0-4 Degrees C)	Glass	14 days	Grab	Coliwasa, scoop	As required where process knowledge is not sufficient
No. 74	Varsol	ICE (0-4 Degrees C)	Glass	14 days	Grab	coliwasa	As required where process knowledge is not sufficient
No. 77	Waste Sodium Hydroxide	ICE (0-4 Degrees C)	Glass	14 days	Grab	coliwasa	As required where process knowledge is not sufficient
No. 81	Waste Paint Chips and Debris	ICE (0-4 Degrees C)	Glass	14 days	Grab	Trier, scoop, tiered thief	As required where process knowledge is not sufficient
No. 88	Arsenic Contaminated Wood	ICE (0-4 Degrees C)	Glass	14 days	Grab	Trier, scoop, tiered thief	As required where process knowledge is not sufficient
No. 89	Waste Aerosols Flammable	NA	NA	NA	NA	NA	NA

Sampling QA/QC Procedures

All sampling conducted for the purposes of characterizing wastes managed by MLAAP will use compatible storage containers, chain-of-custody from sample collection through delivery to the analytical laboratory, and appropriate QA/QC procedures.

Health and Safety Protocols

All sampling is conducted by employees that have completed the OSHA 24-Hour Treatment, Storage and Disposal (TSD) training in accordance with the HAZWOPER Standard- 29 CFR 1910.120. Personnel Protective Equipment (PPE) will vary according to waste being sampled.

In order to minimize contact with potentially hazardous materials the following personal protective equipment will be available and worn as deemed appropriate by MLAAP EHS Department:

- Full Face shield or chemical splash proof goggles
- Tyvek apron or full body coveralls
- Chemical resistant gloves
- Safety glasses
- NIOSH approved respirator with appropriate cartridges

Many metals are carcinogenic, and most are toxic by ingestion, inhalation, and/or skin absorption. Wearing personal protective clothing and maintaining good work practices minimizes the possibility of exposure to metals. Exposure to metals through skin contact can be controlled through use of proper PPE.

Explosives that could be sampled at MLAAP sites include Trinitrotoluene (TNT), RDX, HMX, and others. The exposure route for explosives may be by inhalation, absorption, ingestion, or skin or eye contact. Exposure to explosives via inhalation is expected to be minimal as little dust is generated from sampling. PPE will control the possibility of exposure through skin contact. When sampling explosive materials, conductive shoes will be worn to eliminate electrostatic discharge.

The primary route of exposure to solvents is through the respiratory system, although other routes of exposure may be by skin absorption and/or ingestion. If it is determined that a waste contains volatiles an air respirator will be worn when deemed appropriate by MLAAP EHS. PPE will control the possibility of exposure through skin contact.

SELECTING LABORATORY TESTING AND ANALYTICAL METHODS

Selecting a Laboratory

Laboratory selection is based upon the laboratory having a comprehensive QA/QC program, technical expertise, and an effective reporting system. MLAAP will ensure that selected laboratories are accredited through pertinent accreditation bodies such as NVLAP and NELAP.

Selecting Testing and Analytical Methods

Selection of testing methods is based upon several items including the physical state of the waste, analytes of interest, required detection limits, and information requirements.

Testing for hazardous characteristics of waste streams generated at MLAAP will be performed on all waste streams where characteristics may vary or the content of the waste is not known. In most cases, it is known exactly what the content of the waste stream is and therefore information can gathered from SDS's or similar descriptive information.

Complete military munitions are units that contain a propellant, a primer device, and a projectile often containing an explosive with a fuse device. Typically, all conventional military munitions contain one or more of the above components. These units are made to withstand the rigors of battle, therefore often materials contained in these munitions are not readily accessible. The military builds these munitions to exacting standards and tracks each part and material used in their manufacture. The sampling and analysis of any complete munition and/or component would be a very rare event.

If all avenues of information were inconclusive and the waste munitions had to be sampled and an analysis performed, the following procedure would be used. Note: It cannot be overemphasized that the composition of these munitions is well documented and the need for sampling and analysis would be rarely, if ever required. Since there is a safety hazard posed by the handling and testing of wastes (waste munitions) containing relatively high levels of explosives, and explosive contaminated wastes, they are assumed to be reactive in lieu of testing.

Due to the nature of many types of munitions, traditional test methods are not applicable due to the design and configuration of the subject. In many cases, testing would be unsafe, potentially resulting in damage to valuable equipment, injury or death to analytical personnel. In cases dealing with these types of munitions, waste analysis would be taken from MIDAS manufacturer's information, military Technical Manuals, and/or SDS's. MIDAS details all materials, including the chemical composition, of all munitions manufactured for the DoD. This computer based information system was developed for this application and is available for use at MLAAP. MIDAS can be used to determine the composition of any waste munition.

In the event MLAAP becomes subject to new regulatory requirements, additional testing methodologies will be incorporated into the waste analysis plan.

Sampling Requirements for Wastes

Prior to sampling, all containers with identical marking, similar and/or identical packaging, similar appearance, etc. would be grouped, identified and designated for sampling as a group. Each grouping will be marked (identified), identified on the sampler's field log to match each group represented by the sample.

A trained technician will collect grab samples from each group identified above. The amount of sample collected will be the minimum required for laboratory analysis. Sample container opening devices and sample collection devices will be non-sparking and approved by the MLAAP EHS Department. Sample containers will be labeled to reflect the generator, generator location, generator EPA ID number, hazardous waste nomenclature, hazardous waste codes, sample code, the samplers name, time and date and sample location. Samples will be transported under COC to the MLAAP contracted laboratories for analysis.

Additional procedures are specified to evaluate any miscellaneous potentially explosive wastes as well. They are the "Deflagration to Detonation Transition Test" (DDT) and the "GAP Test." These tests were developed by the U.S. Bureau of Mines for evaluating explosives (or wastes explosives) for the characteristics of reactivity due to detonation. The DDT and GAP test procedures are published by ASTM under the title "Methods of Evaluating Explosive Reactivity of Explosive Contaminated Solid Waste Substances." EPA has determined that reactivity is defined by Department of Transportation (DOT) listing via 49 CFR Part 172.

The Card Gap and DDT tests are performed by independent specialized explosive testing facilities. All other analyses are performed by independent contracted laboratories.

Sampling of Bulk Packaged Explosive, Propellants and/or Pyrotechnics

Bulk packaged hazardous waste (explosives, propellants and or pyrotechnics) are typically packed in cardboard boxes with water proof liners, paperboard drums with a water proof or anti-static liner or non-sparking metal containers. The waste would be assumed to meet the definition of a reactive waste (waste code D003); therefore the minimum number of samples and amount of sample that would provide a representative composite would be collected. In the case of bulk materials, the minimum representative number of sample would be one complete item representative of that group (lot or part (DoDAC) number), while a minimum amount of bulk material would be 250 grams. It must be noted that safety of site sampling personnel and property will be of major concern. All explosive ordnance items to be sampled would be moved to a remote, safe location prior to sampling.

Additional Requirements for Waste to be Disposed Off-Site

Further analyses may be required for acceptance of a waste for off-site disposal. Laboratory arrangements must include data needed for completion of a Waste Analysis Profile and, at a minimum, must include sufficient information to generate the proper DOT shipping name, designation of reportable quantities of hazardous substances, and any other data required by the disposal company. Sufficient analytical data must be obtained to properly complete a shipping manifest for all off-site shipments of hazardous waste

SELECTING WASTE RE-EVALUATION FREQUENCIES

Most MLAAP waste streams are well documented and mature. Process knowledge of what is in the waste is well documented by knowing where the waste was generated and exactly what items were added to the waste. Anytime a process is changed specific samples will be collected from that waste stream.

Table 1.2-6 above provides an example of waste streams on MLAAP and sampling frequencies.

APPENDIX 2.1-1
CERTIFICATE OF TREATMENT, STORAGE AND/OR DISPOSAL

MILAN ARMY AMMUNITION PLANT
HWY 104 SUITE 1
MILAN, TENNESSE 38358

Milan Army Ammunition Plant certifies that on the 00th day of XXXX, waste material received from XXXX described on shipping document (manifest #) XXXX was managed in compliance with all state and federal laws and regulations, including 40 CFR 260 thru 270.

Methods of Management: X01 Miscellaneous Thermal Treatment (Open Detonation)

Description: WASTE RDX, DESENSITIZED (D003), 1.1D, UN0483, PG II, (EX1992090126), (11-0483-07).

By: _____
Mr. XXXX
Open Detonation Unit Activities Management

Should you have any questions, please contact the MLAAP at (731) 686-6675

APPENDIX 2.1-2

HAZARDOUS WASTE TRACKING			Manifest No.		
Hazardous Waste Description - Waste Code:			Quantity:		
RECEIVING INFORMATION Date Received:			Received By		
Container No.	Amount	Weight Lbs.	Fill-Date	Location	Section

TRANSFER INFORMATION					Moved/ Received By:
Date Moved	Container No.	Amount/Ctn. Or Weight	Location	Section	Date, Time, and Signature

Appendix C-2

Storm Water Summary

2022-2025 Outfalls SW2, SW4, and SW9 Stormwater Summary

Outfall	Location	Date Sampled	Rainfall	Flow (total gallons)	TSS (mg/l)	pH	Nitrobodies (mg/L)	Grease (mg/l)
SW2	Area J	9/27/2024	0.22	119,172	4	7.23	0.0003408	1.4
SW2	Area J	4/6/2023	1.51	817.952	2	7.86	0.000187	30.8
SW2	Area J	8/29/2022	-	200,000	26	7.06	ND	1.8

Outfall	Location	Date Sampled	Rainfall	Flow (total gallons)	TSS (mg/l)	pH	Nitrobodies (mg/L)	Grease (mg/l)
SW4	Burning Ground	Removed from NPDES Permit- No Sampling conducted in 2024						
SW4	Burning Ground	4/6/2023	1.51	6,691,774	<2	7.25	ND	28.4
SW4	Burning Ground	8/29/2022	-	200,000	163	4.66	ND	1.7

Outfall	Location	Date Sampled	Rainfall	Flow (total gallons)	TSS (mg/l)	pH	Nitrobodies (mg/L)	Grease (mg/l)
SW9	Salvage Yard	9/27/2024	0.22	14,790	2.5	7.13	0.0012374	1.5
SW9	Salvage Yard	4/6/2023	1.51	101.516	10	8.01	0.000187	16.4
SW9	Salvage Yard	10/14/2022	-	-	20	5.72	ND	ND

Appendix C-3

Groundwater and Plume Maps:

C-1 ADA and Former BG Area TNT Plume Map (Fig. B-11a)
C-2 ADA and Former BG Area RDX Plume Map (Fig. B-12a)
C-3 Simulated Study Area Groundwater Flow Map (Fig. B-9)
C-4 Fall 2024 Groundwater Flow at RCRA Waste Management Area Map (Fig. B-10)

N

Burning Ground Plume

0 495 990 1,980 2,970 Feet

Figure B-11a (C-1)
Ammunition Destruction Area
TNT Plume Map

MLAAP Installation Boundary post 9Aug2022
TNARNG Volunteer Training Site Boundary (Prior to Aug 2022)
Ammunition Destruction Area
TNT_LTM12_polys
NAME
2.8 - 10 ug/L
10 - 50 ug/L
50 - 100 ug/L
100 - 500 ug/L
500 - 1000 ug/L
1,000 - 4,000 ug/L
> 4,000 ug/L
Monitoring_Wells
Former Shooting Pit Locations

Drawn by: B. Corrigan
June 27, 2024

N

Burning Ground Plume

ADA Plume

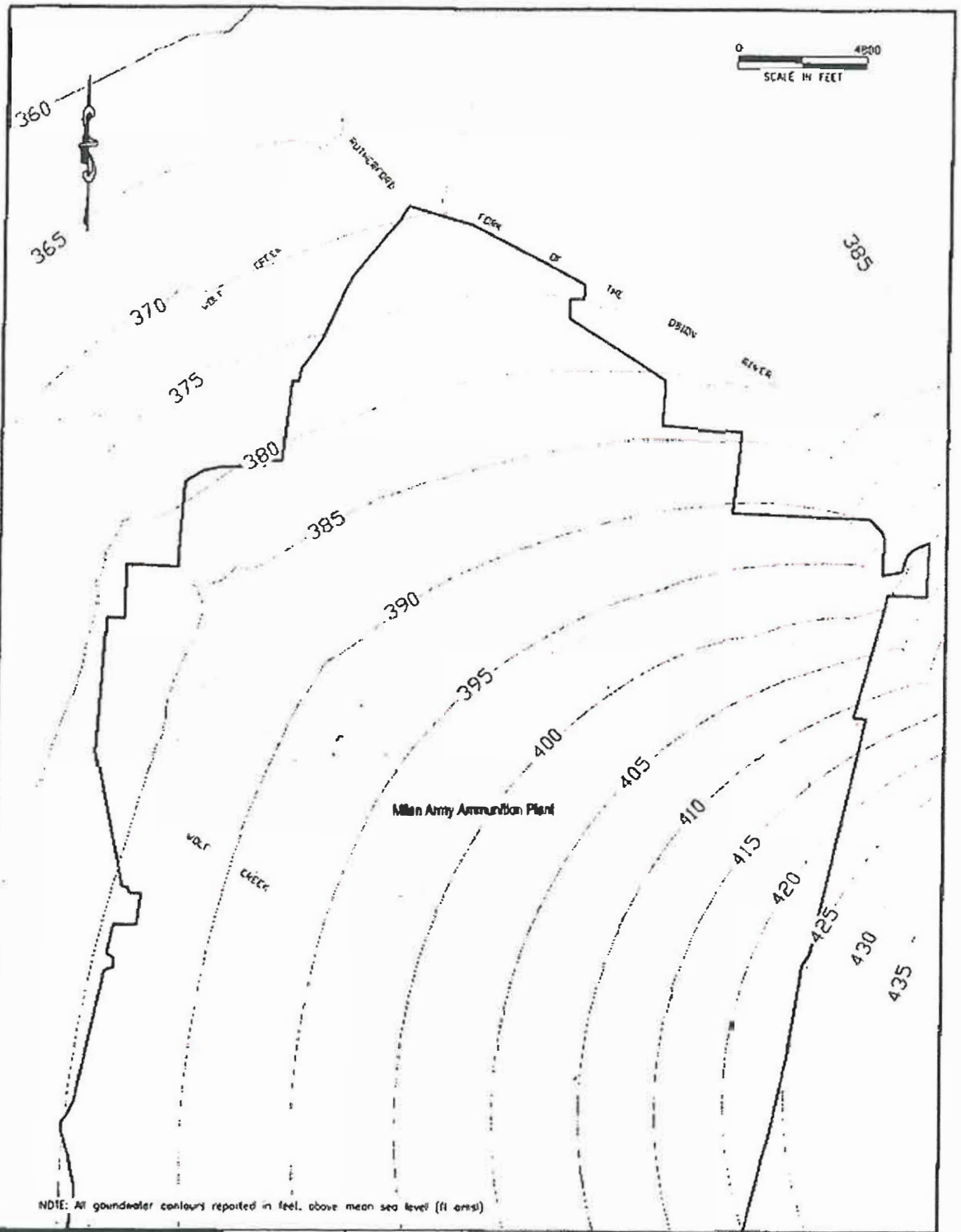
0 495 990 1,980 2,970 Feet

Figure B-12a (C-2)
ADA and Former BG Area
RDX Plume Map

Legend
- TNARNG Volunteer Training Site Boundary (Property Added Aug. 2022)
- MLAAP Installation Boundary post 9Aug2022
- TNARNG Volunteer Training Site Boundary (Prior to Aug 2022)
- Ammunition Destruction Area

RDX Concentrations
- 2 - 10 ug/L
- 10 - 50 ug/L
- 50 - 100 ug/L
- 100 - 500 ug/L
- 500 - 1,000 ug/L
- > 1,000 ug/L
- Monitoring_Wells
- Former Shooting Pit Locations

Drawn by: B. Corrigan
June 27, 2024



ARCADIS

Figure B-9 (C-3)
Simulated Study Area Groundwater Flow Map
Model Layer 1
Milan Army Ammunition Plant

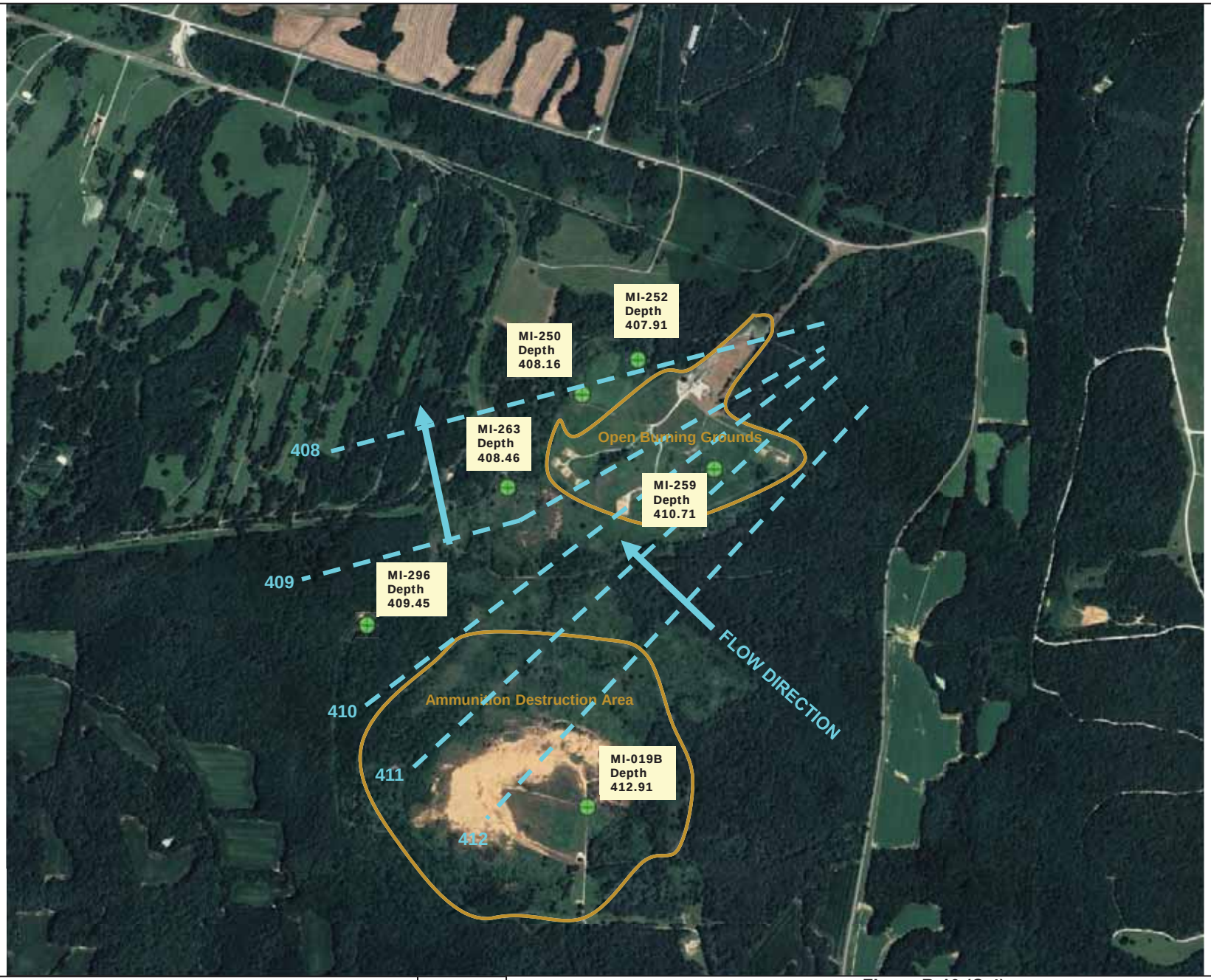


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Figure B-10 (C-4)
FALL 2024 GROUNDWATER FLOW AT RCRA WMA
MAP 2024 AMERICAN ORDINANCE LLC
2280 HWY 104 WEST, SUITE 2, MILAN, TN 38358-3177

DATE: 01/2025 Rev. 10/2025	SOURCE: SATELLITE IMAGERY		FIGURE
Drawn By: KTS	SCALE :NTS	JOB NO. AMERORDN.0007EN	

Appendix C-4

Sampling and Analysis Plan

SOIL AND GROUNDWATER SAMPLING AND ANALYSIS PLAN

PREPARED FOR:

MILAN ARMY AMMUNITION PLANT
MLAAP RCRA WASTE MANAGEMENT AREAS

FORMER BURNING GROUND (BG) AND AMMUNITION DESTRUCTION AREA (ADA)

November 2025

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1.0 PURPOSE

The purpose of this plan is to provide a written Sampling and Analysis Plan for a detection monitoring program for groundwater monitoring at MLAAP Area W in accordance with the groundwater monitoring as required under Federal Regulation 40 CFR Part 265, Subpart F, Section 265.92. The Sampling and Analysis Plan also includes written requirements for soil monitoring at the Area W Ammunition Destruction Area (ADA).

The procedures herein are required to ensure that all data obtained from sampling are of acceptable quality. This plan serves as a reference document for MLAAP employees, contractors and subcontractors, regulatory agencies, and laboratories involved with groundwater monitoring and soil monitoring at MLAAP. For purposes of the Sampling and Analysis Plan for Area W will also be referred to as the MLAAP RCRA Waste Management Area.

Quality assurance (QA) is the activity required to assure desired and verifiable levels of quality in all aspects of a sampling and testing program. Quality control (QC) is the functional mechanism to achieve quality data. The QA program will ensure that the QC program will result in high quality data. This document will describe the QA/QC procedures for each aspect of the confirmation sampling activities, which will meet the data quality objectives of this project. Procedures in this Plan were referenced from Chemical Quality Data Management for Hazardous Waste Remedial Activities, ER-1110-1-263 (Ref. 3), a U.S. Army Corps of Engineers (USACE) regulation, with additional guidance from Development of an RFI Work Plan for RCRA Facility Investigations, SW-87-001 (Ref. 8), "Minimum Chemistry Data Reporting Requirements," (Ref. 2), and RCRA Groundwater Monitoring Technical Enforcement Manual (Ref. 5).

2.0 SITE DESCRIPTION AND BACKGROUND

MLAAP is located in Western Tennessee, east of the City of Milan on State Route 104. MLAAP covers 22,351 acres and contains numerous production, maintenance, and storage areas.

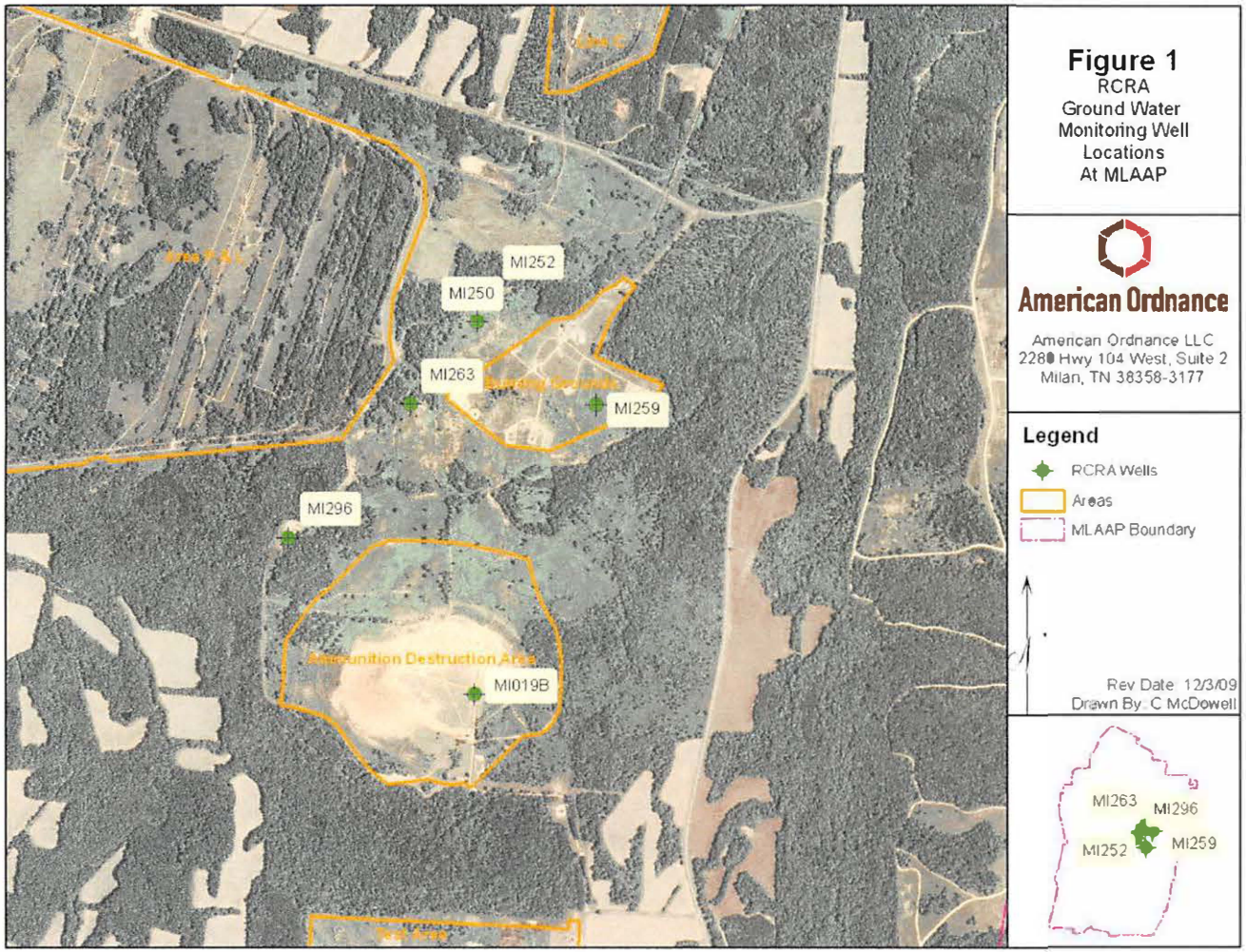
The geography of MLAAP and the surrounding area is that of gently rolling hills with wet-weather streams draining numerous small watersheds. No mountains, lakes, or ridges are a significant part of the regional geography. The land is covered with scattered wood lots, crops, and pastureland. Elevation of the installation above mean sea level ranges from about 590 feet in the southern portion to 320 feet at the northern boundary; predominant slope and drainage are to the north and west.

Three major watersheds drain MLAAP. They are the Middle Fork of the Forked Deer River, which drains a small portion of the igloo storage area; Wolf Creek which drains about 11,000 acres in the southern, central, and northwestern portions; and the Rutherford Fork of the Obion River which drains approximately 6,460 acres in the east and northeastern portion of the plant. Ultimately, all drainage empties into the Obion River which empties into the Mississippi River. Johns Creek is the only continuous flowing stream at MLAAP.

The surface soils at MLAAP consist chiefly of a reddish-brown to yellow mottled silty clay that grades into a clay unit with depth. The soil types include the Memphis, Loring, Grenada, Calloway, Henry, Falaya and Waverly soil associations. Based on topography, the Memphis and Loring series occur on higher elevations and are well-drained soils. The Henry soil series is somewhat poorly drained and is usually associated with flat terrain while the Falaya and Waverly occur in the low areas and are poorly drained.

Drill logs from borings installed at the site indicate that the upper 12 to 15 feet of soil consists of reddish-brown to tan silty lean clay with some layers of sandy and fat clay. Below these depths, sands with varying amounts of silts and clays have been encountered. Occasional gravel, up to 3/8-inch in diameter, has been encountered during boring operations. A more sandy alluvium of lesser thickness (5-10 feet) was observed in several areas across the site. Natural and artificial drainage systems have incised into the alluvium in several locations.

2.1 MLAAP Former Burning Ground and Ammunition Destruction Area



3.0 SAMPLING & ANALYSIS REQUIREMENTS

Sampling will be performed at the BG and ADA in order to meet the requirements of 40 CFR 265.90. Table 3-1 illustrates the monitoring plan at Area W, or MLAAP RCRA Waste Management Area.

Field measurements will be taken onsite during sampling events and recorded in a bound notebook. These field measurements will include the following:

Groundwater

- Time and date of sampling
- Recording of weather conditions, including temperature
- Total depth of well to the nearest 0.01 ft
- Depth to ground water to the nearest 0.01 ft
- Amount of purge water in gallons
- pH, specific conductance and temperature of ground water collected
- Sampling equipment used, site personnel present and calibration procedures

Soil

- Time and date of sampling
- Recording of weather conditions, including temperature
- Depth of Sample
- Location of Sample
- Sampling equipment used & site personnel present

3.1 Monitoring Well Sampling

Groundwater monitoring wells will be purged with a dedicated, disposable Teflon bailer or portable purging system. The portable system typically consists of a submersible or purge pump and a discharge pipe. The purge pump will be operated by a portable generator. After purging is completed, the equipment will be removed from the well and cleaned thoroughly. The wells will then be sampled with clean/new disposable Teflon bailers or directly from the portable purging system.

Table 3-1
Burning Ground/Ammunition Destruction Area Testing Plan for Groundwater

Location	Frequency of Testing	Well Identification	Well Gradient	Parameters	Test Method
RCRA Waste Management Area (includes Former Burning Ground and Ammunition Destruction Area	Semi-Annual	1. MI-019 2. MI-259 3. MI-250 4. MI-252 5. MI-263 6. MI-296	1. Up gradient 2. Up gradient 3. Down gradient 4. Down gradient 5. Down gradient 6. Down gradient	1. Groundwater Indicators a. pH b. Specific Conductance c. Temperature 2. Explosives a. 2,4-DNT b. 2,6-DNT c. 1,3,5-TNB d. 2,4,6-TNT e. RDX f. HMX	1. a. 150.1 b. 120.1 2. 8330

Table 3-2
Ammunition Destruction Area Testing Plan for Soil

Location	Frequency of Testing	Parameters	Test Method
RCRA Waste Management Area	**Semi-Annual**	**1. Extractable Petroleum Hydrocarbons** **2. Explosives** **a. 2,4-DNT** **b. 2,6-DNT** **c. 1,3,5-TNB** **d. 2,4,6-TNT** **e. RDX** **f. HMX** **3. RCRA Metals**	**1. TN EPH** **2. 8330** **3. 6010/7471**

For the purging pump and associated tubing, water from the cleaning tubs will be pumped through these pieces of equipment and into waste containers prior to cleaning with subsequent tubs. The bailers will be rinsed and will be treated as solid waste. The cleaning/purge water will be sent to the Ground Water Treatment Plant (GWTP) for processing. Clean plastic sheeting is to be placed beneath all field sampling equipment in order to alleviate any contamination from the soil. The used sheeting will be disposed of as PPE and stored onsite in accordance with MLAAP SOP Book 12 "Management of Solid and Hazardous Waste".

3.1.1 Monitoring Well Inspection

During any sampling event, upon arrival at the wellhead, the Ground Water Monitoring Well Inspection Form will be filled out completely. The completed form will be returned to the AO Environmental office. The inspection forms will be reviewed to determine if the wells need some type of maintenance. AO staff will perform routine maintenance of the well. If a well needs significant repairs, the Army Environmental Coordinator will be consulted to determine what action should be taken.

Each groundwater monitoring well will be inspected as often as it is sampled and not less than once a year. All completed inspection forms will be on file at the MLAAP Contractor Environmental office.

3.1.2 Measurement of Static Water Level Elevations in Monitoring Wells & Piezometers

All groundwater monitoring wells at MLAAP have steel protective covers, which are secured with padlocks.

Before well evacuation and sampling is performed, the depth of the well and the static water level of the well are measured. Measurements are made from the notch in the top of the well casing and recorded in the field journal and on other appropriate forms. This measurement, with the date and time, is recorded to 0.01 feet on the field data log sheet.

The electronic Model 6000 or similar portable static water level meter is used to measure water levels. If the electronic device is not operational, a second standby electronic measuring device is used. Both devices are identical and are capable of measurement with a reliability of 0.01 feet. The probe will be rinsed in Type II reagent grade water immediately before being lowered into the well and immediately after removing it from the well. If the well/piezometer is heavily contaminated, additional cleaning of the probe may be required.

Water level measurements are then used to calculate the volume of groundwater in the well. The measuring device is decontaminated between uses in separate wells to prevent cross-contamination of wells.

3.1.3 Monitoring Well Evacuation Procedures

Prior to sampling, stagnant water within the well (three casing volumes) will be removed so that fresh formation water can enter. If after removing three volumes of water, the pH, temperature, and conductivity have not stabilized, then additional volumes will be removed. These parameters will be considered to be stabilized within approximately 10% over at least two measurements. As a guide, measurements will be taken at the end of purging each casing volume. In the case where the well runs dry before three well casings can be removed, then the sampling will take place as soon as the well has recharged (i.e. there is no need to remove any more casing volumes). The purged water will be sent to the GWTP for processing. The wells will be sampled as soon as possible after purging, but not before they achieve 85% (percent) recovery.

If full recovery time exceeds two hours, sampling will take place as soon as sufficient volume is available to retrieve samples for each required parameter. If the recharge rate is high for a well, the purge water is removed at a slower rate to prevent agitation of the recharge water. For slowly recharging wells, sampling will take place as soon as sufficient recharge has occurred to fill sampling containers. In all cases, sampling will take place within 24 hours of purging. The sampling crew will record the recharge rate, the date, time, and rate of purging, and any unusual conditions noted with this operation. Non-dedicated purging equipment will be thoroughly cleaned as described in decontamination procedures.

The well casing volume is first determined by using the well depth and water level measurements. A sampling pump or a dedicated sampling bailer (if the well does not have a pump) is then used to remove three volumes of water from the well.

Volumes for the well being purged are determined using the following formula:

Three Casing Volumes =

$$((T\text{-}W)) \times \frac{D^2}{4} \times 7.48) \times 3 = \text{Minimum Purge Amount (gallons)}$$

Where: T = Total depth of well in feet;
W = Depth to static water level in feet;
π = 3.1412;
D = Diameter of the well pipe in feet.

For each well diameter size, a factor may be calculated to simplify the formula.

2 in. well: (T-W) X 0.49 = 3.0 casing volumes
4 in. well: (T-W) X 1.96 = 3.0 casing volumes

If the well does not yield the three volumes, it will be evacuated to dryness once. When the well recovers sufficiently, in situ or field analyses are done on water samples to measure pH, temperature, and specific conductance. As soon as the well has recovered sufficiently samples will then be collected and containerized in the order of parameter volatilization sensitivity. The well will be retested for pH, temperature, and specific conductance after sampling as a measure of purging efficiency. Four replicate measurements for field analyses on each well are taken and recorded on the Field Data Logsheet.

The pH and conductivity meters are calibrated each morning before purging and sampling, and the calibration is checked in the field several times throughout the day. Meters will be checked to more than one standard to ensure accuracy. Calibration data is recorded in the calibration logbook.

3.1.4 Monitoring Well Sampling and Testing

Groundwater monitoring wells will be sampled with a dedicated or disposable Teflon bailer that will be slowly lowered into the well. Each sample container will be filled directly from the bailer. Sampling equipment and containers will be kept from ground contact and may be laid on plastic sheets on the ground. Upgradient wells will be sampled before downgradient wells. Samples of groundwater for chemical analysis will be taken in the following order:

1. Field parameters (including: pH, conductivity, temperature, water levels, and water volumes)

2. Explosives

The sample from each well is collected with as little agitation as possible. If using a bailer to sample a well, the bailer is not dropped into the well, but lowered gently. Samples are put into clean glass containers, which have Teflon-lined lids or septa.

Table B-1 in Appendix B lists container, preservation, and handling requirements for each parameter and Table B-2 in Appendix B lists holding times.

The sequence of operations for groundwater sampling is as follows:

- Purge slow recharging wells (if any) at the outset of the sampling day.
- Purge and sample other wells.
- Sample slow rechargers, if possible.
- Preserve the samples.
- Package and ship the samples to the laboratory or deliver samples to onsite laboratory.

3.2 Soil Sampling

Soil sampling is conducted semi-annually around each of the "operational" thermal treatment units to demonstrate that units have not contaminated surrounding soil. Units that have been out of service for the previous six-month period will not be sampled if they have been sampled since the unit was taken out of service. Soil is analyzed for total explosives, RCRA metals, and extractable petroleum hydrocarbons. Soil analysis results are on file at MLAAP and will be submitted in accordance with MLAAP OB/OD Treatment Permit (TNHW-153).

Three soil samples will be collected from active units at the ADA. Due to the size of Area W, the ADA will be treated as two units, with three soil samples collected from the east field and three soil samples collected from the west field. The samples will be taken from open pits used to treat explosive wastes.

4.0 TRAINING & STAFFING REQUIREMENTS FOR SAMPLING

All field operations will be conducted by the Environmental Department or qualified subcontractors. All personnel collecting groundwater samples at MLAAP will have completed Hazardous Waste and Emergency Response (HAZWOPER) training in accordance with 29 CFR 1910.120.

Personal Protective Equipment (PPE) will vary according to which site is to be monitored. Various areas at MLAAP are known to have high concentrations of explosives in the groundwater and high concentrations of metals in the soil.

Most metals are carcinogenic, and most are toxic by ingestion, inhalation, and/or skin absorption. Wearing personal protective clothing and maintaining good work practices will minimize the possibility of exposure to metals. Exposure to metals through skin contact will be controlled through proper PPE. Exposure to metals via inhalation is expected to be minimal as little dust is generated from soil sampling.

Explosives identified in the groundwater at MLAAP include TNT, RDX, HMX (see Table C-1 for a list of explosives compounds). The exposure route for explosives may be by inhalation, absorption, ingestion, or skin or eye contact. Exposure to explosives via inhalation is expected to be minimal as little dust is generated from groundwater sampling. PPE will control the possibility of exposure through skin contact. Protective gloves will be changed between each well.

In order to minimize contact with potentially hazardous materials the following personal protective equipment may be worn:

- Cotton or Tyvek full body coveralls
- Chemical resistant gloves (nitrile)
- Steel Toe leather or rubber safety work boots
- Hard Hat (if overhead hazards are present)
- Safety glasses

All personnel involved in groundwater sampling will have access to a NIOSH approved air purifying respirator (full-face) appropriate cartridges will be made available to the field personnel as necessary by MLAAP Safety. Respirators will be added to the personnel protective equipment as determined by the onsite safety officer.

5.0 DECONTAMINATION OF SAMPLING EQUIPMENT

The sampling equipment will be transported in sealed, clean containers, and care will be taken to avoid contamination.

General Cleaning for Groundwater Monitoring Equipment:

Cleaning is to include decontamination in three (3) separate consecutive cleaning tubs as follows:

1. The equipment will be washed with a phosphate free detergent. Fully immerse hose, measuring tape, and other equipment and brush clean,

2. Distilled water and a nylon brush in the second tub, and,

3. Step two will be repeated,

4. Allow sampling equipment to dry thoroughly.

Sampling equipment will then be sealed back into clean containers. The spent cleaning water will be sent to the GWTP for processing. For non-disposable bailers, a cleaning seal will accompany each bailer with the following information: equipment identification number, date and time cleaned, and signature of the person who cleaned the equipment. The inclusion of the cleaning seal and numbering of the equipment allows for the tracking of any cleaning or cross contamination problems between samples. Each member of the sampling crew will don a new pair of gloves at each sampling location. The person collecting samples will wear disposable nitrile or latex gloves and will change them between each sampling interval for each sampling site.

General Cleaning for Soil Sampling Equipment:

Decontamination of Soil Sampling equipment will be according to the following procedure:

1. All excess soil will be removed at sampling site.
2. Equipment will be washed with a phosphate free detergent and brushed clean
3. Equipment will be rinsed with distilled water twice.

Each member of the sampling crew will don a new pair of gloves at each sampling location. The person collecting samples will wear disposable nitrile or latex gloves and will change them between each sampling interval for each sampling site.

6.0 FIELD QUALITY ASSURANCE/QUALITY CONTROL

All program personnel are responsible for monitoring and reviewing all procedures used in every stage of the work to ensure that data generated during the execution of the Sampling and Analysis Plan is accurate, complete, precise and representative of the site conditions. The Army Environmental Manager is designated as the Quality Control Manager (QCM) and will be responsible for the proper execution of the field QC.

6.2 Chemical Samples

QA/QC samples for groundwater and soil will be used to verify that the sampling and analytical techniques are being performed properly. QC samples will be taken in the field and analyzed with the field samples by the same off-site laboratory. QA samples will be analyzed by a MLAAP approved laboratory to check the performance of the contract laboratory. QC samples required for groundwater and soil sampling include equipment blanks, and replicates. QA samples also include replicates. QA/QC samples are described below.

Equipment/Field Blanks

Equipment blanks for soil and/or water samples will consist of distilled water that has been poured over or through non-dedicated sampling equipment such as augurs, knives, spoons, or split spoon samplers. Equipment blanks will be shipped in the ice chest with associated samples from the site. Equipment blanks will be prepared and preserved in the same manner as a water sample. Equipment blanks measure the effectiveness of equipment decontamination. One set of equipment blanks will be taken during each sampling event and analyzed for the same constituents as the associated soil or water samples.

Replicate Samples

Replicate samples or splits are extra samples as identical as possible to the original. They may consist of a composite, or as a series of grab samples from the same source. At each sampling event, one random well will be sampled in triplicate. One of each set of these replicates will be sent to a separate laboratory as an audit sample (QA sample) for the contract laboratory and the other two samples will be sent to the analytical lab as a field sample and a QC sample, each with a unique sample number. In cases where only sufficient amount of sample exists for a duplicate set, every fifth sample is a duplicate. This duplicate alternates as a QC and QA sample.

Field Calibration

All field testing equipment is calibrated before use. Calibration is checked in the field several times during the day. Readings are recorded in the Calibration Logbook.

7.0 SAMPLE HANDLING AND TESTING

7.1 Sample Numbering System

Sample numbers are assigned by the project manager and are unique to each site. Sample numbers identify the site, sample location, and type of blank or replicate. Sample numbers typically are assigned as follows:

hhhh-wwww-bb

hhhh is the well, boring number, sampling port/valve, or monitoring location, wwww is only used during soil monitoring to designate the sample location for each site, and bb is a QA/QC modifier, when needed, where

QA = a QA sample (split for SWD Lab)
QC = a QC sample (split for contract lab)
TB = travel blank
EB = equipment blank.

7.2 Preparing Samples

When soil or groundwater samples are taken in the field, they are preserved according to Table B-1. They are then placed in the ice chest and wrapped with bubble wrap or placed in styrofoam inserts with holes to accommodate the jars. The ice chest is filled with ice sealed in large Ziploc bags. The Chain-of-Custody (COC) form and field data form are placed inside in a zip-lock plastic bag placed on top of the ice or taped to the underside of the lid of the ice chest. The ice chest is taped closed with packing tape. A COC seal is placed across the interface of the lid and the body of the ice chest. The samples are then delivered to the shipper. If possible, samples are shipped on the day they are sampled.

7.3 Receiving Samples

After the ice chests are received at the laboratory, the samples are logged in, the COC is signed, and a cooler receipt form is filled out. This form documents the condition of the samples as received. The samples are checked for breakage or leakage and the temperature of the ice bath is checked. If the temperature exceeds 4º Centigrade or if any other problems are noted, this information is recorded on the COC and QCM is notified of the problem. Samples are repackaged and shipped to contract

laboratories using similar procedures as described in Section 6.2. It should be noted that there is no longer an on-site laboratory. Sample receiving procedures will vary by contract laboratory.

7.4 Sample Containers

The type of sample container used for each parameter, the required preservatives, and the maximum holding times are listed in Table B-2. Pre-cleaned containers provided by the laboratory are used for sample collection; therefore, sampling containers will not require additional cleaning prior to collecting the sample.

7.5 Sample Preservation

The proper method of sample preservation for each parameter is listed in Table B-1. Soil samples for the parameters in this sampling plan require only temperature preservation. Since groundwater samples are only analyzed for explosives, no chemical preservation is required; however, all groundwater samples must be kept on ice to maintain a temperature of 4° Centigrade until they are received by the laboratory.

All groundwater samples taken in the field are placed on ice and shipped to the off-site laboratory for next day delivery. When samples are to be shipped off-site for analysis, the samples are packed in shipping containers (ice chests) containing ice or blue ice to maintain an internal temperature not greater than 4° C, during shipment to the laboratory analyzing the samples. The internal temperature of each container is measured and recorded on the COC form prior to sealing the container. The internal temperature will be recorded on the COC form upon opening by the receiving laboratory.

8.0 DATA QUALITY OBJECTIVES

The data quality objectives (DQO's) of this project have been chosen to meet the goals of the RCRA groundwater monitoring program. DQO's are qualitative and quantitative statements that specify the quality of data required to support decisions made during detection monitoring activities. These DQO's will be used throughout the groundwater monitoring process. Data developed will be used to determine compliance with 40 CFR 265.90. These objectives can be achieved with analytical support between Level IIB and Level IV, as described in Reference (Ref.) 7. Level I will be used for field testing. The minimum internal data reporting requirements (from Ref. 2) which will be required of all analytical laboratories includes the following:

- Sample identification numbers cross-referenced with laboratory ID's and QC sample numbers.
- Problems with arriving samples noted on an appropriate form (not applicable to on-site testing).
- Each analyte reported as an actual value or less than a specified quantitation limit as reported by the laboratory.
- Dilution factors, extraction dates, and analysis dates also reported.
- QC samples to be included as laboratory blanks, surrogate spikes, matrix spikes, laboratory duplicates, field duplicates, and field blanks.

The data developed from the scope of work described in this plan will meet the objectives discussed below with respect to precision, representativeness, accuracy, completeness, and comparability. The majority of this data will be developed in the laboratory from the analysis of field samples and the remainder will be measured in the field.

8.1 Accuracy

Accuracy is the degree to which a measurement agrees with the actual value, i.e., and the amount of measurement bias. Accuracy is expressed as a percent recovery of a known concentration of reference material. The accuracy of an analytical procedure is determined by the addition of a known amount of material (matrix spike) to a field sample matrix or a standard matrix. A standard matrix is

made up of distilled water or sterile, clean soil with approximately the same physical properties (porosity, permeability, plasticity, grain size, etc.) as the field sample. The field sample matrix is described as all components of the sample mixture except the analyte (the compound being analyzed). The lab will be required to perform matrix spiking on 5% of field samples, as well as on 5 to 10% of standard matrix samples. Field sample matrix and standard matrix sample spiking show how the sample matrix-analyte chemical interactions affect the analytical results. The matrix behavior of the spiked field sample will be comparable to that of the matrix of the original sample. After analysis for the spike is completed, the accuracy of the procedure is expressed as a percent recovery as shown by the following equation:

$$\text{PERCENT RECOVERY} = \frac{(C_2 - C_1)}{C_0} \text{ X } 100\%$$

where C_0 = amount of analyte added to the sample matrix,
C_1 = amount of analyte present in the unspiked sample matrix (equal to zero for the standard matrix),
and C_2 = amount of spiked material recovered in the analysis.

Typically, the amount of a reference analyte spiked into a field sample matrix is specified by the laboratory quality control program, or 3 to 5 times the background concentration of the analyte in the sample matrix. Samples cannot be spiked for all organic compounds which could possibly exist in the field sample matrix; however, a set of surrogate compounds, each of whose physical and chemical properties is similar to a class of organic compounds, is used as surrogate matrix spikes, or surrogates. Acceptable recovery ranges for each class of organic compounds are discussed in the analytical methods for each parameter.

8.2 Precision

Precision is a measure of the degree of reproducibility of an analytical value and is used as a check on the quality of the sampling and analytical procedures. Precision is determined by analyzing replicate samples. The significance of a precision measurement depends on whether the sample is a field replicate, lab replicate, or a matrix spike replicate. Field replicates are taken at the rate of 10% or one per batch (each daily shipment of samples from a site whichever is greater. Precision of the

analytical method, at each stage, is determined by calculation of a relative percent difference (RPD) between duplicate analytical results of a sample component, relative to the average of those results),

$$RPD = \frac{|C_2 - C_1|}{(C_2 + C_1)/2} \times 100\%$$

where C_1 = analyte concentration in the sample,
C_2 = analyte concentration in the sample replicate,

and $|\ |$ = an absolute value (It is customary to express RPD as a positive number).

These calculations are usually performed on matrix spikes and matrix spike duplicates.

8.3 Completeness

Field completeness will be assessed by comparing the number of samples collected to the number of samples planned. Analytical completeness will be assessed by comparing the total number of samples with valid analytical results to the number of samples collected. The overall project completeness is, therefore, a comparison between the total number of valid samples to the number of samples planned. The results will be calculated following data validation and reduction. Completeness © is determined by:

$$C = \frac{P_1}{P_0} \times 100\%$$

where P_0 = total number of samples planned,
and P_1 = number of valid data points.

A value of 90% or higher is the goal. For values less than 90%, problems in the sampling or analytical procedures will be examined and possible solutions explored.

8.4 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent actual site conditions. The determination of the representativeness of the data will be performed by:

- Comparing actual sampling procedures and COC forms to those described in the sampling and analysis plan;
- Identifying and eliminating non-representative data;
- Evaluating holding times and condition of samples on arrival at the laboratory (not applicable to on site testing), and
- Examining blanks for cross contamination.

Representativeness is a qualitative determination. The representativeness objective of this sampling and analysis plan is to eliminate all non-representative data.

8.5 Comparability

Comparability is a qualitative measure of the confidence with which one data set can be compared to another. These data sets include data generated by different laboratories performed under this sampling and analysis plan, data generated by laboratories in previous investigative phases, data generated by the same laboratory over a period of several years, or data obtained using differing sampling techniques or analytical protocols. The comparability objectives of this sampling and analysis plan are (1) to generate consistent data using standard test methods, and (2) to salvage as much previously generated data as possible. Comparability will be evaluated by comparing the QA samples analyzed by an independent laboratory to their field replicates.

8.6 Sensitivity

Sensitivity is a general term that refers to the calibration sensitivity and the analytical sensitivity of a piece of equipment. The calibration sensitivity is the slope of the calibration curve evaluated in the concentration range of interest. The analytical sensitivity is the ratio of the calibration sensitivity to the standard deviation of the analytical signal at a given analyte concentration. The detection limit, which is based on the sensitivity of the analysis, is the smallest reported concentration in a sample within a specified level of confidence. Quantitation limits represent the sum of all of the uncertainties

in the analytical procedure plus a safety factor. The detection limit is a part of the quantitation limit. Quantitation limits are given in Tables B-4 to B-9 (Appendix B).

8.7 Field Measurements

Field measurements will be performed to Level I standards. These will include measurements of pH, conductivity, and temperature on groundwater samples. Precision on field measurements will be assessed by four replicate measurements to determine reproducibility. These consecutive readings should be ± 1° for temperature, ± 0.02 units for pH, and ± 10% for conductivity. In addition, the percent moisture of pretreated soil will be determined as a operational parameter. It will not be necessary to perform replicate analyses for this test.

9.0 LABORATORY QA/QC REQUIREMENTS

The laboratory will be able to perform analyses for the parameters listed above by the applicable test methods described in "Test methods for Evaluation of Solid Waste, Physical/Chemical Methods", SW-846, Update VII or more recent. A listing of the specific test methods for the above parameters can be found in Table B-2.

The laboratory performing analysis for MLAAP will use as a guide and reference the "Handbook for Analytical Quality Control in Water and Wastewater Laboratories", U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory EPA-600/4-79-02, March 1983, Cincinnati, OH 45268.

The laboratory will follow good laboratory practices for laboratory cleanliness as applied to glassware, apparatus, and facilities in general: reagent preparation and solvent and/or gas usage.

9.1 General Laboratory QA/QC Requirements for Inorganic Parameters

General Laboratory QA/QC requirements for inorganic parameters are as follows:

1. Initial Calibration Curve

The initial calibration curve is checked by analyzing EPA Reference Standard Solutions or other suitable reference solutions. If these measurements differ statistically from the accepted value, the standard stock solution is prepared again or adjusted until analysis of the reference solution provides acceptable measurements.

Fresh stock of calibrating solutions for each analyte is prepared at least monthly or before each set of existing calibration standards is depleted. Analysis of each new set of calibration solutions must agree statistically with the old set before use.

2. Blank Analysis

A calibration blank must be analyzed each time an instrument is calibrated.

3. Duplicate Sample Analysis

Duplicate sample analysis is run at least once for each group of samples, and in most cases for each individual sample. The relative percent difference (RPD) is calculated and reported on a QC report form. If the duplicate results fail to meet the precision requirements, the following steps are taken

until the requirements are met; checking of data for calculation or transcription errors, preparation of new standards, recalibration of instrument, and reanalysis of duplicate samples.

4. Spiked Sample Analysis

Spiked samples are used to provide information about the effect of the sample matrix on the analytical methodology. A spiked sample is analyzed at least once for each set of samples. The results of the spiked sample analysis are recorded on the QC report form. If the spiked sample results fail to meet accuracy requirements, the following steps will be taken until the requirements are met; checking of data for calculation or transcription errors, preparation of new standards, recalibration of instruments, and reanalysis of spiked samples.

9.2 General Laboratory QA/QC Requirements for Organic Analytes

General Laboratory QA/QC requirements for organic analytes are as follows:

1. Instrument Calibration

Instrument calibration is performed following guidelines given in Section 7 of EPA Methods SW846.

2. Blank Analysis

A reagent blank analysis is performed at least once for each set of samples. A reagent blank is a volume of distilled water carried through the entire analytical procedure. The volume of the blank is approximately equal to the sample volume. The reagent blank is used to determine if measurements of samples reflect contamination.

3. Matrix Spiked Duplicate Analysis

Matrix spiked duplicate analysis is performed on at least one sample from each batch or five percent of all samples, whichever is larger. To accomplish this, three additional duplicate samples will be collected and designated for matrix spiked duplicate analysis. The matrix spike will consist of a standard mix of specific organic compounds. The recoveries of the compounds in the mix will provide information about the matrix effect of the sample on the analytical methodology. Results of the spiked sample analyses are recorded on the QC report form.

Recoveries for individual components of the matrix spike as well as the relative percent differences for each component are calculated and recorded. If the recovery or relative percent difference of the spiking matrix does not meet the requirements for accuracy and precision, the following steps are

taken until the requirements are met; checking for errors in calculation or transcription, recalibration of instrumentation, re-analysis of matrix spike duplicate, and re-analysis of all samples analyzed with matrix spike.

Analytical methods from these sources are given in Table B-2. Method detection limits are given in Tables C-1 through C-5 (Appendix C). Quantitation limits are not provided in this plan because they are dependent on the laboratory analyzes the samples, on the concentration of the components in the matrix to be analyzed and on other factors which may come into play such as interferences in the sample. Quantitation limits will be provided with the analytical data reports provided by the laboratory.

9.3 Laboratory Logbook

The laboratory analyzing samples for MLAAP will maintain a logbook detailing such information as sample preparation techniques, experimental conditions, instrument reading, and sample and QA/QC results.

10.0 SAMPLE INTEGRITY

The quality of analytical data is suspect if the integrity of the sample cannot be ensured. Integrity includes the procedures and written records which, when taken together, verify that the sample is as represented.

10.1 Security

Security involves procedures that ensure sample integrity. Security is required until final disposal of the sample after laboratory analysis is complete. Aspects of sample security are discussed below.

10.1.1 Security of the Well and Samples in the Field

Each well will have a locking cap and keys will be given out only to those who need them. Samples, once taken, will be in the possession of the sampling crew or locked in the field laboratory. QA and QC samples will be taken, which, when analyzed, will also document the integrity of the sample.

10.1.2 Security of the Sample in the Lab

Samples will be stored in a secure area in the laboratory with limited access to authorized laboratory personnel. Upon receipt of the ice chests, laboratory personnel will check the temperature of the ice bath, the condition of the samples, and the accuracy of the accompanying paper work.

10.2 Custody

Custody consists of formal records that document integrity. These records are described below.

10.2.1 Chain-of-Custody Form

The COC form is a record that describes the sample, the date and method of sampling, the analyses required, and also contains the following information:

1. Sample and well identification number;
2. Signature or collector;
3. Date and time of collection;
4. Number of containers;
5. Parameters requested for analysis;
6. Signature of person accepting samples at the lab;
7. Dates samples changed possession;
8. Internal temperature of shipping container when sealed for shipment;

9. Internal temperature of shipping container upon receipt by lab; and
10. Laboratory-assigned sample number.

It has spaces for signatures of those receiving and relinquishing the samples. The form is normally signed by the sampler, the individual preparing the samples for shipment, and the receiving individual at the laboratory. The individual preparing the samples for shipment maintains a copy. The original COC is incorporated into the hard copy laboratory report, where it is placed on file. An example of this form is given in Appendix D.

10.2.2 Bill of Lading

A bill of lading (airbill) documents the receipt of samples by the carrier. It is not possible for the carrier's representative to sign the COC since it is sealed in the ice chest. Bills of lading are kept on file in the MLAAP Transportation Department.

10.2.3 Cooler Receipt Form

The cooler receipt form or similar documentation is completed by the laboratory and documents the condition of the samples as received by the lab. This documentation is available in the hard copy laboratory report.

10.3 Sample Tracking and Identification

Other than the items listed in Section 6.2, there is additional documentation which demonstrate sample integrity. These are listed as follows:

10.3.1 Field Logbook

The field logbook is a bound record, kept by the sampling crew, in which sampling information is recorded. It is taken to the field to record all items of interest. It is also used to record equipment calibration, weather, sampling times, analysis conducted in the field and any other pertinent information. In case of concurrent operations, sampling information will be transferred to the field logbook in the field lab. The information for the COC and field data form comes from the field logbook.

10.3.2 Field Data Form

Sample collectors complete a field log sheet for each well sampled. Field measurements such as pH, conductivity, and water levels as well as problems with the location or the sample are noted on this form. Field data forms are taken for all sampling events.

The log sheet contains the following information:

1. Well identification number;
2. Depth of well;
3. Date and time well was purged;
4. Static water level;
5. Minimum amount purged;
6. Total amount purged;
7. Name of collector;
8. Well identification number
9. Date and time samples are collected;
10. Four replicates of pH;
11. Four replicates of specific conductivity/temperature;
12. Preservatives used;
13. Climatic conditions w/ambient air temperature, and
14. Sample collector's name.

Field logbooks are kept on file in the American Ordnance Environmental Office.

10.3.3 Sample Labels

Labels on each jar or air monitoring container include the well number, boring number, valve/port, or sample location, the sample number, the date & time of collection, preservation (if any), parameters requested, and the initials of the sampler.

11.0 DATA REDUCTION, VALIDATION, AND REPORTING

11.1 Field Data

Field data reduction will be performed by AO Environmental staff. Data validation in the field is determined primarily by making several readings (QC checks for reproducibility). Periodic QA oversight is also a part of the validation process. The field data is sent to the AO Environmental Office on the field data form.

11.2 Laboratory Data

Laboratory data are reduced at the contract lab, which generates a laboratory report containing the analytical data, field and quality control duplicate data comparisons, and lab quality control data. Laboratory deliverables include the following:

a) Results of field samples, laboratory blanks, surrogate spikes, surrogate recoveries, matrix spikes, laboratory control samples, laboratory duplicates, matrix spike duplicates, relative percent differences, field duplicates, and field blanks.

b) Sample identification numbers will be cross-referenced with laboratory ID's and QC sample numbers. Table(s) which cross-reference field samples with associated method blanks, matrix spikes, and matrix spike duplicate samples.

c) Legible copies of the fully executed COC forms and cooler receipt forms on which the laboratory has documented the condition of the samples on arrival.

d) Each analyte will be reported as an actual value or less than a specified quantitation limit. Actual sample results, sample quantitation limits, and practical quantitation limits will be reported in a tabular format. Data qualifiers will be used to address sample/analytical anomalies associated with an analyte.

e) Soil samples will be reported on a dry weight basis with moisture content. Sampling dates, dilution factors, extraction dates, and analysis dates will also be reported.

f) A data validation report, which addresses the accuracy, precision, completeness, and representativeness of each analysis will be prepared by the laboratory or the MLAAP Environmental office. This report will contain a table that indicates the sample field

identification number, the date the sample was collected, and what methods of analysis (biological/chemical/physical) were conducted at various laboratories. A discussion regarding the data quality goals and their achievement will be included. The report will also include the name, address, telephone number, and point of contact of all laboratories involved with the analytical effort.

g) ASCII, DBASE, EDD or similar format data files.

h) Confirmation of 10% of the field analyses by a suitable laboratory.

i) Calibration and internal standards information, raw data (which includes equipment/analyst worksheets/logbooks, mass spectra, GC/MS tuning calibrations, chromatograms, sample extraction volumes, etc.), and all instrumentation graphs and traces will be available from the laboratory, if needed.

11.3 Technical Data

Technical data refers to data of several types, such as groundwater flow calculations, stratigraphic maps generated from geologic and geophysical field data, isopleth profiles of contaminants, and groundwater models. Technical data will be reduced, validated, and reported by the project staff.

11.4 Reports to Tennessee Department of Environment and Conservation

An annual summary report will be provided to the Tennessee Department of Environment and Conservation, Division of Solid Waste Management (TDEC, DSWM) in accordance with the MLAAP OB/OD Treatment Permit (TNHW-153).

12.0 CORRECTIVE ACTION

12.1 Field Data

Corrective action for poor field data quality (as determined by replicate measurements or prior expectation) consists of re-measurement until successive readings agree within reasonable limits. Examples of frequently made measurements and limits to which they should agree include:

- pH — measurements should agree within 0.02 pH unit.
- Conductivity — measurements should agree within two numbers of the last significant digit.
- Depth and water level measurements — readings should agree within 0.01 foot.

If re-measurement is not successful, then instrument calibration and operation and the user's technique will be evaluated.

12.2 Laboratory

Laboratory corrective action is described in the analytical method for that analysis.

12.3 Implementing and Reporting

Corrective action will be initiated at the lowest level possible. Corrective action, which involves correcting a mistake for little potential of repetition, need not be reported as long as the error was not reported. For example, an erroneous water level measurement, such as 40 feet in a 30-foot well would be corrected by making several additional readings that agreed with each other and looked reasonable. It would not be necessary to report this error. Corrective action involving a potentially repetitive error or one that had been reported will be documented in writing. For example, an erroneous water level measurement due to a low battery in the water level indicator will be documented because previous suspect water levels may need to be flagged and/or checked. The corrective action report would state the nature of the problem and the potential ramifications, as well as the types of actions taken. In this case, it would be necessary to replace the battery and check the last several days of readings of the indicator. This report will be sent to the AO Environmental Health & Safety Manager.

13.0 DATA EVALUATION AND RESPONSE

13.1 Groundwater

Groundwater monitoring data evaluation and response will be conducted as required in the MLAAP OB/OD hazardous waste Treatment Permit (TNHW-153).

13.2 Soil

Soil monitoring data will be evaluated against published soil screening data for industrial soils. Limits are derived from the EPA Regional Screening Level Summary Table November 2019. If any data point does not exceed the limits set forth in Table 13-1, no further action will be required.

Table 13-1
Limits for Analysis in Soil

Parameter:	Low Level Soil/Sediment Detection limit (mg/kg)	Limits (mg/kg)
METALS:		
Arsenic	0.046	3.0E+00
Barium	0.17	2.2E+05
Cadmium	0.07	9.8E+02
Chromium	0.14	1.8E+06
Lead	0.19	8.0E+02
Mercury	0.0028	4.6E+01
Selenium	0.62	5.8E+03
Silver	0.12	5.8E+03
MISCELLANEOUS:		
Extractable Petroleum Hydrocarbons*	200	1.0E+03
EXPLOSIVES:		
HMX	0.0779	5.7E+04
RDX**	0.109	3.8E+01
1,3,5-TNB	0.0392	3.2E+04
2,4,6-TNT**	0.0631	9.6E+01
2,6-DNT	0.0862	1.5E+00
2,4-DNT	0.0784	7.4E+00
Nitroglycerin	0.0150	8.2E + 01

*Extractable Petroleum Hydrocarbon limit is based upon the Massachusetts Contingency Plan for highly accessible soils that are a drinking water source.

**EPA Regional Screening Levels for Residential Soils per Operable Unit 5 Open Burning Ground were originally 10 mg/kg for RDX and 25 mg/kg for TNT in the Soils Record of Decision July 2011. However, toxicity characteristics for RDX and TNT have been revised

due to a change of the slope factor values in the 30 August 2018 IRIS update. Updated residential RSLs for RDX are 8.3 mg/kg and for TNT are 21 mg/kg. For the purposes of monitoring the site, industrial soil screening levels are utilized.

If a sample exceeds the limits set in Table 13-1, the following procedure will take place for the ADA.

1. The sample result will be compared to QC/QA data to determine possibilities of laboratory error. If laboratory data is invalidated based upon the QA/QC evaluation, locations at the site will be resampled to replace invalidated samples. If parameter values are below Table 13-1 limits, then no further action will be taken. An explanation of the assessment will be provided in the Annual Report.
2. If re-sampling is necessary, the pit will be resampled by taking five (5) aliquots. If sample results are within Action Level Limits, then no further action will be taken. Explanation will be provided in the Annual Report.
3. If sample results exceed Action Level Limits, the soil samples will be subjected to a Synthetic Precipitation Leachate Procedure. If samples do not exceed the Maximum Contaminant Limits (MCL) for groundwater no additional action will be taken.
4. If sample results exceed the MCL for groundwater, a sampling grid will be laid out in nine 10 ft x 10 ft grids extending around the sample location. Due to uneven distribution of the debris on the site, sixteen samples will be collected, one from each node of the grid. The Student T-Test will be utilized to determine sample range at the 95%confidence level.
5. Any soils that require excavation will have confirmation samples collected from the perimeter and from the bottom of the excavation in order to confirm that all contamination has been removed.
6. Based upon the confirmation sample results each 10ft x 10ft cell will be re-excavated or backfilled with clean soils.
7. All results will be submitted to TDEC in the annual report

14.0 REFERENCES

1) U. S. Environmental Protection Agency, September, 1986, "RCRA Groundwater Monitoring Technical Enforcement Guidance Document.

2) U. S. Environmental Protection Agency, November, 1986, "Test Methods for Evaluating Solid Waste", SW 846.

3) U. S. Environmental Protection Agency, Sept. 1993, "Data Quality Objectives Process for Superfund", EPA 540-R-93-071.

4) U. S. Environmental Protection Agency, 1987, "Development of an RFI Work Plan and General Considerations for RCRA Facility Investigations", SW-87-001.

5) U. S. Environmental Protection Agency, Sept. 1994, "Guidance for the Data Quality Objectives Process", EPA/QA/G-4 February 2006 and U. S. Environmental Protection Agency, Sept. 1993, "Data Quality Objectives Process for Superfund, Workbook", EPA 540-R-93-078.

Appendix A
Forms Used in Field Sampling

CONTRACTOR P.O. NO._____

PROJECT NAME/NUMBER_____ ***LAB DESTINATION***_____
REPORT RESULTS TO:_____ ***PHONE NO***_____ ***OFFICE (731) 686-6911***
FAX (731) 686-6787

SAMPLE NUMBER	*SAMPLE LOCATION & DESCRIPTION*	*DATE & TIME COLLECTED*	*ANALYSIS TYPE*	*CONTAINER & PRESERVATIVE*	*NO. OF BOTTLES*	*SAMPLE MATRIX*	*CONDITION ON RECEIPT*	*LAB USE ONLY*

Relinquished by: (Signature)	Date/Time	Received By: (Signature)
Relinquished by: (Signature)	Date/Time	Received By: (Signature)
Relinquished by: (Signature)	Date/Time	Received By: (Signature)
Received for Laboratory by: (Signature)	Date/Time	*Temperature*

SPECIAL INSTRUCTIONS:_____
_____
_____

Monitoring Well Parameter Information Sheet

Monitoring Well No. _____
Well Diameter & Construction: _____
Method of Purging: _____ Pumping Rate: _____ Method of Sampling: _____

Date	Time	Total Depth	Depth to Water	Three Casing Volumes for Purging (gallons)	pH	Specific Conductance (mS/cm)	Temperature °C

Date	Time	pH	Specific Conductance (mS/cm)	Temperature °C	Parameters Within 10%? (Yes/No) If not after Three casing volumes, additional volumes will be removed.	Comments (odor, color, well condition, sediment, presence of product):

Monitoring Well No. _____
Well Diameter & Construction: _____
Method of Purging: _____ Pumping Rate: _____ Method of Sampling: _____

Date	Time	Total Depth	Depth to Water	Three Casing Volumes for Purging (gallons)	pH	Specific Conductance (mS/cm)	Temperature °C

Date	Time	pH	Specific Conductance (mS/cm)	Temperature °C	Parameters Within 10%? (Yes/No) If not after Three casing volumes, additional volumes will be removed.	Comments (odor, color, well condition, sediment, presence of product):

Notes:
4" well casing diameter purge calculation = total depth – depth to water x 1.96
2" well casing diameter purge calculation = total depth – depth to water x 0.49
1" well casing diameter purge calculation = total depth – depth to water x 0.041

MONITORING WELL INSPECTION CHECKLIST

MILAN ARMY AMMUNITION PLANT

INSPECTION FREQUENCY REQUIRED: _____

DATE: _____ TIME: _____ WELL No: _____

Direction: Indicate conditions as acceptable or unacceptable. Explain observations and the date and nature of any repairs or other corrective action.

	ACCEPTABLE	UNACCEPTABLE
OUTER CASING		
INNER CASING		
SLAB		
BUMPER POLES		
PAINT ON OUTER CASING		
WELL NUMBER LEGIBLE		
LOCKING CAP		
INNER CASING COVER CAP		
LOCK OR SEAL		
VEGETATION		
EROSION		
DEBRIS		
FIREANTS		

OBSERVATIONS:

_____

_____

_____

_____

CORRECTIVE ACTION:

_____

_____

_____

_____

INSPECTORS NAME AND TITLE: _____

_____

Appendix A-3

Appendix B
Tables B-1 and B-2

Table B-1 Sample Containers, Preservation, and Preparation						
Sampling Media	**Parameter**	**Size of Container**	**Type of Container**	**# of Containers**	**Ice**	**Method of Preservation**
Groundwater	pH	25 mL	T, P, G	1	Field Determined	NA
Groundwater	Specific Conductance Temperature	100 mL	T, P, G	1	Field Determined	NA
Groundwater & Soil	Explosives	1,000 mL /4 oz	G amber	2	Yes	NA
Soil	Arsenic Barium Cadmium Chromium Lead Mercury Selenium Silver	4 oz	T, P	1	No	NA
Soil	Extractable Petroleum Hydrocarbons	16 ounces	G	1	Yes	NA

Note:
Container size will vary according to laboratory requirements.

Table B-2 Maximum Holding Times and Analytical Methods in Soil and Water				
Parameter	**Extraction**	**Analysis**	**Reference**	**Method #**
Field Tests:				
pH	—	immediate	EPA/600/4-79-020	150.1
Conductivity	—	immediate	EPA/600/4-79-020	120.1
temperature	—	immediate	—	—
Metals:				
Arsenic	—	6 months	SW-846(1)	6010
Barium	—	6 months	SW-846	6010
Cadmium	—	6 months	SW-846	6010
Chromium	—	6 months	SW-846	6010
Lead	—	6 months	SW-846	6010
Selenium	—	6 months	SW-846	6010
Silver		6 months	SW-846	6010
mercury in water		28 days	SW-846	7471
mercury in soil		28 days	SW-846	7471
Explosives:				
2,4-DNT				8330
2,6-DNT				
1,3,5-TNB				
2,4,6-TNT				
RDX				
HMX				
Nitroglycerine			SW-846	
in water				
in soil	7 days 14 days	40 days 40 days		
Extractable Petroleum Hydrocarbons	—	28 days	EPA-821-R-98-002 SW-846	TN-EPH

Note:
(1) SW-846 reference 6

Appendix C
Table C-1 and C-2

Table C-1 Method Detection Limits for Analysis in Soil and Water by Method 8330		
Parameter: Explosives Compounds	**Water (mg/L)**	**Low Level Soil/Sediment (mg/Kg)**
HMX	0.0000876	0.0779
RDX	0.000158	0.109
1,3,5-TNB	0.000200	0.0392
2,4,6-TNT	0.000160	0.0631
2,6-DNT	0.0000645	0.0862
2,4-DNT	0.0000838	0.0784

Table C-2 Method Detection Limits for Analysis in Soil and Water		
Parameter:	**Water (mg/L)**	**Low Level Soil/Sediment (mg/Kg)**
METALS:		
Arsenic	0.00650	0.46
Barium	0.00170	0.17
Cadmium	0.000700	0.07
Chromium	0.00140	0.14
Lead	0.00190	0.19
Mercury	0.0000490	0.0028
Selenium	0.00740	0.62
Silver	0.00280	0.12
MISCELLANEOUS: Extractable Petroleum Hydrocarbons	2	200

Appendix C-1

Appendix D
Table D-1

Table D-1

Monitoring well parameters for the MLAAP OB/OD Ground Water Monitoring.

WELL DESIGNATION	INTSTALLED	SCRN TOP (ft bgs)	SCRN BOT (ft bgs)	TOTAL DEPTH (ft bgs)	WELL DIAM (inches)	STICKUP	GROUND ELEVATION (ft AMSL)	TOP OF CASING (ft AMSL)	TOP SCRN (ft AMSL)	BTM SCRN (ft AMSL)	EASTING SPTN_83_X	NORTHING SPTN_83_Y
MI019B	4/22/2008	85.0	99	100	4.0	2.96	480.68	483.64	395.68	381.68	1205450.74	549228.11
MI250	8/30/1994	117.0	127.0	130	4.0	1.45	516.50	517.95	399.50	389.50	1174047.26	575548.80
MI252	8/30/1994	125.0	135.0	136	4.0	1.68	509.60	511.28	384.60	374.60	1174233.37	575953.86
MI259	8/16/1994	68.0	78.0	75	4.0	0.98	479.60	480.58	411.60	401.60	1175582.79	574449.14
MI263	8/31/1994	115.0	125.0	130	4.0	1.79	527.10	528.89	412.10	402.10	1173154.37	574478.25
MI296	1/31/1995	85.0	95.0	100	4.0	1.70	487.2	488.9	402.20	392.20	1171574.88	572755.64

Appendix C-5
Additional Groundwater Information

Test Parameter	Spring 2007 Sample Data- S/A May										
		MI 250		MI 252		MI 259		MI 263		MI 296	
	Detection Limits	Background Mean	Current (2007) Mean	Background Mean	Current (2007) Mean	Background Mean	Current (2007) Mean	Background Mean	Current (2007) Mean	Background Mean	Current (2007) Mean
Diphenylamine	0.02 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrobodies	0.0011 mg/L	0.91563	1.92833	0.09303	0.11985	0.59349	0.6256	0.02032	0.01275	0.05201	0.12603
Nitroglycerine	0.1 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Test Parameter	2010 Sample Data- S/A Sept		
		MI 019B	
	Detection Limits	Background Mean	Current (2010) Mean
Diphenylamine	0.02 mg/L	ND	0.00500
Nitrobodies	0.005 mg/L	ND	0.00500
Nitroglycerine	0.1 mg/L	ND	0.00500

Sample Date: 5/22/2007
Sample Time: 8:05AM
Chain of Custody: 88

Test Parameter	Detection Limits	MI 250				
		Result 1	Result 2	Result 3	Result 4	Mean
2, 4-DNT	0.0005 mg/L	0.0038	0.0038	0.0038	0.0039	0.00383
2,6-DNT	0.0006 mg/L	0.0035	0.0033	0.0034	0.0038	0.00350
1,3,5-TNB	0.005 mg/L	0.0660	0.0650	0.0660	0.0660	0.06575
2,4,6-TNT	0.005 mg/L	0.7170	0.7230	0.7210	0.7180	0.71975
RDX	0.010 mg/L	1.0220	1.0320	1.0460	1.0290	1.03225
HMX	0.005 mg/L	0.1120	0.1070	0.1020	0.0940	0.10375
Total Nitrobodies		1.9243	1.9341	1.9422	1.9147	1.92883
Diphenylamine	0.02 mg/L	ND	ND	ND	ND	ND
Nitroglycerine	0.1 mg/L	ND	ND	ND	ND	ND

Sample Date: 5/15/2007
Sample Time: 9:30AM
Chain of Custody: 84

Test Parameter	Detection Limits	MI 252				
		Result 1	Result 2	Result 3	Result 4	Mean
2, 4-DNT	0.0005 mg/L	ND	ND	ND	ND	ND
2,6-DNT	0.0006 mg/L	ND	ND	ND	ND	ND
1,3,5-TNB	0.0006 mg/L	ND	ND	ND	ND	ND
2,4,6-TNT	0.0006 mg/L	0.0100	0.0098	0.0097	0.0096	0.00978
RDX	0.010 mg/L	0.0880	0.0850	0.0880	0.0870	0.08700
HMX	0.0007 mg/L	0.0231	0.0232	0.0230	0.0230	0.02308
Total Nitrobodies		0.1211	0.1180	0.1207	0.1196	0.11985
Diphenylamine	0.02 mg/L	ND	ND	ND	ND	ND
Nitroglycerine	0.1 mg/L	ND	ND	ND	ND	ND

Sample Date: 5/21/2007
Sample Time: 14:04AM
Chain of Custody: 87

Test Parameter	Detection Limits	MI 259				
		Result 1	Result 2	Result 3	Result 4	Mean
2, 4-DNT	0.0005 mg/L	0.0020	0.0020	0.0020	0.0020	0.00200
2,6-DNT	0.0006 mg/L	ND	ND	ND	ND	ND
1,3,5-TNB	0.0006 mg/L	0.0021	0.0021	0.0021	0.0021	0.00210
2,4,6-TNT	0.005 mg/L	0.0450	0.0460	0.0450	0.0450	0.04525
RDX	0.010 mg/L	0.5070	0.5050	0.5020	0.4910	0.50125
HMX	0.005 mg/L	0.0710	0.0690	0.0750	0.0850	0.07500
Total Nitrobodies		0.6271	0.6241	0.6261	0.6251	0.62560
Diphenylamine	0.02 mg/L	ND	ND	ND	ND	ND
Nitroglycerine	0.1 mg/L	ND	ND	ND	ND	ND

Note: 0.0505 mg/L was the RDX level for column "Result 2" on original lab report, however, the listed MDL of 0.010 mg/L indicates that the original RDX must be one decimal place off.

Sample Date: 5/30/2007
Sample Time: 8:30AM
Chain of Custody: 93

Test Parameter	Detection Limits	MI 263				
		Result 1	Result 2	Result 3	Result 4	Mean
2, 4-DNT	0.0005 mg/L	ND	ND	ND	ND	ND
2,6-DNT	0.0006 mg/L	ND	ND	ND	ND	ND
1,3,5-TNB	0.0006 mg/L	0.0010	0.0009	0.0009	0.0009	0.00093
2,4,6-TNT	0.0006 mg/L	0.0016	0.0016	0.0015	0.0015	0.00155
RDX	0.0011 mg/L	0.0071	0.0071	0.0070	0.0071	0.00708
HMX	0.0007 mg/L	0.0032	0.0034	0.0032	0.0030	0.00320
Total Nitrobodies		0.0129	0.0130	0.0126	0.0125	0.01275
Diphenylamine	0.02 mg/L	ND	ND	ND	ND	ND
Nitroglycerine	0.1 mg/L	ND	ND	ND	ND	ND

Sample Date: 5/21/2007
Sample Time: 9:44AM
Chain of Custody: 87

Test Parameter	Detection Limits	MI 296				
		Result 1	Result 2	Result 3	Result 4	Mean
2, 4-DNT	0.0005 mg/L	ND	ND	ND	ND	ND
2,6-DNT	0.0006 mg/L	0.0008	0.0008	0.0008	0.0008	0.00080
1,3,5-TNB	0.0006 mg/L	0.0009	0.0009	0.0008	0.0009	0.00088
2,4,6-TNT	0.0006 mg/L	0.0142	0.0142	0.0142	0.0142	0.01420
RDX	0.010 mg/L	0.105	0.110	0.108	0.107	0.10750
HMX	0.0007 mg/L	0.0027	0.0026	0.0026	0.0027	0.00265
Total Nitrobodies		0.1236	0.1285	0.1264	0.1256	0.12603
Diphenylamine	0.02 mg/L	ND	ND	ND	ND	ND
Nitroglycerine	0.1 mg/L	ND	ND	ND	ND	ND

Sample Date: 5/20/2009

Source: **MLAAP RCRA Groundwater Sample Report- Table 6.1-2 MI-019B Quarterly Sample Data Summary**

Test Parameter	Detection Limits	MI 019B				
		Result 1	Result 2	Result 3	Result 4	Mean
Total Nitrobodies	0.005 mg/L	0.0050	0.0050	0.0050	0.0050	0.005
Diphenylamine	0.02 mg/L	0.0050	0.0050	0.0050	0.0050	0.005
Nitroglycerine	0.1 mg/L	0.0050	0.0050	0.0050	0.0050	0.005

TABLE V (Cont.)
SUMMARY OF STATISTICAL DATA
Thirteenth Year, Second Quarter
MLAAP Miscellaneous Thermal Treatment

ADA Wells

Parameter Well Number	Background	Current
Diphenylamaine		
MI268		
MEAN	<0.02	<0.02
VARIANCE	NA	NA
Student t	NA	NA
MI270		
MEAN	<0.02	<0.02
VARIANCE	NA	NA
Student t	NA	NA
MI272		
MEAN	<0.02	<0.02
VARIANCE	NA	NA
Student t	NA	NA
MI274		
MEAN	<0.02	NAP
VARIANCE	NA	NA
Student t	NA	NA
MI277		
MEAN	<0.02	<0.02
VARIANCE	NA	NA
Student t	NA	NA
MI296		
MEAN	<0.02	<0.02
VARIANCE	NA	NA
Student t	NA	NA

TABLE V (Cont.)
SUMMARY OF STATISTICAL DATA
Thirteenth Year, Second Quarter
MLAAP Miscellaneous Thermal Treatment

Burning Ground Wells

Parameter Well Number	Background	Current
Diphenylamaine		
MI250		
MEAN	<0.02	<0.02
VARIANCE	NA	NA
Student t	NA	NA
MI252		
MEAN	<0.02	<0.02
VARIANCE	NA	NA
Student t	NA	NA
MI256		
MEAN	<0.02	<0.02
VARIANCE	NA	NA
Student t	NA	NA
MI259		
MEAN	<0.02	<0.02
VARIANCE	NA	NA
Student t	NA	NA
MI261		
MEAN	<0.02	<0.02
VARIANCE	NA	NA
Student t	NA	NA
MI263		
MEAN	<0.02	<0.02
VARIANCE	NA	NA
Student t	NA	NA
MI264		
MEAN	<0.02	<0.02
VARIANCE	NA	NA
Student t	NA	NA
MI266		
MEAN	<0.02	<0.02
VARIANCE	NA	NA
Student t	NA	NA
MI278		
MEAN	<0.02	<0.02
VARIANCE	NA	NA
Student t	NA	NA

TABLE V (Cont.)
SUMMARY OF STATISTICAL DATA
Thirteenth Year, Second Quarter
MLAAP Miscellaneous Thermal Treatment

ADA Wells

Parameter Well Number	Background	Current
Nitrobodies (total)		
MI268		
MEAN	0.13888	0.08598
VARIANCE	0.02016	0.00021
Student t		NA
MI270		
MEAN	0.00118	0.00983
VARIANCE	0.00020	0.00005
Student t		3.78805
MI272		
MEAN	0.07255	0.00396
VARIANCE	0.02098	0.00005
Student t		NA
MI274		
MEAN	0.00111	NAP
VARIANCE	0.00003	NA
Student t		NA
MI277		
MEAN	<0.0011	<0.0011
VARIANCE	NA	NA
Student t		NA
MI296		
MEAN	0.05201	0.12603
VARIANCE	0.01415	0.00203
Student t		4.03172

TABLE V (Cont.)
SUMMARY OF STATISTICAL DATA
Thirteenth Year, Second Quarter
MLAAP Miscellaneous Thermal Treatment

Burning Ground Wells

Parameter Well Number	Background	Current
Nitrobodies (total)		
MI250		
MEAN	0.91563	1.92883
VARIANCE	0.42329	0.01193
Student t		10.64048
MI252		
MEAN	0.09303	0.11985
VARIANCE	0.03990	0.00139
Student t		0.91448
MI256		
MEAN	0.49389	0.30315
VARIANCE	0.09040	0.00150
Student t		NA
MI259		
MEAN	0.59349	0.6256
VARIANCE	0.08447	0.00129
Student t		0.75966
MI261		
MEAN	2.26889	0.8279
VARIANCE	0.41238	0.00594
Student t		NA
MI263		
MEAN	0.02032	0.01275
VARIANCE	0.01633	0.00024
Student t		NA
MI264		
MEAN	0.00145	<0.0011
VARIANCE	0.00044	0.00
Student t		NA
MI266		
MEAN	0.00644	0.06985
VARIANCE	0.00152	0.00013
Student t		10.81820
MI278		
MEAN	0.00141	<0.0011
VARIANCE	0.00055	NA
Student t		NA

TABLE V (Cont.)
SUMMARY OF STATISTICAL DATA
Thirteenth Year, Second Quarter
MLAAP Miscellaneous Thermal Treatment

ADA wells

Parameter Well Number	Background	Current
Nitroglycerine		
MI268		
MEAN	<0.1	<0.1
VARIANCE	NA	NA
Student t		NA
MI270		
MEAN	<0.1	<0.1
VARIANCE	NA	NA
Student t		NA
MI272		
MEAN	<0.1	<0.1
VARIANCE	NA	NA
Student t		NA
MI274		
MEAN	<0.1	NAP
VARIANCE	NA	NA
Student t		NA
MI277		
MEAN	<0.1	<0.1
VARIANCE	NA	NA
Student t		NA
MI296		
MEAN	<0.1	<0.1
VARIANCE	NA	NA
Student t		NA

TABLE V (Cont.)
SUMMARY OF STATISTICAL DATA
Thirteenth Year, Second Quarter
MLAAP Miscellaneous Thermal Treatment

Burning Ground wells

Parameter Well Number Nitroglycerine	Background	Current
MI250		
MEAN	<0.1	<0.1
VARIANCE	NA	NA
Student t		NA
MI252		
MEAN	<0.1	<0.1
VARIANCE	NA	NA
Student t		NA
MI256		
MEAN	<0.1	<0.1
VARIANCE	NA	NA
Student t		NA
MI259		
MEAN	<0.1	<0.1
VARIANCE	NA	NA
Student t		NA
MI261		
MEAN	<0.1	<0.1
VARIANCE	NA	NA
Student t		NA
MI263		
MEAN	<0.1	<0.1
VARIANCE	NA	NA
Student t		NA
MI264		
MEAN	<0.1	<0.1
VARIANCE	NA	NA
Student t		NA
MI266		
MEAN	<0.1	<0.1
VARIANCE	NA	NA
Student t		NA
MI278		
MEAN	<0.1	<0.1
VARIANCE	NA	NA
Student t		NA

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Milan, TN 38358-3177
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(731)686-6433 fax

ENVIRONMENTAL LABORATORY REPORT **Groundwater Monitoring**

Sample ID: MI250
Location: OB/OD Monitoring Wells
Lab. ID Number: 1-MI250-07142
Sample Date: 5/22/2007
Sample Time: 8:05
Sample Type: Grab
Sampled By: L. Stewart
Chain of Custody: 88
Date Received: 5/22/2007
Condition: Acceptable

Parameter	Result 1	Result 2	Result 3	Result 4	MDL	Method	Analysis Date	QA Reference	Analyst
Arsenic	<	<	<	<	0.053 mg/L	6010	6/21/2007	07-8	J. Koffman
Barium	0.113	0.129	0.124	0.120	0.002 mg/L	6010	6/21/2007	07-8	J. Koffman
Cadmium	<	<	<	<	0.004 mg/L	6010	6/21/2007	07-8	J. Koffman
Chromium	<	<	<	<	0.007 mg/L	6010	6/21/2007	07-8	J. Koffman
Lead	<	<	<	<	0.042 mg/L	6010	6/21/2007	07-10	J. Koffman
Mercury	<	<	<	<	0.0002 mg/L	7470	6/5/2007	07-7	J. Koffman
Selenium	<	<	<	<	0.075 mg/L	6010	6/21/2007	07-8	J. Koffman
Silver	<	<	<	<	0.007 mg/L	6010	6/21/2007	07-8	J. Koffman
Iron	2.266	2.727	2.750	2.732	0.007 mg/L	6010	6/21/2007	07-2	J. Koffman
Manganese	0.305	0.319	0.322	0.321	0.002 mg/L	6010	6/21/2007	07-2	J. Koffman
Sodium	8.75	9.00	9.15	8.96	0.03 mg/L	6010	6/21/2007	07-2	J. Koffman
Chloride	1.650	1.631	1.675	1.638	1.000 mg/L	300.0	5/22/2007	07-3	J. Koffman
Fluoride	<	<	<	<	0.100 mg/L	300.0	5/22/2007	07-3	J. Koffman
Nitrate	4.409	4.405	4.482	4.411	0.140 mg/L	300.0	5/22/2007	07-8	J. Koffman
Sulfate	11.131	11.130	11.310	11.080	1.000 mg/L	300.0	5/22/2007	07-3	J. Koffman
2,4-DNT	0.0038	0.0038	0.0038	0.0039	0.0005 mg/L	8330	6/6/2007	07-2	K. Butler
2,6-DNT	0.0035	0.0033	0.0034	0.0038	0.0006 mg/L	8330	6/6/2007	07-2	K. Butler
1,3,5-TNB	0.066	0.065	0.066	0.066	0.005 mg/L	8330	5/22/2007	07-22	J. Koffman
2,4,6-TNT	0.717	0.723	0.721	0.718	0.005 mg/L	8330	5/22/2007	07-22	J. Koffman
RDX	1.022	1.0320	1.046	1.029	0.010 mg/L	8330	5/22/2007	07-22	J. Koffman
HMX	0.112	0.107	0.102	0.094	0.005 mg/L	8330	5/22/2007	07-22	J. Koffman
Nitroglycerine	<	<	<	<	0.1 mg/L	HPLC	5/23/2007	07-2	J. Koffman
Diphenylamine	<	<	<	<	0.02 mg/L	HPLC	5/23/2007	07-2	J. Koffman

Notes: 1. Method HPLC was developed in our laboratory based on the 8330 technique.
2. Method 300.0 is published in EPA /600/R-93/100 "Methods for Inorganic Substances"
3. All other methods are published in EPA SW-846 "Test Methods for Evaluating Solid Waste,Physical/Chemical Methods", 3rd ed., Revised 1994.

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ENVIRONMENTAL LABORATORY REPORT **Groundwater Monitoring**

Sample ID: MI252
Location: OB/OD Monitoring Wells
Lab. ID Number: 7-MI252-07135
Sample Date: 5/15/2007
Sample Time: 9:30
Sample Type: Grab
Sampled By: L. Stewart
Chain of Custody: 84
Date Received: 5/15/2007
Condition: Acceptable

Parameter	Result 1	Result 2	Result 3	Result 4	MDL	Method	Analysis Date	QA Reference	Analyst
Arsenic	<	<	<	<	0.053 mg/L	6010	6/20/2007	07-7	J. Koffman
Barium	0.023	0.023	0.020	0.023	0.002 mg/L	6010	6/20/2007	07-7	J. Koffman
Cadmium	<	<	<	<	0.004 mg/L	6010	6/20/2007	07-7	J. Koffman
Chromium	<	<	<	<	0.007 mg/L	6010	6/20/2007	07-7	J. Koffman
Lead	<	<	<	<	0.042 mg/L	6010	6/20/2007	07-9	J. Koffman
Mercury	<	<	<	<	0.0002 mg/L	7470	6/5/2007	07-6	J. Koffman
Selenium	<	<	<	<	0.075 mg/L	6010	6/20/2007	07-7	J. Koffman
Silver	<	<	<	0.012	0.007 mg/L	6010	6/20/2007	07-7	J. Koffman
Iron	<	0.008	<	<	0.007 mg/L	6010	6/20/2007	07-1	J. Koffman
Manganese	<	<	0.002	<	0.002 mg/L	6010	6/20/2007	07-1	J. Koffman
Sodium	4.10	4.11	4.13	4.08	0.03 mg/L	6010	6/21/2007	07-1	J. Koffman
Chloride	2.636	2.631	2.612	2.621	1.000 mg/L	300.0	5/15/2007	07-1	J. Koffman
Fluoride	<	<	<	<	0.100 mg/L	300.0	5/15/2007	07-1	J. Koffman
Nitrate	0.532	0.534	0.544	0.551	0.140 mg/L	300.0	5/15/2007	07-6	J. Koffman
Sulfate	6.681	6.726	6.681	6.689	1.000 mg/L	300.0	5/15/2007	07-1	J. Koffman
2,4-DNT	<	<	<	<	0.0005 mg/L	8330	6/5/2007	07-1	K. Butler
2,6-DNT	<	<	<	<	0.0006 mg/L	8330	6/5/2007	07-1	K. Butler
1,3,5-TNB	<	<	<	<	0.0006 mg/L	8330	6/5/2007	07-1	K. Butler
2,4,6-TNT	0.0100	0.0098	0.0097	0.0096	0.0006 mg/L	8330	6/5/2007	07-1	K. Butler
RDX	0.088	0.085	0.088	0.087	0.010mg/L	8330	5/15/2007	07-21	J. Koffman
HMX	0.0231	0.0232	0.0230	0.0230	0.0007 mg/L	8330	6/5/2007	07-1	K. Butler
Nitroglycerine	<	<	<	<	0.1 mg/L	HPLC	5/17/2007	07-1	J. Koffman
Diphenylamine	<	<	<	<	0.02 mg/L	HPLC	5/17/2007	07-1	J. Koffman

Notes: 1. Method HPLC was developed in our laboratory based on the 8330 technique.
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3. All other methods are published in EPA SW-846 "Test Methods for Evaluating Solid Waste,Physical/Chemical Methods", 3rd ed., Revised 1994.

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ENVIRONMENTAL LABORATORY REPORT **Groundwater Monitoring**

Sample ID: MI259
Location: OB/OD Monitoring Wells
Lab. ID Number: 18-MI259-07141
Sample Date: 5/21/2007
Sample Time: 14:04
Sample Type: Grab
Sampled By: L. Stewart
Chain of Custody: 87
Date Received: 5/21/2007
Condition: Acceptable

Parameter	Result 1	Result 2	Result 3	Result 4	MDL	Method	Analysis Date	QA Reference	Analyst
Arsenic	<	<	<	<	0.053 mg/L	6010	6/21/2007	07-8	J. Koffman
Barium	0.045	0.047	0.045	0.047	0.002 mg/L	6010	6/21/2007	07-8	J. Koffman
Cadmium	<	<	<	<	0.004 mg/L	6010	6/21/2007	07-8	J. Koffman
Chromium	<	<	<	<	0.007 mg/L	6010	6/21/2007	07-8	J. Koffman
Lead	<	<	<	<	0.042 mg/L	6010	6/21/2007	07-10	J. Koffman
Mercury	<	<	<	<	0.0002 mg/L	7470	6/5/2007	07-7	J. Koffman
Selenium	<	<	<	<	0.075 mg/L	6010	6/21/2007	07-8	J. Koffman
Silver	<	<	<	<	0.007 mg/L	6010	6/21/2007	07-8	J. Koffman
Iron	0.029	0.025	0.024	0.022	0.007 mg/L	6010	6/21/2007	07-2	J. Koffman
Manganese	0.165	0.146	0.147	0.166	0.002 mg/L	6010	6/21/2007	07-2	J. Koffman
Sodium	15.01	14.79	15.09	15.04	0.03 mg/L	6010	6/21/2007	07-2	J. Koffman
Chloride	1.682	1.685	1.627	1.663	1.000 mg/L	300.0	5/22/2007	07-3	J. Koffman
Fluoride	<	<	<	<	0.100 mg/L	300.0	5/22/2007	07-3	J. Koffman
Nitrate	2.135	2.123	2.113	2.119	0.140 mg/L	300.0	5/22/2007	07-8	J. Koffman
Sulfate	147.76	145.84	146.19	146.69	1.000 mg/L	300.0	5/22/2007	07-3	J. Koffman
2,4-DNT	0.0020	0.0020	0.0020	0.0020	0.0005 mg/L	8330	6/6/2007	07-2	K. Butler
2,6-DNT	<	<	<	<	0.0006 mg/L	8330	6/6/2007	07-2	K. Butler
1,3,5-TNB	0.0021	0.0021	0.0021	0.0021	0.0006 mg/L	8330	6/6/2007	07-2	K. Butler
2,4,6-TNT	0.045	0.046	0.045	0.045	0.005 mg/L	8330	5/22/2007	07-22	J. Koffman
RDX	0.507	0.0505	0.502	0.491	0.010 mg/L	8330	5/22/2007	07-22	J. Koffman
HMX	0.071	0.069	0.075	0.085	0.005 mg/L	8330	5/22/2007	07-22	J. Koffman
Nitroglycerine	<	<	<	<	0.1 mg/L	HPLC	5/23/2007	07-2	J. Koffman
Diphenylamine	<	<	<	<	0.02 mg/L	HPLC	5/23/2007	07-2	J. Koffman

Notes: 1. Method HPLC was developed in our laboratory based on the 8330 technique.
2. Method 300.0 is published in EPA /600/R-93/100 "Methods for Inorganic Substances"
3. All other methods are published in EPA SW-846 "Test Methods for Evaluating Solid Waste,Physical/Chemical Methods", 3rd ed., Revised 1994.

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ENVIRONMENTAL LABORATORY REPORT **Groundwater Monitoring**

Sample ID: MI263
Location: OB/OD Monitoring Wells
Lab. ID Number: 1-MI263-07150
Sample Date: 5/30/2007
Sample Time: 8:30
Sample Type: Grab
Sampled By: L. Stewart
Chain of Custody: 93
Date Received: 5/30/2007
Condition: Acceptable

Parameter	Result 1	Result 2	Result 3	Result 4	MDL	Method	Analysis Date	QA Reference	Analyst
Arsenic	<	<	<	<	0.053 mg/L	6010	6/21/2007	07-8	J. Koffman
Barium	0.014	0.013	0.014	0.013	0.002 mg/L	6010	6/21/2007	07-8	J. Koffman
Cadmium	<	<	<	<	0.004 mg/L	6010	6/21/2007	07-8	J. Koffman
Chromium	<	<	<	<	0.007 mg/L	6010	6/21/2007	07-8	J. Koffman
Lead	<	<	<	<	0.042 mg/L	6010	6/21/2007	07-10	J. Koffman
Mercury	<	<	<	<	0.0002 mg/L	7470	6/5/2007	07-7	J. Koffman
Selenium	<	<	<	<	0.075 mg/L	6010	6/21/2007	07-8	J. Koffman
Silver	<	<	<	<	0.007 mg/L	6010	6/21/2007	07-8	J. Koffman
Iron	0.211	0.219	0.213	0.219	0.007 mg/L	6010	6/21/2007	07-2	J. Koffman
Manganese	0.010	0.009	0.009	0.008	0.002 mg/L	6010	6/21/2007	07-2	J. Koffman
Sodium	3.05	3.08	3.04	3.01	0.03 mg/L	6010	6/21/2007	07-2	J. Koffman
Chloride	2.352	2.340	2.371	2.361	1.000 mg/L	300.0	5/30/2007	07-4	J. Koffman
Fluoride	<	<	<	<	0.100 mg/L	300.0	5/30/2007	07-4	J. Koffman
Nitrate	7.070	7.074	7.084	7.084	0.140 mg/L	300.0	5/30/2007	07-9	J. Koffman
Sulfate	6.440	6.418	6.435	6.519	1.000 mg/L	300.0	5/30/2007	07-4	J. Koffman
2,4-DNT	<	<	<	<	0.0005 mg/L	8330	6/6/2007	07-2	K. Butler
2,6-DNT	<	<	<	<	0.0006 mg/L	8330	6/6/2007	07-2	K. Butler
1,3,5-TNB	0.0010	0.0009	0.0009	0.0009	0.0006 mg/L	8330	6/6/2007	07-2	K. Butler
2,4,6-TNT	0.0016	0.0016	0.0015	0.0015	0.0006 mg/L	8330	6/6/2007	07-2	K. Butler
RDX	0.0071	0.0071	0.0070	0.0071	0.0011 mg/L	8330	6/6/2007	07-2	K. Butler
HMX	0.0032	0.0034	0.0032	0.0030	0.0007 mg/L	8330	6/6/2007	07-2	K. Butler
Nitroglycerine	<	<	<	<	0.1 mg/L	HPLC	5/31/2007	07-3	J. Koffman
Diphenylamine	<	<	<	<	0.02 mg/L	HPLC	5/31/2007	07-3	J. Koffman

Notes: 1. Method HPLC was developed in our laboratory based on the 8330 technique.
2. Method 300.0 is published in EPA /600/R-93/100 "Methods for Inorganic Substances"
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ENVIRONMENTAL LABORATORY REPORT **Groundwater Monitoring**

Sample ID: MI296
Location: OB/OD Monitoring Wells
Lab. ID Number: 9-MI296-07141
Sample Date: 5/21/2007
Sample Time: 9:44
Sample Type: Grab
Sampled By: L. Stewart
Chain of Custody: 87
Date Received: 5/21/2007
Condition: Acceptable

Parameter	Result 1	Result 2	Result 3	Result 4	MDL	Method	Analysis Date	QA Reference	Analyst
Arsenic	<	<	<	<	0.053 mg/L	6010	6/20/2007	07-7	J. Koffman
Barium	<	<	<	<	0.002 mg/L	6010	6/20/2007	07-7	J. Koffman
Cadmium	<	<	<	<	0.004 mg/L	6010	6/20/2007	07-7	J. Koffman
Chromium	<	<	<	<	0.007 mg/L	6010	6/20/2007	07-7	J. Koffman
Lead	<	<	<	<	0.042 mg/L	6010	6/20/2007	07-9	J. Koffman
Mercury	<	<	<	<	0.0002 mg/L	7470	6/5/2007	07-7	J. Koffman
Selenium	<	<	<	<	0.075 mg/L	6010	6/20/2007	07-7	J. Koffman
Silver	<	<	<	<	0.007 mg/L	6010	6/20/2007	07-7	J. Koffman
Iron	0.019	0.019	0.021	0.020	0.007 mg/L	6010	6/20/2007	07-1	J. Koffman
Manganese	<	<	<	<	0.002 mg/L	6010	6/20/2007	07-1	J. Koffman
Sodium	5.99	6.08	5.91	6.03	0.03 mg/L	6010	6/21/2007	07-1	J. Koffman
Chloride	2.672	2.656	2.661	2.670	1.000 mg/L	300.0	5/22/2007	07-3	J. Koffman
Fluoride	<	<	<	<	0.100 mg/L	300.0	5/22/2007	07-3	J. Koffman
Nitrate	4.694	4.683	4.718	4.699	0.140 mg/L	300.0	5/22/2007	07-8	J. Koffman
Sulfate	<	<	<	<	1.000 mg/L	300.0	5/22/2007	07-3	J. Koffman
2,4-DNT	<	<	<	<	0.0005 mg/L	8330	6/6/2007	07-1	K. Butler
2,6-DNT	0.0008	0.0008	0.0008	0.0008	0.0006 mg/L	8330	6/6/2007	07-1	K. Butler
1,3,5-TNB	0.0009	0.0009	0.0008	0.0009	0.0006 mg/L	8330	6/6/2007	07-1	K. Butler
2,4,6-TNT	0.0142	0.0142	0.0142	0.0142	0.0006 mg/L	8330	6/6/2007	07-1	K. Butler
RDX	0.105	0.110	0.108	0.107	0.010mg/L	8330	5/22/2007	07-22	J. Koffman
HMX	0.0027	0.0026	0.0026	0.0027	0.0007 mg/L	8330	6/6/2007	07-1	K. Butler
Nitroglycerine	<	<	<	<	0.1 mg/L	HPLC	5/23/2007	07-2	J. Koffman
Diphenylamine	<	<	<	<	0.02 mg/L	HPLC	5/23/2007	07-2	J. Koffman

Notes: 1. Method HPLC was developed in our laboratory based on the 8330 technique.
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Table 6.1-2 MI-019B Quarterly Sample Data Summary

Test Parameter	Detection Limits	Back-ground Mean	Backgrou nd Variance	3/4/09	3/4/09	3/4/09	3/4/09	5/20/09	5/20/09	5/20/09	5/20/09	8/12/09	8/12/09	8/12/09	8/12/09	10/13/09	10/13/09	10/13/09	10/13/09
Diphenyl-amine	0.02 mg/L	ND	0.00000	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Nitrobodies	0.005 mg/L	ND	0.00000	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Nitroglycerine	0.1 mg/L	ND	0.00000	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Perchlorate	1 ug/L	3.57	22.79037	12.00	12.00	7.00	14.00	1.30	1.30	1.42	1.30	1.0	1.0	1.0	1.0	0.81	0.7	0.69	0.65
Phenolic	0.0200 mg/L	0.04	0.00018	0.05	0.05	0.05	0.05	0.02	0.02	0.02	0.02	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Arsenic	0.053 mg/L	ND	0.00000	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Barium	0.002 mg/L	ND	0.00000	0.011	0.010	0.012	0.011	0.007	0.010	0.011	0.012	0.012	0.011	0.010	0.014	0.012	0.010	0.012	0.011
Cadmium	0.004 mg/L	ND	0.00000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chromium	0.007 mg/L	ND	0.00000	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Lead	0.042 mg/L	ND	0.00000	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Mercury	0.0002 mg/L	ND	0.00000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Selenium	0.075 mg/L	ND	0.00000	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Silver	0.007 mg/L	ND	0.00000	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Iron	0.007 mg/L	0.03	0.00040	0.017	0.017	0.010	0.009	0.019	0.019	0.017	0.018	0.062	0.045	0.058	0.064	0.009	0.011	0.012	0.013
Manganese	0.002 mg/L	0.01	0.00001	0.014	0.014	0.014	0.015	0.012	0.013	0.013	0.013	0.010	0.010	0.010	0.011	0.007	0.007	0.007	0.007
Sodium	0.03 mg/L	4.28	0.06290	4.660	4.570	4.660	4.610	4.070	4.180	4.180	4.350	4.340	4.300	4.310	4.380	3.950	3.930	4.070	3.960
Chloride	1.000 mg/L	1.19	0.05355	1.543	1.434	1.542	1.427	1.146	1.142	1.136	1.120	1.303	1.176	1.287	1.290	0.845	0.873	0.880	0.909
Sulfate	0.080 mg/L	0.71	0.03722	1.049	1.007	1.012	0.946	0.698	0.721	0.701	0.700	0.631	0.586	0.611	0.645	0.496	0.512	0.487	0.516
Conductivity	.1 ms/cm	45.3	221.54257	57.00	outlier	45.60	49.20	44.10	34.60	31.10	30.80	56.20	83.10	58.20	51.00	47.90	32.30	29.60	29.40
Total Organic Carbon	1.0 mg/L	ND	0.00000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Total Organic Halide	0.03	ND	0.00000	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
pH	.1 NTU	6.01	0.50525	6.64	5.88	5.68	5.40	6.16	5.86	5.59	5.58	8.45	5.91	5.81	5.67	6.07	5.95	5.73	5.74

Appendix D-1

Noise Maps:

D-1 OD Unit – ICUZ Noise Zone Map (Fig. B-14)
D-2 Map of Air Blast Receptors (Fig. B-15)

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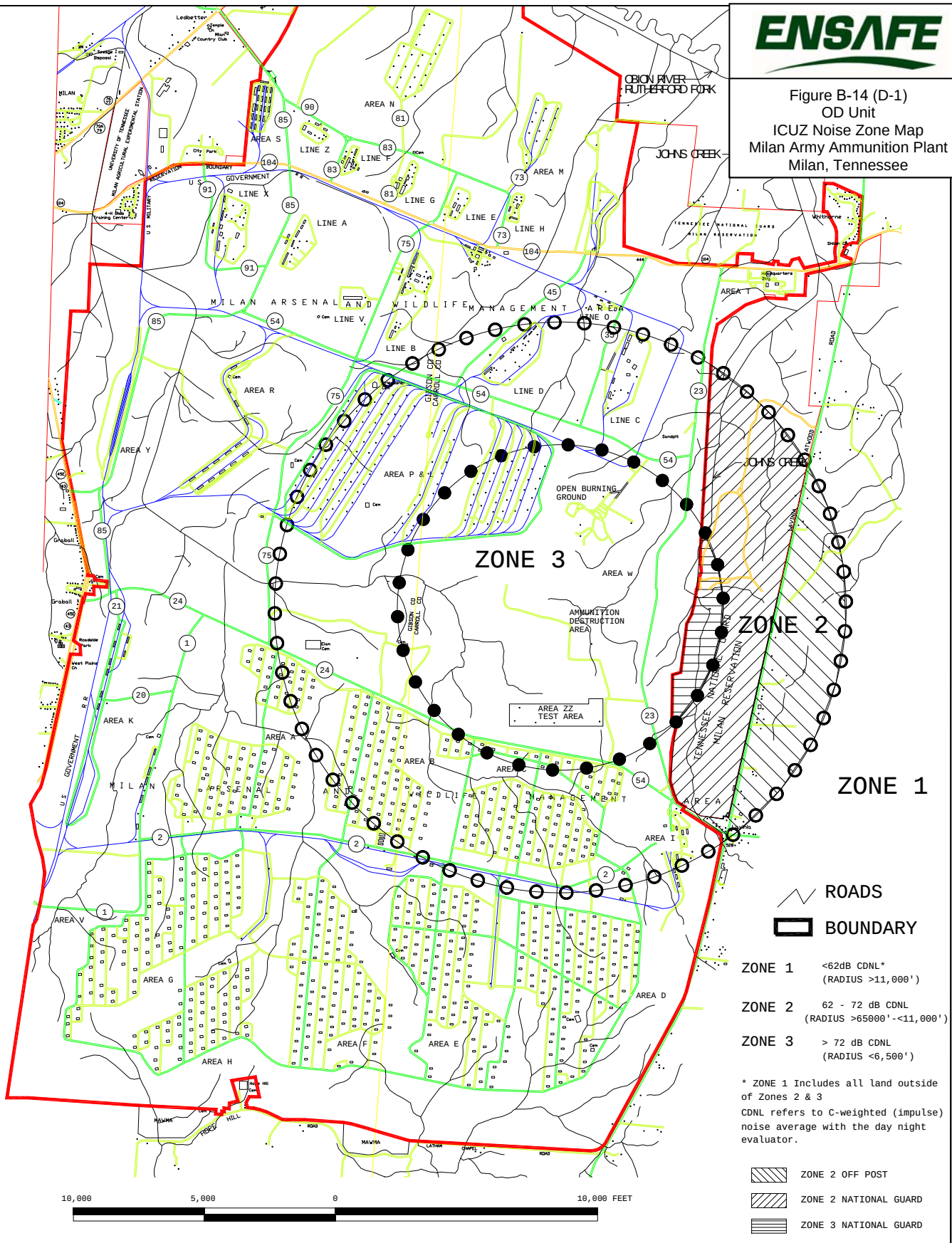
Figure B-14 (D-1)
OD Unit
ICUZ Noise Zone Map
Milan Army Ammunition Plant
Milan, Tennessee



DRAWN BY: DJB
DATE: 7-03
PLANT: MILAN
LINE:
BLDG. NO.:
DWG. LIST:
SCALE: GRAPHIC

American Ordnance
TITLE: MILAN ARMY AMMUNITION PLANT NOISE CONTOURS MAP
DRAWING NUMBER: MAAP - C - 1150 - 1
SUPERSEDES:
SUPERSEDED BY:

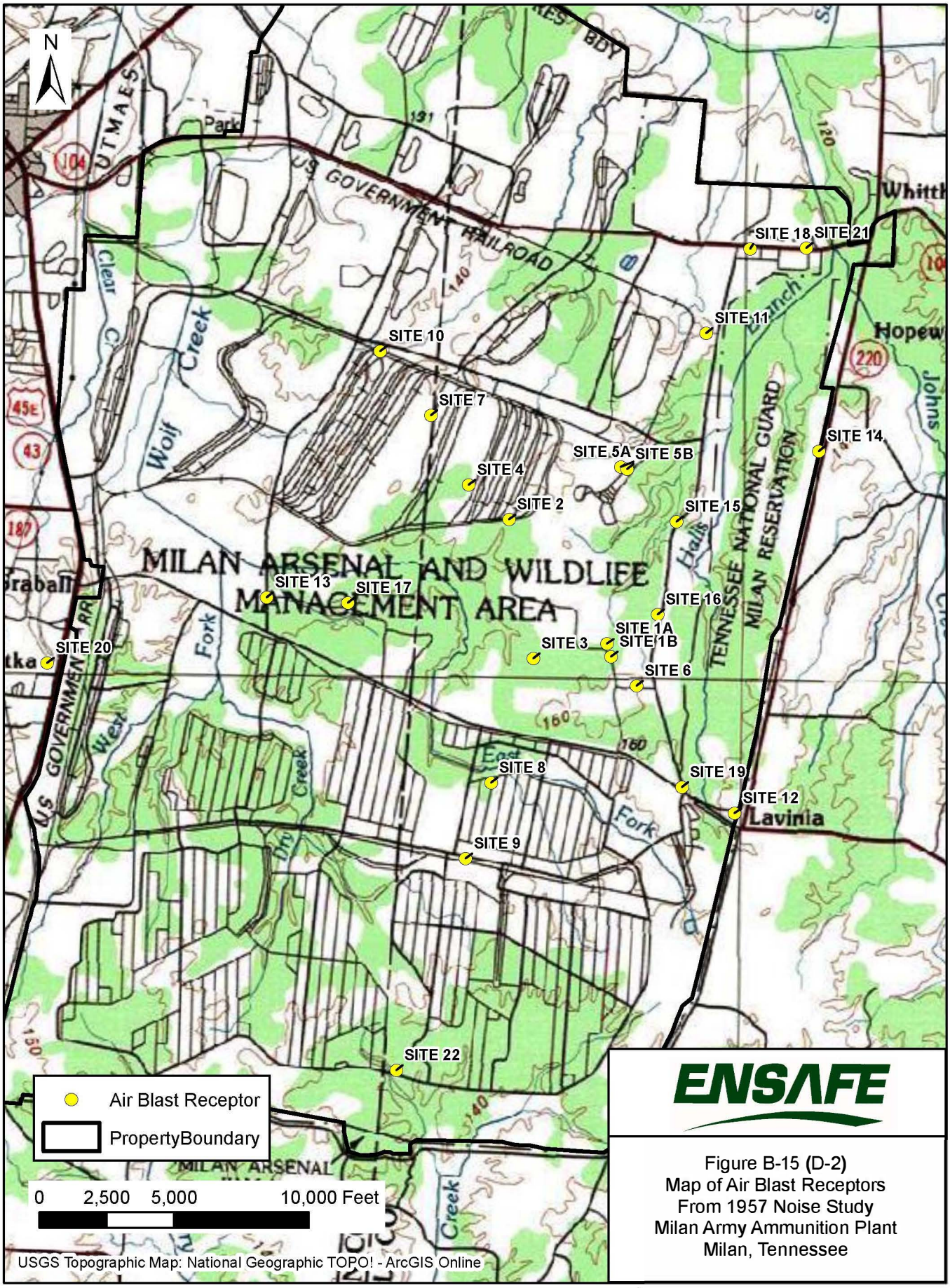


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Figure B-15 (D-2)
Map of Air Blast Receptors
From 1957 Noise Study
Milan Army Ammunition Plant
Milan, Tennessee

7/31/2008 D:\projects\milan\Milan AAP\Map\air_blast_receptors.mxd

Appendix D-2

SOPs & Other Contractor Plan Excerpts:

MR-SOP-1 – Anomaly Avoidance
MR-SOP-2 – Analog Detection and Removal Operations
MR-SOP-3 – Digital Anomaly Removal Operations
MR-SOP-4 – Management of Material Potentially Presenting an Explosive Hazard
SOP G-21 – Demolition Activities
Excerpts from:

- MR-QAPP (Munitions Response- Quality Assurance Project Plan)
- ESS (Explosives Safety Submission)
- APP (Accident Prevention Plan)

Anomaly Avoidance

Document No. MR-SOP-1

Reviewed and Approved by: Date: 12/15/2020

Program Manager, Munitions Response

Document Revisions History

Rev. No.	Rev. Date	Section Affected/Description	Prepared/ Revised By	Reviewed By
01	12/15/2020	Section 2.1, corrected reference for DDESB TP-18 to DDESB, 2020.	Melanie Costello	Ryan Steigerwalt
00		Original Publication	Andrew Fedetz/ Bryan Hnetinka	Brian Grassmyer

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1. Purpose and Scope

The purpose of this Standard Operating Procedure (SOP) is to describe the techniques employed by unexploded ordnance (UXO) personnel and qualified UXO technicians on property known or suspected to contain UXO, other munitions that may have experienced abnormal environments (e.g., discarded military munitions), munitions constituents in high enough concentrations to pose an explosive hazard, or chemical agent (CA), regardless of configuration to avoid contact with potential surface or subsurface explosive or CA hazards, to allow entry to the area for the performance of required operations. These hazards are collectively defined as munitions and explosives of concern (MEC) and material potentially presenting an explosive hazard (MPPEH) in this operating procedure.

Operations requiring anomaly avoidance may include activities such as environmental sampling, monitoring well installation, vegetation removal, digital geophysical mapping, surveying, site visits and other equivalent requirements where MEC and MPPEH may be encountered. This SOP provides Weston Solutions, Inc. (WESTON) employees and subcontractors with the minimum procedures and safety and health requirements applicable to the conduct of anomaly avoidance.

The following operating procedures are not all inclusive nor are they applicable in all situations. This SOP is not a stand-alone document and is to be used together with other work planning documents including site-specific work plan, Accident Prevention Plan (APP) and Site Safety and Health Plan (SSHP), applicable Federal, State, and local regulations, and contract restrictions and guidance.

2. Personnel, Equipment, and Materials

This section describes the personnel, equipment and materials required to implement this SOP.

2.1 Personnel Responsibilities and Duties

All UXO personnel will meet or exceed the requirements of Department of Defense Explosives Safety Board (DDESB) Technical Paper (TP)-18, Minimum Qualifications for Personnel Conducting Munitions and Explosives of Concern-Related Activities (DDESB, 2020), for their respective project functions. The following individual will be involved in anomaly avoidance.

UXO Escort (UXO personnel or qualified technicians) – Duties may include but are not limited to:

- Provide MEC and MPPEH recognition, location and explosives safety functions as appropriate based on level of experience.
- Conduct explosives safety briefings for all site personnel and visitors.
- Initiate MEC reporting procedures in accordance with the approved work plan.
- The UXO escort will be a UXO Technician II or above.
- See DDESB TP-18 for additional detailed clarification on responsibilities.

Since the purpose is anomaly avoidance, the UXO escort is not tasked to perform MEC or MPPEH disposition. In the event that MEC or MPPEH is encountered that cannot be avoided, or, based on its fuzing or current condition, presents an immediate hazard requiring immediate attention, the UXO escort will notify the installation point of contact (POC). The installation POC will notify the appropriate authority of the MEC or MPPEH discovery and the UXO escort will safeguard the site pending arrival of the appropriate authority.

2.2 Equipment and Materials

The following is a list of equipment and materials often required to perform analog operations. Consult work planning documents to revise/ modify this list to meet the specific project requirements.

- Analog geophysical instrument
- Safety gear per APP/SSHP
- Camera
- Line/rope
- Pin flags
- Phone, radio other communication device
- Global positioning system and/or site maps

2.2.1 Inspection and Function Testing

Equipment functionality of all geophysical instruments will be checked daily using an industry standard object or other item that will register a response with the instrument. The site instrument test strip or instrument verification strip can be used if established. Instrument settings will be confirmed. Log the test results per the site-specific planning documents.

3. Procedure and Protocols

When accessing the site and not performing intrusive activities the following procedures are to be considered:

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- The UXO escort must conduct a surface access survey for anomalies before any type of activities commence, including foot and vehicular traffic, approaching and leaving work areas. Typically, the access route will be at least twice as wide as the widest vehicle that will use the route.
- Personnel must be escorted by UXO personnel or qualified UXO technicians at all times in areas potentially containing MEC or MPPEH until the UXO escort has completed the access surveys and the anomaly free areas have been conspicuously marked (i.e. flagging). Escorted personnel will follow behind the UXO escort. If anomalies, or MEC/MPPEH are detected, the UXO escort will halt escorted personnel in place, and select a course around the item.
- The UXO escort must also complete an access survey of an area around the proposed work site that is large enough to support all planned operations. The size of the surveyed area will be site-specific and will take into account, for example, maneuverability of required equipment (e.g., drill rigs, excavation equipment, etc.), parking of support vehicles, and establishment of decontamination stations.
- A Schondstedt GA-52Cx magnetometer or similar analog geophysical instrumentation capable of detecting ferrous MEC and MPPEH will be used to locate subsurface anomalies. If potential MEC and MPPEH are composed of a non-ferrous composition, a White's MXT or similar instrument will be used to locate subsurface anomalies.
- During groundwater monitoring well installation or other invasive activities where the intrusive/ excavation depth is greater than the geophysical instrument's detection capabilities, and/or where MEC and MPPEH are below detection depth of the geophysical instrumentation, downhole magnetometry using a downhole Foerster FEREX (Mk26) locator, or suitable/similar instrument, will be performed by the UXO escort. An equivalent electromagnetic (EM) instrument capable of detecting non-ferrous material should be used as appropriate. Where excavations are performed over a larger area, excavation in lifts may be needed if identified in the work plan. Instrument detection depth or lift thickness should be identified in the work plan. For monitoring well installation:
  - The first lift based on instrument detection depth will be assessed using the selected analog geophysical instrument during hand-auguring, post-hole digging, or initial drilling.
  - After the first lift of material has been removed, the next interval based on instrument detection depth will be assessed by the use of the selected downhole analog geophysical instrument. This process will be continued in similar increments until a depth is reached where MEC or MPPEH is unlikely to be encountered or planned intrusive/ excavation depth is achieved.
  - If anomalies are detected, the intrusive/ excavation work will be relocated and reinitiated as close as possible to the initial or planned location.
- If anomalies or surface MEC or MPPEH are encountered, they will be marked with flagging and the work location will be relocated to an anomaly free area to avoid contact. The UXO escort will clearly mark the boundaries of the surveyed area using survey flagging and pin flags.
- No personnel will be allowed outside the surveyed areas.
- If anomalies are detected at a proposed work location or too many anomalies are detected in a general area of interest, the work/investigation area will be moved to an anomaly free location.

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MEC and MPPEH will be described in the daily log. The description may include location, item type, fuzed/unfuzed, size (diameter and length) or other discernable features.

3.1 Safety

Anomaly avoidance will be conducted under the supervision of UXO-qualified personnel or technicians per DDESB TP-18. While onsite, WESTON personnel will strictly adhere to the APP/ SSHP and the following general safety practices:

- Access to operating areas will be limited to only those personnel necessary to accomplish the specific operation.
- All personnel will attend a safety briefing prior to entering the operating area.
- Anyone can stop operations for an unsafe act or situation.
- Safety violations and/or unsafe acts will be immediately reported to the Site Safety and Health Officer.
- Failure to comply with safety rules/procedures may result in termination of employment.

4. Data Management/ Documentation

All aspects of anomaly avoidance will be documented for reporting purposes. Follow site-specific forms provided in the work planning documents throughout the course of operations.

5. Quality Control

The site-specific quality control program is documented in the work planning documents. Overarching quality control aspects that will be monitored by the UXO Escort include the following:

- Confirm all work planning documents have been read by project personnel and all practices and procedures are understood and followed.
- Test equipment functionality of geophysical instrumentation daily and document the results.

6. Reporting

Project personnel are responsible for providing objective documentation in sufficient detail showing that they have met the requirements of this SOP and relevant project plans. Collect, retain and maintain the documentation resulting from this SOP with the project record files in accordance with the work plan.

7. Terms, Definitions and Abbreviations

7.1 Definitions/Terms

No terms or definitions are included in this SOP.

7.2 Acronyms/Abbreviations

APP	Accident Prevention Plan
DDESB	Department of Defense Explosives Safety Board
MEC	Munitions and Explosives of Concern

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MPPEH	Material Potentially Presenting an Explosive Hazard
SOP	Standard Operating Procedure
SSHP	Site Specific Health and Safety Plan
TP	Technical Paper
UXO	Unexploded Ordnance
WESTON	Weston Solutions, Inc.

8. References

DDESB. 2020. TP 18 - Minimum Qualifications for Personnel Conducting Munitions and Explosives of Concern-Related Activities.

USACE. 2013. EM 385-1-97, Explosives Safety and Health Requirements Manual.

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Analog Detection and Removal Operations

Document No. MR-SOP-2

Reviewed and Approved by: Date: 5/27/2021

Program Manager, Munitions Response

Document Revisions History

Rev. No.	Rev. Date	Section Affected/Description	Prepared/ Revised By	Reviewed By
04	5/27/2021	Section 3 has been revised to replace instructional text regarding MPPEH management with a statement that inspection of MPPEH will follow the procedures outlined in MR-SOP-4, and DoD Manual (DoDM) 4172. Section 2.2 added GPS or other project-specific navigational instrument to list of materials.	Melanie Costello	Ryan Steigerwalt
03	12/15/2020	Reference update of DDESB TP-18 2020.	Melanie Costello	Ryan Steigerwalt
02	5/27/2020	References update of 6055.09 and EM 200-1-15.	Shawn MacMillan	Melanie Costello
01	8/27/2018	Section 3.4 Earth Moving Machinery/ A discussion was added about “high input” operations.	Lara Lugo	Melanie Costello
00		Original Publication	Bryan Hnetinka	Brian Grassmyer

1. Purpose and Scope

The purpose of this Standard Operating Procedure (SOP) is to identify the methods to be employed when conducting analog detection and removal operations commonly referred to as “mag & dig” or “mag & flag” surveys. This SOP provides Weston Solutions, Inc. (WESTON) employees and subcontractors with the minimum procedures and safety and health requirements applicable to the conduct of analog detection and removal operations at sites with munitions and explosives of concern (MEC).

The following operating procedures are not all inclusive nor are they applicable in all situations. This SOP is not a stand-alone document and is to be used together with other work planning documents including site-specific work plan, Accident Prevention Plan (APP) and Site Safety and Health Plan (SSHP), applicable Federal, State, and local regulations, and contract restrictions and guidance.

2. Personnel, Equipment, and Materials

This section describes the personnel, equipment and materials required to implement this SOP.

2.1 Personnel Responsibilities and Duties

All unexploded ordnance (UXO) personnel will meet or exceed the requirements of Department of Defense Explosives Safety Board (DDESB) Technical Paper (TP)-18, Minimum Qualifications for Personnel Conducting Munitions and Explosives of Concern-Related Activities (DDESB, 2020), for their respective project functions. The following individuals will be involved in analog operations.

Senior UXO Supervisor (SUXOS) – Ensures operations related to MEC are being conducted in accordance with this SOP and applicable planning documents. Duties may include but are not limited to:

- Managing UXO Teams and Other Teams and assigning specific tasks.
- Coordinating MEC operations with other site activities.
- Inspect recovered items for the presence of energetic material.
- Maintain a log of MEC operations at the site.
- See DDESB TP-18 for additional detailed clarification on responsibilities.

UXO Safety Officer (UXOSO) – Communicates directly with WESTON's Health and Safety Lead on all matters concerning safety. Duties may include but are not limited to:

- Ensure all explosive safety procedures are performed in accordance with site-specific project plans.
- Analyze explosives operational risk, hazards, and safety requirements.
- Confirm compliance with all site-specific safety requirements for explosives operations.
- Enforce personnel limits and safety exclusion zones for MEC operations.
- Monitors all activities associated with explosives transportation, storage, and destruction.
- Position may be dual-hatted with the UXO Quality Control Specialist (UXOQCS). See DDESB TP-18 for additional detailed clarification on responsibilities.

UXOQCS – Communicates directly with WESTON's Quality Control Lead on all matters concerning quality. Duties may include but are not limited to:

- Ensure all quality procedures are performed in accordance with site-specific project plans.
- Confirm compliance with all site-specific quality requirements for explosives operations.
- Establish a site-wide seeding program and monitors recovery results.
- Position may be dual-hatted with the UXOSO. See DDESB TP-18 for additional detailed clarification on responsibilities.

UXO Team Leader/ UXO Technician III – Responsible for operations of his/her team including safety and quality. Duties may include but are not limited to:

- Supervise the UXO Team to ensure safe operating practices and work is being performed at a high quality. The UXO Team Leader may work as a member of the sweep line and perform other tasks.

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- Determine if work is complete at each assigned area.
- Classify recovered items and identify MEC by the specific nomenclature if possible.
- Maintain a log of UXO Team operations.
- Complete required forms or other documentation specified in the work planning documents.
- Will be able to perform the responsibilities of a UXO Technician II. See DDESB TP-18 for additional detailed clarification on responsibilities.

UXO Technician II – Responsible for safely detecting and investigating anomalies. Duties may include but are not limited to:

- Operate analog geophysical equipment to detect anomalies.
- Conduct intrusive investigations and make preliminary identification and classification of recovered items.
- Supervise UXO Technician I's and conduct other duties as assigned.
- Will be able to perform the responsibilities of a UXO Technician I. See DDESB TP-18 for additional detailed clarification on responsibilities.

UXO Technician I – Aids in the investigation of anomalies. Duties may include but are not limited to:

- Operate analog geophysical equipment to detect anomalies.
- Conduct intrusive investigations.
- See DDESB TP-18 for additional detailed clarification on responsibilities.

2.2 Equipment and Materials

The following is a list of equipment and materials often required to perform analog operations. Consult work planning documents to revise/ modify this list to meet the specific project requirements.

- Analog geophysical instrument
- Safety gear per APP/SSHP
- Intrusive tools (e.g. shovel, pick, digging bar, hand trowel)
- Bucket
- Camera
- Radio
- Line/rope
- Pin flags
- Communication device
- Global Positioning System (GPS) or other project-specific navigational instrument

2.2.1 Inspection and Function Testing

Equipment functionality of all geophysical instruments will be checked daily at the instrument test strip. The operator will verify the response from known items is appropriate. Instrument settings will be confirmed. Log the test results per the site-specific planning documents.

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3. Procedure and Protocols

Analog detection and removal operations can be conducted along transects in support of site characterization or individual or contiguous grids. Typically analog geophysical instruments are utilized where digital geophysical systems would be ineffective or cost prohibited. Sites where analog geophysical sensors are utilized may have vegetation or terrain challenges or at sites where anomaly density is too high to accurately analyze and interpret digital data outputs.

3.1 Safety

All analog detection and removal activities at sites containing MEC will be conducted under the supervision of UXO-qualified personnel per DDESB TP-18. Only essential personnel and UXOSO approved authorized visitors will be allowed within the exclusion zone during intrusive operations. If access is required by non-essential personnel contact the SUXOS to halt all intrusive work. During operations, WESTON personnel will strictly adhere to the APP/ SSHP and the following general safety practices:

- Access to operating areas will be limited to only those personnel necessary to accomplish the specific operation.
- The exclusion zone should be monitored by the UXOSO and Team Leaders for unauthorized entry and stop intrusive work when non-essential personnel enter the area.
- MEC will only be handled by qualified UXO Technicians.
- During MEC operations the minimum separation distance (MSD) between MEC and non-MEC operations is based on the unintentional detonation fragmentation distance of the munition with the greatest fragmentation distance (MGFD), as stated in the Explosives Site Plan (ESP) or Explosives Safety Submission (ESS).
- All personnel will attend a safety briefing prior to entering the operating area.
- Anyone can stop operations for an unsafe act or situation.
- Safety violations and/or unsafe acts will be immediately reported to the SUXOS and/or UXOSO.
- Failure to comply with safety rules/procedures may result in termination of employment.

3.2 Sweep Procedures

Specific instructions for site layout and survey locations will be provided in the site specific planning documents.

3.2.1 Transect Survey Procedures

The following transect survey approach will be performed by the UXO Team:

- Any pre-planned analog transect locations will be reviewed with the UXO Team at the morning briefing.
- Each analog instrument planned to be used for transect surveys will be checked at the instrument test strip to confirm functionality.
- The first transect and starting point will be located using a GPS or equivalent navigation aid. The transect ID will be confirmed with the instruction provided by the SUXOS.
- The pre-planned transects will be followed by the UXO Team using a GPS or equivalent navigation aid to display transect locations and/or track waypoints along the transects.

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- The actual path traversed by the UXO Team will be recorded with a GPS and transferred to the project geographic information system (GIS) daily.
- During traversal the UXO Technician moves the analog geophysical instrument back and forth from one side to the other in a manner to ensure complete coverage within a five (5)-foot-wide lane. Both forward movement and the swing of the geophysical instrument are performed at a pace that ensures the entire lane is searched and that the instrument is able to appropriately respond to subsurface anomalies.
- When an anomaly is detected, the UXO Technician halts and investigates the anomaly at that time. Anomalies detected along each transect will be investigated as they are detected.
- Visual observations will also be made by the team and recorded on dig lists as each transect is traversed.
- Throughout this operation the team leader closely monitors the team's individual performance to ensure these procedures are being performed correctly.

3.2.2 Grid Survey Procedures

The following grid survey approach will be performed by the UXO Team:

- Any pre-planned analog grid locations will be reviewed with the UXO Team at the morning briefing.
- Each analog instrument planned to be used for grid surveys will be checked at the instrument test strip to confirm functionality.
- The first grid will be located using GPS. The grid ID will be confirmed with the instructions provided by the SUXOS.
- The UXO team will divide each grid into 5 feet wide lanes using rope, pin flags, cones, etc.
- Each lane will be surveyed using an analog geophysical instrument. The operation will begin at one end of each lane and move in a forward direction toward the opposing baseline.
- During traversal the UXO Technician moves the analog geophysical instrument back and forth from one side to the other in a manner to ensure complete coverage within a 5 foot wide lane. Both forward movement and the swing of the geophysical instrument are performed at a pace that ensures the entire lane is searched and that the instrument is able to appropriately respond to subsurface anomalies. The survey will be performed in such a manner that there is sufficient overlap between lanes to confirm full coverage surveys.
- When an anomaly is detected, the UXO Technician halts and investigates the anomaly at that time. Anomalies detected along each transect will be investigated as they are detected.
- Visual observations will also be made by the team and recorded on dig lists as each transect is traversed.
- Throughout this operation the team leader closely monitors the team's individual performance to ensure these procedures are being performed correctly.

3.3 Subsurface Investigations

Subsurface anomalies will be investigated by UXO Technicians as they are identified during the survey (e.g. transect or grid).

- All identified anomalies within the grid will be intrusively investigated. Excavations for individual anomalies will be conducted using an analog geophysical instrument to assist the team in determining the location of the target item.

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- The UXO Technicians excavating anomalies shall initially remove no more than a 6-inch layer of soil alongside the location of the anomaly, being careful not to interact with the item.
- The UXO Technician will conduct a visual and geophysical search of the excavation to further pin point the anomaly source as needed.
- This process shall be repeated until the audible signal from the geophysical instrument indicates the object is close to the surface. Once this determination has been made, soil will be removed by hand until the source of the anomaly is located.
- Once the item is uncovered, characterize and recover the item.
- Re-check the area with the analog geophysical instrument and continue removal efforts if a signal persists.
- Backfill any excavation after completing documentation unless otherwise instructed.
- Repeat process until the assigned area is complete.

3.4 Earth Moving Machinery

The UXO Team may use earth moving machinery (EMM) to assist in manual excavation of anomalies. A UXO Technician on the ground must guide excavation. Once the EMM is within 12 inches of the item, complete the excavation manually. There is no need to harden/shield the EMM to protect its operator when EMM is used to remove soil overburden to within 12 inches from the item.

Use of EMM may be required to access, excavate, inspect and process material. These operations are considered to be "Low Input" per DDESB Defense Explosive Safety Regulation (DESR) 6055.09, Edition 1. Shielding is required to protect the operator from fragmentation. The operator will be afforded protection from blast overpressure based on the K24 distance. The MSD may be reduced to the K18 distance if hearing protection is used. Refer to the ESP or ESS for approved minimum separation distances. Low Input operations are not intended to intentionally deform material including MEC but depends on the risk assessment and type of MEC that may be encountered.

"High Input" processing operations (e.g. shredders, crushers) are intended to physically deform material including any MEC being processed and certain excavations depending upon the risk assessment. Non-essential personnel shall be provided protection for intentional detonations based on the MGFD. Shielding is required to protect the operator from fragmentation. The operator will be afforded protection from blast overpressure based on the K24 distance. The MSD may be reduced to the K18 distance if hearing protection is used. Refer to the ESP or ESS for approved minimum separation distances.

3.5 Material Potentially Presenting an Explosive Hazard

Inspection of material potentially presenting an explosive hazard (MPPEH) will follow the procedures outlined in MR-SOP-4, and DoD Manual (DoDM) 4172.

4. Data Management/ Documentation

All aspects of analog detection and removal operations will be documented for reporting purposes. Follow site-specific forms provided in the work planning documents throughout the course of operations.

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5. Quality Control

The site-specific quality control program is documented in the work planning documents. Overarching quality control aspects that will be monitored by the UXOQCS include the following:

- Confirm all work planning documents have been read by project personnel and all practices and procedures are understood and followed.
- Test equipment functionality of geophysical instrumentation daily and document the results.
- Develop a site-wide seeding program if required by work planning documents to confirm coverage and detection capability of the UXO Team. Track and report daily by location and team.
- Assess UXO Team performance periodically to confirm project objectives are achieved.

6. Reporting

Project personnel are responsible for providing objective documentation in sufficient detail showing that they have met the requirements of this SOP and relevant project plans. Collect, retain and maintain the documentation resulting from this SOP with the project record files in accordance with the work plan.

7. Terms, Definitions and Abbreviations

7.1 Definitions/Terms

No terms or definitions are included in this SOP.

7.2 Acronyms/Abbreviations

APP	Accident Prevention Plan
DDESB	Department of Defense Explosives Safety Board
DESR	Defense Explosive Safety Regulation
DoDM	Department of Defense Manual
EMM	Earth Moving Machinery
ESP	Explosives Site Plan
ESS	Explosives Safety Submission
EMM	earth moving machinery
GIS	geographic information system
GPS	Global Positioning System
MEC	Munitions and Explosives of Concern
MGFD	Munition with the Greatest Fragmentation Distance
MPPEH	Material Potentially Presenting an Explosive Hazard
MSD	Minimum Separation Distance
SOP	Standard Operating Procedure
SUXOS	Senior UXO Supervisor
SSHP	Site Specific Health and Safety Plan
TP	Technical Paper
UXO	Unexploded Ordnance
UXOQCS	UXO Quality Control Specialist

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UXOSO UXO Safety Officer
WESTON Weston Solutions, Inc.

8. References

DDESB. 2019. Defense Explosives Safety Regulation 6055.09, Edition 1.

DDESB. 2020. Minimum Qualifications for Personnel Conducting Munitions and Explosives of Concern-Related Activities.

DoD. 2021. DoD Manual 4140.72, Management of Material Potentially Presenting an Explosive Hazard. Effective date: 7 May 2021. USACE. 2013. EM 385-1-97, Explosives Safety and Health Requirements Manual.

USACE. 2018. EM 200-1-15, Technical Guidance for Military Munitions Response Actions.

Weston Solutions, Inc. MR-SOP-4, Management of Material Potentially Presenting an Explosive Hazard (current version).

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Digital Anomaly Removal Operations

Document No. MR-SOP-3

Reviewed and Approved by: Date: 12/15/2020

Program Manager, Munitions Response

Document Revisions History

Rev. No.	Rev. Date	Section Affected/Description	Prepared/ Revised By	Reviewed By
03	12/15/2020	Updated reference for DDESB TP-18 2020.	Melanie Costello	Ryan Steigerwalt
02	5/27/2020	References update of 6055.09 and EM 200-1-15	Shawn MacMillan	Melanie Costello
01	8/27/2018	Section 3.4 Earth Moving Machinery/ A discussion was added about “high input” operations.	Lara Lugo	Melanie Costello
00		Original Publication	Melanie Costello	Brian Grassmyer

1. Purpose and Scope

The purpose of this Standard Operating Procedure (SOP) is to identify the methods to be employed when conducting removal operations following a digital geophysical mapping (DGM) survey. This SOP provides Weston Solutions, Inc. (WESTON) employees and subcontractors with the minimum procedures and safety and health requirements applicable to the conduct of intrusive operations at sites with munitions and explosives of concern (MEC).

The following operating procedures are not all inclusive nor are they applicable in all situations. This SOP is not a stand-alone document and is to be used together with other work planning documents including site-specific work plan, Accident Prevention Plan (APP) and Site Safety and Health Plan (SSHP), applicable Federal, State, and local regulations, and contract restrictions and guidance.

2. Personnel, Equipment, and Materials

This section describes the personnel, equipment and materials required to implement this SOP.

2.1 Personnel Responsibilities and Duties

All UXO personnel will meet or exceed the requirements of Department of Defense Explosives Safety Board (DDESB) Technical Paper (TP)-18, Minimum Qualifications for Personnel Conducting Munitions and Explosives of Concern-Related Activities (DDESB, 2020), for their respective project functions. The following individuals will be involved in intrusive operations at detected anomaly locations.

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Senior UXO Supervisor (SUXOS) – Ensures operations related to MEC are being conducted in accordance with this SOP and applicable planning documents. Duties may include but are not limited to:

- Managing UXO Teams and Other Teams and assigning specific tasks.
- Coordinating MEC operations with other site activities.
- Inspect recovered items for the presence of energetic material.
- Maintain a log of MEC operations at the site.
- See DDESB TP-18 for additional detailed clarification on responsibilities.

UXO Safety Officer (UXOSO) – Communicates directly with WESTON's Health and Safety Lead on all matters concerning safety. Duties may include but are not limited to:

- Ensure all explosive safety procedures are performed in accordance with site-specific project plans.
- Analyze explosives operational risk, hazards, and safety requirements.
- Confirm compliance with all site-specific safety requirements for explosives operations.
- Enforce personnel limits and safety exclusion zones for MEC operations.
- Monitors all activities associated with explosives transportation, storage, and destruction.
- Position may be dual-hatted with the UXOQCS. See DDESB TP-18 for additional detailed clarification on responsibilities.

UXO Quality Control Specialist (UXOQCS) – Communicates directly with WESTON's Quality Control Lead on all matters concerning quality. Duties may include but are not limited to:

- Ensure all quality procedures are performed in accordance with site-specific project plans.
- Confirm compliance with all site-specific quality requirements for explosives operations.
- Position may be dual-hatted with the UXOSO. See DDESB TP-18 for additional detailed clarification on responsibilities.

Quality Control (QC) Geophysicist – Communicates directly with WESTON's Quality Control Lead on all matters concerning quality. Duties may include but are not limited to:

- Reviews and approves reacquisition list.
- Monitors intrusive investigation results with respect to the digital geophysical signature.
- Confirms QC seeds have been selected and intrusively investigated.

UXO Team Leader/ UXO Technician III – Responsible for operations of his/her team including safety and quality. Duties may include but are not limited to:

- Supervise the UXO Team to ensure safe operating practices and work is being performed at a high quality. The UXO Team Leader may work as a member of the dig team and perform other tasks.
- Determine if work is complete at each assigned area.
- Classify recovered items and identify MEC by the specific nomenclature if possible.
- Maintain a log of UXO Team operations.

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- Complete required forms or other documentation specified in the work planning documents.
- Will be able to perform the responsibilities of a UXO Technician II. See DDESB TP-18 for additional detailed clarification on responsibilities.

UXO Technician II – Responsible for safely detecting and investigating anomalies. Duties may include but are not limited to:

- Operate analog or geophysical equipment for anomaly avoidance and to refine the location of anomalies.
- Conduct intrusive investigations and make preliminary identification and classification of recovered items.
- Supervise UXO Technician I's and conduct other duties as assigned.
- Will be able to perform the responsibilities of a UXO Technician I. See DDESB TP-18 for additional detailed clarification on responsibilities.

UXO Technician I – Aids in the investigation of anomalies. Duties may include but are not limited to:

- Operate analog or digital geophysical equipment to refine the location of anomalies.
- Conduct intrusive investigations.

2.2 Equipment and Materials

The following is a list of equipment and materials often required to perform intrusive operations at anomaly locations. Consult work planning documents to revise/ modify this list to meet the specific project requirements.

- Analog geophysical instrument
- Original project-specific DGM survey equipment if required by the project plans (for example EM61-MK2)
- Safety gear per APP/SSHP
- Intrusive tools (e.g. shovel, pick, digging bar, hand trowel)
- Bucket
- Camera
- Radio
- Line/rope
- Pin flags
- Communication device

2.2.1 Inspection and Function Testing

Equipment functionality of all geophysical instruments will be checked daily at the instrument test strip. The operator will verify the response from known items is appropriate. Instrument settings will be confirmed. Log the test results per the site-specific planning documents.

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3. Procedure and Protocols

Intrusive operations at anomaly locations occur following a DGM survey along a transect in support of site characterization or at individual or contiguous grids. Typically a Field Geophysicist will operate a digital sensor such as an EM61-MK2 to collect data and transfer to the geophysical Data Analyst to process and interpret the data and ultimately select anomaly locations. The anomaly locations are added to a dig list to be reacquired using a navigation system such as a global positioning system. Following reacquisition, the UXO Team will investigate the anomaly to determine if it is munitions related or non-munitions related debris. The procedures and protocols described below focus on activities that occur following anomaly reacquisition.

3.1 Safety

All digital detection and removal activities at sites containing MEC will be conducted under the supervision of UXO-qualified personnel per DDESB TP-18. Only essential personnel and UXOSO approved authorized visitors will be allowed within the exclusion zone during intrusive operations. If access is required by non-essential personnel contact the SUXOS to halt all intrusive work. During operations, WESTON personnel will strictly adhere to the APP/ SSHP and the following general safety practices:

- Access to operating areas will be limited to only those personnel necessary to accomplish the specific operation.
- The exclusion zone should be monitored by the UXOSO and Team Leaders for unauthorized entry and stop intrusive work when non-essential personnel enter the area.
- MEC will only be handled by qualified UXO Technicians.
- During MEC operations the minimum separation distance (MSD) between MEC and non-MEC operations is based on the unintentional detonation fragmentation distance of the munition with the greatest fragmentation distance (MGFD), as stated in the Explosives Site Plan (ESP) or Explosives Safety Submission (ESS).
- All personnel will attend a safety briefing prior to entering the operating area.
- Anyone can stop operations for an unsafe act or situation.
- Safety violations and/or unsafe acts will be immediately reported to the SUXOS and/or UXOSO.
- Failure to comply with safety rules/procedures may result in termination of employment.

3.2 Anomaly Reacquisition

Anomalies interpreted from the DGM survey data and added to the dig list are surveyed using a navigation system (i.e. GPS, robotic total station (RTS), professional surveyor or manual measurement from grid corners). Target locations are marked in the field using non-metallic pin flags or marking paint. Each marker is labeled with a target identification number so that the status of each anomaly can be tracked and documented through reacquisition, excavation and final QC procedures. Specific instructions for anomaly reacquisition will be provided in the site specific planning documents or other SOP's.

3.3 Anomaly Location Investigation

Reacquired anomalies will be investigated by UXO Technicians as they are marked out and identified.

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- All reacquired and marked anomalies will be intrusively investigated. Excavations for individual anomalies will be conducted using an analog geophysical instrument to assist the team in determining the location of the target item unless otherwise stated in work planning documents.
- The UXO Technicians excavating anomalies shall initially remove no more than a 6-inch layer of soil alongside the location of the anomaly, being careful not to interact with the item.
- The UXO Technician will conduct a visual and geophysical search of the excavation to further pin point the anomaly source as needed.
- This process shall be repeated until the audible signal from the geophysical instrument indicates the object is close to the surface. Once this determination has been made, soil will be removed by hand until the source of the anomaly is located.
- Once the item is uncovered, characterize and recover the item.
- Re-check the area with the analog geophysical instrument and continue removal efforts if a signal persists.
- Backfill any excavation after completing documentation unless otherwise instructed.
- Repeat process until the assigned area is complete.

3.3.1 Earth Moving Machinery

The UXO Team may use earth moving machinery (EMM) to assist in manual excavation of anomalies. A UXO Technician on the ground must guide excavation. Once the EMM is within 12 inches of the item, complete the excavation manually. There is no need to harden/shield the EMM to protect its operator when EMM is used to remove soil overburden to within 12 inches from the item.

Use of EMM may be required to access, excavate, inspect and process material. These operations are considered to be "Low Input" per Defense Explosives Safety Regulation (DESR) 6055.09. Shielding is required to protect the operator from fragmentation. The operator will be afforded protection from blast overpressure based on the K24 distance. The MSD may be reduced to the K18 distance if hearing protection is used. Refer to the ESP or ESS for approved minimum separation distances. Low Input operations are not intended to intentionally deform material including MEC but depends on the risk assessment and type of MEC that may be encountered.

"High Input" processing operations (e.g. shredders, crushers) are intended to physically deform material including any MEC being processed and certain excavations depending upon the risk assessment. Non-essential personnel shall be provided protection for intentional detonations based on the MGFD. Shielding is required to protect the operator from fragmentation. The operator will be afforded protection from blast overpressure based on the K24 distance. The MSD may be reduced to the K18 distance if hearing protection is used. Refer to the ESP or ESS for approved minimum separation distances.

3.3.2 Material Potentially Presenting an Explosive Hazard

Inspection of material potentially presenting an explosive hazard (MPPEH) will follow the following general procedures. Refer to site-specific planning documents for site-specific instruction:

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- After initial inspection of MPPEH by a UXO Technician II, the UXO Technician III must perform a second independent inspection.
- After the second inspection document the material as material documented as safe (MDAS) in the team leader's logbook and turn MDAS over to the SUXOS for final disposition.
- Mark identified MEC for disposal and notify the SUXOS. The demolition procedure should be referenced.
- MEC acceptable to move as determined by the SUXOS and UXOSO may be relocated within the site for subsequent disposal operations. MEC unacceptable to move will be blown-in-pace.
- MEC will be safeguarded until disposal operations can take place unless otherwise directed.

3.3.3 Post-Dig Anomaly Resolution

Post-dig anomaly resolution sampling is conducted after intrusive investigation to verify that the source of the anomaly has been removed during the intrusive investigation. The original geophysical instrument used to detect anomalies, or one that performs better than the original, should be used to verify that the anomaly has been resolved. Consult work planning documents for specific instrumentation.

The work planning documents should detail the number of anomalies that require post-dig verification sampling. The UXOQCS and QC Geophysicist will implement the post-dig anomaly resolution process as prescribed in the work planning documents.

4. Data Management/ Documentation

All aspects of the removal operations will be documented for reporting purposes. Follow site-specific forms provided in the work planning documents throughout the course of operations.

5. Quality Control

The site-specific quality control program is documented in the work planning documents. Overarching quality control aspects that will be monitored by the UXOQCS include the following:

- Confirm all work planning documents have been read by project personnel and all practices and procedures are understood and followed.
- Test equipment functionality of geophysical instrumentation daily and document the results.
- Track and report recovery of QC seeds daily by location and team.
- Assess UXO Team performance periodically to confirm project objectives are achieved.
- Monitor dig results to confirm item attributes match digital signatures.

6. Reporting

Project personnel are responsible for providing objective documentation in sufficient detail showing that they have met the requirements of this SOP and relevant project plans. Collect, retain and maintain the documentation resulting from this SOP with the project record files in accordance with the work plan.

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7. Terms, Definitions and Abbreviations

7.1 Definitions/Terms

No terms or definitions are included in this SOP.

7.2 Acronyms/Abbreviations

APP	Accident Prevention Plan
DDESB	Department of Defense Explosives Safety Board
DESR	Defense Explosives Safety Regulation
DGM	Digital Geophysical Mapping
EMM	Earth Moving Machinery
ESP	Explosives Site Plan
ESS	Explosives Safety Submission
GPS	Global Positioning System
MDAS	Material Documented as Safe
MEC	Munitions and Explosives of Concern
MGFD	Munition with the Greatest Fragmentation Distance
MPPEH	Material Potentially Presenting an Explosive Hazard
MSD	Minimum Separation Distance
RTS	Robotic Total Station
SOP	Standard Operating Procedure
SUXOS	Senior UXO Supervisor
SSHP	Site Specific Health and Safety Plan
TP	Technical Paper
UXO	Unexploded Ordnance
UXOQCS	UXO Quality Control Specialist
UXOSO	UXO Safety Officer
WESTON	Weston Solutions, Inc.

8. References

DDESB. 2019. Defense Explosives Safety Regulation 6055.09, Edition 1.

DDESB. 2020. Minimum Qualifications for Personnel Conducting Munitions and Explosives of Concern-Related Activities.

USACE. 2013. EM 385-1-97, Explosives Safety and Health Requirements Manual.

USACE. 2018. EM 200-1-15, Technical Guidance for Military Munitions Response Actions.

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Management of Material Potentially Presenting an Explosive Hazard

Document No. MR-SOP-4

Reviewed and Approved by: _____ Date: 2/6/2024

Program Manager, Munitions Response

Document Revisions History

Rev. No.	Rev. Date	Section Affected/Description	Prepared/ Revised By	Reviewed By
05	Feb 1, 2024	Section 3.1.3: Removed text in reference to OESS as personnel verifying MPPEH inspection. Section 3.1.5 & 3.1.6: Modified text to match the requirements of DoDM 4140.72	Brandon Sutter	Ryan Steigerwalt
04	May 27, 2021	Added reference and citations for DoDM 4140.72 Management of MPPEH, May 7, 2021	Melanie Costello	Ryan Steigerwalt
03	December 15, 2020	Updated reference for DDESB TP-18, 2020.	Melanie Costello	Ryan Steigerwalt
02	May 2020	Section 3.1 expanded container markings requirements. Reference update for 4140.62.	Shawn MacMillan	Melanie Costello
01	Dec 2018	3.1 Certification and Verification Procedures/ Part (3) was revised to clarify that the OESS only verifies the inspection process and not MPPEH	Doug Boyd	Ryan Steigerwalt
00		Original Publication	Melanie Costello, Lara Lugo	Bruce Moe, Andrew Caldwell, Brian Grassmyer

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1. Purpose and Scope

The purpose of this Standard Operating Procedure (SOP) is to identify the methods to be employed when certifying and verifying material potentially presenting an explosive hazard (MPPEH) as material documented as an explosive hazard (MDEH) or material documented as safe (MDAS). This SOP provides Weston Solutions, Inc. (WESTON) employees and subcontractors with the minimum procedures and safety and health requirements applicable to the conduct of managing MPPEH, MDEH and MDAS.

The following operating procedures are not all inclusive nor are they applicable in all situations. This SOP is not a stand-alone document and is to be used together with other work planning

documents including site-specific work plan, Accident Prevention Plan (APP) and Site Safety and Health Plan (SSHP), applicable Federal, State, and local regulations, and contract restrictions and guidance.

2. Personnel Responsibilities and Duties

All unexploded ordnance (UXO) personnel will meet or exceed the requirements of Department of Defense Explosives Safety Board (DDESB) Technical Paper (TP)-18, Minimum Qualifications for Personnel Conducting Munitions and Explosives of Concern-Related Activities (DDESB, 2020) and Engineering Manual (EM) 385-1-97 for their respective project functions. The following individuals will be involved in MPPEH management.

UXO Technician I:

- Tentatively identifies a located item as MPPEH with confirmation by a UXO Technician II or UXO Technician III.

UXO Technician II:

- Performs a 100% inspection of each item as it is recovered and determines the following:
    - Is the item unexploded ordnance (UXO), discarded military munitions (DMM), munitions debris (MD) or range related debris (RRD)?
    - Does the item contain explosives hazards or other dangerous fillers?
    - Does the item require detonation?
    - Does the item require demilitarization or venting to expose dangerous fillers?
    - Does the item require draining of engine fluids, removal of illuminating dials and other visible liquid hazardous, toxic or radiological waste (HTRW)?
- Segregates items requiring demilitarization or venting procedures from items ready for certification.
- Processes items found to contain explosive hazards (i.e., MDEH) or other dangerous fillers in accordance with applicable procedures.

UXO Technician III:

- Performs a 100% re-inspection of all recovered items to determine if it is free of explosive hazards or other dangerous fillers, engine fluids, illuminating dials and other visible HTRW.
- Supervises detonation of items containing explosive hazards or other dangerous fillers and venting/ demilitarization procedures.
- Supervises the consolidation of MPPEH to be assessed, and MDEH and MDAS ultimately containerized and sealed, ensuring MD and RRD are segregated.

UXO Quality Control Specialist (UXOQCS):

- Conducts daily audits of the procedures used by UXO teams and individuals for processing MPPEH.

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- Performs and documents random inspections by item, volume of items or by area of all MPPEH collected to ensure no items with explosive hazards, engine fluids, illuminating dials or visible liquid HTRW materials are identified as MD or RRD.
- Position may be dual-hatted with the UXOSO. See DDESB TP-18 for additional detailed clarification on responsibilities.

UXO Safety Officer (UXOSO):

- Ensures all procedures for processing MPPEH are being performed safely and consistent with the work planning documents including APP, SSHP and/or applicable instructions and regulations including DoDI 4140.62, DoDM 4140.72, and EM 385-1-97.
- Position may be dual-hatted with the UXOQCS. See DDESB TP-18 for additional detailed clarification on responsibilities.

Senior UXO Supervisor (SUXOS):

- Implements the work plan.
- Completes DD Form 1348-1A for all MD and RRD to be transferred for final disposition.
- Performs random checks of the material to satisfy that the MD and RRD is free of explosive hazards necessary to complete DD Form 1348-1A.
- Certifies all MD and RRD as free of explosive hazards, engine fluids, illuminating dials and other visible liquid HTRW.
- Ensures inspected debris is secured in a closed, labeled and sealed container.

3. Procedures and Protocols

3.1 Certification and Verification Procedures

Assess all MPPEH to determine its explosives safety status (i.e., MDEH or MDAS) before transferring the material within Department of Defense (DoD) facilities or releasing it from DoD control. MPPEH for which the explosives safety status has been documented as either MDEH or MDAS must be strictly segregated and secured from each other and MPPEH. Authorized and technically qualified personnel (see Section 2) must certify the MPPEH as MDAS before it can be released. MPPEH procedures comply with DoDI 4140.62, DoDM 4140.72, and EM 385-1-97.

Follow this certification and verification procedures for material suspected or determined to be MPPEH before transporting it within or out of DoD control:

1) Obtain certification and verification that 100% inspected and an independent 100% re-inspection has been completed and that the material has been determined to be free of explosives before certifying it as MDAS.
2) The SUXOS certifies that the items are free of explosive hazards and can be classified as MDAS.
3) The UXOQCS or similarly trained individuals, verifies the MPPEH inspection process has been followed.
4) When certified and verified as free of explosive hazards, MD/RRD collected will be placed in containers and sealed. Each container will be closed in a manner that requires that the

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seal be broken to gain access to the interior of the container. The containers will be labeled with a unique ID and documented as follows:

- USACE (or DoD organization)/Installation Name/Weston Solutions, Inc./Container number (e.g., 0001)/Seal number. Additional containers will be numbered 0002, 0003, etc.
- A seal will bear the same unique identification number as the container or the container will be clearly marked with the seal's identification if different from the container.
- A document description of the container will be provided with the following information for each container: contents, weight of container, location where munitions or range-related debris was obtained, name of contractor, names of certifying and verifying individuals, unique container identification, and seal identification, if required. Provides these documents in the final report.

5) Use DD Form 1348-1A as the certification/verification document with the following information:
   - Document date
   - Basic material content (type of metal – steel or mixed)
   - Total weight
   - SUXOS, OESS (or UXOQCS) names
   - Company name and DoD representatives organization and addresses, telephone numbers
   - Container seal number
   - Site name, city and state where MD and/or RRD was obtained
6) Enter the following certification/ verification on each DD Form 1348-1A for the turnover of MD. The SUXOS and UXOQCS must sign the form:
   - " *The material listed on this form has been inspected, processed by DDESB-approved means, or undergone the application of expert knowledge, in compliance with DoD policy, and to the best of my knowledge and belief, does not pose an explosive hazard.*."
7) Enter the following certification/ verification on each DD Form 1348-1A for MD or RRD transferred within or released from DoD control. The SUXOS andUXOQCS must sign the form:
   - " *The material listed on this form has been inspected, processed by DDESB-approved means, or undergone the application of expert knowledge, in compliance with DoD policy, and to the best of my knowledge and belief, does not pose an explosive hazard., and/or engine fluids, illuminating dials and other visible liquid HTRW materials.*"
8) The SUXOS or designee shall ensure that the following information is obtained from the qualified recycler upon receipt of the material identified on DD Form 1348-1A"
   - Quantity of material received
   - Signature
   - Date

3.2 Maintaining Chain of Custody and Final Disposition

Release the certified and verified materials only to an organization that will perform the following:

1) Provide certification on company letterhead stating the following:

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- "*Upon receiving the unopened labeled containers each with its unique identification and unbroken seal ensuring a continued chain of custody, and after reviewing and concurring with all the provided supporting documentation, sign for having received and agreed with the provided documentation that the sealed containers contained no explosive hazards when received. The contents of these sealed containers will not be sold, traded or otherwise given to another party until the contents have been smelted and are only identifiable by their basic content.*"

2) Send notification and supporting documentation to WESTON documenting that the sealed containers have been smelted and are now only identifiable by their basic content.

The following steps should then be taken:

1) Incorporate documentation in the final report.
2) If the chain of custody is broken, the affected MPPEH must undergo a second 100% inspection, a second 100% re-inspection, and be documented to verify its explosives safety status.
3) Provide documentation to the WESTON resource manager to be maintained in the project file.
4) Document MDAS being transferred within or released from DoD control on a chain of custody form.
5) SUXOS or designee contacts the receiving agent/ recycler to obtain MDAS final demilitarization documentation.

4. Data Management/ Documentation

The following documentation is required:

- Two original copies of DD Form 1348-1A, completed with signatures by SUXOS, OESS (or UXOQCS), and recycler.
- Chain of custody form.
- Certification letter.

5. Quality Control

In accordance with DoDM 4140.72, MPPEH for which the explosives safety status has been documented as either MDEH or MDAS must be strictly segregated and secured from each other and MPPEH. All personnel involved with MPPEH inspections and management must carefully follow all safeguards and security control measures to prevent comingling of processed material. If suspicion arises that comingling has occurred, notify the SUXOS and UXOQCS immediately. Reprocess the questionable material in accordance with this SOP.

Train all UXO-qualified personnel in the recognition and safe handling of used and unused military munitions and specific types of MPPEH in accordance with DoDI 4140.62 and DoDM 4140.72, and qualify all UXO-qualified personnel in accordance with DDESB TP 18.

6. Reporting

All documentation shall be appended to the final report. Maintain copies for 3 years.

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7. Terms, Definitions and Abbreviations

7.1 Definitions/Terms

No terms or definitions are included in this SOP.

7.2 Acronyms/Abbreviations

APP	Accident Prevention Plan
DDESB	Department of Defense Explosives Safety Board
DMM	Discarded Military Munitions
DoD	Department of Defense
DoDI	Department of Defense Instruction
DoDM	Department of Defense Manual
EM	Engineering Manual
HTRW	Hazardous, Toxic and Radiological Waste
MD	Munitions Debris
MDAS	Material Documented as Safe
MDEH	Material Documented as an Explosive Hazard
MPPEH	Material Potentially Presenting an Explosive Hazard
OESS	Ordnance and Explosives Safety Officer
RRD	Range Related Debris
SOP	Standard Operating Procedure
SUXOS	Senior UXO Supervisor
SSHP	Site Specific Health and Safety Plan
TP	Technical Paper
USACE	United States Army Corps of Engineers
UXO	Unexploded Ordnance
UXOQCS	UXO Quality Control Specialist
UXOSO	UXO Safety Officer
WESTON	Weston Solutions, Inc.

8. References

DoD. 2019. DoD Instruction 4140.62, Material Potentially Presenting an Explosive Hazard. Effective date: 20 August 2015. Change 3 Effective date: 9 September 2019.

DoD. 2021. DoD Manual 4140.72, Management of Material Potentially Presenting an Explosive Hazard. Effective date: 7 May 2021.

DDESB. 2020. Technical Paper 18, Minimum Qualifications for Personnel Conducting Munitions and Explosives of Concern-Related Activities.

USACE. 2013. EM 385-1-97, Explosives Safety and Health Requirements Manual.

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STANDARD OPERATING PROCEDURE G-21
DEMOLITION ACTIVITIES

1. PURPOSE

The purpose of this standard operating procedure (SOP) is to provide the step-by-step procedures for personnel to safely perform periodic demolition activities, related to either immediate response blow-in-place (BIP) operations or pre-planned consolidated demolition operations, during the field activities.

Unexploded ordnance (UXO) hazards are unique and require a greater level of awareness and attention-to-detail than everyday projects. These procedures provide step-by-step instructions. References contain comprehensive procedures for conducting demolition operations and should be referred to for any situation not covered by this instruction. This SOP complies with the requirements of all applicable Army and U.S. Department of Defense instructions and safety regulations, federal, state, and local requirements and applicable Occupational Safety and Health Administration (OSHA) Standards.

2. SCOPE

This SOP applies to all Weston Solutions, Inc. (Weston) personnel involved in demolition/disposal operations at the site.

3. REFERENCE DOCUMENTS

OSHA General Industry Standards, 29 Code of Federal Regulations (CFR) 1910 (OSHA, 1974)
Rothenbuhler Remote Firing Device (RFD) Operating Manual ("RFD Operating Manual")
Engineer Manual (EM) 385-1-97 (U.S. Army Corps of Engineers [USACE], 2013)

4. RESPONSIBILITIES

4.1 PROJECT MANAGER

The Project Manager is responsible for ensuring availability of resources required to safely implement this SOP.

4.2 SENIOR UNEXPLODED ORDNANCE SUPERVISOR (SUXOS)

The SUXOS is responsible for ensuring that all disposal operations are conducted in a safe and professional manner. The SUXOS will assign a Demolition Supervisor and other essential personnel as required for the disposal operation. The SUXOS will initiate all public telephone notifications and act as an independent safety observer during disposal operations if the Unexploded Ordnance Safety Officer (UXOSO) is unavailable.

4.3 UNEXPLODED ORDNANCE SAFETY OFFICER (UXOSO)

The UXOQCS/SO is responsible for ensuring that UXO disposal operations involving hazardous and/or explosive materials are conducted in a safe and professional manner.

The UXOQCS/SO will act as an independent safety observer during demolition/disposal operations and will observe and in no way participate in demolition activities. If the SUXOS is unavailable, the UXOQCS/SO will initiate all public telephone notifications.

4.4 DEMOLITION SUPERVISOR

The Demolition Supervisor will be a UXO Technician III in accordance with Department of Defense Explosives Safety Board (DDESB) Technical Paper (TP) 18 (DDESB, 2020) and will be responsible for the supervision of drawing of explosive stores, preparation, placement, and firing of all explosive charges. A Demolition Supervisor is required for all demolition operations. The Demolition Supervisor will be selected prior to the start of any demolition operation and is the primary supervisor for the disposal operation and will report to the SUXOS.

5. TELEPHONE NOTIFICATION

Weston will initiate all telephone notifications upon the event of munitions and explosives of concern (MEC) detonation.

6. ELECTRONIC NOTIFICATION

6.1 WESTON

Weston will initiate all electronic notifications upon the event of MEC detonation. The notification list, including email addresses, is included in the Explosives Management Plan (Appendix N of the Munitions Response – Quality Assurance Project Plan [MR-QAPP] for the Morgan General Ordnance Depot [MGOD] Munitions Response Site [MRS] 01 [MRS-01]).

6.2 NOTIFICATION LIST

The following individuals will receive a demolition activities log post completion: USACE Ordnance and Explosives Safety Specialist (OESS), Weston Project Manager, USACE Project Manager, and Weston MEC Quality Assurance Manager, with the SUXOS, UXOSO and UXO Quality Control Specialist (UXOQCS) copied on the email.

6.3 NOTIFICATION LANGUAGE

The post notification demolition log will include at the minimum the following items: SUXOS will provide:

- Timeline of details for the demolition activities that day.
- Personnel involved.
- All notified of the demolition activities.
- The demolition location.
- Item(s) to be destroyed or demilitarized.
- Quantities and types of commercial explosives used.
- Identify any problems, misfires, ineffective shots, or corrective actions.

UXOQCS/SO will provide the safety sign in roster with name title and signature of everyone present and involved in the activities.

7. EQUIPMENT AND MATERIALS

7.1 PERSONAL PROTECTIVE EQUIPMENT (PPE)

- Leather gloves except when handling electric/Nonel caps.
- Safety glasses.
- Level D PPE.

7.2 EQUIPMENT

The following items will be required at a minimum for all demolition operations:

- Explosive transport vehicle with Day Box (safety inspected, properly equipped, fire extinguishers etc.).
- Digital photograph or video camera.
- Two-way radios.
- Rothenbuhler, RFD.
- Galvanometer.
- Wire cutters, electrical tape, crimpers, duct tape and other demolition items in the explosive tool kit.
- Single strand firing line for distancing RFD from detonation.
- Shovels, rakes and other hand tools as required.

7.3 COMMUNICATION EQUIPMENT

The primary method of communication on the range will be handheld radios with cellular phones as a backup. A minimum of two working radios are required to be on-site, and radios will be tested prior to the start of disposal operations.

Cell phones will not be allowed in the area of the demolition set-up or around munitions or the demolition areas. SUXOS and UXOQCS/SO will maintain separation distances, observe the demolition operation, and have cell phones for emergency communication.

7.4 SAFETY EQUIPMENT

- Siren/horn.
- Road barricades, if applicable. We will post road guards at designated points for exclusion zone enforcement.
- First aid/trauma kit.
- Fire extinguishers.

7.5 COMMERCIAL EXPLOSIVE MATERIALS

The following are included, but not limited to:

- Jet perforators – 19.5 grains (or smaller, depending on explosives vendor and/or munitions).
- Detonating cord – 80 grain per foot.
- Electric or Nonel caps.
- Tetryl boosters ¼, ½, or 1 pound in weight.

8. SAFETY

8.1 GENERAL SAFETY PRECAUTIONS

All personnel conducting demolition operations involving the use of explosives will follow the approved guidance provided in this instruction and associated references. Any deviation from the approved SOP must be authorized by the SUXOS.

The following "General Safety Precautions" apply to all ordnance disposal work:

- Smoking or spark/flame producing devices will not be permitted within 100 feet of any explosive material.
- The Demolition Supervisor will supervise the control of all blasting caps and/or initiating devices.
- The Demolition Supervisor will maintain control o f the RFD Key until activities are complete for the day.
- All crimping and priming procedures will be directed and supervised by the Demolition Supervisor.
- The preparation of initiators will be performed at a distance not less than 50 feet from any other explosives.
- Use the minimum number of personnel necessary to perform the demolition operation safely (a minimum of three is required).
- Ensure the area is clear of any unauthorized personnel, vehicles, or low flying aircraft before beginning any demolition procedure.
- Do not handle, use, or remain near explosives during the approach or egress of an electrical storm within 10 miles. All personnel involved in any demolition operation in such a case should immediately retreat to vehicles or buildings while maintaining custody of explosives.

- Always point the explosive end of blasting caps, detonators, and other explosive devices away from the body and any other person who may be in close proximity. These items are extremely dangerous and may cause serious injury if they prematurely detonate.
- Use only approved tools when handling demolition materials.
- Personnel conducting demolition operations will wear all nature fiber clothing to minimize the risk of static electricity.
- Personnel should anticipate the possible presence of accumulated static electricity and take necessary precautions to minimize the potential hazards by grounding as needed.
- Operations will be scheduled so that the last detonation will occur prior to diminishing daylight; no explosive operations will be conducted at night.
- Use electric blasting caps of the same manufacture, if possible, for each demolition shot involving more than one cap.
- Does not strike, tamper, or attempt to remove or investigate the contents of a blasting cap, detonator, or explosive initiating device. A detonation may occur.
- Do not pull on the lead wires of electric blasting caps, detonators, or other explosive devices. A detonation may occur.
- Do not bury blasting caps, misfires will require an investigation and visibility is necessary.
- Review electromagnetic radiation (EMR) precautions and electrical grounding procedures as indicated in the applicable reference publications prior to commencing any electric demolition procedure.
- Do not transmit on a radio or use a cellular phone within distance of electrically initiated caps. (25 feet).
- Use only the minimum amount of explosives necessary to destroy the item(s) being detonated.

8.2 ELECTRIC FIRING SAFETY PRECAUTIONS (REMOTE FIRING DEVICE)

The following “Electric Firing Safety Precautions” apply to all ordnance disposal work utilizing the RFD:

- The operating procedures contained in the RFD Operating Manual will be followed when using the RFD.
- Use only special silver chloride dry-cell batteries in the galvanometer. Other types of batteries may produce sufficient voltage to detonate blasting caps.

- Do not remove the shunt from the lead wires of blasting caps except to test continuity or connect into a firing circuit. The individual removing the shunt will ground himself/herself prior to this operation to prevent accumulated static electricity from possibly firing the blasting cap.

- Unroll the lead wires so that the cap is as far as possible from the operator and pointing away from him. Place the blasting cap under a sand bag or behind a barricade before removing the shunt and testing for continuity. Make sure the cap is not pointing toward other personnel or explosives.

- Do not hold the blasting cap directly in the hand when uncoiling leads. The lead wires should be straightened by hand; not thrown, waved, or snapped to loosen the coils.

- Test electric blasting caps for continuity prior to connecting them to the firing circuit. Upon completion of testing, the lead wires will be shunted by twisting the bare ends of the wire together. The wires will remain shunted until they are to be connected to the firing circuit.

- Keep all parts of the firing circuit insulated (electrical tape) from the ground or other conductors such as bare wires, rails, pipes, or other paths of stray current.

- Do not connect the RFD to the firing circuit until all pre-firing tests have been completed in accordance with owner's manual and the demolition charge is ready in all respects to be fired.

- Keep the power end of the firing wire shunted until ready to connect the RFD.

The Demolition Supervisor will order the firing wires to be connected to the RFD when he is certain the area is clear of excess personnel, equipment all site personnel are accounted for and roads and other pathways are secured.

9. OPERATIONS

9.1 PRE-DISPOSAL OPERATIONS

Prior to performing the MEC disposal field activities, the following actions will be completed:

- Identify the MEC item. The UXOQCS/SO and SUXOS will implement the most appropriate response action that is protective of human health, property, and the environment for the discovered item.

- Record the location of the MEC item; photographs will be taken, and the MEC information will go into Weston RespondFast® data collection for tracking purposes.

- Identify the exclusion zones for non-essential personnel for the demolition operation.

- Select the personnel to perform disposal operations involving MEC/material documented as an explosives hazard (MDEH)/material potentially presenting an explosives hazard (MPPEH) and/or demilitarization.

- The SUXOS will select personnel based on current qualifications to ensure all personnel become familiar with instructions and references. All personnel will follow the procedures outlined in this instruction and references when conducting demolition operations. Ensure all personnel participating in disposal operations involving the use of explosives are aware of the hazards associated.

- Notify all agencies outlined in the work plan, local emergency services providers and the local community, as necessary.

- Immediate response BIP operation notifications will be made as soon as possible prior to the demolition activities.

- Pre-planned demolition operations notifications will be made as soon as possible based on explosives availability and coordinating agencies.

- Monitor weather forecasts and notify the SUXOS whenever a hazardous weather condition exists or may develop. Demolition operations will not take place when any of the following conditions exist:

  - Lightning activity within 10 miles.
  - Sand, snow, or dust storms of sufficient severity to create static electricity.
  - Wind is more than 35 miles per hour (mph).

- During dry conditions demolition operations may be delayed or suspended when there is a high probability of fire as determined by the UXOQCS/SO and SUXOS. Fire prevention activities will be utilized if necessary to include:

  - Engineering controls
  - Vegetation reduction
  - Pre-wetting

- Conduct UXO Demolition Operations Safety Briefings before the start of each disposal operation for all personnel participating in the disposal activities. Also, conduct a debrief to discuss overall performance and lessons learned, if any.

- Maintain a copy of this SOP instruction with demo logbook. All personnel assigned to specified disposal activities will review SOP.

9.2 INITIAL PREPARATIONS/RANGE PROCEDURES

Before each disposal operation, the SUXOS and the assigned work crew will inspect the disposal areas to identify any hazards for safe operations. Hazards are determined on a case-by-case basis and are dependent upon the location of the demolition operation. The work crew will stage all equipment and other associated equipment and material necessary for operations to begin. The UXOQCS/SO will also ensure that all necessary vehicles and equipment are in compliance with necessary regulations.

9.2.1 UXOQCS/SO Pre-Operational Procedures

The UXOQCS/SO will conduct a Daily Safety Brief before each day's activities for all personnel participating in the detonation/disposal operations. The UXOQCS/SO will also inspect each member of the team to ensure the following:

- No silk, rayon, nylon, or other synthetic-fiber garments are worn (static electricity hazard).
- Leather palmed gloves are worn except when handling caps or firing wire.
- Safety glasses are worn.
- All spark and flame producing materials are absent from the disposal site.
- Cell phones are off all personnel setting up the demolition shot.

9.2.2 Demolition Supervisor Pre-Operational Procedures

The Demolition Supervisor will ensure the following actions are performed:

- Assign and post road guards as necessary.
- Ensure the disposal operation site is secure.
- Will notify all site personnel when the range is hot and to keep non-essential radio traffic to a minimum.
- Explosive materials will be drawn from the explosive vendor and stored in the truck's magazines prior to demolition operations.
- Brief the demolition party on the sequence of events for each shot.
- Verify the area is secure and get permission from the SUXOS before any explosive procedures begin.

9.3 PROCEDURES FOR ELECTRIC INITIATION (REMOTE FIRING DEVICE)

The following actions, procedural steps, and precautions are provided for the electric initiation of explosive charges utilizing an RFD. The Demolition Supervisor will:

- Maintain positive control of the key for firing device until demolition activities are completed for the day.
- Prepare the plan of the day for all demolition activities.
- Ensure the engineering controls are ready to be put in place and the area is free of secondary debris.
- Direct the demolition party to proceed down range and place the prepared main charge.
- Direct the placement of engineering controls over the charge to ensure the mitigation of fragmentation hazards.
- Ensure compliance with all safety precautions and operating procedures contained in the RFD Operating Manual.
- Direct all members of the demolition party when shot is set up to proceed to a safe area so the shot can be primed.
- Ensure that all personnel are accounted for and road guards maintain exclusion zone is all clear.
- Get permission to prime the shot from SUXOS.
- Assist in priming the shot and retreat to the safe area.
- Get permission to fire the shot from SUXOS, have team member yell “fire in the hole” three times audible in multiple directions.
- Initiate the shot.
- Visually check the range after a 5-minute wait, assuming a successful detonation.

ALL PERSONNEL WILL LISTEN FOR THE DETONATION AND, IF NECESSARY, START MISFIRE PROCEDURES.

9.4 MISFIRE PROCEDURES

9.4.1 General Misfire Procedures

In case of any type of misfire, the Demolition Supervisor will start misfire procedures. The Demolition Supervisor will:

- Ensure that all personnel remain in a safe area unless specifically assigned a function.
- Request UXOQCS/SO to observe procedures at the demolition site from a safe distance in case of an accident.
- Wait a minimum of 60 minutes after last unsuccessful attempt to detonate before proceeding to the demolition area for corrective action.
- Ensure all excess personnel remain in a safe area until the misfire procedures have been completed.

9.4.2 Electric Misfire Procedures (Remote Firing Device)

In the event of an electrical misfire:

- The misfire procedures listed in the RFD Operating Manual will be followed to include the firing device safe-arm key will be removed and unit powered down.
- Wait a minimum of 60 minutes after last unsuccessful attempt to detonate before proceeding to the demolition area for corrective action.
- Return to demolition area, locate receiver, remove key, and power unit down; now disconnect firing wires from the unit and shunt.
- Follow firing wire from the receiver to locate cap. NEVER detach electric caps from the main detonating cord or the explosive charge.
- If the firing device was the problem, re-do check-out procedure in accordance with owner's manual and after receiving permission to prime from SUXOS, prime and try shot again.
- If the firing device was not the problem, troubleshoot the problem and fix and try again.

9.5 POST-DETONATION INSPECTION

Following each detonation, an inspection of the demolition area and surroundings will be accomplished to identify and locate the area(s) the detonation(s) occurred for incomplete detonation, ineffective shots or residue of explosives, and other debris that may have originated

from the detonation. Material suspected to contain explosives or explosive residues will be placed back in the detonation area and treated in a subsequent detonation on the same day. If all explosives are consumed and all items involved were treated successfully, Demolition Supervisor will announce "All Clear" for the remaining demolition team to come down and continue to clean up detonation areas and remove all debris created by the detonation.

Debris that is free of energetic material will be inspected a minimum of two times transported to the staging area for certification and verification and reclassified as material documented as safe (MDAS).

9.6 POST-OPERATIONAL REQUIREMENTS

The following actions are required for post-operational shutdown. The Demolition Supervisor will:

- Inform the SUXOS after the last detonation of the day that all explosives are consumed, all items are destroyed or demilitarized and demolition operations are completed for the day.
- Inform road guards to allow normal traffic flow and return to previous assignment.
- Direct crew members to remove all trash and nonhazardous residue from the disposal area and deposit it in appropriate receptacles; all explosive labels will be removed from boxes before being dumped in public trash receptacles.
- Record the disposal items and update the MEC information form and incidental finds forms, as appropriate.
- Inventory and replenish, if needed, all demolition gear and consumables used.

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MUNITIONS RESPONSE – QUALITY ASSURANCE PROJECT PLAN (MR-QAPP)

CLOSURE ACTIVITIES, SUBPART X OPEN DETONATION TREATMENT UNIT

MILAN ARMY AMMUNITION PLANT, MILAN, TENNESSEE

January 2025

Contract No.: W912DY22D0086
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Prepared For:

UNITED STATES ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE
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EXPLOSIVES SAFETY SUBMISSION

NON-TIME CRITICAL REMOVAL ACTION

CLOSURE ACTIVITIES – SUBPART X OPEN DETONATION TREATMENT UNIT

JOINT MUNITIONS COMMAND
MILAN ARMY AMMUNITION PLANT
MILAN, TENNESSEE

CONTRACT NO: W912DY-22-D-0086
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ACCIDENT PREVENTION PLAN

RCRA CLOSURE ACTIVITIES SUBPART X OPEN DETONATION TREATMENT UNIT

MILAN ARMY AMMUNITION PLANT, TENNESSEE

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Milan AAP ICUZ Study- 2017

MILAN ARMY AMMUNITION PLANT
INSTALLATION COMPATIBLE
USE ZONE STUDY

January 2017

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MILAN ARMY AMMUNTION PLANT INSTALLATION COMPATIBLE USE ZONE STUDY

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EXECUTIVE SUMMARY

OVERVIEW

One of the goals of the Department of the Army is to plan, initiate, and carry out actions and programs designed to minimize adverse impacts upon the quality of the human environment without impairing the Army's mission. The Installation Compatible Use Zone (ICUZ) Program implements Army policy for such planning. The ICUZ program promotes land use that is compatible with the military noise environment through communication, cooperation and collaboration between Milan Army Ammunition Plant (MLAAP) and the surrounding community.

The ICUZ study quantifies the noise environment from military training sources and recommends the most appropriate uses of noise-impacted areas. This study replaces the January 2014 MLAAP Installation Noise Management Plan and provides information that reflects the most accurate account of activities as of 2016.

Army Regulation (AR) 200-1 lists housing, schools, and medical facilities as examples of noise-sensitive land uses. Regulation guidelines state for land use planning purposes, noise-sensitive land uses are acceptable within the Noise Zone I, generally not compatible in Noise Zone II, and not recommended (incompatible) in Noise Zone III. Army Regulation 200-1 offers land use recommendations, which if adopted both on and off the installation, would facilitate future development that is unaffected by military noise. These guidelines are applied throughout the ICUZ document as individual operations are analyzed.

CONCLUSIONS

PISTOL RANGE

Zone II extends less than a half mile beyond the western boundary at the intersection of U.S. Highway 45 and Chapel Hill Road. There are approximately a dozen homes within Zone II off-post. Zone III remains within MLAAP.

OPEN DETONATION (OD) RANGE

Land Use Compatibility

The Noise Zones from the Open Detonation (OD) Range are contained within the installation boundary. The contours indicate the surrounding environment is compatible with the annual average noise levels produced at the OD range. Yet, there is potential for individual events to cause annoyance and possibly generate noise complaints. Dependent upon weather conditions, there is a low to moderate risk of complaints due to demolition activity.

Single Event Levels

Peak levels correlate with the receiver's perception of noise levels. People in an area experiencing peak sound pressure levels between 115 and 130 dB may describe events as noticeable and distinct. Peak sound pressure levels above 130 dB are generally objectionable, and are often described as very loud and startling.

Under unfavorable weather, the OD Range generates peak sound pressure levels between 115 and 130 dB extend up to 2 miles beyond the eastern military properties. Citizens within these areas may find the activity noticeable and distinct. Peak sound levels above 130 dB extend into the adjacent Tennessee Army National Guard property. There are no noise-sensitive land uses within this area. It should be noted that occasional OD operations maybe audible within 5 miles of MLAAP. This possibility occurs under non-typical circumstances such as the coverage (stemming) of the explosives does not provide the full anticipated effect. Under more favorable propagation conditions, the peak noise levels between 115 and 130 dB extend beyond the eastern military properties less than a quarter mile, encompassing less than a dozen homes.

RECOMMENDATIONS

This ICUZ study describes the noise characteristics of a specific operational environment, and as such, will change if a significant operational change is made. Therefore, if the MLAAP mission undergo changes, the ICUZ should be reviewed to determine if the current noise assessment is sufficient. At a minimum, it is recommended that every five years the ICUZ and/or Noise Zones be reviewed and updated as needed to incorporate pertinent changes to the noise environment.

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ACRONYMS AND ABBREVIATIONS

ADA	Ammunition Destruction Area
APHC	Army Public Health Center
AR	Army Regulation
ARNG	Army National Guard
CDNL	C-Weighted Day-Night Average Sound Level
CY	Calendar Year
dB	Decibel(s)
dBA	Decibels, A-Weighted
dBC	Decibels, C-Weighted
dBP	Decibels, Unweighted Peak
DNL	Day-Night Average Sound Level
DoD	Department of Defense
DODI	Department of Defense Instruction
ERG	Explosives Research Group
FICUN	Federal Interagency Committee on Urban Noise
ICUZ	Installation Compatible Use Zone
JLUS	Joint Land Use Study
lbs	Pounds
LEQ	Equivalent Sound Level
LUPZ	Land Use Planning Zone
MLAAP	Milan Army Ammunition Plant
NEW	Net Explosive Weight
NLR	Noise Level Reduction
OEA	Office of Economic Adjustment
PAO	Public Affairs Office
SARNAM	Small Arms Range Noise Assessment Model
SEL	Sound Exposure Level
TNARNG	Tennessee Army National Guard

1 INTRODUCTION

1.1 GENERAL

The Installation Compatible Use Zone (ICUZ) study provides a strategy for noise management on and in the areas surrounding Milan Army Ammunition Plant (MLAAP). Elements of the ICUZ program include noise analysis, education about noise and Army noise metrics, complaint management, and when necessary, noise abatement procedures.

The report is provided to assist both installation personnel and local community officials. Specifically, the ICUZ provides a methodology for analyzing noise exposure associated with military operations and provides land use guidelines for achieving compatibility between the noise generated by the Army and the surrounding communities.

As local communities prepare and modify comprehensive development plans, it is recommended that the conclusions from this study be considered in the planning process with a goal to encourage compatible land use.

1.2 PURPOSE AND NEED

The Army has an obligation to U.S. citizens to recommend land use around its installations which will: (a) protect citizens from noise and other hazards; and (b) protect the public's investment in these training facilities. To meet these obligations, the Army will recommend land uses that are compatible with military operations while allowing maximum beneficial use of adjacent properties. The U.S. Department of Defense (DoD) and component Services have published guidelines that reflect these land use recommendations.

Through Army Regulation (AR) 200-1, noise exposure on communities is translated into Noise Zones. Regulation guidelines state that for land use planning purposes, noise-sensitive land uses range from acceptable to not compatible within the Noise Zones. These guidelines are applied throughout the ICUZ as individual or combined training operations are analyzed. The program defines the following four Noise Zones:

- Zone III - Noise-sensitive land uses are not recommended (incompatible).
- Zone II - Although local conditions such as availability of developable land or cost may require noise-sensitive land uses in Zone II, this type of land use is generally not compatible and is strongly discouraged on the installation and in surrounding communities. All viable alternatives should be considered to limit development in Zone II to non-sensitive activities such as industry, manufacturing, transportation and agriculture.
- Zone I - Noise-sensitive land uses are acceptable within the Zone I. However, though an area may only receive Zone I levels, military operations may be loud enough to be heard - or even judged loud on occasion. Zone I is not one of the contours shown on the map; rather it is the entire area outside of the Zone II contour.

- The Land Use Planning Zone (LUPZ) is a subdivision of Zone I. The LUPZ is the upper limit of Zone I (i.e. 5 decibels (dB) lower than the bottom limit of Zone II). Within this area, noise-sensitive land uses are generally acceptable. However, communities and individuals often have different views regarding what level of noise is acceptable or desirable. To address this, some local governments have implemented land use planning measures out beyond the Zone II limits. Additionally, implementing planning controls within the LUPZ can develop a buffer to avert future noise conflicts. The LUPZ only applies to large caliber weapons activity and aircraft noise.

The need for noise compatibility assessments in the Army is a greater challenge today than at any point in the past. Rapid population growth has brought residential development directly adjacent to many Army installations, which were at one point relatively remote locations. This development, often referred to as encroachment, has brought military installations and civilian communities in much closer proximity, leading to issues of incompatibility.

To prevent incompatibilities between military operations and civilian land use from reaching a significant level, the Army must take reasonable steps to protect the community from training noise, and it must work with the local governments and land owners to make sure that adjoining lands are developed in ways compatible with the noise environment. Of particular concern are areas within the aforementioned Noise Zones, as well as areas that may occasionally be subjected to noise levels that the local community may find objectionable. Although historically encroachment at MLAAP has not been an issue, completing the ICUZ study analysis will identify areas which may present future incompatibilities.

1.3 PROCESS AND PROCEDURE

1.3.1 REGULATORY REQUIREMENTS

This assessment has been conducted in accordance with the DoD Instruction Directive 4715.13 subject: *DoD Noise Program* (DoD 2005) and Army Regulation (AR) 200-1, *Environmental Protection and Enhancement,* Chapter 14, *Operational Noise* (U.S. Army 2007).

1.3.2 NOISE EXPOSURE MODELS

Operational data includes the types of weapons and ammunitions fired, number of rounds fired, time of day in which rounds are fired, and the location of firing areas and targets. The data were input into computer software models which calculate noise exposure levels associated with the multiple types of military operations ongoing at MLAAP. A summary of the computer models is provided below:

- The computer model used to create the Noise Zones for small arms (.50 caliber and below) ranges is the Small Arms Range Noise Assessment Model (SARNAM). SARNAM incorporates the latest available information on weapons noise source models, directivity, sound propagation, and the effects of noise mitigation and safety structures

when necessary. The SARNAM calculation algorithms assume weather conditions or wind direction that favors sound propagation. Small caliber weapons noise is addressed utilizing the peak metric and therefore has no assessment period.

The BNOISE2 modeling program calculates noise levels generated by firing large caliber (20mm and greater) and high-explosive charges. The sounds from large caliber weapons, demolitions, and other impulsive sounds generally create the largest complaint issues because the sound can travel far, is difficult to mitigate and can be accompanied by vibration that may increase the public's annoyance. Noise Zones for large caliber weapons are addressed using the C-weighted Day-Night average sound Level (CDNL). The Noise Zones were modeled using an assessment period of 250 days. This is the Army standard for all Active installations and/or ranges per AR 200-1 guidance.

1.4 NOISE BASICS

Sound is defined as a physical disturbance in a medium (i.e. gas, liquid, or solid) that is capable of being detected by the human ear. Sound waves in air are caused by variations in pressure above and below an even (static) value in atmospheric pressure. These changes in atmospheric pressure as they relate to human hearing can have great variance. For example, a whisper at two meters would be as low as 0.0006 Pascals, whereas an M16 rifle fired at the shooter's ear would be 1,000 Pascals.

Due to this large range of sound pressures and that the human ear responds more closely to a logarithmic scale (rather than a linear), the decibel (dB) system was developed to quantify sound energy (loudness) into a meaningful and manageable scale. On this scale, the range of average human hearing runs from approximately zero (threshold of hearing) to 140. Using the example above, the whisper at two meters would register 29.5 dB and the M16 rifle shot at the shooters ear would be 154 dB.

1.4.1 NOISE METRICS

When measuring sound, the levels are often filtered (i.e. frequency weighted) to accommodate how the human ear functions. This process is known as "A-weighting" and can be assumed for all sound levels in this report unless otherwise specified. Military impulsive sounds (e.g., explosions, artillery blasts) can be felt as well as heard and utilize "C-Weighting" where the low-frequency components of these sounds are not de-emphasized to the same extent as A-weighting. Explanations of the noise metrics that are used in this assessment are listed below.

- **Day–Night Average Sound Level (DNL).** DNL is a noise metric describing the average noise level over the course of a 24-hour period. A 10 dB addition is applied to operations that happen during night time hours (10 p.m. through 7 a.m.) because noise tends to be more intrusive at night than during the day. DNL accounts for the total or cumulative noise level at a given location.
- **Maximum Sound Level $_{(Lmax)}$.** The highest sound level measured during a single event in which the sound level changes value with time (e.g., an aircraft overflight) is called the maximum sound level, or $_{Lmax.}$ The maximum sound level is important in judging the

interference caused by a noise event with conversation, television or radio listening, sleeping, or other common activities.

- **Peak (dBP).** Peak is a single-event sound level without frequency weighting.
- **PK15(met).** PK15(met) is a single-event peak noise level that is exceeded only 15 percent of the time by the loudest munitions type detonation. This metric accounts for variations caused by weather conditions and favors noise propagation. The PK15(met) metric does not communicate any information about how often the loudest munitions type is detonated.
- **PK50(met).** PK50(met) is similar to the PK15(met) except that it represents the peak noise level that is exceeded 50 percent of the time. This metric also accounts for weather but assumes conditions which are not favorable for noise propagation, rather average or neutral weather conditions with regards to noise.

1.4.2 SOUND PROPAGATION

One of the principle influences on sound propagation is the day-to-day weather conditions. Wind and temperature significantly influence how far sound travels from a source and how loud it will be at the receiver's location. As sound travels through air, a receiver downwind of the source will be subjected to higher sound levels than a receiver upwind; in effect the wind is actually helping move the sound to the downwind receiver, while upwind the sound must "swim against the current."

Combine wind direction with temperature variation (as a rule, sound usually travels further in cold temperatures) and one may observe the phenomena of *atmospheric refraction*. This is the process by which atmospheric conditions actually bend and/or focus sound waves toward some areas and away from others.

When a temperature inversion is present, military operations may sound much louder than normal, or be heard at greater distances. The inversion layer acts as a boundary for the sound, trapping it close to the ground. This can create areas of high intensity sound far from the sound's source. As a result, on most days it may be possible to detonate 10 pounds of explosives without disturbing a community (neutral weather conditions), while on another day with a temperature inversion, the detonation of 1 pound at the same location may be disruptive (unfavorable weather conditions).

Figure 1-1 illustrates how temperature inversions bend (refract) the sound created by a typical explosion. The sound waves from the explosion initially travel upward, but the inversion reflects the sound back downward toward the ground, generating high noise levels many miles away. Under normal conditions, the noise levels at that distance would otherwise be much lower.

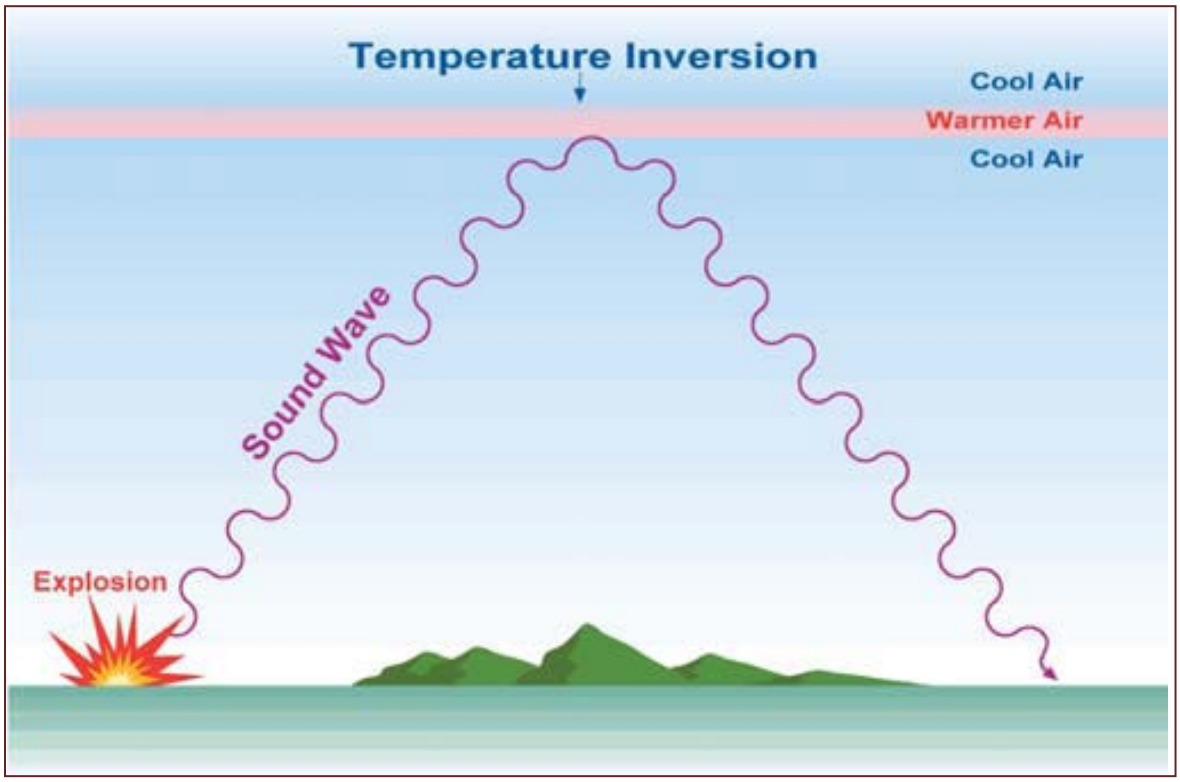

Figure 1-1. Example of a Temperature Inversion

Based on these phenomenon it's easy to see how predicting sound travel can be very difficult, but the Explosives Research Group (ERG) and the University of Utah developed guidelines to help determine what would be "good" or "bad" firing times. These guidelines are summarized in Table 1.1.

Another factor in sound propagation can be the natural topography of the land in and around the firing ranges and impact areas, as well as outside the installation. Naturally occurring terrain features have an effect on blast noise sound waves (air-blast) through both reflection and diffraction. To account for terrain effects, the BNOISE2 model uses algorithms in the calculation engine along with USGS Digital elevation Model (DEM) data. DEM data are available for all contiguous United States, Hawaii and most of Alaska. It should be noted that the mitigation effects of topography on blast noise are highly dependent upon the terrain feature's location and size.

Table 1-1 University of Utah Criteria for "Good" and "Bad" Firing Conditions

"Good" Firing Conditions	"Bad" Firing Conditions
Clear skies with billowy cloud formations, especially during warm periods of the year. A rising barometer immediately following a storm.	Days of steady winds (5-10 mph) with gusts of greater velocities (above 20 mph) in the direction of nearby residences. Clear days on which "layering" of smoke or fog are observed. Cold, hazy, or foggy mornings. Days following a day when large extremes of temperature (about 36°F) between day and night are observed. Generally high barometer readings with low temperatures.

Source: University of Utah, 1958

1.5 NOISE MANAGEMENT PROGRAM

In accordance with AR 200-1, Army installations are responsible for maintaining a Noise Management Program. The program includes two main components:

(1) *Evaluate and document the impact of noise produced by ongoing and proposed actions/activities.*

(2) *Monitor, record, archive and address operational noise complaints.*

The ICUZ study is generally the center of the noise management program. The ICUZ is designed to provide needed information so installations can work with communities to solve noise incompatibility issues. The ICUZ study along with an effective noise complaint procedure will help installations address complaints, advise local planning commissions, and be instrumental in developing action plans which may limit future encroachment threats.

1.5.1 NOISE COMPLAINT MANAGEMENT

The goal of a complaint procedure is to reduce the potential for noise complaints by keeping the public informed about what is happening and to satisfy the complainants so that noise complaints do not escalate. A proactive noise complaint program will help prevent the degradation of the mission due to controversy over noise impacts, while protecting the health and safety of the local civilian and military community.

Experience has shown that a centralized procedure to log and investigate noise complaints is most effective when responding to public inquires. This makes monitoring, recording and archiving noise complaints more efficient and useful to the program manager. At MLAAP, the American Ordnance Security Office (731-686-6565) is the single point of contact for all inquiries regarding noise/vibration and follow-up. Figure 1-2 illustrates the basic process.

A log is maintained containing pertinent information about each complaint/inquiry, such as the date, name, address, contact information, the nature of the complaint and the action taken. The goal of a complaint procedure is to reduce the potential for noise complaints by keeping the public informed about what is happening and to satisfy the complainants so noise complaints do not escalate.

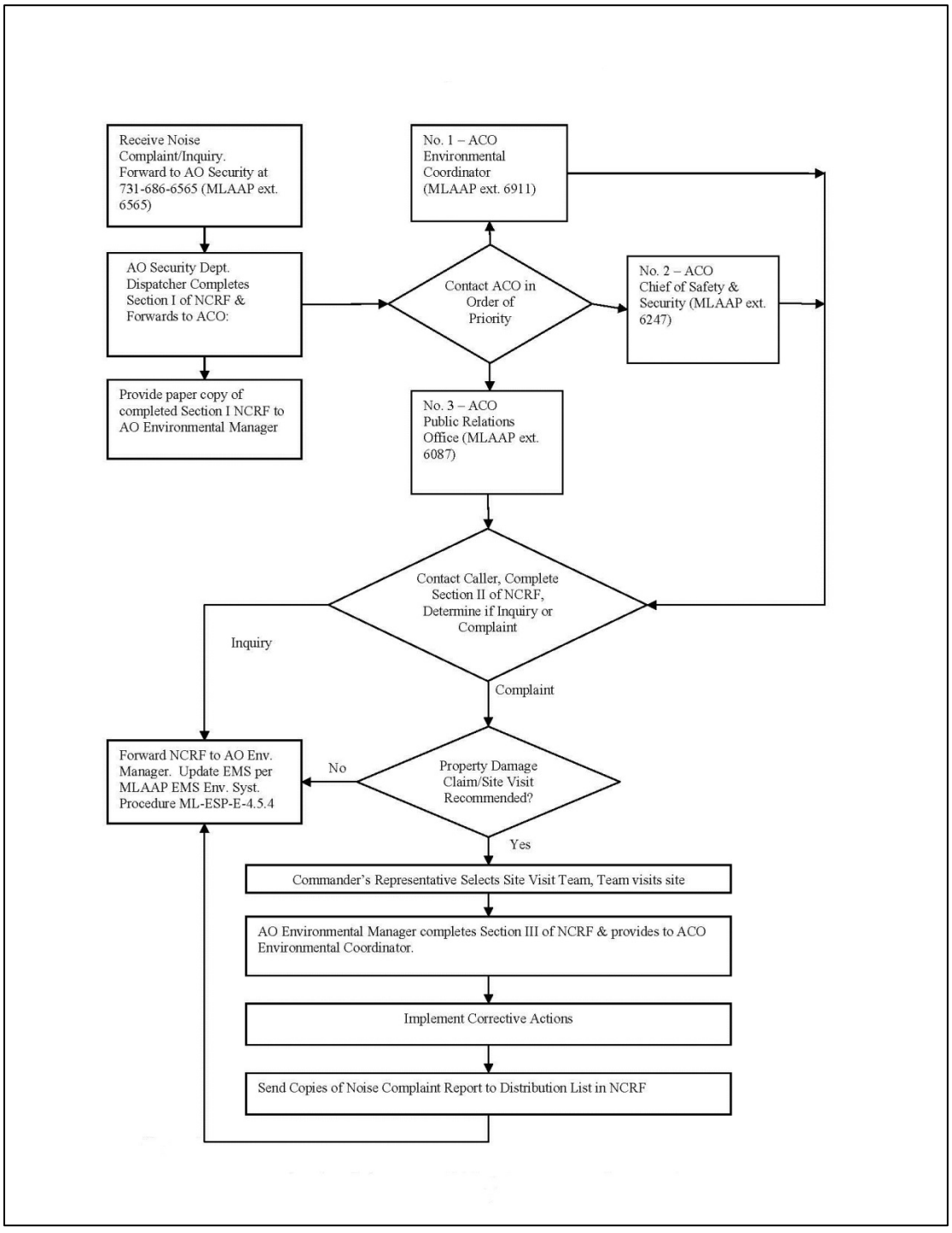

Figure 1-2. Procedures for In-coming Noise Complaints

2 MILAN ARMY AMMUNITION PLANT

2.1 LOCATION

Milan Army Ammunition Plant (MLAAP) is located in the central part of west Tennessee in Carroll and Gibson Counties (Figure 2-1). The installation is evenly divided longitudinally between the two counties. The installation lies north of Interstate 40, approximately 60 miles east of the Mississippi River. Neighboring towns include Milan (to the northwest), Lavinia (to the east), and Media (to the southwest). Tennessee Army National Guard (TNANRG) property is adjacent to the eastern boundary.

2.2 HISTORY

The land comprising MLAAP, was purchased from 387 Gibson and Carroll County landowners in 1941, and totaled 28,541.4 acres. Construction for the plant began in January 1941 and was completed in January 1942. Initially, the plant was divided into two separate units; the Wolf Creek Ordnance Plant and the Milan Ordnance Depot. In July 1943, the two plants were merged into a single facility called Milan Ordnance Center. In October 1945, Milan Ordnance Center was redesignated Milan Arsenal. In August 1973, the name Milan Arsenal was changed to Milan Army Ammunition Plant. The MLAAP is a government-owned, contractor-operated military industrial installation under the jurisdiction of the Joint Munitions Command. [1]

2.3 FACILITIES AND RANGES

The MLAAP installation is a 22,000 plus acre industrial complex consisting of inactive production lines maintained, an ammunition storage area containing 873 earth-covered igloos, various supporting industrial areas including facilities maintenance areas and ammunition destruction areas and administrative areas.

The Open Burning /Open Detonation (OB/OD) area (on the east side of MLAAP) contains four burn pads with 11 burn pans and a demolition range with multiple pits. MLAAP is authorized under a RCRA permit to treat 24,000 pounds per day by open burning and 10,000 pounds per day by open detonation. Although the demo range is authorized for up to 500-pounds per pit, the Net Explosive Weight (NEW) rarely exceeds 300 pounds.

The Pistol Range is the only small arms range on MLAAP. It is located in the southwest corner of MLAAP. The range is used by MLAAP security personnel and local law enforcement for proficiency training with pistols.

[1] 2014, MLAAP, IONMP.

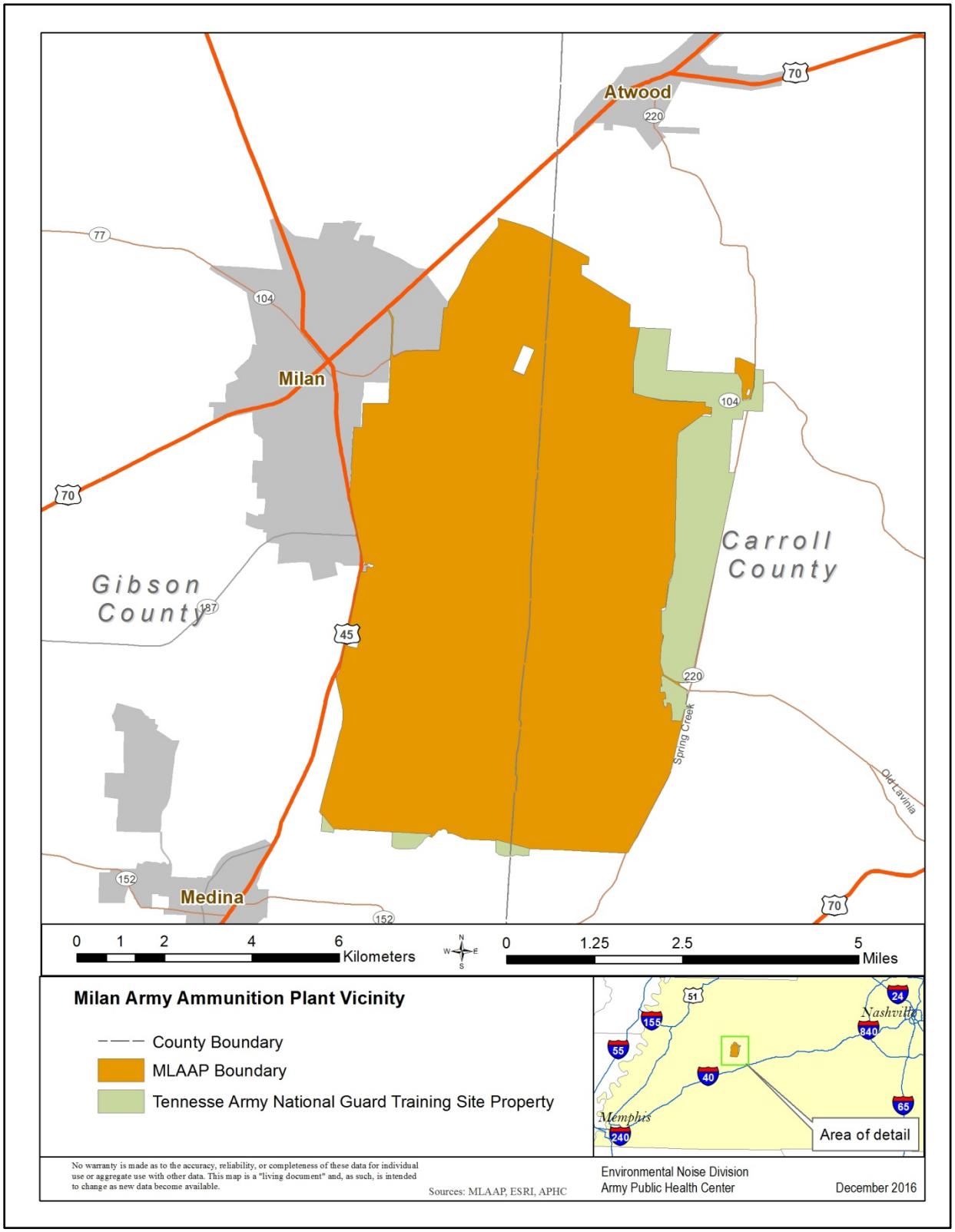

Figure 2-1. Milan Army Ammunition Plant General Location

2.4 LOCAL COMMUNITIES

There are several small communities within 1.5 miles of MLAAP. Milan abuts the northwest corner, Atwood to the northeast, Lavinia adjacent to the eastern boundary of the TNARNG property, and Medina to the southwest. The land surrounding MLAAP is primarily agricultural but there are a few small towns in the vicinity.

As seen in Table 2-1, the area surrounding MLAAP had minimal growth in the past five years. Figure 2-3 shows the population density (per square mile) surrounding MLAAP. The majority of the area is low density, with populations less than 250 per square mile. The highest concentration of people is to the northwest (Milan).

Table 2-1. Population Surrounding MLAAP

	2000	2010	2015 Est.
Atwood	980	938	918
Lavinia	1,169	1,037	1,068
Medina	1,017	3,479	4,124
Milan	7,768	7,851	7,813
Carroll County	29,479	28,522	27,910
Gibson County	48,152	49,683	49,399

Source: U.S. Census Bureau 2013 Block Group Data

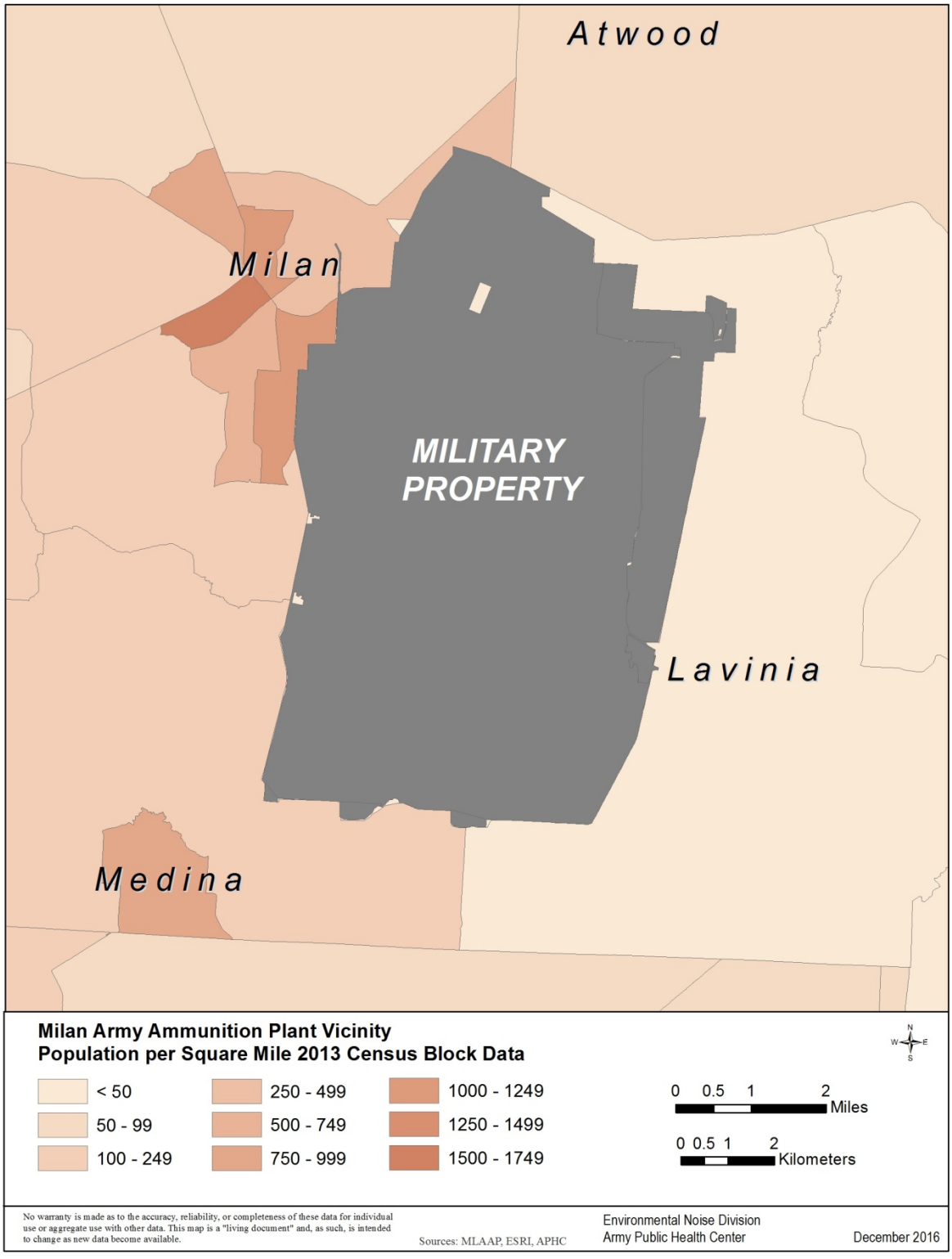

Figure 2-2. MLAAP Vicinity Population per Square Mile

3 NOISE ASSESSMENT GUIDELINES

The APHC recommends land use options based on the type of noise source. The original Federal Interagency Committee on Urban Noise (FICUN, 1980) guidelines are applicable to noise sources which are typically measured using A-weighting such as aircraft and ground vehicles. Using the FICUN guidelines, the Army in conjunction with recommendations of the National Academy of Sciences Committee on Hearing, Bioacoustics and Biomechanics (CHABA 1981), developed Noise Zone limits and land use recommendations for property within the weapons and explosive Noise Zones (U.S. Army 2007, U.S. Air Force 2015). Table 3-1 lists the noise limits as shown in Army Regulation (AR) 200-1. Appendix B contains the land use recommendations applicable to MLAAP.

Table 3-1. Noise Limits for Noise Zones

Noise Zone	Noise Limits			Noise-Sensitive Land Use
	Aviation ADNL (dB)	Impulsive CDNL (dB)	Small Arms dB Peak	
LUPZ	60 – 65	57 – 62	n/a	Generally Compatible
I	< 65	< 62	< 87	Generally Compatible
II	65 – 75	62 – 70	87 – 104	Generally Not Compatible
III	> 75	> 70	> 104	Not Compatible

Source: AR 200-1
Notes:
dB = decibel, ADNL = A-weighted Day-Night Level, CDNL = C-weighted Day-Night Level

There are often existing "noise-sensitive" land uses defined as non-conforming within a Noise Zone. In most cases this is not a risk to community quality of life or mission sustainment. Average noise levels may be the best tool for long-term land use planning, but they may not adequately assess the probability of community noise complaints.

As recommended in AR 200-1, this assessment includes supplemental metrics to identify where detonations may periodically reach levels high enough to generate complaints (Table 3-2). In many instances Noise Zones will indicate land use compatibility; however, noise complaints from impulsive events typically are attributable to a specific event rather than annual average noise levels. Peak levels are useful for estimating the risk of receiving a noise complaint from impulsive events, as they correlate with the receiver's perception of noise levels.

Table 3-2. Complaint Risk Guidelines

Perceptibility	**dB Peak**	**Risk of Receiving Noise Complaints**
May be Audible	< 115	Low
Noticeable, Distinct	115 - 130	Moderate
Very Loud, May Startle	> 130	High
*Perceptibility is subjective. The classifications are based on how a typical person might describe the event.		

- People in an area experiencing peak sound pressure levels between 115 and 130 dB may describe events as noticeable and distinct. From within this area, the installation has a moderate risk of receiving noise complaints. The magnitude of the complaint risk is dependent upon frequency of occurrence in addition to factors such as time of day activity occurs, propagation conditions under which activity takes place, and noise sensitivity of individuals in these areas.
- Peak sound pressure levels above 130 dB are generally objectionable, and are often described as very loud and startling. These levels correlate with a high risk of noise complaints.
- If the operations which generate high peak sound pressure levels in the community are very infrequent, land use controls may not be warranted. However, prior public notification is important for mitigating complaint risk, and also an important role of being good neighbors.
- Peak sound pressure levels directly correlate with airborne vibration which is the dominant cause of structural response from military training. Peak sound pressure levels above 120 dB may rattle windows or loose ornaments (e.g. pictures on walls) and annoy occupants but will not cause structural damage. It is widely recognized that structural damage is improbable when peak sound pressure levels do not exceed 140 dB.

Peak levels can vary significantly for the same activity dependent on weather conditions.

- Unfavorable Weather Conditions: PK15(met) is the peak sound level, factoring in the statistical variations caused by weather, that is likely to be exceeded only 15 percent of the time (i.e., 85 percent certainty that sound will be within this range). This “85 percent solution” gives the installation and the community a means to consider the areas that at times may be impacted by training noise. PK15(met) levels would occur under unfavorable weather conditions that enhance sound propagation.
- Neutral Weather Conditions: PK50(met) is the Peak level that would be expected 50 percent of the time. These levels would be seen during neutral weather conditions. It should be noted that if activities take place under favorable weather conditions, such as the wind blowing away from the receiver, noise levels would be lower.

The unfavorable weather conditions PK15(met) metric is a good tool to indicate areas that may periodically be exposed to high noise levels. When land use planning programs such as real estate disclosure, a Joint Land Use Study or the Army Compatible Use Buffer are implemented, the PK15(met) complaint risk areas can be used to delineate areas of focus. However, since the complaint risk areas are based on individual event levels and are not dependent on the number of events, planners should also consider frequency of operations when making land use decisions.

4 RANGE NOISE ASSESSMENT

4.1 SMALL ARMS NOISE

The small arms designation includes weapons of .50 caliber or less. There is a single small arms range at MLAAP, the Pistol Range, located in the southwest portion of the property near the boundary.

Various pistols such as the 9 mm and 45 caliber were used to create the Noise Zones (Figure 4-1). Zone III remains with the MLAAP boundary. Zone II extends less than 600 meters beyond the western boundary at the intersection of U.S. Highway 45 and Chapel Hill Road. There are approximately a dozen homes within Zone II off-post. Table 4-1 lists the off-post and total acreage for each Noise Zone.

Small arms Noise Zones are based on Peak levels. Therefore, although the number of rounds fired will affect how often training is heard and may influence the public's perception, increasing or decreasing the number of rounds will not change the size of the Noise Zones.

Table 4-1. Small Arms Noise Zones Acreage

Noise Zone	Total Acreage	Off-post Acreage
Zone II	833	148
Zone III	59	0

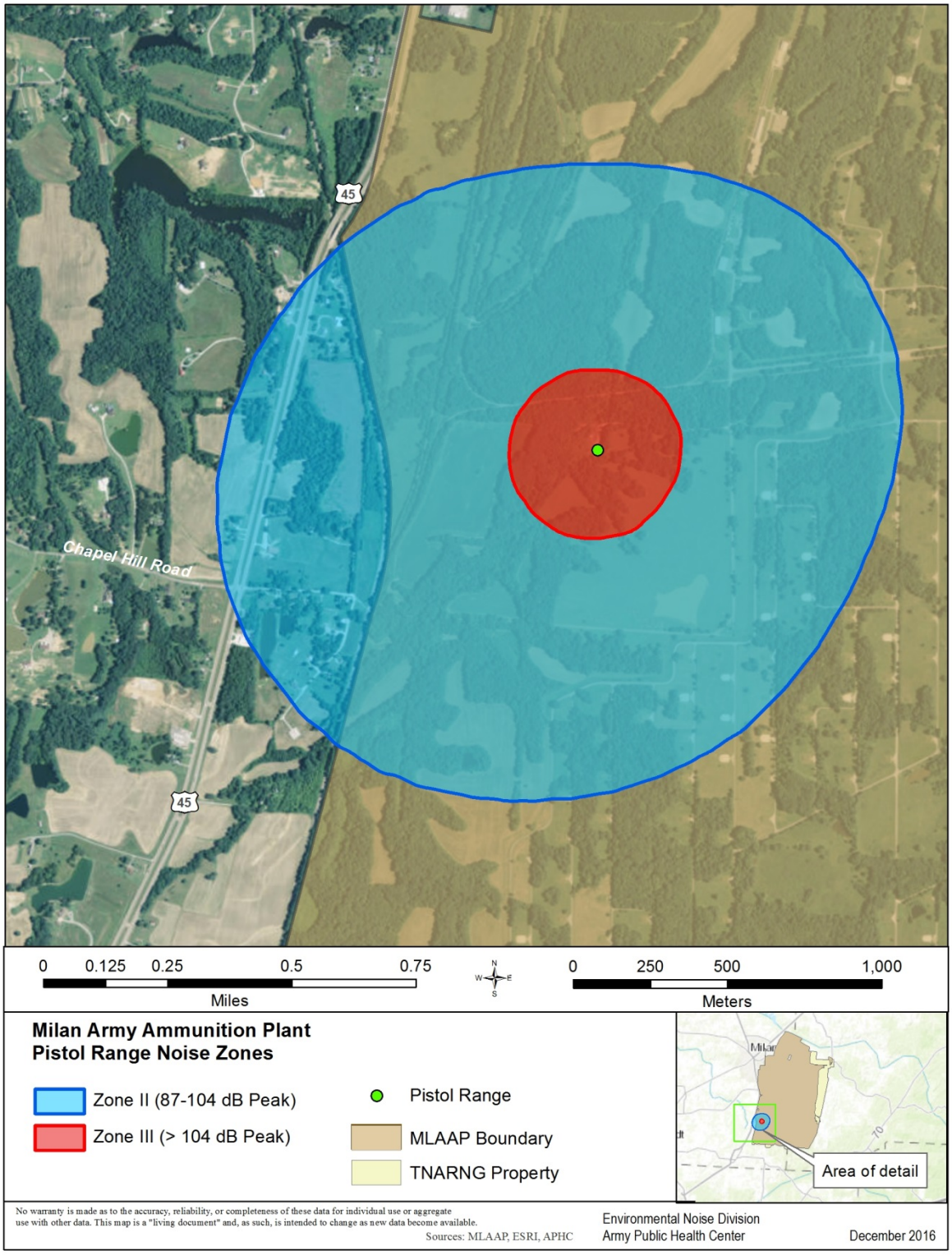

Figure 4-1. Pistol Range Noise Zones

4.2 LARGE CALIBER AND DEMOLITION NOISE

Large arms noise assessment includes weapons 20mm or greater and explosive charges. At MLAAP, the Demilitarization of conventional munitions at the demolition range is the sole source in this category (Open Detonation (OD) Range). Demilitarization involves the physical destruction of ammunition stockpiles, which at MLAAP includes a multitude of mines, rockets and projectiles.

The maximum permit load is 20 pits with each containing no more than 500 lbs of Net Explosive Weight (NEW). Typically 4-8 pits are used with 250-300 lbs NEW each, with a minimum of four-feet of earth coverage.

The operating period and the total NEW vary from year to year. In 2015 the pits were active from January – October (42,225 lbs). In 2016 the first demilitarization cycle did not occur until late May (70,371 lbs). The OD pits are typically used Monday – Thursday, between 8:00 am and 12:00 pm. On average the OD pits are used between 35 and 50 days per year, with 5 active pits as the most common number of events per day. Events (detonations) are in quick succession with minimum of a 10 second delay between events.

Table 4-2 lists the number of events by NEW for the past two years. The Noise Zones are based on Calendar Year 2016 expenditure of 70,371 lbs NEW (Table 4-2). The acoustic range of the Noise Zones covers the expenditure of 67,000 – 82,000 lbs NEW over a one year period.

Table 4-2. Demolition Expenditure

Net Explosive Weight (NEW) lbs	Number of Events	
	Jan – Oct 2015	May – Oct 2016
200 - 249	24	249
250 - 274	69	16
275 - 299	67	12
300 - 324	0	2
324 - 349*	0	5

DATE	**TOTAL NEW lbs**	**TOTAL NUMBER OF EVENTS**	**AVERAGE NEW**
Jan – Oct 2015	42,225	160	264
May – Oct 2016	70,371	284	248

*The highest NEW was 335 lbs.

4.2.1 LARGE CALIBER AND DEMOLITION NOISE ZONES

Figure 4-2 depicts the CDNL Noise Zones for OD operations. The Noise Zones remain within MLAAP, which indicates that the surrounding environment is compatible with the annual average noise levels produced from OD operations. Yet, there is potential for individual events to cause annoyance and possibly generate noise complaints.

4.2.2 LARGE CALIBER AND DEMOLITION SINGLE EVENT PEAK LEVELS

Annual average noise levels are the most suitable for long-term land use planning. However, individual detonation events can be audible outside of a Noise Zone and in some cases objectionable to the surrounding community. Using Peak level (Unweighted) assessments can forecast where sound may be audible or loud from singular events. Table 3-2 (Section 3) listed the perceptibility of Peak noise levels. It's worth noting that the vibration that often accompanies low-frequency noise from large caliber weapons and demolition activity is almost always air-borne (not ground-borne). Occasional picture or window rattling from air-borne vibration may occur; however, this rattling does not indicate damage, and usually occurs at levels well below those required to cause structural damage (>140 dBP).

Figure 4-5 depicts the single event Peak sound level contours for the OD operations. The contours are based on the same detonations expenditures used for the CDNL Noise Zones. The figure illustrates weather conditions that enhance sound propagation (unfavorable weather). Under unfavorable weather, peak noise levels between 115 and 130 dB extend beyond the eastern military properties up to 3,000 meters (1.9 miles). Citizens within these areas may find the activity noticeable and distinct. Peak noise levels above 130 dB extend into the TNARNG property. There are no noise-sensitive land uses within this area. It should be noted that occasional OD operations maybe noticeable to a greater extent (within approximately 5 miles of MLAAP). This possibility occurs under non-typical circumstances such as extreme variances in weather conditions or when the coverage (stemming) of the explosives does not provide the full anticipated effect.

Under more favorable propagation conditions (neutral weather) the peak noise levels between 115 and 130 dB extend beyond the eastern military properties less than 400 meters (0.25 miles) encompassing less than a dozen homes.

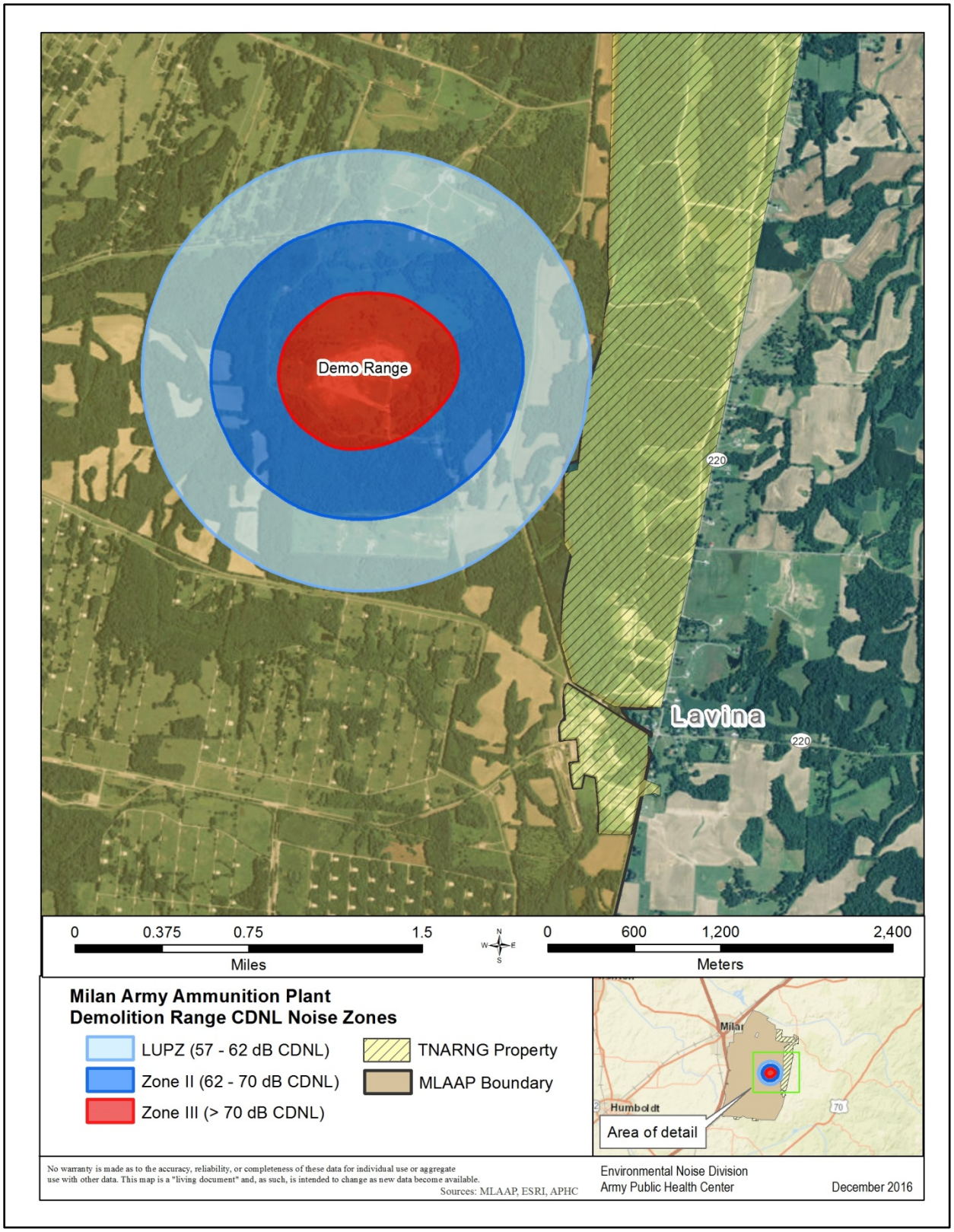

Figure 4-2. Demolition Operations Noise Zones

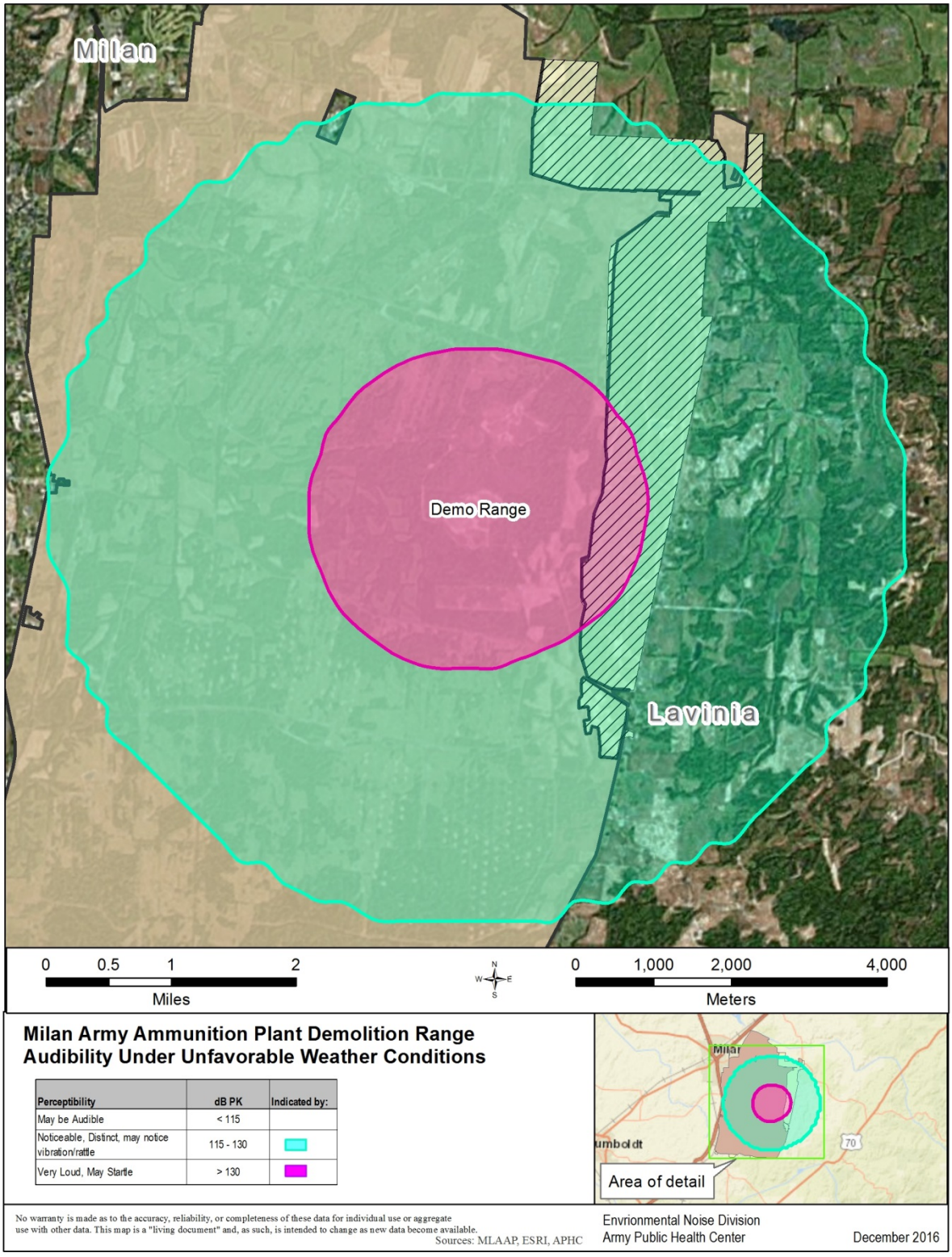

Figure 4-3. Demolition Range Single Event Peak Sound Levels

5 NOISE RELATED LAND USE POLICY AND CONTROL

5.1 INTRODUCTION

Implementation of the ICUZ program is intended be a joint effort between MLAAP and the adjacent communities. The role of MLAAP is to minimize noise impacts on the surrounding local communities by operational activities on the installation. The role of the communities is to ensure that development in the surrounding area is compatible with accepted planning, zoning, and development principles and practices to protect the installation's mission. Sensible, proactive land use planning outside the installation's boundary can create a win-win situation for both the military and its neighboring civilian communities.

5.2 ACHIEVING LAND USE COMPATIBILITY

Achieving land use compatibility requires both flexibility and creativity from land use planners, installation commanders, and the citizenry. The previous sections of this document detailed the operational noise impacts. The following sections detail land use planning tools which are available to both the installation and local communities.

5.3 LAND USE PLANNING OPTIONS

The following land use planning tools are available to help local governments create areas of compatible use around military installations. Many on the list are already in use; however, the installation and local governments are strongly encouraged to revisit and/or update any of these options to find the equitable solutions that best work for their situation. These planning tools may be used individually or in combination.

Zoning. The most common method of land use control is *zoning*, or the partitioning of areas into sections reserved for different purposes. This method is an exercise of the police powers of state and local governments that designates the uses permitted in each parcel of land. It normally consists of a zoning ordinance that delineates the various use districts and a zoning map based on the land use element of the community's comprehensive general plan.

Easements. Easements can be an effective and permanent form of land use control; in many instances, better than zoning when trying to resolve an installation's compatibility issues. Easements are permanent (with the title held by the purchaser until sold or released), work equally well within different jurisdictions, are enforceable through civil courts, and may be acquired often at a fraction of the cost of the land value. Another consideration may be that the land is left free for full development with noise-compatible uses.

Subdivision Regulations. Subdivision regulations are a means by which local governments can ensure that proper lot layout, design, and improvements are included in new residential or commercial developments. These requirements may be anything from dictating the width of the roads to placement of the water and/or sewer systems. Since most local governments require some type of public dedication of open space when approving development plans, the installation may lobby to have a provision added to the subdivision regulations that requires this open space to be located nearest the installation boundary to create a buffer.

Disclosure of Noise Levels. Since noise levels in a community can be effectively modeled, as well as measured and recorded, making noise level information readily available can sometimes be all it takes to discourage incompatible land uses. These noise levels can be disclosed in several ways, including ordinances (or amendments to existing ordinances), deeds, posting noise levels on any sale/lease/rent sign, and initiating voluntary programs among local realtors to provide potential buyers with installation-provided information and noise level/contour mapping.

Deed Restrictions/Covenants. A deed is a document conveying ownership of land from one party to another, and restrictions called *covenants* can be added to the deed to specify restrictions on the use of the land. These covenants are on top of the restrictions already imposed by the current zoning of the property and in many instances may supersede zoning by prohibiting specified uses that would otherwise be allowed. Restrictive covenants "run with the land;" that is, no matter how often the land is resold, these covenants remain in effect until the specified length of the covenant has expired (usually 20-30 years).

In order to utilize this option, the installation must already own or must acquire the property. Then, when reselling the property, the installation specifies which uses are permitted on the land thereby preventing incompatible uses (such as residential housing) for as long as the restrictions remain in effect.

5.4 THE ARMY COMPATIBLE USE BUFFER (ACUB) PROGRAM

Along with the aforementioned Noise Zones, the Army has a specific program designed to limit the effects of encroachment. The ACUB program was borne out of a 2002 expansion of the Private Lands Initiative (10 USC §2684a) allowing military departments to partner with private organizations to establish conservation easements or buffer areas around active installations. These partnerships are beneficial in a number of ways:

- Military readiness is maintained when training days are not lost to encroachment issues.
- Open spaces are protected from development and many times may be used by the public for recreational purposes.
- The military need not buy and maintain more land in order to meet its training needs.
- Critical habitat for threatened and endangered species can be preserved or created.

5.5 JOINT LAND USE STUDY (JLUS)

The JLUS is a collaborative land use planning effort involving the military installation and adjacent local governments that evaluates the planning rationale necessary to support and encourage compatible development of land surrounding the installation. Stated another way, it is a means for the installation and local governments to develop a land use plan that effectively addresses the long-term land use needs of the of the surrounding communities, yet still provides the military with the mission flexibility it needs to meet training doctrine.

The JLUS program is sponsored by the Department of Defense Office of Economic Adjustment (OEA) (DODI, 2004), and it provides technical and financial assistance to the planning agencies for developing master plans that are consistent, when economically feasible, with the noise, accident potential, and safety concerns from an installation's training and operations. The cost of the plan is split between the OEA and the jurisdictions involved.

The scope of the program is divided into three major tasks:

1. Impact Analysis. Impact analysis provides an in-depth review of existing and proposed land use patterns; drainage (as it effects land use designations); mission encroachment (particularly noise); transportation improvements, existing and proposed routes; and noise/vibration.

2. Land Use and Mission Compatibility Plan. Examines the above findings to identify conflicts in land use and provide alternative land use solutions; to project the impact on growth potential for adjacent areas; and to project the impact of military missions on the surrounding jurisdictions.

3. Implementation. Lists a series of actions and proposals for adoption by local jurisdictions to resolve land use conflicts and move toward a compatible land use plan for the installation, the adjacent counties, and the communities therein.

While the study report makes certain recommendations, each participating jurisdiction must decide which recommendations are best suited to their particular needs. Implementation follows the final recommendations at the discretion of elected officials in each jurisdiction and the installation military command.

6 SUMMARY

6.1 CONCLUSIONS

PISTOL RANGE

Zone II extends less than a half mile beyond the western boundary at the intersection of U.S. Highway 45 and Chapel Hill Road. There are approximately a dozen homes within Zone II off-post. Zone III remains within MLAAP.

OPEN DETONATION (OD) RANGE

Land Use Compatibility
The Noise Zones from the OD Range are contained within the installation boundary. The contours indicate that the surrounding environment is compatible with annual average noise levels produced. Yet, there is potential for individual events to cause annoyance and possibly generate noise complaints. Dependent upon weather conditions, there is a low to moderate risk of complaints due to demilitarization activities.

Single Event Levels
Peak levels correlate with the receiver's perception of noise levels. People in an area experiencing peak sound pressure levels between 115 and 130 dB may describe events as noticeable and distinct. Peak sound pressure levels above 130 dB are generally objectionable, and are often described as very loud and startling.

Under unfavorable weather, the OD Range generates peak noise levels between 115 and 130 dB extend beyond the eastern military properties up to 2 miles. Citizens within these areas may find the activity noticeable and distinct. Peak noise levels above 130 dB extend into TNARNG property. There are no noise-sensitive land uses within this area. It should be noted that occasional OD operations maybe audible within 5 miles of MLAAP. This possibility occurs under non-typical circumstances such as when the coverage (stemming) of the explosives does not provide the full anticipated effect. Under more favorable propagation conditions, peak noise levels between 115 and 130 dB extend beyond the eastern military properties less than a quarter mile encompassing less than a dozen homes.

6.2 RECOMMENDATIONS

This ICUZ study describes the noise characteristics of a specific operational environment, and as such, will change if a significant operational change is made. Therefore, if MLAAP mission undergo changes, the ICUZ should be reviewed to determine if the current noise assessment is sufficient. At a minimum, it is recommended that every five years the ICUZ and/or Noise Zones be reviewed and updated as needed to incorporate pertinent changes to the noise environment.

A GLOSSARY OF TERMS

A-Weighted Sound Level – a sound level (in decibels) that has been weighted to correspond with the non-linear sensitivity of the human ear. A-weighting discriminates against the lower frequencies and is used to measure most common military sounds such as transportation and small-arms fire.

Ambient Noise – the background noise that is usually present at a particular location; anything from cars on a highway, to insects in the woods.

Atmospheric Refraction – the bending and/or focusing of sound waves by the varying layers and densities of the earth's atmosphere.

C-Weighted Sound Level – like A-weighting, this is another sound level weighting technique that is used to normalize the low, impulsive sounds to the range of human hearing. It is used when measuring low frequency sound such as those from large arms, demolitions, and sonic booms.

Community – those individuals, organizations, or special interest groups affected by or interested in decisions affecting towns, cities, or unincorporated areas near or adjoining a military installation, and officials of local, state, and Federal governments, and Native American tribal councils responsible for the decision making and administration of programs affecting those communities.

Day-Night Average Sound Level (DNL) – the 24-hour average frequency-weighted sound level, in decibels, from midnight to midnight, obtained after the addition of 10 decibel "adjustment" to sound levels between midnight and 7 a.m. and 10 p.m. to midnight (0000 to 0700 hours and 2200 to 2400 hours). A-weighting (ADNL) is understood unless otherwise specified, but C-weighting (CDNL) is also common.

Decibels (dB) – a logarithmic sound pressure unit of measure.

Encroachment – use or development of the land around a military installation that is incompatible with the operations of that installation.

Equivalent Sound Level (LEQ) – the level of a constant sound which, in a given situation and time period, has the same energy as does a time varying sound. For noise sources which are not in continuous operation, the equivalent sound level may be obtained by summing individual sound exposure level (SEL) values and normalizing them over the appropriate time period.

Frequency – the number of complete oscillation cycles per unit of time. The unit of frequency is the Hertz.

Frequency Weighting – the process of factoring in certain frequencies more or less heavily in order to bring the sound measurement more in line with the characteristics of the receiver (and thus make the numbers more meaningful to the task at hand). Example: A- or C-weighting to specifically parallel the sensitivity of the human ear.

Hertz – the unit of frequency equal to once cycle per second.

Impulse (or Impulsive) Noise – noise of short duration (typically less than one second), high intensity, abrupt onset and rapid decay, and often rapidly changing spectral composition. Impulsive noise is characteristically associated with such sources as explosions, impacts, the discharge of forearms, the passage of supersonic aircraft (creating sonic booms), and many industrial processes.

Land Use Planning Zone (LUPZ) – The Land Use Planning Zone (LUPZ) is a subdivision of Zone I. The LUPZ is 5 dB lower than the Zone II.

Large Caliber – conventional military weapons over 20 millimeters in diameter.

Noise – any sound without value or unwanted sound.

Noise Level Reduction – the difference, in decibels, between the sound level outside a building and the sound level inside a designated room in the building (usually A-weighted). The NLR is dependent upon the transmission loss characteristics of the building surfaces exposed to an exterior noise source, the particular noise characteristics of the exterior noise source, and the acoustic properties if the designated room in the building.

Noise Zone III – the area around a noise source in which the C-weighted day-night sound level (CDNL) is greater than 70 dB (demolition and large caliber weapons), the A-weighted day-night level (ADNL) is greater than 75 dB (aviation), or the dB Peak is greater than 104 (small caliber weapons).

Noise Zone II – the area around a noise source in which the CDNL is 62-70 dB (demolition and large caliber weapons), the ADNL is 65-75 dB (aviation), or the dB Peak is 87-104 (small caliber weapons).

Noise Zone I – included all areas around a noise source in which the CDNL is less than 62 dB (demolition and large caliber weapons), the ADNL is less than 65 dB (aviation), or the dB Peak is less than 87 (small caliber weapons). This area is usually suited for all types of land use activities.

Peak – Peak is a single-event sound level without weighting.

PK15(Met) – peak sound level, without frequency weighting and accounting for the statistical variation cause by weather, expected to be exceeded by 15% of all events that might occur. A PK15(met) level of greater than 130 dB has a high risk of complaints, 115-130 dB has a moderate risk of complaints, and below 115 dB has a low risk of complaints.

PK50(Met) - is similar to the PK15(met) except that it represents the peak noise level that is exceeded 50 percent of the time. This metric also accounts for weather but assumes conditions which are not favorable for noise propagation.

Propagation – the process by which sound travels through space or material; may be affected by such things as weather, terrain, and barriers.

Small Arms – conventional military weapons .50 caliber and below in diameter.

Sound Exposure Level (SEL) – the total energy of a sound event normalized to a specific amount of time (e.g., one second) so that sounds of different durations may be compared directly.

Sound Level Meter – an instrument consisting of an amplifier, microphone, and a graduated readout that provides a direct reading of the sound pressure level at a particular location. Sound may be measured in a variety of metrics (e.g., ADNL, CDNL, Peak, etc.) and they must satisfy the requirements of the American National Standards Institute Standard for Sound Level Meters (S1.4-1983).

Unweighted Peak Sound Level – the peak, single event sound level without weighting, without taking into account berms or other attenuation, and without any particular certainty.

B LAND USE GUIDELINES

Land use recommendations vary based on the type of noise source. Using the Federal Interagency Committee on Urban Noise guidelines, the Army in conjunction with recommendations of the National Academy of Sciences Committee on Hearing, Bioacoustics and Biomechanics (CHABA 1981), developed Noise Zone limits for weapons and explosive noise. Tables B-1 and B-2 contain land use recommendations for land within the weapons and explosive Noise Zones.

TABLE B-1. LAND USE COMPATIBILITY FOR SMALL ARMS NOISE

LAND USE		SUGGESTED LAND USE COMPATIBILITY	
SLUCM NO.	LAND USE NAME	Noise Zone II 87-104 dBP	Noise Zone III >104 dBP
10	Residential		
11	Household units	N[1]	N
11.11	Single units: detached	N[1]	N
11.12	Single units: semidetached	N[1]	N
11.13	Single units: attached row	N[1]	N
11.21	Two units: side-by-side	N[1]	N
11.22	Two units: one above the other	N[1]	N
11.31	Apartments: walk-up	N[1]	N
11.32	Apartment: elevator	N[1]	N
12	Group quarters	N[1]	N
13	Residential hotels	N[1]	N
14	Mobile home parks or courts	N[1]	N
15	Transient lodgings	25	N
16	Other residential	N[1]	N
20	Manufacturing		
21	Food and kindred products; manufacturing	Y[2]	Y[3]
22	Textile mill products; manufacturing	Y[2]	Y[3]
23	Apparel and other finished products; products made from fabrics, leather, and similar materials; manufacturing	Y[2]	Y[3]
24	Lumber and wood products (except furniture); manufacturing	Y[2]	Y[3]
25	Furniture and fixtures; manufacturing	Y[2]	Y[3]
26	Paper and allied products; manufacturing	Y[2]	Y[3]
27	Printing, publishing, and allied industries	Y[2]	Y[3]
28	Chemicals and allied products; manufacturing	Y[2]	Y[3]
29	Petroleum refining and related industries	Y[2]	Y[3]
30	Manufacturing (continued)		
31	Rubber and misc. plastic products; manufacturing	Y[2]	Y[3]
32	Stone, clay and glass products; manufacturing	Y[2]	Y[3]
33	Primary metal products; manufacturing	Y[2]	Y[3]
34	Fabricated metal products; manufacturing	Y[2]	Y[3]
35	Professional scientific, and controlling instruments; photographic and optical goods; watches and clocks	25	35
39	Miscellaneous manufacturing	Y[2]	Y[3]
40	Transportation, communication and utilities		
41	Railroad, rapid rail transit, and street railway transportation	Y[2]	Y[3]
42	Motor vehicle transportation	Y[2]	Y[3]
43	Aircraft transportation	Y[2]	Y[3]
44	Marine craft transportation	Y[2]	Y[3]
45	Highway and street right-of-way	Y[2]	Y[3]
46	Automobile parking	Y[2]	Y[3]
47	Communication	25	35
48	Utilities	Y[2]	Y
49	Other transportation, communication and utilities	25	35

TABLE B-1. LAND USE COMPATIBILITY FOR SMALL ARMS NOISE, cont'd

LAND USE		SUGGESTED LAND USE COMPATIBILITY	
SLUCM NO.	LAND USE NAME	Noise Zone II 87-104 dBP	Noise Zone III >104 dBP
50	Trade		
51	Wholesale trade	Y[2]	Y[3]
52	Retail trade – building materials, hardware and farm equipment	25	35
53	Retail trade – including shopping centers, discount clubs, home improvement stores, electronics superstores, etc.	25	35
54	Retail trade – food	25	35
55	Retail trade – automotive, marine craft, aircraft and accessories	25	35
56	Retail trade – apparel and accessories	25	35
57	Retail trade – furniture, home, furnishings and equipment	25	35
58	Retail trade – eating and drinking establishments	25	35
59	Other retail trade	25	35
60	Services		
61	Finance, insurance and real estate services	25	35
62	Personal services	25	35
62.4	Cemeteries	Y[2]	Y[3]
63	Business services	25	35
63.7	Warehousing and storage	Y[2]	Y[3]
64	Repair services	Y[2]	Y[3]
65	Professional services	25	N
65.1	Hospitals, other medical facilities	N	N
65.16	Nursing homes	N	N
66	Contract construction services	25	35
67	Government services	25	35
68	Educational services	35	N
68.1	Child care services, child development centers, and nurseries	35	N
69	Miscellaneous		
69.1	Religious activities	35	N
70	Cultural, entertainment and recreational		
71	Cultural activities (& churches)	35	N
71.2	Nature exhibits	N	N
72	Public assembly	N	N
72.1	Auditoriums, concert halls	35	N
72.11	Outdoor music shells, amphitheaters	N	N
72.2	Outdoor sports arenas, spectator sports	N	N
73	Amusements	Y	N
74	Recreational activities (including gold courses, riding stables, water recreation)	N	N
75	Resorts and group camps	N	N
76	Parks	N	N
79	Other cultural, entertainment and recreation	N	N

TABLE B-1. LAND USE COMPATIBILITY FOR SMALL ARMS NOISE, cont'd

LAND USE		SUGGESTED LAND USE COMPATIBILITY	
SLUCM NO.	LAND USE NAME	Noise Zone II 87-104 dBP	Noise Zone III >104 dBP
80	Resource production and extraction		
81	Agriculture (except live- stock)	Y[4]	Y[5]
81.5	Livestock farming	Y[4]	N
81.7	Animal breeding	Y[4]	N
82	Agriculture related activities	Y[4]	Y[5]
83	Forestry activities	Y[4]	Y[5]
84	Fishing activities	Y	Y
85	Mining activities	Y	Y
89	Other resource production or extraction	Y	Y

Notes:
SLUCM – Standard Land Use Coding Manual, U.S. Department of Transportation
dBP- unweighted Peak decibel level
Y (Yes) – Land use and related structures compatible without restrictions.
N (No) – Land use and related structures are not compatible and should be prohibited.
Y^x – Yes with restrictions. The land use and related structures generally are compatible. However, see note(s) indicated by the superscript.
N^x – No with exceptions. The land use and related structures are generally incompatible. However, see note(s) indicated by the superscript.
25, 30, or 35 – The numbers refer to noise level reduction (NLR) levels. NLR (outdoor to indoor) is achieved through the incorporation of noise attenuation into the design and construction of a structure. Land use and related

Note 1:

a. Although local requirements for on- or off-base housing may require noise-sensitive land uses within Noise Zone II, such land use is generally not recommended. The absence of viable alternative development options should be determined and an evaluation should be conducted locally prior to local approvals indicating that a demonstrated community need for the residential use would not be met if development were prohibited in these zones. Existing residential development is considered as pre-existing, non-conforming land uses.

b. Where the community determines that these uses must be allowed, measures to achieve outdoor to indoor NLR of at least 30 decibels (dB) in Noise Zone II should be incorporated into building codes and be considered in individual approvals.

c. Normal permanent construction can be expected to provide an NLR of 20 dB, thus the reduction requirements are often stated as 10 dB over standard construction and normally assume mechanical ventilation, upgraded sound transmission class ratings in windows and doors, and closed windows year round.

d. NLR criteria will not eliminate outdoor noise problems. However, building location, site planning, design, and use of berms and barriers can help mitigate outdoor noise exposure particularly from ground level sources. Measures that reduce noise at a site should be used wherever practical in preference to measures that only protect interior spaces.

Note 2. Measures to achieve NLR of 25 must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.

Note 3. Measures to achieve NLR of 30 must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.

Note 4. Residential buildings require an NLR of 30.

Note 5. Residential buildings are not permitted.

TABLE B-2. LAND USE COMPATIBILITY: DEMOLITION AND LARGE ARMS NOISE

LAND USE		SUGGESTED LAND USE COMPATIBILITY		
SLUCM NO.	LAND USE NAME	LUPZ CDNL or CNEL 57-62	Noise Zone II CDNL or CNEL 62-70	Noise Zone III CDNL or CNEL 70+
10	Residential	Y[1]	N[2,3]	N[3]
11	Household units	Y[1]	N[2,3]	N[3]
11.11	Single units: detached	Y[1]	N[2,3]	N[3]
11.12	Single units: semidetached	Y[1]	N[2,3]	N[3]
11.13	Single units: attached row	Y[1]	N[2,3]	N[3]
11.21	Two units: side-by-side	Y[1]	N[2,3]	N[3]
11.22	Two units: one above the other	Y[1]	N[2,3]	N[3]
11.31	Apartments: walk-up	Y[1]	N[2,3]	N[3]
11.32	Apartment: elevator	Y[1]	N[2,3]	N[3]
12	Group quarters	Y[1]	N[2,3]	N[3]
13	Residential hotels	Y[1]	N[2,3]	N[3]
14	Mobile home parks or courts	Y[1]	N[2,3]	N[3]
15	Transient lodgings	Y	Y	N
16	Other residential	Y[1]	N[2,3]	N[3]
20	Manufacturing			
21	Food and kindred products; manufacturing	Y	Y[4]	Y[4]
22	Textile mill products; manufacturing	Y	Y[4]	Y[4]
23	Apparel and other finished products; products made from fabrics, leather, and similar materials; manufacturing	Y	Y[4]	Y[4]
24	Lumber and wood products (except furniture); manufacturing	Y	Y[4]	Y[4]
25	Furniture and fixtures; manufacturing	Y	Y[4]	Y[4]
26	Paper and allied products; manufacturing	Y	Y[4]	Y[4]
27	Printing, publishing, and allied industries	Y	Y[4]	Y[4]
28	Chemicals and allied products; manufacturing	Y	Y[4]	Y[4]
29	Petroleum refining and related industries	Y	Y[4]	Y[4]
30	Manufacturing (continued)			
31	Rubber and misc. plastic products; manufacturing	Y	Y[4]	Y[4]
32	Stone, clay and glass products; manufacturing	Y	Y[4]	Y[4]
33	Primary metal products; manufacturing	Y	Y[4]	Y[4]
34	Fabricated metal products; manufacturing	Y	Y[4]	Y[4]
35	Professional scientific, and controlling instruments; photographic and optical goods; watches and clocks	Y	N	N
39	Miscellaneous manufacturing	Y	Y[4]	Y[4]

TABLE B-2. LAND USE COMPATIBILITY: DEMOLITION AND LARGE ARMS NOISE, cont'd

LAND USE		SUGGESTED LAND USE COMPATIBILITY		
SLUCM NO.	LAND USE NAME	LUPZ CDNL or CNEL 57-62	Noise Zone II CDNL or CNEL 62-70	Noise Zone III CDNL or CNEL 70+
40	Transportation, communication and utilities			
41	Railroad, rapid rail transit, and street railway transportation	Y	Y	Y
42	Motor vehicle transportation	Y	Y	Y
43	Aircraft transportation	Y	Y	Y
44	Marine craft transportation	Y	Y	Y
45	Highway and street right-of-way	Y	Y	Y
46	Automobile parking	Y	Y	Y
47	Communication	Y	N	N
48	Utilities	Y	Y	Y
49	Other transportation, communication and utilities	Y	Y	N
50	Trade			
51	Wholesale trade	Y	Y	N
52	Retail trade – building materials, hardware and farm equipment	Y	Y	N
53	Retail trade – including shopping centers, discount clubs, home improvement stores, electronics superstores, etc.	Y	Y	N
54	Retail trade – food	Y	Y	N
55	Retail trade – automotive, marine craft, aircraft and accessories	Y	Y	N
56	Retail trade – apparel and accessories	Y	Y	N
57	Retail trade – furniture, home, furnishings and equipment	Y	Y	N
58	Retail trade – eating and drinking establishments	Y	Y	N
59	Other retail trade	Y	Y	N
60	Services			
61	Finance, insurance and real estate services	Y	Y	N
62	Personal services	Y	Y	N
62.4	Cemeteries	Y	Y	Y
63	Business services	Y	Y	N
63.7	Warehousing and storage	Y	Y[4]	Y[4]
64	Repair services	Y	Y	N
65	Professional services	Y	Y	N
65.1	Hospitals, other medical facilities	Y[1]	N	N
65.16	Nursing homes	Y[1]	N	N
66	Contract construction services	Y	Y	N
67	Government services	Y	Y	N
68	Educational services	Y[1]	N	N
68.1	Child care services, child development centers, and nurseries	Y[1]	N	N

TABLE B-2. LAND USE COMPATIBILITY: DEMOLITION AND LARGE ARMS NOISE, cont'd

LAND USE		SUGGESTED LAND USE COMPATIBILITY		
SLUCM NO.	LAND USE NAME	LUPZ CDNL or CNEL 57-62	Noise Zone II CDNL or CNEL 62-70	Noise Zone III CDNL or CNEL 70+
69	Miscellaneous			
69.1	Religious activities	Y[1]	N	N
70	Cultural, entertainment and recreational			
71	Cultural activities (& churches)	Y[1]	N	N
71.2	Nature exhibits	Y[1]	N	N
72	Public assembly	Y[1]	N	N
72.1	Auditoriums, concert halls	Y[1]	N	N
72.11	Outdoor music shells, amphitheaters	Y[1]	N	N
72.2	Outdoor sports arenas, spectator sports	Y	N	N
73	Amusements	Y	Y	N
74	Recreational activities (including gold courses, riding stables, water recreation)	Y	N	N
75	Resorts and group camps	Y	N	N
76	Parks	Y	N	N
79	Other cultural, entertainment and recreation	Y	N	N
80	Resource production and extraction			
81	Agriculture (except live- stock)	Y	Y	Y
81.5	Livestock farming	Y	N	N
81.7	Animal breeding	Y	N	N
82	Agriculture related activities	Y	Y	Y
83	Forestry activities	Y	Y	Y
84	Fishing activities	Y	Y	Y
85	Mining activities	Y	Y	Y
89	Other resource production or extraction	Y	Y	Y

Note 1: LUPZ- Land Use Planning Zone is a subdivision of Land Use Zone I and functions as a buffer for Noise Zone II. Communities and individuals often have different views regarding acceptable or desirable levels of noise. To address this, some local governments have implemented land use planning measures beyond Noise Zone II limits. In addition to mitigating current noise impacts, implementing such controls within the LUPZ can create a buffer to prevent the possibility of future noise conflicts.

Note 2: Although local requirements for on- or off-base housing may require noise-sensitive land uses within Noise Zone II, such land use is generally not compatible within Noise Zone II. Measures to achieve overall noise level reduction inside structures do not solve noise difficulties outside the structure. Barriers are not effective reducing the noise from artillery and armor, the detonation of either large caliber military munitions or a large quantity of explosives. Additionally, noise level reduction inside structures does not mitigate the vibration generated by the low-frequency energy of large caliber weapons firing and detonations.

Note 3: Within Zones, existing "noise sensitive land uses are considered as pre-existing incompatible land uses. In most cases these uses are not a risk to either mission sustainment or a community's quality of life. Most long-term members near Army installations or activities acknowledge hearing military operations and activities but they are usually not alarmed or bothered by the noise.

Note 4: Although noise levels may be compatible, caution should be exercised in siting any activity which may be sensitive to vibration.

C REFERENCES

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Appendix F-1
General Inspection Schedule Forms

Weather Data Statistics & Open Detonation Operating Log

Weather Data Statistics-OD Operating Log **Reporting Month \ Year :**

Installation: Milan Army Ammunition Plant

Demolition Range Location: Area W / ADA

General Time and Weather Data				Wind Data		Treatment Details				Explosives Licensing	Material Destroyed
Day / Time	Temp.	%Relative Humidity	Sky Condition	Wind Speed (MPH)	Wind Direction	Location	Above or Below Ground	Quantity Treated (N.E.W)	Units	DA Form 4508 NO Or ATF License	

Security Fence Weekly Inspection Log
Area W - Open Detonation Treatment Area (Ammunition Destruction Area)
Milan Army Ammunition Plant

Date & Time Inspected										
Inspectors' Name/Badge Number										
Condition of Fence: damaged, breaks, etc. (including poles, barbwire, and ties)										
Condition of Gates: damage, proper operation, secure										
Security Locks and Chains: locked and secure										
Signs: damaged, missing or not spaced properly										
Condition of Adjacent Areas: washouts around fence, need mowing, etc										
Comments:										
Correction Action Taken:										

Inspectors' initials in appropriate blocks indicate that no problem or noncompliance issues were found.
File form at Army Environmental Office and Site Trailer When Complete

MLN-1287 (10/24/25)

Satellite Accumulation Area Weekly Inspection Log
Milan Army Ammunition Plant

Location Inspected										
Date & Time Inspected										
Condition of Container										
Proper Labels & Marking										
Security of Container (Closed & Grounded as applicable)										
Estimated amount in container										
Security of Area										
Inspector Name & Badge Number										
Correction Action Taken:										
Comments										

Inspectors' initials in appropriate blocks indicate that no problem or noncompliance issues were found.
File form at Army Environmental Office and Site Trailer When Complete

Central Accumulation Area
Daily Inspection Log
Milan Army Ammunition Plant

Building Number:_____

Inspector's Signatures & Badge No's										
Date Inspected										
Time Inspected										
Condition of Containers (leaking, bulged, damaged, etc.)										
Proper labeling on containers (labels missing, not legible, etc.)										
Container Security (closed)										
Communication System (Two way radios or Telephone operating properly)										
Spill Kit (missing, inadequate supply, broken)										
Security (door locks broken, left open, etc.)										
Warning signs (missing, damaged, etc.)										
Fire Extinguisher										
Corrective Action:										
Comments:										

1) Inspector initials in appropriate blocks indicate that no problems or non-compliance issues were found.
2) All inspectors must sign form for all inspections completed by them.
3) Inspections to Include all Central Accumulation Areas

File form at Army Environmental Office and Site Trailer When Complete

Appendix G-1

Evacuation Route Map:

G-1 Evacuation Route (Fig. B-16)

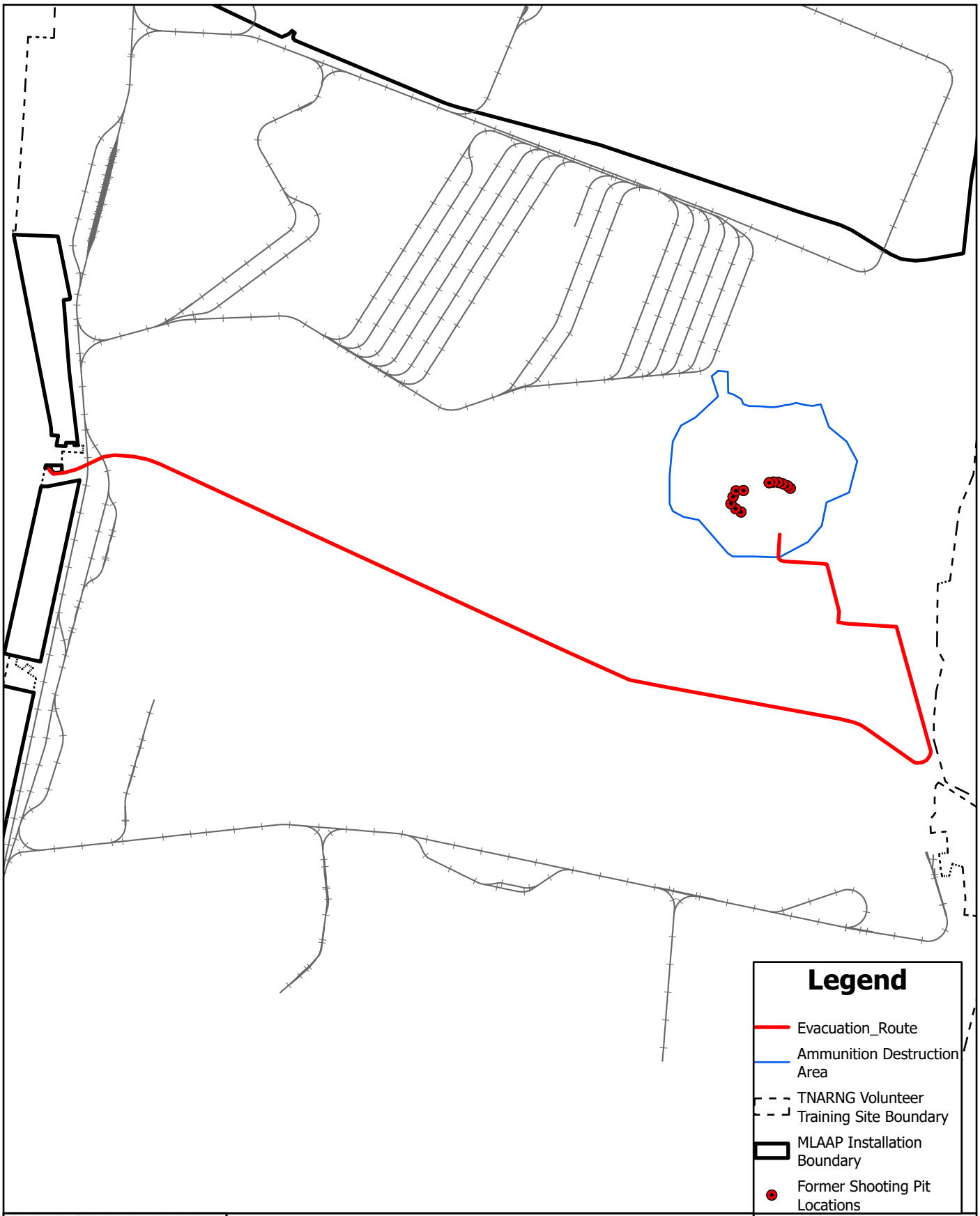


Figure B-16 (G-1)
Evacuation Map

Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, Sources: Esri, Maxar, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap, and the GIS user community

2025

Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet

N

0 0.33 0.65 Mi

0 0.5 1 Km

Appendix I-1

Excerpt of 9th Annual Remediation Action Status Report

Including figures:

I-1 OU Site Location Map (Fig. B-17)
I-2 OU MLAAP Site Map (Fig. B-18)
I-3 Horizontal Distribution of RDX in Site-Wide Groundwater- RASR Year 9 (Fig. B-19)
I-4 Horizontal Distribution of TNT in Site-Wide Groundwater- RASR Year 9 (Fig. B-20)
I-5 Cross-Section Location Map and Groundwater Flow Direction (Fig. B-21)
I-6 OU5 and Line C Groundwater Potentiometric Surface Map (Fig. B-22)
I-7 OU5 and Line C RDX Concentrations in Groundwater (Fig. B-23)
I-8 OU5 and Line C TNT Concentrations in Groundwater (Fig. B-24)
I-9 Cross-Section J-J' RDX Plume Through OU5 (Fig. B-25)
I-10 Estimated Areas Remaining Above the Interim Goals at the End of Date for Active Remediation (Year 15, 2030) (Fig. B-26)

DRAFT FINAL

NINTH ANNUAL REMEDIAL ACTION STATUS REPORT

SITE-WIDE GROUNDWATER

01 JULY 2022 TO 30 JUNE 2023

ENVIRONMENTAL REMEDIATION SERVICES

FORMER MILAN ARMY AMMUNITION PLANT, TENNESSEE

13 March 2024

Prepared for:

Contract No.: W9124J-18-D-0004, Delivery Order W9124J-19-F-0083

1. Introduction and Background Summary

Environmental Chemical Corporation (ECC) has been retained by the United States (U.S.) Army Environmental Command (USAEC; USAEC will be referred to as U.S. Army throughout this report) to perform environmental restoration activities for the former Milan Army Ammunition Plant (MLAAP; Site) in Milan, Tennessee (**Figure 1-1**). This work is being conducted under Contract Number W9124J-18-D-0004, delivery order W9124J-19-F-0083.

This Ninth Annual Remedial Action Status Report (RASR) addresses groundwater impacted with explosives constituents at the MLAAP installation and associated impacted groundwater off post (collectively referred to as "site-wide groundwater"). Remedial alternatives developed to satisfy the Remedial Action Objectives (RAOs) for Site-Wide Groundwater were assessed in the Feasibility Study (FS) (ARCADIS U.S., Inc. [ARCADIS], 2013) approved by the U.S. Environmental Protection Agency (USEPA) and Tennessee Department of Environment and Conservation (TDEC) in November 2013. As documented in the Record of Decision (ROD) for Site-Wide Groundwater (MLAAP, 2014), the remedial alternative selected to protect human health and the environment is Alternative 2, Optimize/Extend Current Extraction Systems, Monitored Natural Attenuation (MNA), and Land Use Controls (LUCs). The Selected Remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

MLAAP was placed on the National Priorities List (NPL) on 22 July 1987 based on the overall site score calculated via the Hazard Ranking System (HRS) pursuant to CERCLA. The HRS ranking was assigned based on releases at the O-Line area of the plant (discharges and pond leachate) that contaminated on-site and off-site groundwater. The Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) identification number for MLAAP is TN0210020582. The U.S. Army, USEPA, and TDEC signed a CERCLA Federal Facility Agreement (FFA) in 1989 to establish a formal framework by which all signatory parties will proceed with investigation and subsequent cleanup of impacted groundwater at MLAAP. Execution of the FFA is a requirement of CERCLA Section 120.

To execute the installation restoration strategy effectively, MLAAP has been divided into five operable units (OUs): OU1, OU2 (not shown), OU3, OU4, and OU5 (**Figure 1-2**). This RASR discusses groundwater cleanup efforts conducted by the U.S. Army within OU1, OU2, OU3, OU4, and OU5, which were consolidated by the ROD (MLAAP, 2014) and are collectively referred to as "site-wide groundwater." Groundwater collected annually as part of the OU1/OU3 sampling event includes specific OU2 area monitoring wells identified within the 2014 Final Remedial Action Work Plan (RAWP), dated September 2014 (ECC, 2014a). Therefore, groundwater beneath and surrounding the OU2 Ponds Cap is evaluated as part of the OU3 plume evaluation, in accordance with the side-wide groundwater ROD.

This RASR summarizes remedial actions and results of sampling events conducted between 01 July 2022 and 30 June 2023, which is the 14th year of groundwater monitoring subsequent to the establishment a long-term monitoring program (LTMP) that commenced in 2009. The original 2009 LTMP was a temporary program put in place during dispute resolution to provide a sufficient set of data from appropriate monitoring

wells to support further plume characterization, continue the evaluation of natural attenuation, and monitor the performance of the three components of the Selected Remedy for the MLAAP groundwater plumes. The LTMP period culminated with the 2014 groundwater ROD (MLAAP, 2014) and implementation of the remedy in accordance with the 2014 RAWP (ECC, 2014a). Optimization actions implemented were documented in the Remedial Action Completion Report (RACR) (ECC, 2016). Since the completion of the initial optimization, all site management and performance are documented and are adjusted annually based on the recommendations of the annual RASR.

Each year of monitoring comprises the third and fourth quarter of the previous calendar year and first and second quarter of the current calendar year. Work was performed in accordance with the MLAAP site-wide plans, as follows: the Final RAWP, dated September 2014 (ECC, 2014a); the Final Quality Assurance Project Plan (QAPP), finalized in February 2021 (ECC, 2021a); and the Site Safety and Health Plan (SSHP), included as an Attachment to the Accident Prevention Plan (APP) finalized in February 2020 (ECC, 2020). Sampling and analytical protocols and Field Standard Operating Procedures (SOPs) are included in the revised MLAAP QAPP (ECC, 2021a), replacing the historical the Site-Wide Field Sampling Plan (FSP) (ARCADIS, 2005). All gauging and sampling field procedures were performed in accordance with USEPA Region 4 Field Branches Quality System and Technical Procedures (www.epa.gov/region4/sesd/fbqstp/).

1.1 Purpose and Scope

The Selected Remedy (Optimize/Extend Current Extraction Systems, MNA, and LUCs) is defined in **Section 1.3**. The purpose of each RASR is to evaluate remedy performance. The RASR provides an annual status update that summarizes activities required to implement the Selected Remedy for site-wide groundwater at MLAAP, including the following:

- Groundwater treatment plant (GWTP) operations summary (including groundwater modeling and extraction well pumping rate modifications);
- LUC inspection results and a summary of implemented corrective actions;
- Results of annual sampling (groundwater and surface water);
- A volumetric comparison between the extraction well capture zones and explosives plumes; and,
- Results of the annual remedy performance and optimization evaluation (Prioritization and Decision Tree processes) for cyclotrimethylenetrinitramine (RDX).

1.2 Current Understanding of Site Conditions

Due to past practices at MLAAP, nine explosives constituents have been identified as constituents of concern (COCs) in on-post and off-post groundwater (**Table 1-1**). These groundwater COCs include: 1,3-dinitrobenzene, 2,4,6-trinitrotoluene (TNT), 2,4-dinitrotoluene (DNT), 2,6-DNT, 2-amino-4,6-DNT, 4-amino-2,6-DNT, 2-nitrotoluene, nitrobenzene, and RDX. RDX and TNT are the primary COCs in MLAAP groundwater. In addition to these nine COCs, explosive constituents 1,3,5-trinitrobenzene, 3-nitrotoluene, 4-nitrotoluene, octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX), and tetryl are also monitored in groundwater (and surface water). Although not considered a significant concern, these other explosive

constituents are monitored to evaluate overall groundwater quality, particularly in relation to total explosive concentrations in untreated and treated groundwater.

For the Year 1 through Year 8 annual RASRs, the COC groundwater and surface water monitoring data were compared to risk-based cleanup levels developed for and documented within the ROD for Site-Wide Groundwater (MLAAP, 2014). An Explanation of Significant Differences (ESD) to the ROD for Site-Wide Groundwater, finalized in July 2022 (MLAAP, 2022b), revised the groundwater cleanup levels and surface water screening criteria based upon updated risk criteria. Therefore, Year 9 groundwater monitoring data are compared to these revised cleanup levels, as presented in **Table 1-1**. The groundwater cleanup levels for the primary COCs (RDX and TNT) did not change (both remaining at 2.0 micrograms per liter [µg/L]), and thus much of the evaluation performed within the RASR is not impacted by the changes in groundwater cleanup levels.

The site-wide groundwater impacts at MLAAP have been grouped into explosives-contaminant plumes, and are identified based on their location and source areas as follows: OU1, OU3, OU4 Region 1 (OU4-R1), OU4 Region 2 (OU4-R2), Lines B and D, Line C, and OU5.

To support the implementation of the remedy, a RAWP (ARCADIS, 2014) was developed for site-wide groundwater and revised into a final document by ECC in response to regulator comments (ECC, 2014a). Input from the LTMP (2009-2014) provided the necessary data for the RAWP to determine actions required to implement the Selected Remedy to meet RAOs. Since the ROD for Site-Wide Groundwater (MLAAP, 2014) was implemented, groundwater sampling locations are determined by the remedy management framework and documented in the annual RASR.

The groundwater monitoring period (July 2022 through June 2023) reported within this Ninth Annual RASR is identified as Year 9, based upon the ROD (MLAAP, 2014), and as discussed in **Section 1.3**. A total of 308 samples were collected during Year 9 from 18 extraction wells, 287 monitoring wells, and three surface water locations within the Rutherford Fork of the Obion River (RFOR). These sampling locations were based on the RAWP sampling list with adjustments documented within the Eighth Annual RASR (ECC, 2023b). The only two variances to the sampling list, as identified within the Eighth Annual RASR, Table 5-1, were the addition of a sample collected from inactive extraction well XP-06, and the lack of a sample collected from OU4-R2 plume well monitoring well MI438. Per standard procedure, all MLAAP extraction wells are listed within Table 5-1, but are to be sampled only when active. Extraction well XP-06 was inactive during Year 9; however, the Army chose to collect a sample from this well for additional plume data. This variance did not have a negative impact on the RASR Year 9 monitoring program. Monitoring well MI438 could not be sampled during the Q4 2022 OU4-R2 sampling period due to a well access issue. As well MI438 is on a 5-year sampling frequency, and this well's next sampling event has been revised to be sampled in Year 10, there is no significant impact to the groundwater monitoring program.

Over 200 monitoring or extraction wells are sampled annually, while additional monitoring wells are sampled on a two-, five-, or 10-year interval. The total number of wells in the monitoring program, and the frequency of sampling for a number of wells, have been adjusted yearly since its inception, based on site conditions

and groundwater analytical results. Per the Eighth Annual RASR, Table 5-1 (ECC, 2023b), the total number of wells in the monitoring program during Year 9 is at 410 (all wells, all sampling frequencies).

There are also a number of additional groundwater monitoring wells that have been installed by the Army since the beginning of groundwater investigation activities; while some of these wells are gauged annually to document groundwater flow, these wells are not currently sampled (at any frequency) as part of the monitoring program. There are a total of 568 wells present and maintained by the Army within and around the MLAAP property. Monitoring wells may be added to the monitoring program (or removed), based on data evaluation in the annual RASR.

Portions of the OU1/3 plume, the OU4-R1 plume, and the OU4-R2 plume have migrated off post. Groundwater extraction systems are currently operating (and will continue to operate) with the objective of preventing or minimizing additional off-site migration at two of these plumes (OU1/3 and OU4-R1). The existing GWTPs are located within OU3 and OU4-R1. While the MNA component of the remedy is in place, active treatment of the OU4-R2 plume is currently considered less of a priority than the other two off-site plumes because current and projected RDX concentrations are below the thresholds for active treatment; therefore, there is currently no groundwater extraction in place for this plume. Additional details regarding the GWTPs are provided in **Section 3**. Detailed descriptions of the individual OUs are provided in the ECC RAWP (ECC, 2014a).

1.3 Remedial Action Objectives and the Selected Remedy

1.3.1 Remedial Action Objectives

The Selected Remedy has been designed to achieve the RAOs identified in the ROD. RAOs specify constituents and media of concern, potential exposure pathways, and cleanup levels designed to protect human health and the environment. Cleanup levels for groundwater and screening levels for surface water are presented in **Table 1-1**. The RAOs identified in the ROD are as follows:

- Restore groundwater quality, wherever practicable and consistent with the NCP expectation, throughout the Site plumes to meet cleanup levels for COCs (including the health advisory standard of 2.0 µg/L for RDX). The RDX cleanup level is based upon the classification of the aquifer as a drinking water source (i.e., general use) by the Tennessee Water Quality Control Act and TDEC water quality criteria regulations.
- Prevent and/or minimize further migration of the contaminated groundwater plumes at MLAAP.
- Protect receptors from exposure to groundwater containing COCs at concentrations above acceptable risk-based remedial goals (**Table 1-1**).
- In areas where groundwater discharges to surface water, control migration of COCs in groundwater to protect surface waters from discharge of COCs at concentrations that pose an unacceptable risk (**Table 1-1**).

The Selected Remedy includes a combination of groundwater extraction and treatment via granular activated carbon (GAC), as well as MNA to remediate groundwater that contains explosives constituents at

concentrations that exceed health-based cleanup levels. The Selected Remedy includes a period of combined pump and treat with MNA in current areas of low concentrations followed by a period of MNA once all pump and treat systems are shut down. The pump and treat systems in each plume area are continually optimized to provide efficient COC mass reduction and/or hydraulic control, to maximize the use of the existing treatment plants at OU3 and OU4, and to shorten the overall lifecycle of active remediation. The length of time required for the active remediation component is expected to vary within each plume area and will be dependent on factors, such as location within the plume, starting COC concentrations, and performance monitoring results. It was anticipated that the pump and treat systems will be operated for approximately 15 years and the total overall timeframe to achieve cleanup levels will be 60 years. The timeframe of 15 years was an estimate calculated using various existing site data and could be longer. The actual pumping timeframe will be determined using a remedy management framework developed to evaluate remedy performance and guide optimization decisions. The remediation timeframe began on 01 January 2015.

As discussed in **Section 1.2**, an ESD to the ROD for Site-Wide Groundwater was finalized in July 2022 (MLAAP, 2022b). As agreed upon between the Army and USEPA and TDEC, the ESD revises some of the groundwater cleanup levels and surface water screening criteria, based upon revisions to regulatory human health risk levels. As the ESD was finalized subsequent to completion of the RASR Year 8 monitoring program, these revised cleanup levels and screening criteria are presented within RASR Year 9 (**Table 1-1**).

LUCs to prevent access, use, and exposure to contaminated groundwater that present unacceptable risk to human health are part of the Selected Remedy. These LUCs include measures to prevent unauthorized access to the MLAAP facility, limit groundwater extraction and use on post, maintain existing groundwater use restrictions for off-post properties, and provide education of the existing City of Milan ordinance that prohibits the use of private drinking water wells within the city limits.

The following sections describe the three components of the Selected Remedy, Extraction Systems, MNA, and LUCs, in more detail.

1.3.2 Summary of Selected Remedy

The three remedy components listed below are as presented in the site-wide groundwater ROD (MLAAP, 2014).

1.3.2.1 Extraction Systems

The existing MLAAP groundwater treatment systems utilize pump and treat technology to intercept contaminated groundwater for the purpose of performing contaminant mass removal and/or hydraulic containment. Groundwater is currently extracted from the OU1/3, OU4, OU5, and Lines B and D plumes; each active extraction well has a pump installed which extracts groundwater from the aquifer and pumps the water through a piping network, conveying the groundwater to either the OU3 GWTP or the OU4 GWTP for treatment (see **Figures 6-1** or **6-2,** which show plant locations and extraction well conveyance piping). Extracted groundwater is treated using GAC; subsequently, treated groundwater is discharged to the RFOR (OU3 GWTP) or Wolf Creek (OU4 GWTP). The extraction component of the Selected Remedy

(Optimize/Extend Current Extraction Systems) refers to modifying the existing extraction systems (e.g., installing new extraction wells as required, modifying pumping rates) without increasing the current treatment capacity of either of the GWTP systems.

Pump and treat systems have been installed specifically in areas where impacted groundwater is not expected to attenuate naturally within the established 60-year remediation timeframe and/or where immediate potential for risk to a receptor exists. Ongoing optimization/extension of the existing extraction systems will expedite removal of COC mass in areas where concentrations are highest and thereby reduce the overall remediation timeframe. The optimization process includes an annual evaluation of plume water quality data to assess whether there are other locations within the plume footprint that require active treatment, or whether adjustments to extraction rates at individual wells might achieve remedial goals more expeditiously, as presented in **Section 7**.

1.3.2.2 Monitored Natural Attenuation

Natural attenuation relies on dispersion, immobilization, and biological transformation to attenuate anthropogenic contaminants in groundwater. The time required for these processes to lower contaminant concentrations to levels protective of human health and the environment varies between hydrogeologic systems and chemical contaminants. Through acquisition of groundwater COC data at MLAAP, as well as wet chemistry data, the effectiveness of natural degradation processes at this site has been established in accordance with the USEPA MNA guidance document (USEPA, 1999). Consequently, MNA is, and will continue to be, implemented in areas outside the influence of the groundwater extraction systems and within areas of active remediation after extraction has been discontinued in the future, to monitor the effectiveness of natural attenuation processes and degradation of COCs (primarily RDX) in groundwater. Areas currently outside of active treatment areas include all of Line C and OU4-R2, most of Lines B and D, and parts of OU1/3 and OU5. As described further in **Section 5.4**, the U.S. Army has developed a process to assess when portions of the active remedy are no longer effective and should be discontinued.

1.3.2.3 Land Use Controls

The LUC objectives for site-wide groundwater, based on the RAOs and as identified in the Groundwater ROD (MLAAP, 2014), are as follows:

1. Provide direct and immediate protection from human exposure to contaminated groundwater by restricting and/or controlling the use of groundwater at all areas on-post and in areas off-post where portions of the plume have migrated. Any changes to these restrictions require prior written approval obtained from the Army, USEPA, and TDEC.
2. Maintain the integrity of the remedy (including existing or future monitoring wells and remediation systems) unless prior written approval is obtained from the Army, USEPA, and TDEC.

As part of the ongoing groundwater remedy, LUCs have been established to restrict groundwater use and legally binding property agreements are in place restricting groundwater use for private property adjacent to MLAAP.

products MNX, DNX, and TNX for all wells that were sampled at least once for degradation products. **Appendix I.3** provides a figure showing locations of wells that have been sampled at least once for RDX degradation products. The figure provides a graphical representation of the maximum MNX value reported for each well. MNX was selected for this representation, as it has generally been detected more frequently and at higher concentrations than DNX or TNX.

6.3.5.5 Field Chemistry Results

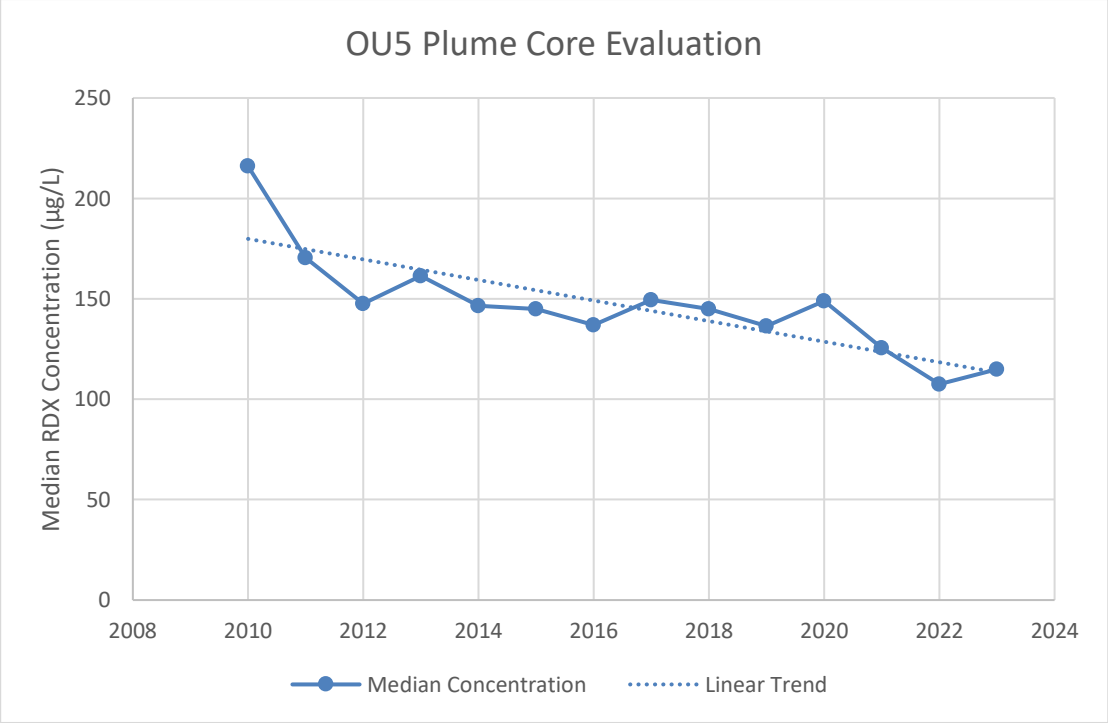
DO measurements were collected in the field for each well that was sampled during the annual sample event. **Appendix I.3** contains a figure showing iso-concentration contours for DO. As shown in the figure, slightly depressed DO levels are mostly evident in the higher RDX concentration areas of the Line C plume, ranging from 5 to 7 mg/L.

6.3.6 OU5 Data Evaluation

The current RDX and TNT plumes are illustrated on **Figures 6-19** and **6-20**, respectively. A cross sectional view of the RDX plume is presented in **Figure 6-21**.

6.3.6.1 Plume Core Evaluation

As described in **Section 5.3.1**, a plume core evaluation was performed by assessing median RDX concentrations by year for wells located within the plume cores. A Mann-Kendall trend test was used to determine if there was a significant linear upward or downward trend across time. Wells within the plume core were defined as those wells with at least one RDX result greater than 100 µg/L during the evaluation period (2009-present). This definition results in a total of 23 wells used for the plume core evaluation, and essentially limits the plume core evaluation to the part of the OU5 plume associated with the Open Burning Ground, the larger of the two OU5 plumes. There is insufficient data to perform a plume core analysis for the plume associated with the former Ammunition Destruction Area (the smaller isolated plume that is located southwest of the main plume associated with the Open Burning Ground). The time series plot below provides the median RDX concentrations by year:

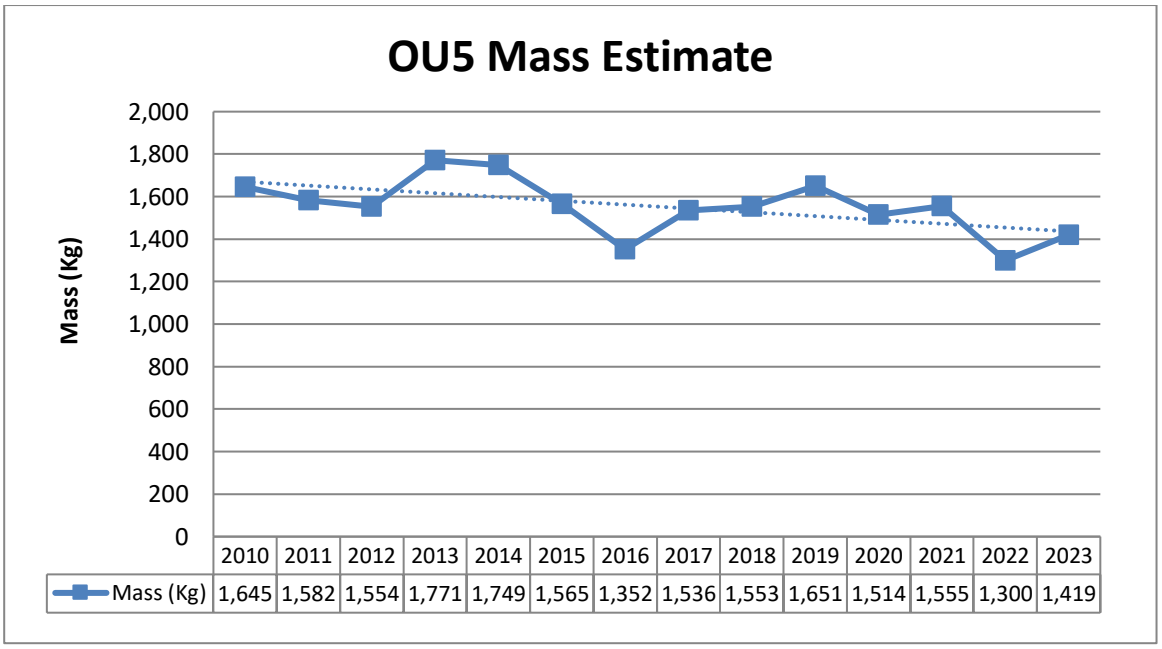


Results of the Mann-Kendall trend test indicate that there is statistically significant evidence of a decreasing trend (**Appendix I.2**). The source data for the chart (including median concentrations) are summarized in **Appendix I.2**.

An additional method of assessing the change of plume cores over time was completed for the Year 8 and Year 9 RASRs. This method involves a visual comparison of the interpolated plume cores from 2015 to 2023. The visual comparisons are provided in **Appendix I.6**. The figure included in the appendix shows the evolution of the plume core from 2015 to 2023. Defining the plume core by the 100 µg/L isocontour, the core has generally remained stable from 2015 to 2023.

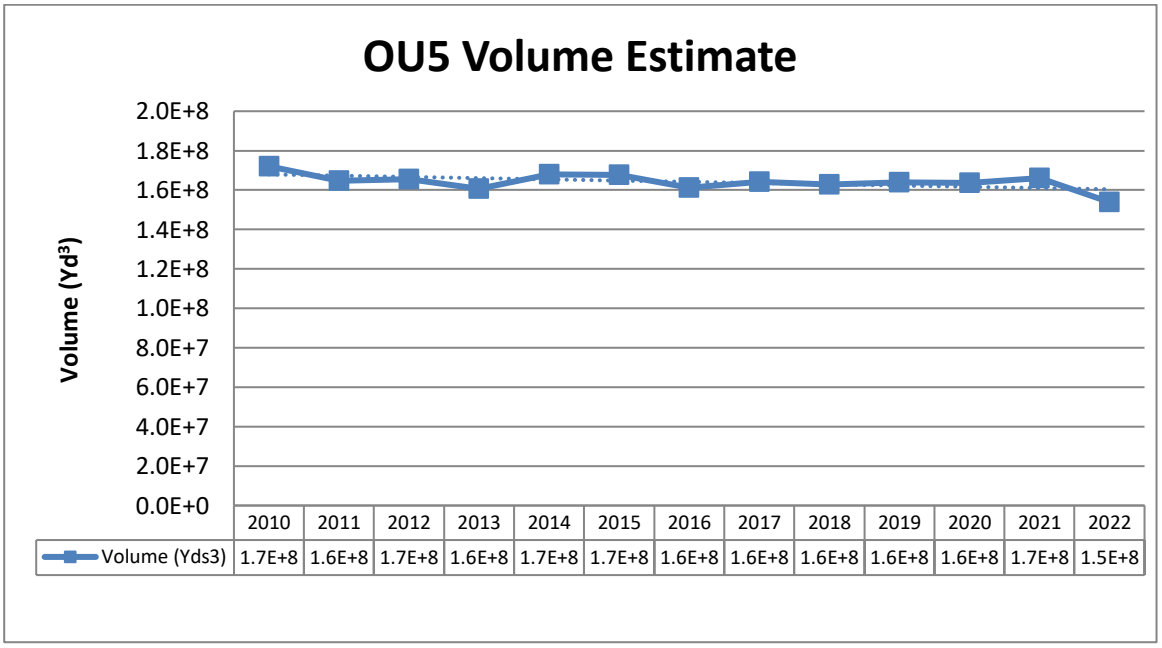
6.3.6.2 Plume Footprint, Plume Volumes, Contaminant Dissolved Mass, and Center of Mass Analysis

Dissolved phase masses, RDX plume volumes, and COMs were determined for OU5. The estimated dissolved mass and plume volume were calculated for each year. The mass estimates for each year are provided in the chart below:



The estimated mass of RDX for the current year is 1,419 Kg. Results of the Mann-Kendall trend test indicate statistical evidence of a decreasing trend from 2010 to 2023 at the 0.1 level of significance (**Appendix I.3**).

The volume estimates are provided in the chart below:



The chart indicates that the estimated volume has remained relatively stable since 2010, at approximately $1.7x10^8$ yd^3. Results of the Mann-Kendall trend test indicate statistical evidence of a decreasing trend from 2010 to 2023 at the 0.1 level of significance (**Appendix I.3**).

The COM was calculated for each year. **Appendix I.3** depicts the locations of the COMs over time for each year. Between 2010 and the current year, the COM has migrated approximately 1,000 ft downgradient.

6.3.6.3 Sentinel Well Results

Two collocated pairs of sentinel wells (MI270/MI271 and MI291/MI292) are associated with the OU5 plume. OU5 essentially consists of two 'sub-plumes'. The larger sub-plume area, the core of which is currently centered in the vicinity of well MI683, is associated with the historical source area at the Open Burning Ground. The smaller sub-plume area, currently located to the southwest of the larger sub-plume in the vicinity of wells MI289 and MI296, is associated with the historical source area at the Ammunition Destruction Area. The two sentinel well pairs associated with the OU5 plume are sentinels for the smaller sub-plume.

Wells MI270 and MI271 were sampled during the annual sampling event. This well pair was added to the RASR sampling program for RASR Year 8 based on a recommendation from the Year 6 RASR (ECC, 2021c). This well pair has historically defined the eastern extent of the small OU5 sub-plume. The reported RDX concentration at MI270 was 0.44 µg/L, below the cleanup level of 2 µg/L. The RDX concentration at MI271 was non-detect. No recent trend data is available for this well pair.

MI292 was sampled during the current reporting period while MI291 was not. Well MI291 previously had a reported concentration of 2 µg/L in 2020. Concentrations at MI291 have been at or below the cleanup level since 2015. Concentrations at MI292 have been below the cleanup level since 2016. Sentinel well pair MI291/292 replaced well pair MI413/414 in RASR Year 4, as they are better located to monitor potential migration of the leading edge of the plume.

Well trends for sentinel wells are provided in **Appendix I.4**.

6.3.6.4 Monitored Natural Attenuation/Geochemical Degradation Product Results

Groundwater samples collected from seven wells within OU5 were analyzed for RDX degradation products; results are included on **Table G-6** of **Appendix G**. Results of the OU5 degradation product analysis are summarized as follows:

- Groundwater samples collected from seven wells (MI160, MI250, MI258, MI279, MI289, MI298 and MI299) were sampled and analyzed for degradation products MNX, DNX, and TNX. Well locations are shown on **Figure 6-19**;
- RDX was detected at concentrations above the laboratory DL in all six wells;
- MNX was detected in all wells except MI289;
- DNX was detected at three wells (MI16, MI250 and MI299);
- TNX was detected at four wells (MI160, MI250, MI279 and MI299); and,
- The maximum concentration of MNX (6.2 µg/L) was detected at well MI250.

Historical results indicate that degradation products are widespread throughout the plume footprint, an area that is covered by the MNA remedy component (excepting the capture zone area for EXT-111). **Appendix I.5** provides time series plots for RDX degradation products MNX, DNX, and TNX for all wells that were sampled at least once for degradation products. **Appendix I.3** provides a figure showing locations of wells that have been sampled at least once for RDX degradation products. The figure provides a graphical representation of the maximum MNX value reported for each well. MNX was selected for this representation as it has generally been detected more frequently and at higher concentrations than DNX or TNX. As expected, and as shown in the figure, MNX concentrations are generally lower around the periphery of the plume footprint and increase towards the higher concentration areas of the RDX plume.

6.3.6.5 Field Chemistry Results

DO measurements were collected in the field for each well that was sampled during the annual sample event. **Appendix I.3** provides a figure showing iso-concentration contours for DO. As shown in the figure, slightly depressed DO levels are mostly evident within the OU5 plume footprint, generally ranging from 4 to 8 mg/L.

Figures

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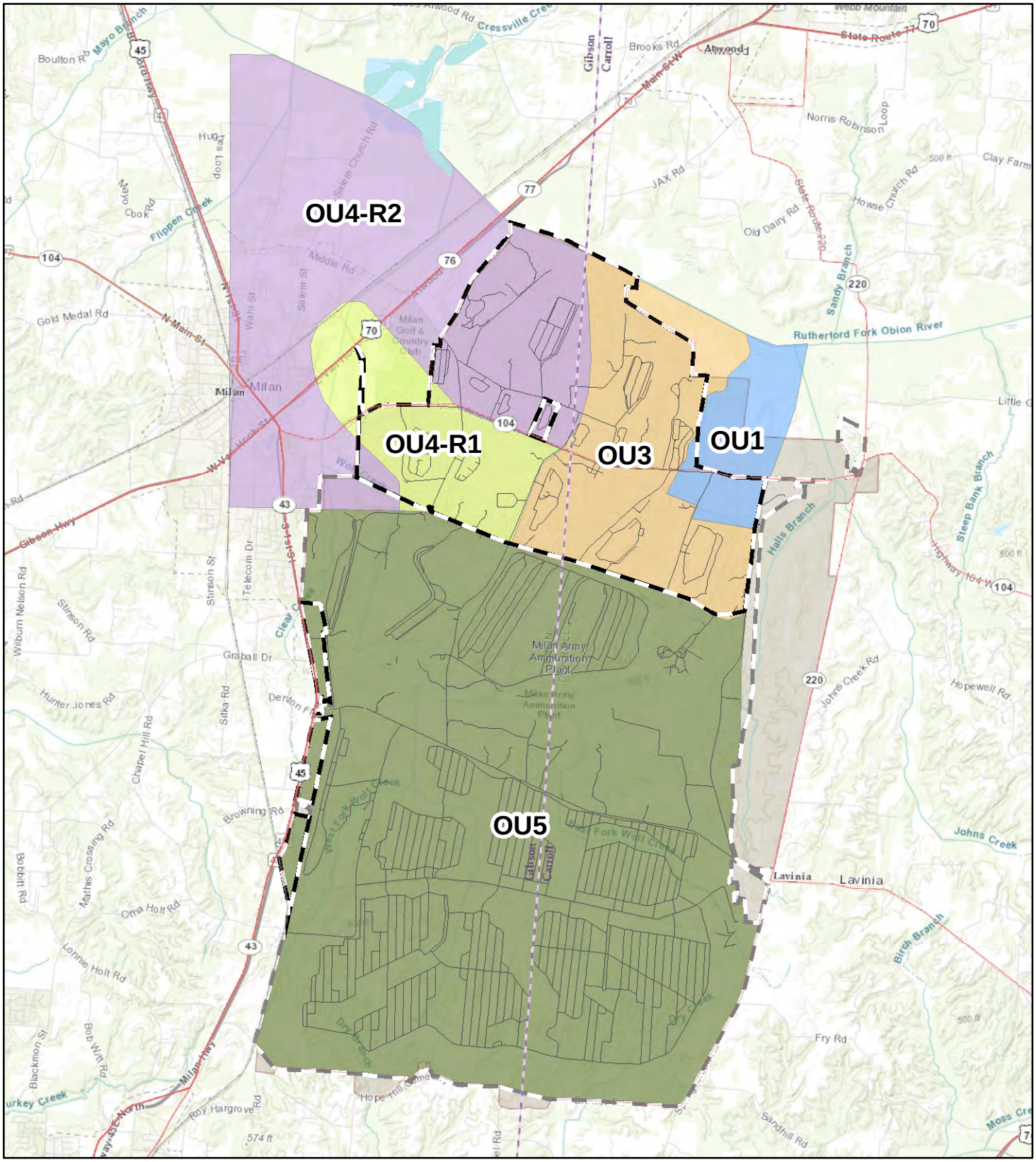


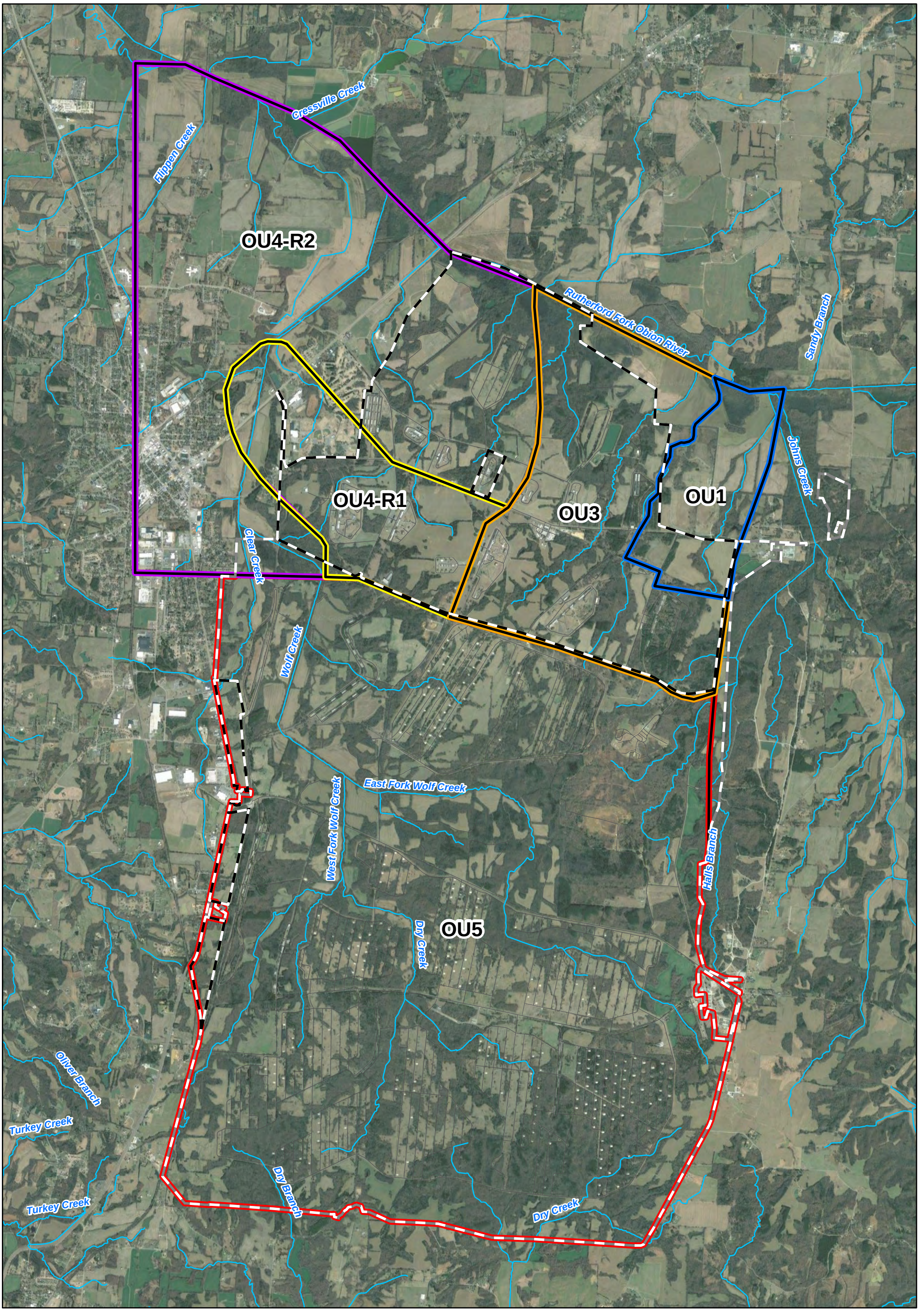
MILAN ARMY AMMUNITION PLANT
MILAN, TENNESSEE

OU Site Location Map

Environmental Chemical Corporation

FIGURE
B-17 (I-1)

ECC GIS Server E:\Projects\MLAAP\MapDocuments\RASR\Year14\Fig1-1_SiteLocationMap.mxd June 2023 Map Size: A



Legend

- Installation Boundary
- Parcel transferred to TNARNG
- Stream/River
- Road

Groundwater Operable Unit Boundaries

- OU1
- OU3
- OU4-R1
- OU4-R2
- OU5

N

0 0.5 1

Miles

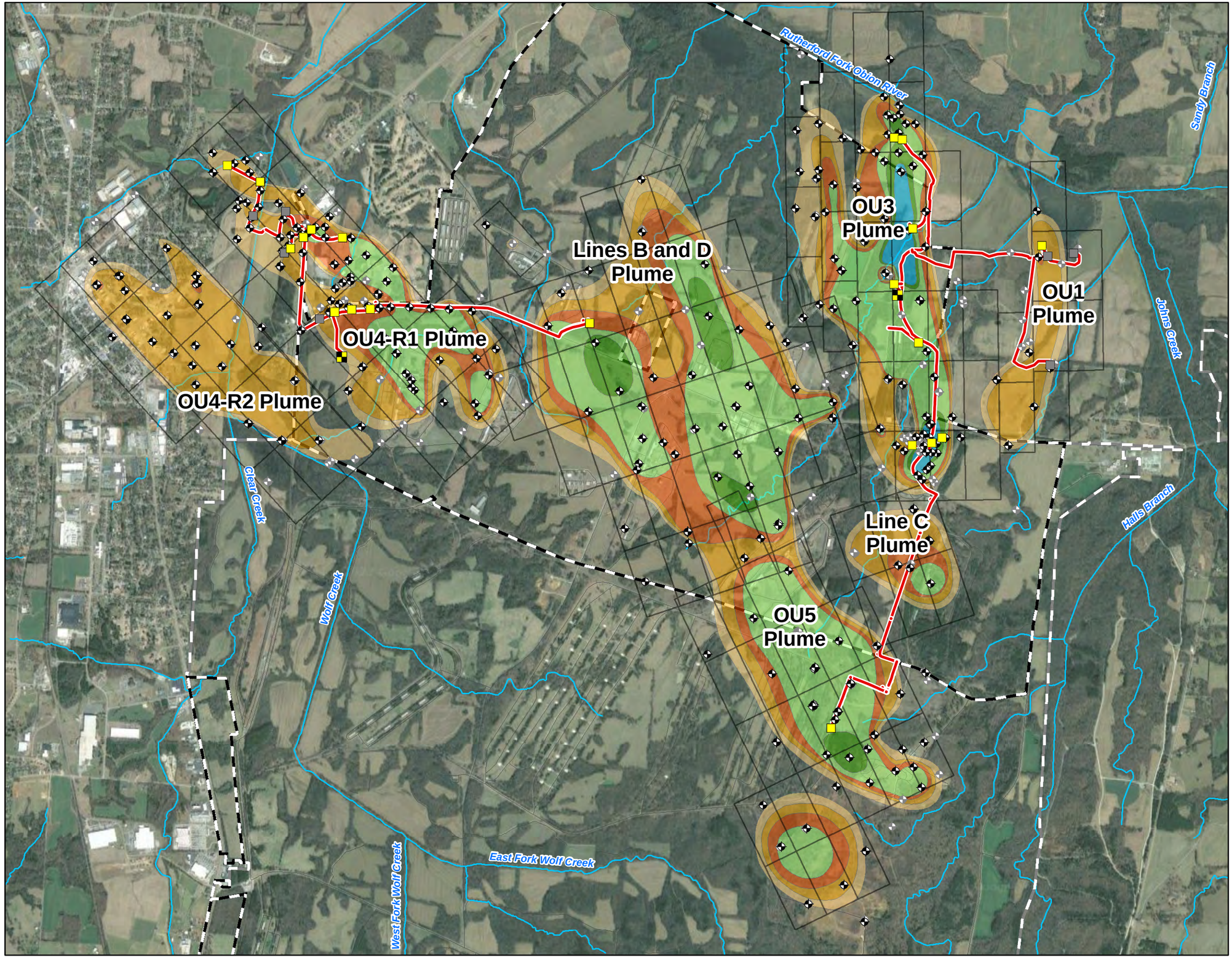
MILAN ARMY AMMUNITION PLANT
MILAN, TENNESSEE

OU MLAAP Site Map

Environmental Chemical Corporation

FIGURE
B-18 (I-2)

ECC GIS Server E:\Projects\MLAAP\MapDocuments\RASR\Year14\Fig1-2_MLAAP_SiteMap.mxd June 2023 Map Size: B



Legend

- Groundwater Treatment Plants (GWTPs)
- Monitoring Well Data Used for Plume Configuration
- Monitoring Well
- Active Extraction Well
- Inactive Extraction Well
- Existing Extraction Piping
- GMA Grid

RDX Concentrations (2022-2023)

- 2 - 10 µg/L
- 10 - 50 µg/L
- 50 - 100 µg/L
- 100 - 500 µg/L
- 500 - 1,000 µg/L
- > 1,000 µg/L
- Installation Boundary
- Parcel transferred to TNARNG
- Stream/River
- Road

N

0 0.5 1

Miles

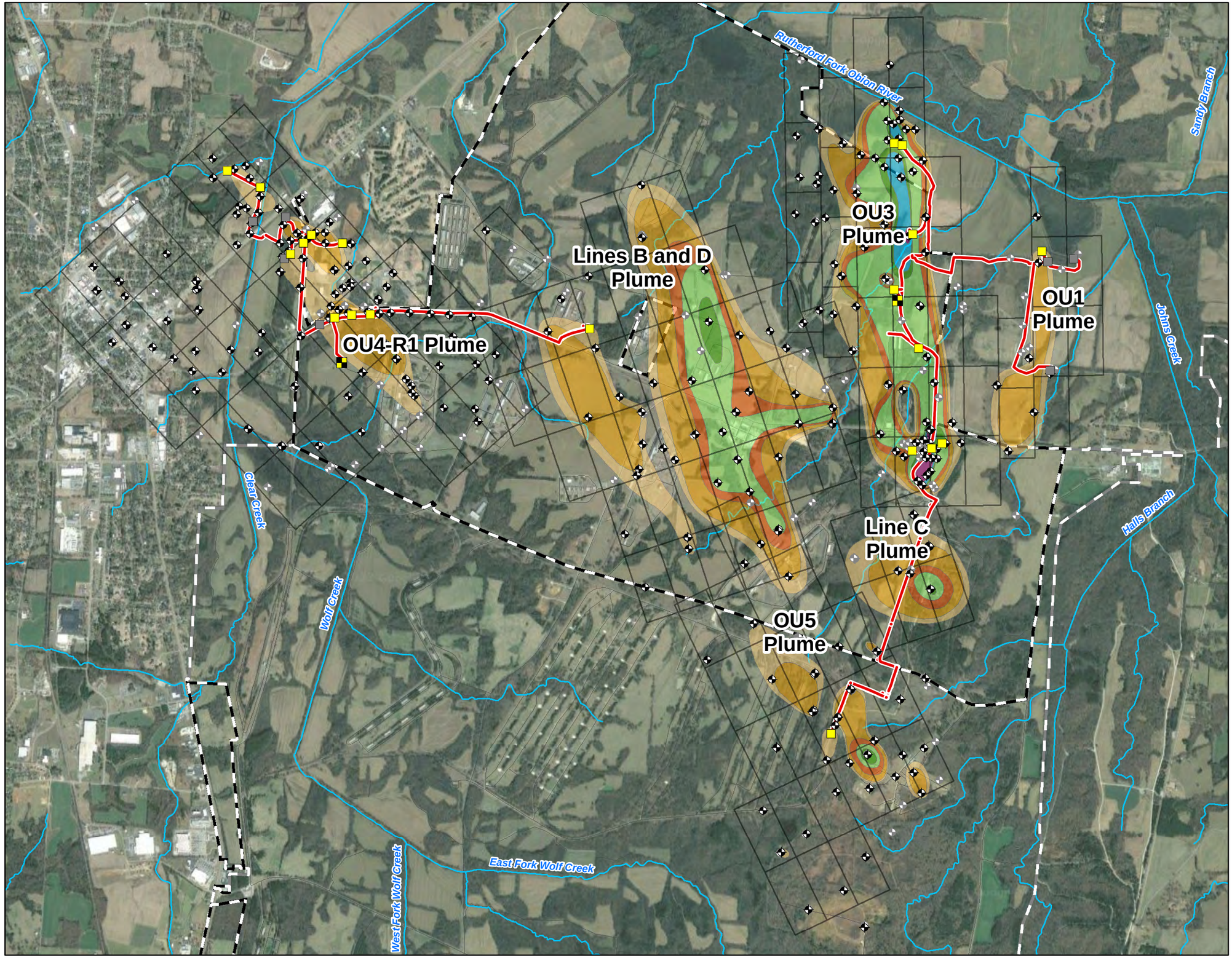
MILAN ARMY AMMUNITION PLANT
MILAN, TENNESSEE

Horizontal Distribution of RDX in Site-Wide Groundwater - RASR Year 9

Environmental Chemical Corporation

FIGURE
B-19 (I-3)

ECC GIS Server E:\Projects\MLAAP\MapDocuments\RASR\Year14\Fig6-01_RASR09_RDXplume.mxd June 2023 Map Size: B



Legend

- Groundwater Treatment Plants (GWTPs)
- Monitoring Well Data Used for Plume Configuration
- Monitoring Well
- Active Extraction Well
- Inactive Extraction Well
- Existing Extraction Piping
- GMA Grid

TNT Concentrations (2022-2023)

- 2 - 10 µg/L
- 10 - 50 µg/L
- 50 - 100 µg/L
- 100 - 500 µg/L
- 500 - 1000 µg/L
- 1,000 - 2,000 µg/L
- > 2,000 µg/L
- Installation Boundary
- Parcel transferred to TNARNG
- Stream/River
- Road

N

0 0.5 1

Miles

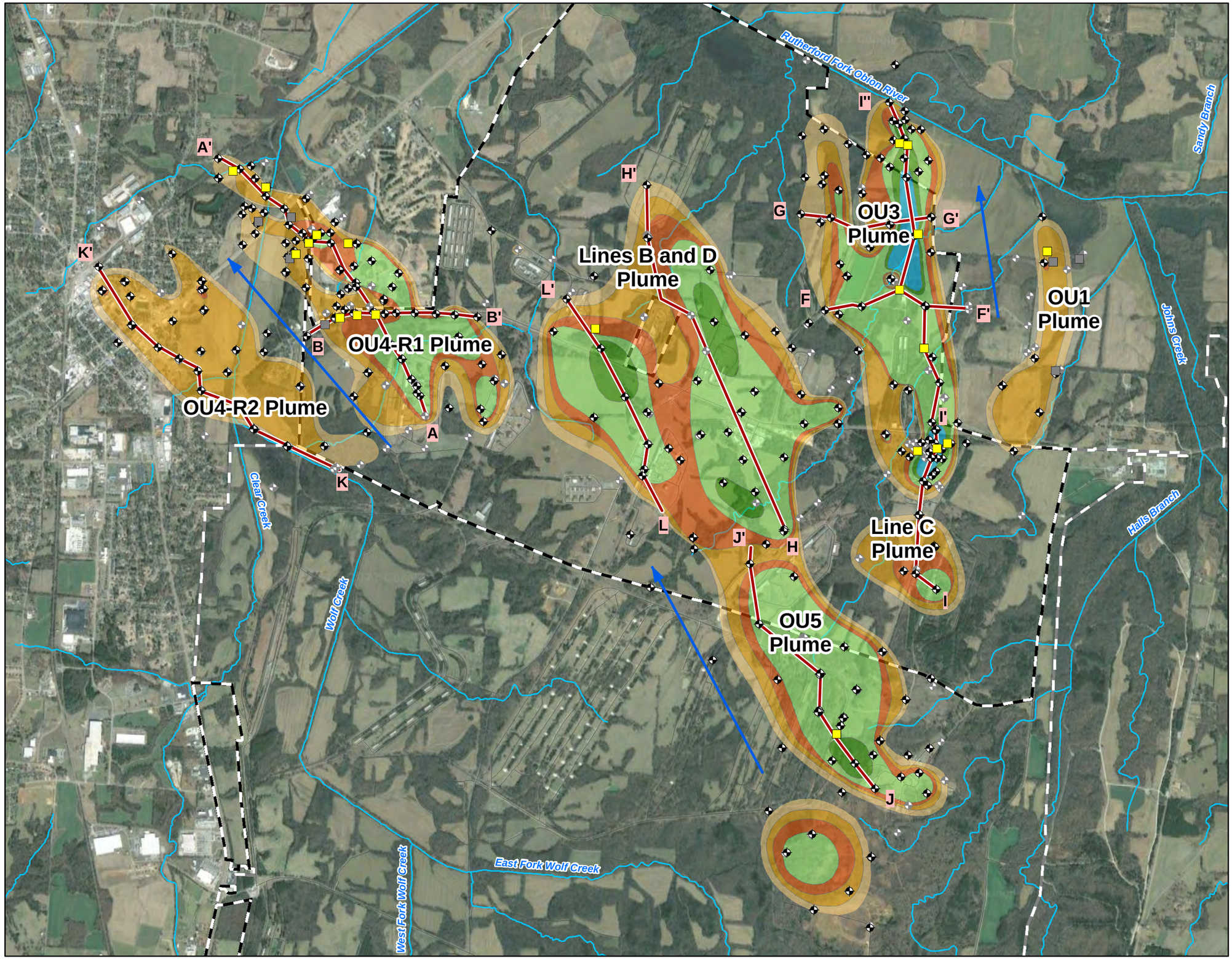
MILAN ARMY AMMUNITION PLANT
MILAN, TENNESSEE

Horizontal Distribution of TNT in Site-Wide Groundwater - RASR Year 9

Environmental Chemical Corporation

FIGURE
B-20 (I-4)

ECC GIS Server E:\Projects\MLAAP\MapDocuments\RASR\Year14\Fig6-02_RASR09_TNTplume.mxd June 2023 Map Size: B



Legend

- Monitoring Well Data Used for Plume Configuration
- Monitoring Well
- Active Extraction Well
- Inactive Extraction Well
- Cross-section
- Approximate Groundwater Flow Direction

RDX Concentrations (2022-2023)

- 2 - 10 µg/L
- 10 - 50 µg/L
- 50 - 100 µg/L
- 100 - 500 µg/L
- 500 - 1,000 µg/L
- > 1,000 µg/L
- Installation Boundary
- Parcel transferred to TNARNG
- Stream/River
- Road

N

0 0.5 1

Miles

MILAN ARMY AMMUNITION PLANT
MILAN, TENNESSEE

Cross-section Location Map and Groundwater Flow Direction

Environmental Chemical Corporation

FIGURE
B-21 (I-5)

ECC GIS Server E:\Projects\MLAAP\MapDocuments\RASR\Year14\Fig6-03_RASR09_CrossSectionLine.mxd June 2023 Map Size: B

Line C Plume

OU5 Plume

MI486 398.70
MI387 400.27
MI680 399.16
MI065 400.13
MI663 401.70
MI490 401.33
MI675 400.22
MI664 402.60
MI159 401.70
MI286 402.85
MI701 403.87
MI063 404.75
MI709 402.11
MI702 403.76
MI299 404.55
MI264 406.62
MI162 407.27
MI281 406.00
MI266 408.48
MI280 406.95
MI684 407.14
EXT-111
MI252 409.53
MI287 410.35
MI017 407.20
MI254 410.63
MI413 406.34
MI250 410.00
MI713 408.36
MI683 409.77
MI256 411.43
MI257 412.09
MI261 411.16
MI263 410.19
MI259 412.28
MI291 408.70
MI260 412.60
MI289 411.10
MI271 413.40
MI296 411.25
MI269 414.39
MI272 414.53
MI019 416.35

399'
400'
401'
402'
403'
404'
405'
406'
407'
408'
409'
410'
411'
412'
413'
414'
415'
416'

East Fork Wolf Creek

Legend

- Monitoring Well with Potentiometric Surface Elevation (ft-amsl)
- Active Extraction Well
- Approximate Groundwater Flow Direction
- Potentiometric Surface Elevation Contour (ft-amsl)
- Installation Boundary

RDX Concentrations (2022-2023)

- 2 - 10 µg/L
- 10 - 50 µg/L
- 50 - 100 µg/L
- 100 - 500 µg/L
- 500 - 1,000 µg/L
- > 1,000 µg/L

- Stream/River

N

0 500 1,000
Feet

Notes:
ft-amsl - feet above mean sea level
1. Monitoring wells were gauged at OU5 and Line C in Quarter 1 2023.
2. Potentiometric surface elevations in parentheses not used for contouring.
3. Because of effects from well efficiency, water levels collected from active extraction wells were not used for contouring.

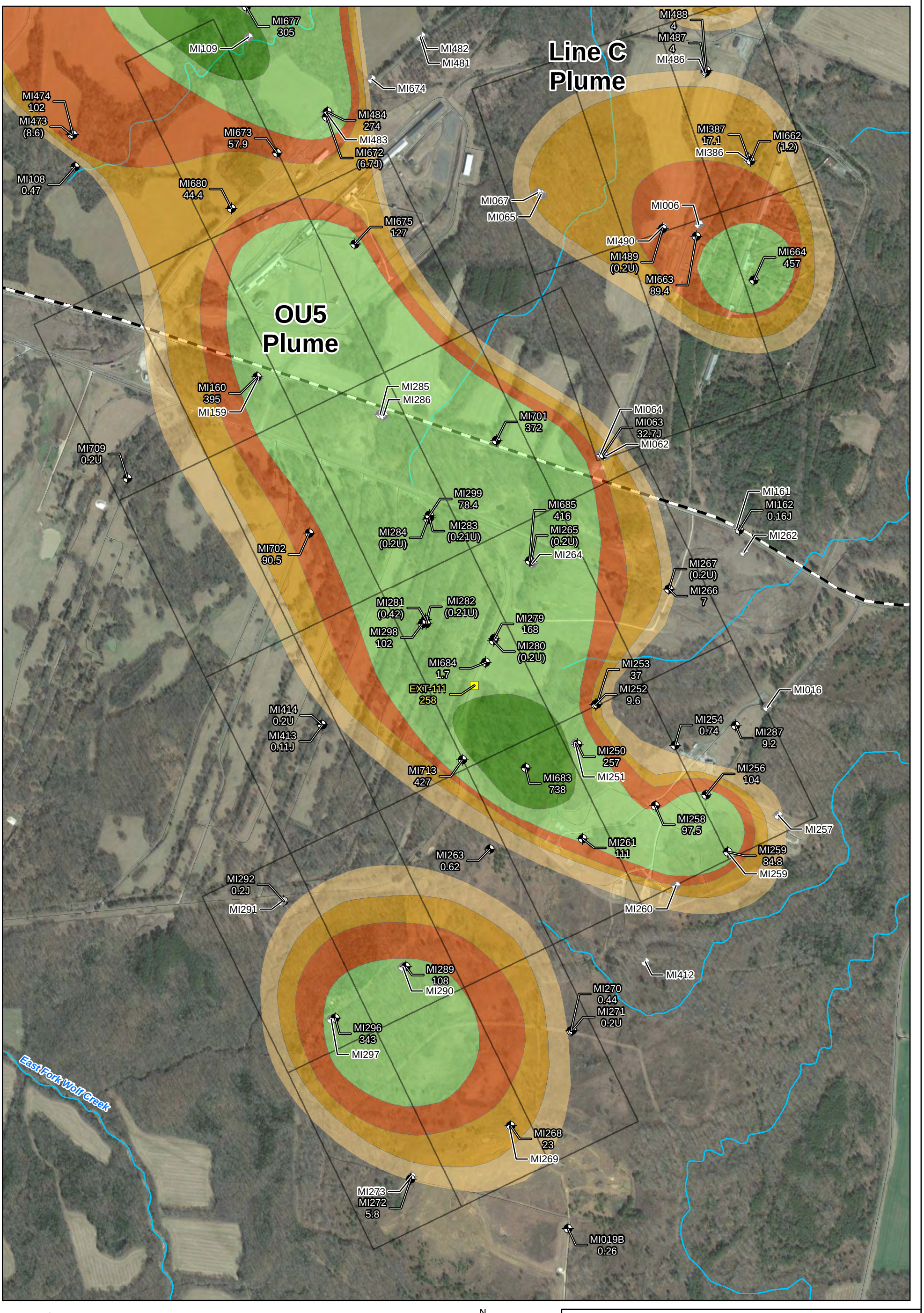
MILAN ARMY AMMUNITION PLANT
MILAN, TENNESSEE

OU5 and Line C Groundwater Potentiometric Surface Map

Environmental Chemical Corporation

FIGURE
B-22 (I-6)

ECC GIS Server E:\Projects\MLAAP\MapDocuments\RASR\Year14\Fig6-18_RASR09_OU5LineC_GW.mxd June 2023 Map Size: B



Legend

- Monitoring Well Data Used for Plume Configuration
- Monitoring Well
- Active Extraction Well
- Inactive Extraction Well
- Installation Boundary
- GMA Grid

RDX Concentrations (2022-2023)

- 2 - 10 µg/L
- 10 - 50 µg/L
- 50 - 100 µg/L
- 100 - 500 µg/L
- 500 - 1,000 µg/L
- > 1,000 µg/L

- Stream/River
- Road

N

0 500 1,000

Feet

Notes:

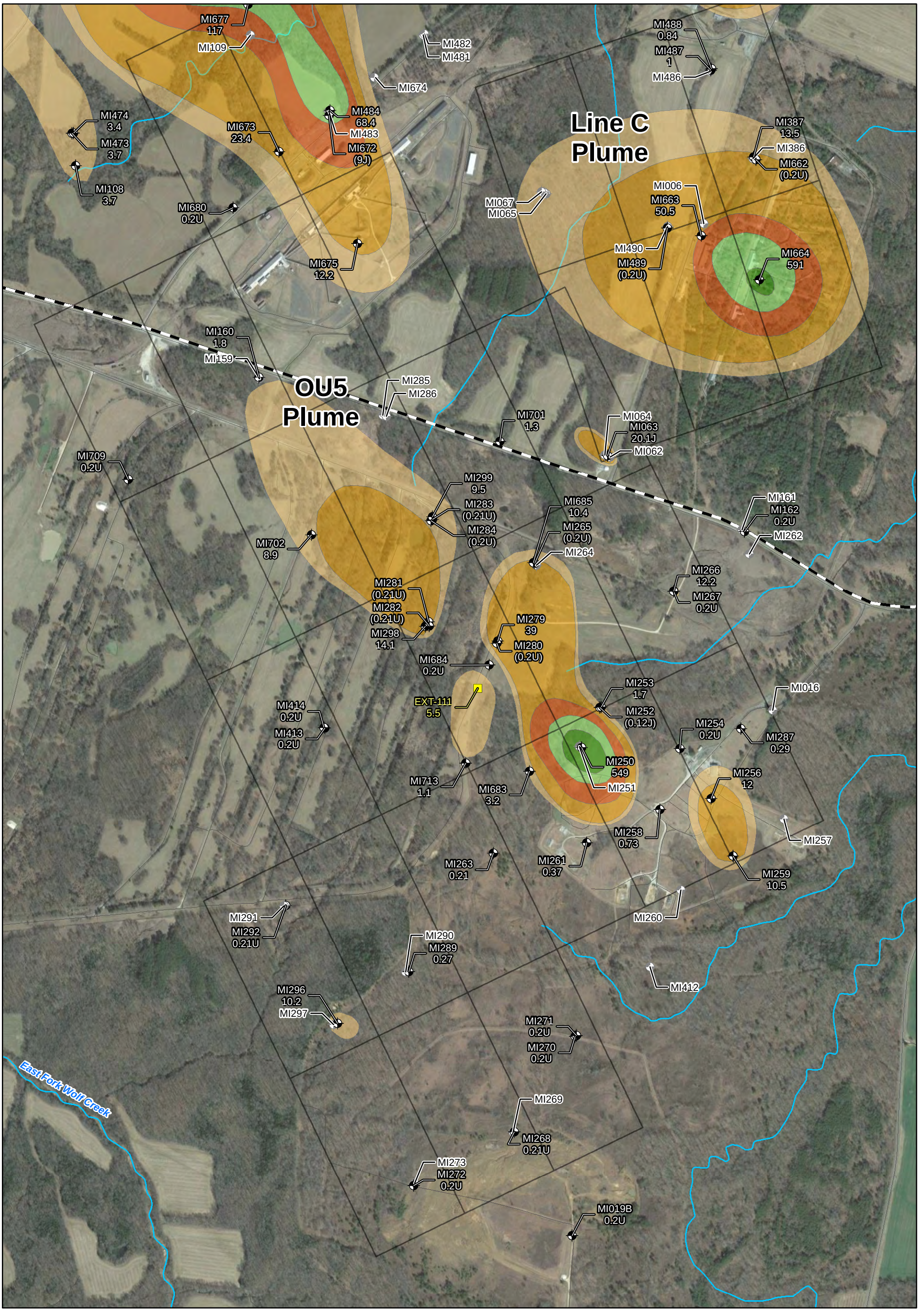
1. Monitoring wells were sampled at OU5 and Line C in Quarter 1 2023.
2. Posted results in µg/L
3. RDX results in parentheses not used for plume contouring

MILAN ARMY AMMUNITION PLANT
MILAN, TENNESSEE

OU5 and Line C
RDX Concentrations in Groundwater

Environmental Chemical Corporation

FIGURE
B-23 (I-7)



Legend

- Monitoring Well Data Used for Plume Configuration
- Monitoring Well
- Active Extraction Well
- Inactive Extraction Well
- Installation Boundary
- GMA Grid

TNT Concentrations (2022-2023)

- 2 - 10 µg/L
- 10 - 50 µg/L
- 50 - 100 µg/L
- 100 - 500 µg/L
- 500 - 1000 µg/L
- 1,000 - 2,000 µg/L
- > 2,000 µg/L

- Stream/River
- Road

N

0 500 1,000

Feet

Notes:
1. Monitoring wells were sampled at OU5 and Line C in Quarter 1 2023.
2. Posted results in µg/L
3. TNT results in parentheses not used for plume contouring

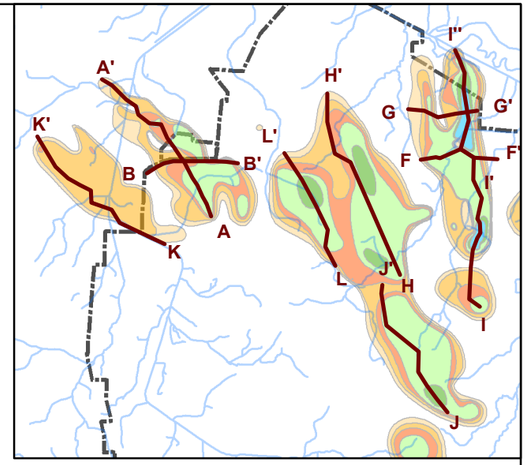
MILAN ARMY AMMUNITION PLANT
MILAN, TENNESSEE

OU5 and Line C
TNT Concentrations in Groundwater

Environmental Chemical Corporation

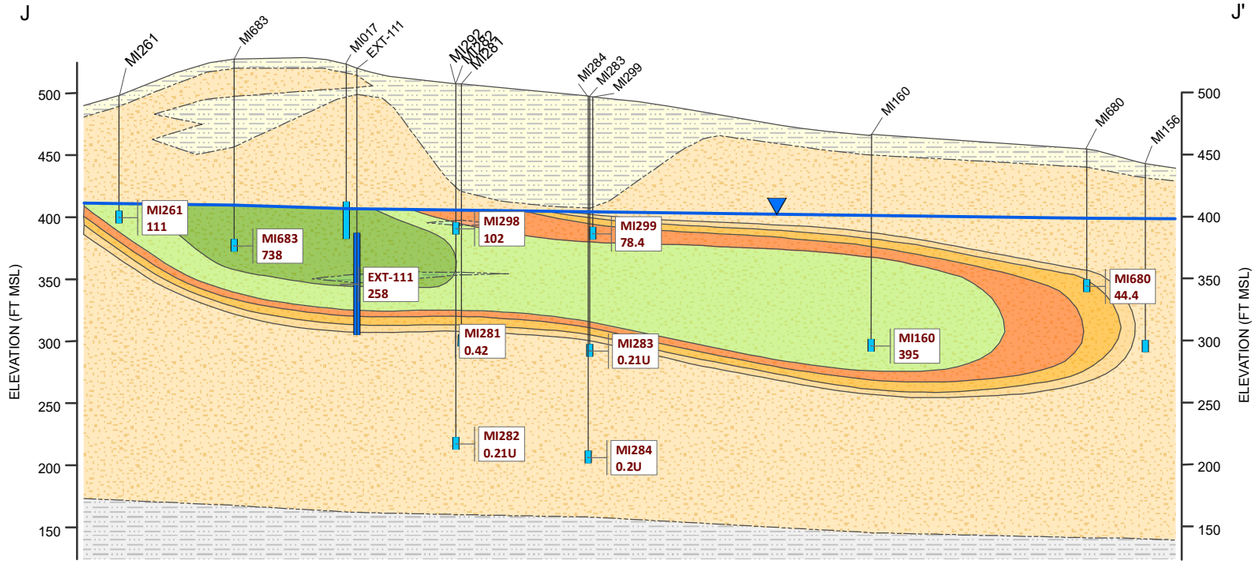
FIGURE
B-24 (I-8)

ECC GIS Server E:\Projects\MLAAP\MapDocuments\RASR\Year14\Fig6-20_RASR09_OU5LineC_TNT.mxd June 2023 Map Size: B



SOUTH
J

NORTH
J'



Legend

- Water Table
- Extraction Well Screen
- Monitoring Well Screen

RASR Year 9 RDX Concentrations (2022-2023)

- 2 - 10 µg/L
- 10 - 50 µg/L
- 50 - 100 µg/L
- 100 - 500 µg/L
- 500 - 1,000 µg/L
- > 1,000 µg/L

Stratigraphy

- Silt, Clay and Sand
- Sand
- Silt and/or Clay

Notes:
1. Posted RDX concentrations in ug/L.
2. If no concentration label, then well was not sampled in RASR Year 9.

J = estimated value

N

0 1,000 2,000

Feet

VERTICAL EXAGGERATION = 10X

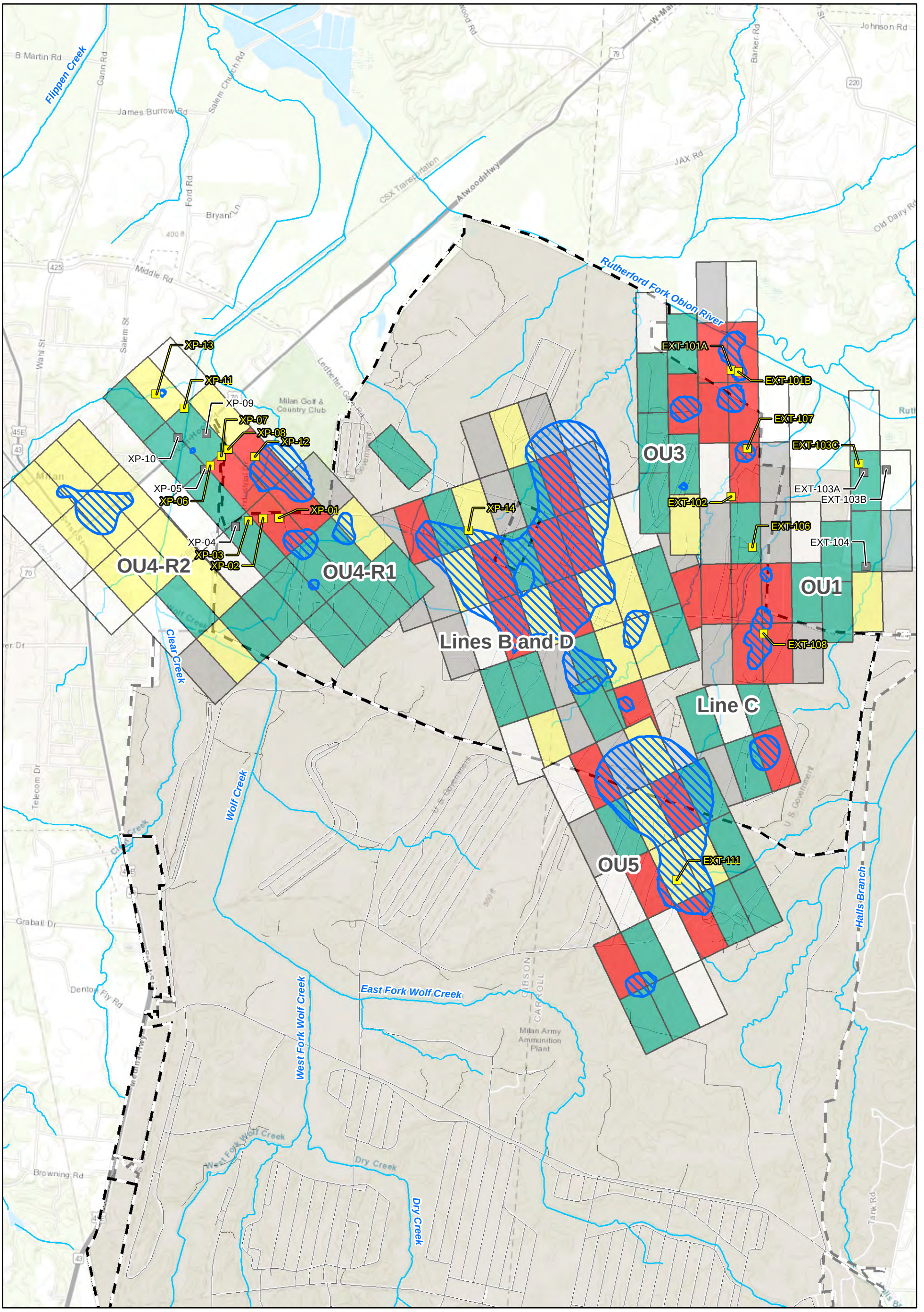
MILAN ARMY AMMUNITION PLANT
MILAN, TENNESSEE

Cross-Section J-J'
RDX Plume
Through OU5

Environmental Chemical Corporation

FIGURE
B-25 (I-9)

ECC GIS Server F:\Projects\MLAAP\MapDocuments\RASR\Year8\Fig6-01_Year8_RDXplume.mxd July 2017 Map Size: B



Legend

- Active Extraction Well
- Inactive Extraction Well
- Projected Areas above the Interim Goal (95 µg/L) in 2030
- Installation Boundary
- Parcel transferred to TNARNG
- Stream/River

GMA Grid

Priority

- First
- Second
- Third
- Fourth
- No Monitoring Wells in the Program

N

0 1,500 3,000

Feet

MILAN ARMY AMMUNITION PLANT
MILAN, TENNESSEE

Estimated Areas Remaining above the Interim Goals at the End Date for Active Remediation (Year 15, 2030)

Environmental Chemical Corporation

FIGURE
B-26 (I-10)

ECC GIS Server E:\Projects\MLAAP\MapDocuments\RASR\Year14\Fig7-07_RASR09_Remedy_Estimate2030.mxd September 2023 Map Size: B

Appendix J-1

Regional Screening Level (RSL) Summary Table, Nov 2024

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; T = ATSDR DRAFT; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; D = OW; R = ORD; N = WI; W = TEF applied; E = RPF applied; G = see user's guide; c = cancer; n = noncancer; * = where: nc SL < 100X ca SL; ** = where nc SL < 10X ca SL; SSL values are based on DAF=1; m = ceiling limit exceeded; s = Csat exceeded; V = volatile; M = mutagen.

Toxicity and Chemical-specific Information														Contaminant		Screening Levels												Protection of Groundwater SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	mutagen	GIABS	ABS_d	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tap Water (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
				3.00E-04	O					1	0.1		Acephate	30560-19-1	1.9E+01	n	2.5E+02	n					6.0E+00	n		1.3E-03	n		
		2.20E-06	I			9.00E-03	I	V		1		1.07E+05	Acetaldehyde	75-07-0	1.1E+01	c**	4.9E+01	c**	1.3E+00	c**	5.6E+00	c**	2.6E+00	c**		5.2E-04	c**		
				2.00E-02	I					1	0.1		Acetochlor	34256-82-1	1.3E+03	n	1.6E+04	n					3.5E+02	n		2.8E-01	n		
				9.00E-01	I			V		1		1.14E+05	Acetone	67-64-1	7.0E+04	n	1.1E+06	nms					1.8E+04	n		3.7E+00	n		
						2.00E-03	X			1	0.1		Acetone Cyanohydrin	75-86-5	2.8E+06	nm	1.2E+07	nm	2.1E+00	n	8.8E+00	n							
						6.00E-02	I	V		1		1.28E+05	Acetonitrile	75-05-8	8.1E+02	n	3.4E+03	n	6.3E+01	n	2.6E+02	n	1.3E+02	n		2.6E-02	n		
				1.00E-01	I			V		1		2.52E+03	Acetophenone	98-86-2	7.8E+03	ns	1.2E+05	nms					1.9E+03	n		5.8E-01	n		
3.80E+00	C	1.30E-03	C							1	0.1		Acetylaminofluorene, 2-	53-96-3	1.4E-01	c	6.0E-01	c	2.2E-03	c	9.4E-03	c	1.6E-02	c		7.5E-05	c		
				5.00E-04	I	2.00E-05	I	V		1		2.27E+04	Acrolein	107-02-8	1.4E-01	n	6.0E-01	n	2.1E-02	n	8.8E-02	n	4.2E-02	n		8.4E-06	n		
5.00E-01	I	1.00E-04	I	2.00E-03	I	6.00E-03	I		M	1	0.1		Acrylamide	79-06-1	2.4E-01	c	4.6E+00	c	1.0E-02	c	1.2E-01	c	5.0E-02	c		1.1E-05	c		
				5.00E-01	I	2.00E-04	P	V		1		1.09E+05	Acrylic Acid	79-10-7	2.0E+01	n	8.3E+01	n	2.1E-01	n	8.8E-01	n	4.2E-01	n		8.5E-05	n		
5.40E-01	I	6.80E-05	I	9.00E-05	T	2.00E-03	I	V		1		1.13E+04	Acrylonitrile	107-13-1	2.5E-01	c*	1.1E+00	c*	4.1E-02	c*	1.8E-01	c*	5.2E-02	c*		1.1E-05	c*		
						6.00E-03	P			1	0.1		Adiponitrile	111-69-3	8.5E+06	nm	3.6E+07	nm	6.3E+00	n	2.6E+01	n							
5.60E-02	C			1.00E-02	I					1	0.1		Alachlor	15972-60-8	9.7E+00	c*	4.1E+01	c					1.1E+00	c	2.0E+00	8.7E-04	c	1.6E-03	
				1.00E-03	I					1	0.1		Aldicarb	116-06-3	6.3E+01	n	8.2E+02	n					2.0E+01	n	3.0E+00	4.9E-03	n	7.5E-04	
				1.00E-03	I					1	0.1		Aldicarb Sulfone	1646-88-4	6.3E+01	n	8.2E+02	n					2.0E+01	n	2.0E+00	4.4E-03	n	4.4E-04	
										1	0.1		Aldicarb sulfoxide	1646-87-3											4.0E+00			8.8E-04	
1.70E+01	I	4.90E-03	I	3.00E-05	I			V		1			Aldrin	309-00-2	3.9E-02	c*	1.8E-01	c	5.7E-04	c	2.5E-03	c	9.2E-04	c		1.5E-04	c		
				4.00E-03	P	1.00E-04	X	V		1		1.11E+05	Allyl Alcohol	107-18-6	3.5E+00	n	1.5E+01	n	1.0E-01	n	4.4E-01	n	2.1E-01	n		4.2E-05	n		
2.10E-02	C	6.00E-06	C			1.00E-03	I	V		1		1.42E+03	Allyl Chloride	107-05-1	7.2E-01	c**	3.2E+00	c**	4.7E-01	c**	2.0E+00	c**	7.3E-01	c**		2.3E-04	c**		
				1.00E+00	P	5.00E-03	P			1			Aluminum	7429-90-5	7.7E+04	n	1.1E+06	nm	5.2E+00	n	2.2E+01	n	2.0E+04	n		3.0E+04	n		
				4.00E-04	I					1			Aluminum Phosphide	20859-73-8	3.1E+01	n	4.7E+02	n					8.0E+00	n					
				9.00E-03	I					1	0.1		Ametryn	834-12-8	5.7E+02	n	7.4E+03	n					1.5E+02	n		1.6E-01	n		
2.10E+01	C	6.00E-03	C							1	0.1		Aminobiphenyl, 4-	92-67-1	2.6E-02	c	1.1E-01	c	4.7E-04	c	2.0E-03	c	3.0E-03	c		1.5E-05	c		
				8.00E-02	P					1	0.1		Aminophenol, m-	591-27-5	5.1E+03	n	6.6E+04	n					1.6E+03	n		6.1E-01	n		
				4.00E-03	X					1	0.1		Aminophenol, o-	95-55-6	2.5E+02	n	3.3E+03	n					7.9E+01	n		3.0E-02	n		
				2.00E-02	P					1	0.1		Aminophenol, p-	123-30-8	1.3E+03	n	1.6E+04	n					4.0E+02	n		1.5E-01	n		
				2.50E-03	I					1	0.1		Amitraz	33089-61-1	1.6E+02	n	2.1E+03	n					8.2E+00	n		4.2E+00	n		
						5.00E-01	I	V		1			Ammonia	7664-41-7					5.2E+02	n	2.2E+03	n							
				2.00E-03	X					1	0.1		Ammonium Picrate	131-74-8	1.3E+02	n	1.6E+03	n					4.0E+01	n		1.9E-01	n		
				2.00E-01	I					1			Ammonium Sulfamate	7773-06-0	1.6E+04	n	2.3E+05	nm					4.0E+03	n					
						3.00E-03	X	V		1		1.37E+04	Amyl Alcohol, tert-	75-85-4	8.2E+01	n	3.4E+02	n	3.1E+00	n	1.3E+01	n	6.3E+00	n		1.3E-03	n		
5.70E-03	I	1.60E-06	C	7.00E-03	P	1.00E-03	I			1	0.1		Aniline	62-53-3	9.5E+01	c**	4.0E+02	c*	1.0E+00	n	4.4E+00	n	1.3E+01	c*		4.6E-03	c*		
4.00E-02	P			2.00E-03	X					1	0.1		Anthraquinone, 9,10-	84-65-1	1.4E+01	c**	5.7E+01	c*					1.4E+00	c*		1.4E-02	c*		
				4.00E-04	I	3.00E-04	A			0.15			Antimony (metallic)	7440-36-0	3.1E+01	n	4.7E+02	n	3.1E-01	n	1.3E+00	n	7.8E+00	n	6.0E+00	3.5E-01	n	2.7E-01	
				5.00E-04	H					0.15			Antimony Pentoxide	1314-60-9	3.9E+01	n	5.8E+02	n					9.7E+00	n					
				4.00E-04	H					0.15			Antimony Tetroxide	1332-81-6	3.1E+01	n	4.7E+02	n					7.8E+00	n					
						2.00E-04	I			0.15			Antimony Trioxide	1309-64-4	2.8E+05	nm	1.2E+06	nm	2.1E-01	n	8.8E-01	n							
1.50E+00	I	4.30E-03	I	3.00E-04	I	1.50E-05	C			1	0.03		Arsenic, Inorganic	7440-38-2	6.8E-01	c*G	3.0E+00	cG	6.5E-04	c*	2.9E-03	c*	5.2E-02	c	1.0E+01	1.5E-03	c	2.9E-01	
				3.50E-06	C	5.00E-05	I			1			Arsine	7784-42-1	2.7E-01	n	4.1E+00	n	5.2E-02	n	2.2E-01	n	7.0E-02	n					
										1			Asbestos (units in fibers)	1332-21-4											7.0E+06(G)				
				3.60E-01	O					1	0.1		Asulam	3337-71-1	2.3E+04	n	3.0E+05	nm					7.2E+03	n		1.8E+00	n		
2.30E-01	C			3.00E-03	A					1	0.1		Atrazine	1912-24-9	2.4E+00	c*	1.0E+01	c					3.0E-01	c	3.0E+00	2.0E-04	c	1.9E-03	
8.80E-01	C	2.50E-04	C							1	0.1		Auramine	492-80-8	6.2E-01	c	2.6E+00	c	1.1E-02	c	4.9E-02	c	7.8E-02	c		7.1E-04	c		
				4.00E-04	I					1	0.1		Avermectin B1	65195-55-3	2.5E+01	n	3.3E+02	n					8.0E+00	n		1.4E+01	n		
				3.00E-03	A	1.00E-02	A			1	0.1		Azinphos-methyl	86-50-0	1.9E+02	n	2.5E+03	n	1.0E+01	n	4.4E+01	n	5.6E+01	n		1.7E-02	n		
1.10E-01	I	3.10E-05	I					V		1			Azobenzene	103-33-3	5.6E+00	c	2.6E+01	c	9.1E-02	c	4.0E-01	c	1.2E-01	c		9.3E-04	c		
				1.00E+00	P	7.00E-06	P			1	0.1		Azodicarbonamide	123-77-3	8.6E+03	n	4.0E+04	n	7.3E-03	n	3.1E-02	n	2.0E+04	n		6.8E+00	n		
				2.00E-01	I	5.00E-04	H			0.07			Barium	7440-39-3	1.5E+04	n	2.2E+05	nm	5.2E-01	n	2.2E+00	n	3.8E+03	n	2.0E+03	1.6E+02	n	8.2E+01	
				5.00E-03	O			V		1			Benfluralin	1861-40-1	3.9E+02	n	5.8E+03	n					2.8E+01	n		9.4E-01	n		
				5.00E-02	I					1	0.1		Benomyl	17804-35-2	3.2E+03	n	4.1E+04	n					9.7E+02	n		8.5E-01	n		
				2.00E-01	I					1	0.1		Bensulfuron-methyl	83055-99-6	1.3E+04	n	1.6E+05	nm					3.9E+03	n		1.0E+00	n		
				3.00E-02	I					1	0.1		Bentazon	25057-89-0	1.9E+03	n	2.5E+04	n					5.7E+02	n		1.2E-01	n		
4.00E-03	P			1.00E-01	I			V		1		1.16E+03	Benzaldehyde	100-52-7	1.7E+02	c*	8.2E+02	c					1.9E+01	c		4.1E-03	c		
5.50E-02	I	7.80E-06	I	4.00E-03	I	3.00E-02	I	V		1		1.82E+03	Benzene	71-43-2	1.2E+00	c*	5.1E+00	c*	3.6E-01	c*	1.6E+00	c*	4.6E-01	c*	5.0E+00	2.3E-04	c*	2.6E-03	
						4.00E-03	C	V		1		1.82E+02	Benzene, Trimethyl	25551-13-7	5.1E+01	n	2.2E+02	ns	4.2E+00	n	1.8E+01	n	8.3E+00	n		1.2E-02	n		
1.00E-01	X			3.00E-04	X					1	0.1		Benzenediamine-2-methyl sulfate, 1,4-	6369-59-1	5.4E+00	c**	2.3E+01	c*					7.8E-01	c**		2.2E-04	c**		
				1.00E-03	P			V		1		1.26E+03	Benzenethiol	108-98-5	7.8E+01	n	1.2E+03	n					1.7E+01	n		1.1E-02	n		
2.30E+02	I	6.70E-02	I	3.00E-03	I				M	1	0.1		Benzidine	92-87-5	5.3E-04	c	1.0E-02	c	1.5E-05	c	1.8E-04	c	1.1E-04	c		2.8E-07	c		
				4.00E+00	I					1	0.1		Benzoic Acid	65-85-0	2.5E+05	nm	3.3E+06	nm					7.5E+04	n		1.5E+01	n		
								V		1		3.24E+02	Benzotrichloride	98-07-7	5.3E-02	c	2.5E-01	c					3.0E-03	c		6.6E-06	c		
				1.00E-01	P					1	0.1		Benzyl Alcohol	100-51-6	6.3E+03	n	8.2E+04	n					2.0E+03	n		4.8E-01	n		
1.70E-01	I	4.90E-05	C	2.00E-03	P	1.00E-03	P	V		1		1.46E+03	Benzyl Chloride	100-44-7	1.1E+00	c*	4.8E+00	c*	5.7E-02	c*	2.5E-01	c*	8.9E-02	c*		2.1E-04	c*		
		2.40E-03	I	2.00E-03	I	2.00E-05	I			0.007			Beryllium and compounds	7440-41-7	1.6E+02	n	2.3E+03	n	1.2E-03	c*	5.1E-03	c*	2.5E+01	n	4.0E+00	1.9E+01	n	3.2E+00	
				9.00E-03	P					1	0.1		Bifenox	42576-02-3	5.7E+02	n	7.4E+03	n					1.0E+02	n		7.6E-01	n		
				1.50E-02	I					1	0.1		Biphenthrin	82657-04-3	9.5E+02	n	1.2E+04	n					3.0E+02	n		1.4E+03	n		
8.00E-03	I			5.00E-01	I	4.00E-04	X	V		1			Biphenyl, 1,1'-	92-52-4	4.7E+01	n	2.0E+02	n	4.2E-01	n	1.8E+00	n	8.3E-01	n		8.7E-03	n		
				4.00E-02	I			V		1		1.02E+03	Bis(2-chloro-1-methylethyl) ether	108-60-1	3.1E+03	ns	4.7E+04	ns					7.1E+02	n		2.6E-01	n		
				3.00E-03	P					1	0.1		Bis(2-chloroethoxy)methane	111-91-1	1.9E+02	n	2.5E+03	n					5.9E+01	n		1.3E-02	n		
1.10E+00	I	3.30E-04	I					V		1		5.05E+03	Bis(2-chloroethyl)ether	111-44-4	2.3E-01	c	1.0E+00	c	8.5E-03	c	3.7E-02	c	1.4E-02	c		3.6E-06	c		
2.20E+02	I	6.20E-02	I					V		1		4.22E+03	Bis(chloromethyl)ether	542-88-1	8.3E-05	c	3.6E-04	c	4.5E-05	c	2.0E-04	c	7.2E-05	c		1.7E-08	c		
				5.00E-02	I					1	0.1		Bisphenol A	80-05-7	3.2E+03	n	4.1E+04	n					7.7E+02	n		5.8E+01	n		
				2.00E-01	I	2.00E-02	H			1			Boron And Borates Only	7440-42-8	1.6E+04	n	2.3E+05	nm	2.1E+01	n	8.8E+01	n	4.0E+03	n		1.3E+01	n		
				2.00E+00	P	2.00E-02	P	V		1			Boron Trichloride	10294-34-5	1.6E+05	nm	2.3E+06	nm	2.1E+01	n	8.8E+01	n	4.2E+01	n					
				4.00E-02	C	1.30E-02	C	V		1			Boron Trifluoride	7637-07-2	3.1E+03	n	4.7E+04	n	1.4E+01	n	5.7E+01	n	2.6E+01	n					
7.00E-01	I	1.40E-04	C	4.00E-03	I					1			Bromate	15541-45-4	9.9E-01	c	4.7E+00	c	2.0E-02	c	8.8E-02	c	1.1E-01	c	1.0E+01	8.5E-04	c	7.7E-02	
				1.00E-04	X	6.00E-05	X	V		1		2.38E+03	Bromo-2-chloroethane, 1-	107-04-0	3.5E-01	n	1.5E+00	n	6.3E-02	n	2.6E-01	n	1.2E-01	n		3.3E-05	n		
				3.00E-04	X			V		1		8.96E+02	Bromo-3-fluorobenzene, 1-	1073-06-9	2.3E+01	n	3.5E+02	n					4.9E+00	n		4.7E-03	n		
				3.00E-04	X			V		1		3.23E+02	Bromo-4-fluorobenzene, 1-	460-00-4	2.3E+01	n	3.5E+02	ns					4.6E+00	n		4.4E-03	n		
				1.70E-03	C					1	0.1		Bromoacetic acid	79-08-3	1.1E+02	n	1.4E+03	n					3.4E+01	n	6.0E+01(G)	6.9E-03	n	1.2E-02	

TR=1E-06
THQ=1

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; T = ATSDR DRAFT; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; D = OW; R = ORD; N = WI; W = TEF applied; E = RPF applied; G = see user's guide; c = cancer; n = noncancer; * = where: nc SL < 100X ca SL; ** = where nc SL < 10X ca SL; SSL values are based on DAF=1; m = ceiling limit exceeded; s = Csat exceeded; V = volatile; M = mutagen.

Toxicity and Chemical-specific Information													Contaminant		Screening Levels										Protection of Groundwater SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	mutagen	GIABS	ABS_d	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tap Water (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
				8.00E-03	I	6.00E-02	I	V		1		6.79E+02	Bromobenzene	108-86-1	2.9E+02	n	1.8E+03	ns	6.3E+01	n	2.6E+02	n	6.2E+01	n		4.2E-02	n	
						4.00E-02	X	V		1		4.04E+03	Bromochloromethane	74-97-5	1.5E+02	n	6.3E+02	n	4.2E+01	n	1.8E+02	n	8.3E+01	n		2.1E-02	n	
6.20E-02	I	3.70E-05	C	8.00E-03	P			V		1		9.32E+02	Bromodichloromethane	75-27-4	2.9E-01	c	1.3E+00	c	7.6E-02	c	3.3E-01	c	1.3E-01	c	8.0E+01(G)	3.6E-05	c	2.2E-02
7.90E-03	I	1.10E-06	I	2.00E-02	I			V		1		9.15E+02	Bromoform	75-25-2	1.9E+01	c*	8.6E+01	c	2.6E+00	c	1.1E+01	c	3.3E+00	c	8.0E+01(G)	8.7E-04	c	2.1E-02
				1.40E-03	I	5.00E-03	I	V		1		3.59E+03	Bromomethane	74-83-9	6.8E+00	n	3.0E+01	n	5.2E+00	n	2.2E+01	n	7.5E+00	n		1.9E-03	n	
				5.00E-03	H			V		1			Bromophos	2104-96-3	3.9E+02	n	5.8E+03	n					3.5E+01	n		1.5E-01	n	
		3.70E-06	C			1.00E-01	A	V		1		9.66E+02	Bromopropane, 1-	106-94-5	1.6E+00	c	7.1E+00	c	7.6E-01	c	3.3E+00	c	1.5E+00	c		4.6E-04	c	
1.03E-01	O			1.50E-02	O					1	0.1		Bromoxynil	1689-84-5	5.3E+00	c	2.2E+01	c					6.1E-01	c		5.2E-04	c	
1.03E-01	O			1.50E-02	O			V		1			Bromoxynil Octanoate	1689-99-2	6.7E+00	c	3.2E+01	c					2.4E-01	c		2.1E-03	c	
6.00E-01	C	3.00E-05	I			2.00E-03	I	V		1		6.67E+02	Butadiene, 1,3-	106-99-0	7.6E-02	c*	3.3E-01	c*	9.4E-02	c*	4.1E-01	c*	7.1E-02	c*		3.9E-05	c*	
				1.00E-01	I			V		1		7.64E+03	Butanol, N-	71-36-3	7.8E+03	ns	1.2E+05	nms					2.0E+03	n		4.1E-01	n	
5.00E-04	I			4.00E-01	I	5.00E+00	I	V		1			Butyl Alcohol, t-	75-65-0	1.4E+03	c*	6.5E+03	c*	5.2E+03	n	2.2E+04	n	1.5E+02	c*		3.2E-02	c*	
				2.00E+00	P	3.00E+01	P	V		1		2.13E+04	Butyl alcohol, sec-	78-92-2	1.3E+05	nms	1.5E+06	nms	3.1E+04	n	1.3E+05	n	2.4E+04	n		5.0E+00	n	
				5.00E-02	I			V		1			Butylate	2008-41-5	3.9E+03	n	5.8E+04	n					4.6E+02	n		4.5E-01	n	
2.00E-04	C	5.70E-08	C							1	0.1		Butylated hydroxyanisole	25013-16-5	2.7E+03	c	1.1E+04	c	4.9E+01	c	2.2E+02	c	1.5E+02	c		2.9E-01	c	
3.60E-03	P			3.00E-01	P					1	0.1		Butylated hydroxytoluene	128-37-0	1.5E+02	c	6.4E+02	c					3.4E+00	c		1.0E-01	c	
				5.00E-02	P			V		1		1.08E+02	Butylbenzene, n-	104-51-8	3.9E+03	ns	5.8E+04	ns					1.0E+03	n		3.2E+00	n	
				1.00E-01	X			V		1		1.45E+02	Butylbenzene, sec-	135-98-8	7.8E+03	ns	1.2E+05	nms					2.0E+03	n		5.9E+00	n	
				1.00E-01	X			V		1		1.83E+02	Butylbenzene, tert-	98-06-6	7.8E+03	ns	1.2E+05	nms					6.9E+02	n		1.6E+00	n	
				2.00E-02	A					1	0.1		Cacodylic Acid	75-60-5	1.3E+03	n	1.6E+04	n					4.0E+02	n		1.1E-01	n	
		1.80E-03	I	1.00E-04	A	1.00E-05	A			0.025	0.001		Cadmium (Diet)	7440-43-9	7.1E+00	n	1.0E+02	n	1.6E-03	c**	6.8E-03	c**						
		1.80E-03	I	1.00E-04	A	1.00E-05	A			0.05	0.001		Cadmium (Water)	7440-43-9					1.6E-03	c**	6.8E-03	c**	1.8E+00	n	5.0E+00	1.4E-01	n	3.8E-01
				5.00E-01	I	2.20E-03	C			1	0.1		Caprolactam	105-60-2	3.1E+04	n	4.0E+05	nm	2.3E+00	n	9.6E+00	n	9.9E+03	n		2.5E+00	n	
1.50E-01	C	4.30E-05	C	2.00E-03	I					1	0.1		Captafol	2425-06-1	3.6E+00	c*	1.5E+01	c	6.5E-02	c	2.9E-01	c	4.0E-01	c*		7.1E-04	c*	
2.30E-03	C	6.60E-07	C	1.30E-01	I					1	0.1		Captan	133-06-2	2.4E+02	c*	1.0E+03	c	4.3E+00	c	1.9E+01	c	3.1E+01	c*		2.2E-02	c*	
				1.00E-01	I					1	0.1		Carbaryl	63-25-2	6.3E+03	n	8.2E+04	n					1.8E+03	n		1.7E+00	n	
				5.00E-03	I					1	0.1		Carbofuran	1563-66-2	3.2E+02	n	4.1E+03	n					9.4E+01	n	4.0E+01	3.7E-02	n	1.6E-02
				1.00E-01	I	7.00E-01	I	V		1		7.38E+02	Carbon Disulfide	75-15-0	7.7E+02	ns	3.5E+03	ns	7.3E+02	n	3.1E+03	n	8.1E+02	n		2.4E-01	n	
7.00E-02	I	6.00E-06	I	4.00E-03	I	1.00E-01	I	V		1		4.58E+02	Carbon Tetrachloride	56-23-5	6.5E-01	c	2.9E+00	c	4.7E-01	c	2.0E+00	c	4.6E-01	c	5.0E+00	1.8E-04	c	1.9E-03
						1.00E-01	P	V		1		5.89E+03	Carbonyl Sulfide	463-58-1	6.7E+01	n	2.8E+02	n	1.0E+02	n	4.4E+02	n	2.1E+02	n		5.1E-01	n	
				1.00E-02	I					1	0.1		Carbosulfan	55285-14-8	6.3E+02	n	8.2E+03	n					5.1E+01	n		1.2E+00	n	
				1.00E-01	I					1	0.1		Carboxin	5234-68-4	6.3E+03	n	8.2E+04	n					1.9E+03	n		1.0E+00	n	
						9.00E-04	I			1			Ceric oxide	1306-38-3	1.3E+06	nm	5.4E+06	nm	9.4E-01	n	3.9E+00	n						
				1.00E-01	I			V		1			Chloral Hydrate	302-17-0	7.8E+03	n	1.2E+05	nm					2.0E+03	n		4.0E-01	n	
				1.50E-02	I					1	0.1		Chloramben	133-90-4	9.5E+02	n	1.2E+04	n					2.9E+02	n		7.0E-02	n	
										1	0.1		Chloramines, Organic	E701235											4.0E+03(G)			
4.03E-01	H									1	0.1		Chloranil	118-75-2	1.3E+00	c	5.7E+00	c					1.8E-01	c		1.5E-04	c	
				5.00E-04	G			V		1	0.04		Chlordane (alpha)	5103-71-9	3.6E+01	n	5.0E+02	n					3.6E+00	n		4.9E-01	n	
				5.00E-04	G			V		1	0.04		Chlordane (gamma)	5103-74-2	3.6E+01	n	5.0E+02	n					1.0E+01	n		1.4E+00	n	
3.50E-01	I	1.00E-04	I	5.00E-04	I	7.00E-04	I	V		1	0.04		Chlordane (technical mixture)	12789-03-6	1.7E+00	c*	7.7E+00	c*	2.8E-02	c*	1.2E-01	c*	2.0E-02	c*	2.0E+00	2.7E-03	c*	2.7E-01
1.00E+01	I	4.60E-03	C	3.00E-04	I					1	0.1		Chlordecone (Kepone)	143-50-0	5.4E-02	c	2.3E-01	c	6.1E-04	c	2.7E-03	c	3.5E-03	c		1.2E-04	c	
				7.00E-04	A					1	0.1		Chlorfenvinphos	470-90-6	4.4E+01	n	5.7E+02	n					1.1E+01	n		3.1E-02	n	
				9.00E-02	O					1	0.1		Chlorimuron, Ethyl-	90982-32-4	5.7E+03	n	7.4E+04	n					1.8E+03	n		6.0E-01	n	
				1.00E-01	I	1.45E-04	A	V		1		2.78E+03	Chlorine	7782-50-5	1.8E-01	n	7.8E-01	n	1.5E-01	n	6.4E-01	n	3.0E-01	n	4.0E+03(G)	1.5E-04	n	2.0E+00
				3.00E-02	I	2.00E-04	I	V		1			Chlorine Dioxide	10049-04-4	2.3E+03	n	3.4E+04	n	2.1E-01	n	8.8E-01	n	4.2E-01	n	8.0E+02(G)			
				3.00E-02	I					1			Chlorite (Sodium Salt)	7758-19-2	2.3E+03	n	3.5E+04	n					6.0E+02	n	1.0E+03			
						5.00E-01	I	V		1		1.15E+03	Chloro-1,1-difluoroethane, 1-	75-68-3	5.4E+04	ns	2.3E+05	nms	5.2E+04	n	2.2E+05	n	1.0E+05	n		5.2E+01	n	
		3.00E-04	I	2.00E-02	H	2.00E-02	I	V	M	1		7.86E+02	Chloro-1,3-butadiene, 2- (Chloroprene)	126-99-8	3.6E-03	c	4.4E-02	c	3.4E-03	c	4.1E-02	c	6.8E-03	c		3.6E-06	c	
4.60E-01	H									1	0.1		Chloro-2-methylaniline HCl, 4-	3165-93-3	1.2E+00	c	5.0E+00	c					1.7E-01	c		1.5E-04	c	
1.00E-01	P	7.70E-05	C	3.00E-03	X					1	0.1		Chloro-2-methylaniline, 4-	95-69-2	5.4E+00	c*	2.3E+01	c	3.6E-02	c	1.6E-01	c	7.0E-01	c*		4.0E-04	c*	
2.70E-01	X							V		1		1.18E+04	Chloroacetaldehyde, 2-	107-20-0	2.6E+00	c	1.2E+01	c					2.9E-01	c		5.8E-05	c	
				3.50E-03	C					1	0.1		Chloroacetic Acid	79-11-8	2.2E+02	n	2.9E+03	n					7.0E+01	n	6.0E+01(G)	1.4E-02	n	1.2E-02
						3.00E-05	I			1	0.1		Chloroacetophenone, 2-	532-27-4	4.3E+04	n	1.8E+05	nm	3.1E-02	n	1.3E-01	n						
2.00E-01	P			5.00E-04	P					1	0.1		Chloroaniline, p-	106-47-8	2.7E+00	c*	1.1E+01	c*					3.7E-01	c*		1.6E-04	c*	
				2.00E-02	I	5.00E-02	P	V		1		7.61E+02	Chlorobenzene	108-90-7	2.8E+02	n	1.3E+03	ns	5.2E+01	n	2.2E+02	n	7.8E+01	n	1.0E+02	5.3E-02	n	6.8E-02
				1.00E-01	X					1	0.1		Chlorobenzene sulfonic acid, p-	98-66-8	6.3E+03	n	8.2E+04	n					2.0E+03	n		4.7E-01	n	
1.10E-01	C	3.10E-05	C	2.00E-02	I					1	0.1		Chlorobenzilate	510-15-6	4.9E+00	c	2.1E+01	c	9.1E-02	c	4.0E-01	c	3.1E-01	c		1.0E-03	c	
				3.00E-02	X					1	0.1		Chlorobenzoic Acid, p-	74-11-3	1.9E+03	n	2.5E+04	n					5.1E+02	n		1.3E-01	n	
		8.60E-06	C	3.00E-03	P	3.00E-01	P	V		1		2.90E+02	Chlorobenzotrifluoride, 4-	98-56-6	2.2E+00	c*	9.6E+00	c	3.3E-01	c	1.4E+00	c	6.5E-01	c*		2.3E-03	c*	
				4.00E-02	P			V		1		7.28E+02	Chlorobutane, 1-	109-69-3	3.1E+03	ns	4.7E+04	ns					6.4E+02	n		2.6E-01	n	
						5.00E+01	I	V		1		1.68E+03	Chlorodifluoromethane	75-45-6	4.9E+04	ns	2.1E+05	nms	5.2E+04	n	2.2E+05	n	1.0E+05	n		4.3E+01	n	
				2.00E-02	P			V		1		1.11E+05	Chloroethanol, 2-	107-07-3	1.6E+03	n	2.3E+04	n					4.0E+02	n		8.1E-02	n	
3.10E-02	C	2.30E-05	I	1.00E-02	I	1.95E-03	T	V		1		2.54E+03	Chloroform	67-66-3	3.2E-01	c*	1.4E+00	c*	1.2E-01	c*	5.3E-01	c*	2.2E-01	c*	8.0E+01(G)	6.1E-05	c*	2.2E-02
						9.00E-02	I	V		1		1.32E+03	Chloromethane	74-87-3	1.1E+02	n	4.6E+02	n	9.4E+01	n	3.9E+02	n	1.9E+02	n		4.9E-02	n	
2.40E+00	C	6.90E-04	C					V		1		9.32E+03	Chloromethyl Methyl Ether	107-30-2	2.0E-02	c	8.9E-02	c	4.1E-03	c	1.8E-02	c	6.5E-03	c		1.4E-06	c	
3.00E-01	P			3.00E-03	P	1.00E-05	X			1	0.1		Chloronitrobenzene, o-	88-73-3	1.8E+00	c	7.7E+00	c	1.0E-02	n	4.4E-02	n	2.4E-01	c		2.2E-04	c	
6.00E-02	P			7.00E-04	P	2.00E-03	P			1	0.1		Chloronitrobenzene, p-	100-00-5	9.0E+00	c**	3.8E+01	c*	2.1E+00	n	8.8E+00	n	1.2E+00	c*		1.1E-03	c*	
				5.00E-03	I			V		1		2.74E+04	Chlorophenol, 2-	95-57-8	3.9E+02	n	5.8E+03	n					9.1E+01	n		8.9E-02	n	
						4.00E-04	C	V		1		6.17E+02	Chloropicrin	76-06-2	2.0E+00	n	8.2E+00	n	4.2E-01	n	1.8E+00	n	8.3E-01	n		2.5E-04	n	
1.70E-02	C			1.50E-02	I					1	0.1		Chlorothalonil	1897-45-6	3.2E+01	c*	1.4E+02	c*					4.0E+00	c*		9.0E-03	c*	
				2.00E-02	I			V		1		9.07E+02	Chlorotoluene, o-	95-49-8	1.6E+03	ns	2.3E+04	ns					2.4E+02	n		2.3E-01	n	
				2.00E-02	X			V		1		2.53E+02	Chlorotoluene, p-	106-43-4	1.6E+03	ns	2.3E+04	ns					2.5E+02	n		2.4E-01	n	
2.40E+02	C	6.90E-02	C							1	0.1		Chlorozotocin	54749-90-5	2.3E-03	c	9.6E-03	c	4.1E-05	c	1.8E-04	c	3.2E-04	c		7.1E-08	c	
				5.00E-03	O					1	0.1		Chlorpropham	101-21-3	3.2E+02	n	4.1E+03	n					7.1E+01	n		6.4E-02	n	
				1.00E-03	A					1	0.1		Chlorpyrifos	2921-88-2	6.3E+01	n	8.2E+02	n					8.4E+00	n		1.2E-01	n	
				1.00E-02	H					1	0.1		Chlorpyrifos Methyl	5598-13-0	6.3E+02	n	8.2E+03	n					1.2E+02	n		5.4E-01	n	
				5.00E-02	O					1	0.1		Chlorsulfuron	64902-72-3	3.2E+03	n	4.1E+04	n					9.9E+02	n		8.3E-01	n	
				1.00E-02	I					1	0.1		Chlorthal-dimethyl	1861-32-1	6.3E+02	n	8.2E+03	n					1.2E+02	n		1.5E-01	n	
				8.00E-04	H					1	0.1		Chlorthiophos	60238-56-4	5.1E+01	n	6.6E+02	n					2.8E+00	n		7.3E-02	n	
						6.00E-05	C			0.013			Chromium(III) (Soluble Compounds)	16065-83-1	8.5E+04	n	3.6E+05	nm	6.3E-02	n	2.6E-01	n						

TR=1E-06
THQ=1

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; T = ATSDR DRAFT; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; D = OW; R = ORD; N = WI; W = TEF applied; E = RPF applied; G = see user's guide; c = cancer; n = noncancer; * = where: nc SL < 100X ca SL; ** = where nc SL < 10X ca SL; SSL values are based on DAF=1; m = ceiling limit exceeded; s = Csat exceeded; V = volatile; M = mutagen.

Toxicity and Chemical-specific Information												Contaminant		Screening Levels										Protection of Groundwater SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	mutagen	GIABS	ABS_d	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tap Water (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
				1.50E+00	I					0.013			Chromium(III), Insoluble Salts	16065-83-1	1.2E+05	nm	1.8E+06	nm				2.2E+04	n		4.0E+07	n	
1.60E-01	I	1.10E-02	I	9.00E-04	I	3.00E-05	I		M	0.025			Chromium(VI)	18540-29-9	9.5E-01	c*	2.0E+01	c*	9.2E-05	c	1.1E-03	c	1.1E-01	c		2.1E-03	c	
										0.013			Chromium, Total	7440-47-3										1.0E+02			1.8E+05
				1.30E-02	I					1	0.1		Clofentezine	74115-24-5	8.2E+02	n	1.1E+04	n				2.3E+02	n		1.4E+01	n	
		9.00E-03	P	3.00E-04	P	6.00E-06	P			1			Cobalt	7440-48-4	2.3E+01	n	3.5E+02	n	3.1E-04	c*	1.4E-03	c*	6.0E+00	n		2.7E-01	n	
		6.20E-04	I					V	M	1			Coke Oven Emissions	E649830					1.6E-03	c	2.0E-02	c						
				4.00E-02	H					1			Copper	7440-50-8	3.1E+03	n	4.7E+04	n				8.0E+02	n	1.3E+03	2.8E+01	n	4.6E+01
				5.00E-02	I	6.00E-01	C			1	0.1		Cresol, m-	108-39-4	3.2E+03	n	4.1E+04	n	6.3E+02	n	2.6E+03	n	9.3E+02	n		7.4E-01	n	
				5.00E-02	I	6.00E-01	C			1	0.1		Cresol, o-	95-48-7	3.2E+03	n	4.1E+04	n	6.3E+02	n	2.6E+03	n	9.3E+02	n		7.5E-01	n	
				2.00E-02	P	6.00E-01	C			1	0.1		Cresol, p-	106-44-5	1.3E+03	n	1.6E+04	n	6.3E+02	n	2.6E+03	n	3.7E+02	n		3.0E-01	n	
				1.00E-01	A					1	0.1		Cresol, p-chloro-m-	59-50-7	6.3E+03	n	8.2E+04	n				1.4E+03	n		1.7E+00	n	
				1.00E-01	A	6.00E-01	C			1	0.1		Cresols	1319-77-3	6.3E+03	n	8.2E+04	n	6.3E+02	n	2.6E+03	n	1.5E+03	n		1.3E+00	n	
1.90E+00	H			1.00E-03	P			V		1		1.66E+04	Crotonaldehyde, trans-	123-73-9	3.7E-01	c	1.7E+00	c				4.0E-02	c		8.2E-06	c	
				1.00E-01	I	4.00E-01	I	V		1		2.68E+02	Cumene	98-82-8	1.9E+03	ns	9.9E+03	ns	4.2E+02	n	1.8E+03	n	4.5E+02	n		7.4E-01	n	
2.20E-01	C	6.30E-05	C							1	0.1		Cupferron	135-20-6	2.5E+00	c	1.0E+01	c	4.5E-02	c	1.9E-01	c	3.5E-01	c		6.1E-04	c	
8.40E-01	H			2.00E-03	H					1	0.1		Cyanazine	21725-46-2	6.5E-01	c	2.7E+00	c				8.8E-02	c		4.1E-05	c	
													Cyanides														
				1.00E-03	I	9.00E-03	C			1			~Calcium Cyanide	592-01-8	7.8E+01	n	1.2E+03	n	9.4E+00	n	3.9E+01	n	2.0E+01	n				
				5.00E-03	I					1			~Copper Cyanide	544-92-3	3.9E+02	n	5.8E+03	n				1.0E+02	n				
				6.00E-04	I	8.00E-04	G	V		1		9.54E+05	~Cyanide (CN-)	57-12-5	2.4E+01	n	1.6E+02	n	8.3E-01	n	3.5E+00	n	1.5E+00	n	2.0E+02	1.5E-02	n	2.0E+00
				1.00E-03	I			V		1			~Cyanogen	460-19-5	7.8E+01	n	1.2E+03	n				2.0E+01	n				
				9.00E-02	I			V		1			~Cyanogen Bromide	506-68-3	7.0E+03	n	1.1E+05	nm				1.8E+03	n				
				5.00E-02	I			V		1			~Cyanogen Chloride	506-77-4	3.9E+03	n	5.8E+04	n				1.0E+03	n				
				6.00E-04	I	8.00E-04	I	V		1		1.00E+07	~Hydrogen Cyanide	74-90-8	2.3E+01	n	1.5E+02	n	8.3E-01	n	3.5E+00	n	1.5E+00	n		1.5E-02	n	
				2.00E-03	I	9.00E-03	C			1			~Potassium Cyanide	151-50-8	1.6E+02	n	2.3E+03	n	9.4E+00	n	3.9E+01	n	4.0E+01	n				
				5.00E-03	I					0.04			~Potassium Silver Cyanide	506-61-6	3.9E+02	n	5.8E+03	n				8.2E+01	n				
				1.00E-01	I					0.04			~Silver Cyanide	506-64-9	7.8E+03	n	1.2E+05	nm				1.8E+03	n				
				1.00E-03	I	9.00E-03	C			1			~Sodium Cyanide	143-33-9	7.8E+01	n	1.2E+03	n	9.4E+00	n	3.9E+01	n	2.0E+01	n	2.0E+02			
				5.00E-02	I					1			~Zinc Cyanide	557-21-1	3.9E+03	n	5.8E+04	n				1.0E+03	n				
						6.00E+00	I	V		1		1.17E+02	Cyclohexane	110-82-7	6.5E+03	ns	2.7E+04	ns	6.3E+03	n	2.6E+04	n	1.3E+04	n		1.3E+01	n	
2.00E-02	X			2.00E-02	X					1	0.1		Cyclohexane, 1,2,3,4,5-pentabromo-6-chloro-	87-84-3	2.7E+01	c*	1.1E+02	c				2.8E+00	c		1.6E-02	c	
				5.00E+00	I	7.00E-01	P	V		1		5.11E+03	Cyclohexanone	108-94-1	2.8E+04	ns	1.3E+05	nms	7.3E+02	n	3.1E+03	n	1.4E+03	n		3.4E-01	n	
				5.00E-03	P	1.00E+00	X	V		1		2.83E+02	Cyclohexene	110-83-8	3.1E+02	ns	3.1E+03	ns	1.0E+03	n	4.4E+03	n	7.0E+01	n		4.6E-02	n	
				2.00E-01	I			V		1		2.93E+05	Cyclohexylamine	108-91-8	1.6E+04	n	2.3E+05	nm				3.8E+03	n		1.0E+00	n	
				2.50E-02	I					1	0.1		Cyfluthrin	68359-37-5	1.6E+03	n	2.1E+04	n				1.2E+02	n		3.1E+01	n	
				5.00E-01	O					1	0.1		Cyromazine	66215-27-8	3.2E+04	n	4.1E+05	nm				9.9E+03	n		2.5E+00	n	
				3.00E-02	I					1	0.1		Dalapon	75-99-0	1.9E+03	n	2.5E+04	n				6.0E+02	n	2.0E+02	1.2E-01	n	4.1E-02
1.80E-02	C	5.10E-06	C	1.50E-01	I					1	0.1		Daminozide	1596-84-5	3.0E+01	c	1.3E+02	c	5.5E-01	c	2.4E+00	c	4.3E+00	c		9.5E-04	c	
7.00E-04	I			7.00E-03	I					1	0.1		Decabromodiphenyl ether, 2,2',3,3',4,4',5,5',6,6'- (BDE-209)	1163-19-5	4.4E+02	n	3.3E+03	c**				1.1E+02	c**		6.2E+01	c**	
				4.00E-05	I					1	0.1		Demeton	8065-48-3	2.5E+00	n	3.3E+01	n				4.2E-01	n				
1.20E-03	I			6.00E-01	I					1	0.1		Di(2-ethylhexyl)adipate	103-23-1	4.5E+02	c*	1.9E+03	c				6.5E+01	c	4.0E+02	4.7E+00	c	2.9E+01
6.10E-02	H									1	0.1		Diallate	2303-16-4	8.9E+00	c	3.8E+01	c				5.4E-01	c		8.0E-04	c	
				7.00E-04	A					1	0.1		Diazinon	333-41-5	4.4E+01	n	5.7E+02	n				1.0E+01	n		6.5E-02	n	
8.00E-01	P	6.00E-03	P	2.00E-04	P	2.00E-04	I	V	M	1		9.79E+02	Dibromo-3-chloropropane, 1,2-	96-12-8	5.3E-03	c	6.4E-02	c	1.7E-04	c	2.0E-03	c	3.3E-04	c	2.0E-01	1.4E-07	c	8.6E-05
2.50E-01	C			3.00E-04	C					1	0.1		Dibromoacetic acid	631-64-1	2.2E+00	c**	9.2E+00	c*				3.1E-01	c*	6.0E+01(G)	6.3E-05	c*	1.2E-02
				4.00E-04	X			V		1		1.59E+02	Dibromobenzene, 1,3-	108-36-1	3.1E+01	n	4.7E+02	ns				5.3E+00	n		5.1E-03	n	
				1.00E-02	I			V		1			Dibromobenzene, 1,4-	106-37-6	7.8E+02	n	1.2E+04	n				1.3E+02	n		1.2E-01	n	
8.40E-02	I			2.00E-02	I			V		1		8.02E+02	Dibromochloromethane	124-48-1	8.3E+00	c	3.9E+01	c				8.7E-01	c	8.0E+01(G)	2.3E-04	c	2.1E-02
2.00E+00	I	6.00E-04	I	9.00E-03	I	9.00E-03	I	V		1		1.34E+03	Dibromoethane, 1,2-	106-93-4	3.6E-02	c	1.6E-01	c	4.7E-03	c	2.0E-02	c	7.5E-03	c	5.0E-02	2.1E-06	c	1.4E-05
						4.00E-03	X	V		1		2.82E+03	Dibromomethane (Methylene Bromide)	74-95-3	2.4E+01	n	9.9E+01	n	4.2E+00	n	1.8E+01	n	8.3E+00	n		2.1E-03	n	
				3.00E-04	P					1	0.1		Dibutyltin Compounds	E1790661	1.9E+01	n	2.5E+02	n				6.0E+00	n				
				3.00E-02	I					1	0.1		Dicamba	1918-00-9	1.9E+03	n	2.5E+04	n				5.7E+02	n		1.5E-01	n	
										1	0.1		Dichloramine	3400-09-7										4.0E+03(G)			
		4.20E-03	P					V		1		5.54E+02	Dichloro-2-butene, 1,4-	764-41-0	2.1E-03	c	9.4E-03	c	6.7E-04	c	2.9E-03	c	1.3E-03	c		6.6E-07	c	
		4.20E-03	P					V		1		5.19E+02	Dichloro-2-butene, cis-1,4-	1476-11-5	7.4E-03	c	3.2E-02	c	6.7E-04	c	2.9E-03	c	1.3E-03	c		6.2E-07	c	
		4.20E-03	P					V		1		7.60E+02	Dichloro-2-butene, trans-1,4-	110-57-6	7.4E-03	c	3.2E-02	c	6.7E-04	c	2.9E-03	c	1.3E-03	c		6.2E-07	c	
5.00E-02	I			4.00E-03	I					1	0.1		Dichloroacetic Acid	79-43-6	1.1E+01	c*	4.6E+01	c*				1.5E+00	c*	6.0E+01(G)	3.1E-04	c*	1.2E-02
				9.00E-02	I	2.00E-01	H	V		1		3.76E+02	Dichlorobenzene, 1,2-	95-50-1	1.8E+03	ns	9.3E+03	ns	2.1E+02	n	8.8E+02	n	3.0E+02	n	6.0E+02	3.0E-01	n	5.8E-01
5.40E-03	C	1.10E-05	C	7.00E-02	A	8.00E-01	I	V		1			Dichlorobenzene, 1,4-	106-46-7	2.6E+00	c	1.1E+01	c	2.6E-01	c	1.1E+00	c	4.8E-01	c	7.5E+01	4.6E-04	c	7.2E-02
4.50E-01	I	3.40E-04	C							1	0.1		Dichlorobenzidine, 3,3'-	91-94-1	1.2E+00	c	5.1E+00	c	8.3E-03	c	3.6E-02	c	1.3E-01	c		8.2E-04	c	
				9.00E-03	X					1	0.1		Dichlorobenzophenone, 4,4'-	90-98-2	5.7E+02	n	7.4E+03	n				7.8E+01	n		4.7E-01	n	
				2.00E-01	I	1.00E-01	X	V		1		8.45E+02	Dichlorodifluoromethane	75-71-8	8.7E+01	n	3.7E+02	n	1.0E+02	n	4.4E+02	n	2.0E+02	n		3.0E-01	n	
2.40E-01	I	6.90E-05	C	5.00E-04	A					1	0.1		Dichlorodiphenyldichloroethane, p,p'- (DDD)	72-54-8	2.3E+00	c*	9.6E+00	c*	4.1E-02	c	1.8E-01	c	3.2E-02	c*		7.5E-03	c*	
3.40E-01	I	9.70E-05	C	5.00E-04	A			V		1			Dichlorodiphenyldichloroethylene, p,p'- (DDE)	72-55-9	2.0E+00	c*	9.3E+00	c*	2.9E-02	c	1.3E-01	c	4.6E-02	c		1.1E-02	c	
3.40E-01	I	9.70E-05	I	5.00E-04	I					1	0.03		Dichlorodiphenyltrichloroethane, p,p'- (DDT)	50-29-3	1.9E+00	c*	8.5E+00	c*	2.9E-02	c	1.3E-01	c	2.3E-01	c*		7.7E-02	c*	
5.70E-03	C	1.60E-06	C	2.00E-01	P			V		1		1.69E+03	Dichloroethane, 1,1-	75-34-3	3.6E+00	c	1.6E+01	c	1.8E+00	c	7.7E+00	c	2.8E+00	c		7.8E-04	c	
9.10E-02	I	2.60E-05	I	6.00E-03	X	7.00E-03	P	V		1		2.98E+03	Dichloroethane, 1,2-	107-06-2	4.6E-01	c*	2.0E+00	c*	1.1E-01	c*	4.7E-01	c*	1.7E-01	c*	5.0E+00	4.8E-05	c*	1.4E-03
				5.00E-02	I	3.96E-03	A	V		1		1.19E+03	Dichloroethylene, 1,1-	75-35-4	4.8E+00	n	2.0E+01	n	4.1E+00	n	1.7E+01	n	8.2E+00	n	7.0E+00	2.9E-03	n	2.5E-03
				2.00E-03	I	4.00E-02	X	V		1		2.37E+03	Dichloroethylene, cis-1,2-	156-59-2	6.3E+01	n	3.7E+02	n	4.2E+01	n	1.8E+02	n	2.5E+01	n	7.0E+01	7.4E-03	n	2.1E-02
				2.00E-02	I	4.00E-02	X	V		1		1.85E+03	Dichloroethylene, trans-1,2-	156-60-5	7.0E+01	n	3.0E+02	n	4.2E+01	n	1.8E+02	n	6.8E+01	n	1.0E+02	2.1E-02	n	3.1E-02
				3.00E-03	I					1	0.1		Dichlorophenol, 2,4-	120-83-2	1.9E+02	n	2.5E+03	n				4.6E+01	n		2.3E-02	n	
				1.00E-02	I					1	0.05		Dichlorophenoxy Acetic Acid, 2,4-	94-75-7	7.0E+02	n	9.6E+03	n				1.7E+02	n	7.0E+01	4.5E-02	n	1.8E-02
3.70E-02	P	3.70E-06	P	4.00E-02	P	4.00E-03	I	V		1		1.36E+03	Dichloropropane, 1,2-	78-87-5	2.5E+00	c**	1.1E+01	c**	7.6E-01	c**	3.3E+00	c**	8.5E-01	c**	5.0E+00	2.8E-04	c**	1.7E-03
				2.00E-02	P			V		1		1.49E+03	Dichloropropane, 1,3-	142-28-9	1.6E+03	ns	2.3E+04	ns				3.7E+02	n		1.3E-01	n	
				3.00E-03	I					1	0.1		Dichloropropanol, 2,3-	616-23-9	1.9E+02	n	2.5E+03	n				5.9E+01	n		1.3E-02	n	
1.00E-01	I	4.00E-06	I	3.00E-02	I	2.00E-02	I	V		1		1.57E+03	Dichloropropene, 1,3-	542-75-6	1.8E+00	c*	8.2E+00	c*	7.0E-01	c*	3.1E+00	c*	4.7E-01	c*		1.7E-04	c*	
2.90E-01	I	8.30E-05	C	5.00E-04	I	5.00E-04	I			1	0.1		Dichlorvos	62-73-7	1.9E+00	c*	7.9E+00	c*	3.4E-02	c*	1.5E-01	c*	2.6E-01	c*		8.1E-05	c*	
				3.00E-05	O					1	0.1		Dicrotophos	141-66-2	1.9E+00	n	2.5E+01	n				6.0E-01	n		1.4E-04	n	
				8.00E-02	P	3.00E-04	X	V		1		2.56E+02	Dicyclopentadiene	77-73-6	1.3E+00	n	5.4E+00	n	3.1E-01	n	1.3E+00	n	6.3E-01	n		2.2E-03	n	
1.60E+01	I	4.60E-03	I	5.00E-05	I					1	0.1		Dieldrin	60-57-1	3.4E-02	c*	1.4E-01	c	6.1E-04	c	2.7E-03	c	1.8E-03	c		7.1E-05	c	

TR=1E-06
THQ=1

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; T = ATSDR DRAFT; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; D = OW; R = ORD; N = WI; W = TEF applied; E = RPF applied; G = see user's guide; c = cancer; n = noncancer; * = where: nc SL < 100X ca SL; ** = where nc SL < 10X ca SL; SSL values are based on DAF=1; m = ceiling limit exceeded; s = Csat exceeded; V = volatile; M = mutagen.

Toxicity and Chemical-specific Information														Contaminant		Screening Levels												Protection of Groundwater SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	mutagen	GIABS	ABS_d	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tap Water (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
		3.00E-04	C			5.00E-03	I			1	0.1		Diesel Engine Exhaust	E17136615					9.4E-03	c	4.1E-02	c						
				2.00E-03	P	2.00E-04	P			1	0.1		Diethanolamine	111-42-2	1.3E+02	n	1.6E+03	n	2.1E-01	n	8.8E-01	n	4.0E+01	n		8.1E-03	n		
				3.00E-02	P	1.00E-04	P			1	0.1		Diethylene Glycol Monobutyl Ether	112-34-5	1.9E+03	n	2.4E+04	n	1.0E-01	n	4.4E-01	n	6.0E+02	n		1.3E-01	n		
				6.00E-02	P	3.00E-04	P			1	0.1		Diethylene Glycol Monoethyl Ether	111-90-0	3.8E+03	n	4.8E+04	n	3.1E-01	n	1.3E+00	n	1.2E+03	n		2.4E-01	n		
				1.00E-03	P			V		1		1.12E+05	Diethylformamide	617-84-5	7.8E+01	n	1.2E+03	n					2.0E+01	n		4.1E-03	n		
3.50E+02	C	1.00E-01	C							1	0.1		Diethylstilbestrol	56-53-1	1.6E-03	c	6.6E-03	c	2.8E-05	c	1.2E-04	c	5.1E-05	c		2.8E-05	c		
				8.30E-02	O					1	0.1		Difenzoquat	43222-48-6	5.2E+03	n	6.8E+04	n					1.7E+03	n		2.6E+02	n		
				2.00E-02	I					1	0.1		Diflubenzuron	35367-38-5	1.3E+03	n	1.6E+04	n					2.9E+02	n		3.3E-01	n		
						4.00E+01	I	V		1		1.43E+03	Difluoroethane, 1,1-	75-37-6	4.8E+04	ns	2.0E+05	nms	4.2E+04	n	1.8E+05	n	8.3E+04	n		2.8E+01	n		
						3.00E+01	X	V		1		6.91E+02	Difluoropropane, 2,2-	420-45-1	2.4E+04	ns	1.0E+05	ns	3.1E+04	n	1.3E+05	n	6.3E+04	n		1.4E+02	n		
4.40E-02	C	1.30E-05	C					V		1			Dihydrosafrole	94-58-6	9.9E+00	c	4.5E+01	c	2.2E-01	c	9.4E-01	c	3.0E-01	c		1.9E-04	c		
						7.00E-01	P	V		1		2.26E+03	Diisopropyl Ether	108-20-3	2.2E+03	n	9.4E+03	ns	7.3E+02	n	3.1E+03	n	1.5E+03	n		3.7E-01	n		
				8.00E-02	I			V		1		5.30E+02	Diisopropyl Methylphosphonate	1445-75-6	6.3E+03	ns	9.3E+04	ns					1.6E+03	n		4.5E-01	n		
				2.18E-02	O					1	0.1		Dimethipin	55290-64-7	1.4E+03	n	1.8E+04	n					4.4E+02	n		9.6E-02	n		
				2.20E-03	O					1	0.1		Dimethoate	60-51-5	1.4E+02	n	1.8E+03	n					4.4E+01	n		9.9E-03	n		
1.60E+00	P								M	1	0.1		Dimethoxybenzidine, 3,3'-	119-90-4	7.6E-02	c	1.4E+00	c					1.5E-02	c		1.9E-05	c		
				2.00E-02	X	2.00E-04	X	V		1		5.35E+03	Dimethyl Sulfide	75-18-3	6.2E-01	n	2.6E+00	n	2.1E-01	n	8.8E-01	n	4.2E-01	n		1.0E-04	n		
1.70E-03	P			6.00E-02	P					1	0.1		Dimethyl methylphosphonate	756-79-6	3.2E+02	c*	1.4E+03	c*					4.6E+01	c*		9.6E-03	c*		
4.60E+00	C	1.30E-03	C							1	0.1		Dimethylamino azobenzene [p-]	60-11-7	1.2E-01	c	5.0E-01	c	2.2E-03	c	9.4E-03	c	5.0E-03	c		2.1E-05	c		
5.80E-01	H									1	0.1		Dimethylaniline HCl, 2,4-	21436-96-4	9.4E-01	c	4.0E+00	c					1.3E-01	c		1.2E-04	c		
2.00E-01	P			2.00E-03	X					1	0.1		Dimethylaniline, 2,4-	95-68-1	2.7E+00	c*	1.1E+01	c					3.7E-01	c		2.1E-04	c		
2.70E-02	P			2.00E-03	I			V		1		8.30E+02	Dimethylaniline, N,N-	121-69-7	2.6E+01	c**	1.2E+02	c*					2.5E+00	c*		9.0E-04	c*		
1.10E+01	P								M	1	0.1		Dimethylbenzidine, 3,3'-	119-93-7	1.1E-02	c	2.1E-01	c					2.1E-03	c		1.4E-05	c		
				1.00E-01	P	3.00E-02	I	V		1		1.06E+05	Dimethylformamide	68-12-2	2.6E+03	n	1.5E+04	n	3.1E+01	n	1.3E+02	n	6.1E+01	n		1.2E-02	n		
				1.00E-04	X	2.00E-06	X	V		1		1.72E+05	Dimethylhydrazine, 1,1-	57-14-7	5.7E-02	n	2.4E-01	n	2.1E-03	n	8.8E-03	n	4.2E-03	n		9.3E-07	n		
5.50E+02	C	1.60E-01	C					V		1		1.89E+05	Dimethylhydrazine, 1,2-	540-73-8	8.8E-04	c	4.1E-03	c	1.8E-05	c	7.7E-05	c	2.8E-05	c		6.5E-09	c		
				2.00E-02	I					1	0.1		Dimethylphenol, 2,4-	105-67-9	1.3E+03	n	1.6E+04	n					3.6E+02	n		4.2E-01	n		
				6.00E-04	I					1	0.1		Dimethylphenol, 2,6-	576-26-1	3.8E+01	n	4.9E+02	n					1.1E+01	n		1.3E-02	n		
				1.00E-03	I					1	0.1		Dimethylphenol, 3,4-	95-65-8	6.3E+01	n	8.2E+02	n					1.8E+01	n		2.1E-02	n		
4.50E-02	C	1.30E-05	C					V		1		4.73E+02	Dimethylvinylchloride	513-37-1	1.1E+00	c	4.8E+00	c	2.2E-01	c	9.4E-01	c	3.3E-01	c		1.1E-04	c		
				8.00E-05	X					1	0.1		Dinitro-o-cresol, 4,6-	534-52-1	5.1E+00	n	6.6E+01	n					1.5E+00	n		2.6E-03	n		
				2.00E-03	I					1	0.1		Dinitro-o-cyclohexyl Phenol, 4,6-	131-89-5	1.3E+02	n	1.6E+03	n					2.3E+01	n		7.7E-01	n		
				4.00E-04	X	2.00E-03	X			1	0.1		Dinitroaniline, 3,5-	618-87-1	2.5E+01	n	3.3E+02	n	2.1E+00	n	8.8E+00	n	7.7E+00	n		4.1E-03	n		
				1.00E-04	P					1	0.1		Dinitrobenzene, 1,2-	528-29-0	6.3E+00	n	8.2E+01	n					1.9E+00	n		1.8E-03	n		
				1.00E-04	I					1	0.1		Dinitrobenzene, 1,3-	99-65-0	6.3E+00	n	8.2E+01	n					2.0E+00	n		1.8E-03	n		
				1.00E-04	P					1	0.1		Dinitrobenzene, 1,4-	100-25-4	6.3E+00	n	8.2E+01	n					2.0E+00	n		1.8E-03	n		
				2.00E-03	I					1	0.1		Dinitrophenol, 2,4-	51-28-5	1.3E+02	n	1.6E+03	n					3.9E+01	n		4.4E-02	n		
6.80E-01	I									1	0.1		Dinitrotoluene Mixture, 2,4/2,6-	E1615210	8.0E-01	c	3.4E+00	c					1.1E-01	c		1.5E-04	c		
3.10E-01	C	8.90E-05	C	2.00E-03	I					1	0.102		Dinitrotoluene, 2,4-	121-14-2	1.7E+00	c*	7.4E+00	c	3.2E-02	c	1.4E-01	c	2.4E-01	c		3.2E-04	c		
1.50E+00	P			3.00E-04	X					1	0.099		Dinitrotoluene, 2,6-	606-20-2	3.6E-01	c*	1.5E+00	c					4.9E-02	c		6.7E-05	c		
				1.00E-04	X					1	0.006		Dinitrotoluene, 2-Amino-4,6-	35572-78-2	7.7E+00	n	1.1E+02	n					1.9E+00	n		1.5E-03	n		
				1.00E-04	X					1	0.009		Dinitrotoluene, 4-Amino-2,6-	19406-51-0	7.7E+00	n	1.1E+02	n					1.9E+00	n		1.5E-03	n		
4.50E-01	X			9.00E-04	X					1	0.1		Dinitrotoluene, Technical grade	25321-14-6	1.2E+00	c*	5.1E+00	c					1.0E-01	c		1.4E-04	c		
				1.00E-03	I					1	0.1		Dinoseb	88-85-7	6.3E+01	n	8.2E+02	n					1.5E+01	n	7.0E+00	1.3E-01	n	6.2E-02	
1.00E-01	I	5.00E-06	I	3.00E-02	I	3.00E-02	I	V		1		1.16E+05	Dioxane, 1,4-	123-91-1	5.3E+00	c	2.4E+01	c	5.6E-01	c*	2.5E+00	c*	4.6E-01	c		9.4E-05	c		
													Dioxins																
6.20E+03	I	1.30E+00	I							1	0.03		~Hexachlorodibenzo-p-dioxin, Mixture	34465-46-8	1.0E-04	c	4.7E-04	c	2.2E-06	c	9.4E-06	c	1.3E-05	c		1.7E-05	c		
1.30E+05	C	3.80E+01	C	7.00E-10	I	4.00E-08	C	V		1	0.03		~TCDD, 2,3,7,8-	1746-01-6	4.8E-06	c*	2.2E-05	c*	7.4E-08	c	3.2E-07	c	1.2E-07	c	3.0E-05	5.9E-08	c	1.5E-05	
				3.00E-02	I					1	0.1		Diphenamid	957-51-7	1.9E+03	n	2.5E+04	n					5.3E+02	n		5.2E+00	n		
						4.00E-04	X	V		1			Diphenyl Ether	101-84-8	3.4E+01	n	1.4E+02	n	4.2E-01	n	1.8E+00	n	8.3E-01	n		3.4E-03	n		
				8.00E-04	X					1	0.1		Diphenyl Sulfone	127-63-9	5.1E+01	n	6.6E+02	n					1.5E+01	n		3.6E-02	n		
				1.00E-01	O					1	0.1		Diphenylamine	122-39-4	6.3E+03	n	8.2E+04	n					1.3E+03	n		2.3E+00	n		
8.00E-01	I	2.20E-04	I							1	0.1		Diphenylhydrazine, 1,2-	122-66-7	6.8E-01	c	2.9E+00	c	1.3E-02	c	5.6E-02	c	7.8E-02	c		2.5E-04	c		
				2.20E-03	I					1	0.1		Diquat	2764-72-9	1.4E+02	n	1.8E+03	n					4.0E+01	n	2.0E+01	3.3E-01	n	1.7E-01	
7.40E+00	C	2.10E-03	C							1	0.1		Direct Black 38	1937-37-7	7.3E-02	c	3.1E-01	c	1.3E-03	c	5.8E-03	c	1.1E-02	c		5.1E+00	c		
7.40E+00	C	2.10E-03	C							1	0.1		Direct Blue 6	2602-46-2	7.3E-02	c	3.1E-01	c	1.3E-03	c	5.8E-03	c	1.1E-02	c		1.7E+01	c		
6.70E+00	C	1.90E-03	C							1	0.1		Direct Brown 95	16071-86-6	8.1E-02	c	3.4E-01	c	1.5E-03	c	6.5E-03	c	1.2E-02	c		1.6E-01	c		
				4.00E-05	I					1	0.1		Disulfoton	298-04-4	2.5E+00	n	3.3E+01	n					5.0E-01	n		9.4E-04	n		
				1.00E-02	I			V		1			Dithiane, 1,4-	505-29-3	7.8E+02	n	1.2E+04	n					2.0E+02	n		9.7E-02	n		
				2.00E-03	I					1	0.1		Diuron	330-54-1	1.3E+02	n	1.6E+03	n					3.6E+01	n		1.5E-02	n		
				2.00E-02	O					1	0.1		Dodine	2439-10-3	1.3E+03	n	1.6E+04	n					4.0E+02	n		2.1E+00	n		
				5.00E-02	O			V		1			EPTC	759-94-4	3.9E+03	n	5.8E+04	n					7.5E+02	n		4.0E-01	n		
				6.00E-03	I			V		1			Endosulfan	115-29-7	4.7E+02	n	7.0E+03	n					1.0E+02	n		1.4E+00	n		
				6.00E-03	P					1	0.1		Endosulfan Sulfate	1031-07-8	3.8E+02	n	4.9E+03	n					1.1E+02	n		2.1E+00	n		
				2.00E-02	I					1	0.1		Endothall	145-73-3	1.3E+03	n	1.6E+04	n					3.8E+02	n	1.0E+02	9.1E-02	n	2.4E-02	
				3.00E-04	I					1	0.1		Endrin	72-20-8	1.9E+01	n	2.5E+02	n					2.3E+00	n	2.0E+00	9.2E-02	n	8.1E-02	
9.90E-03	I	1.20E-06	I	6.00E-03	P	1.00E-03	I	V		1		1.05E+04	Epichlorohydrin	106-89-8	1.9E+01	n	8.2E+01	n	1.0E+00	n	4.4E+00	n	2.0E+00	n		4.5E-04	n		
						2.00E-02	I	V		1		1.53E+04	Epoxybutane, 1,2-	106-88-7	1.6E+02	n	6.7E+02	n	2.1E+01	n	8.8E+01	n	4.2E+01	n		9.2E-03	n		
				4.00E-02	P					1	0.1		Ethanol, 2-(2-methoxyethoxy)-	111-77-3	2.5E+03	n	3.3E+04	n					8.0E+02	n		1.6E-01	n		
				5.00E-03	I					1	0.1		Ethephon	16672-87-0	3.2E+02	n	4.1E+03	n					1.0E+02	n		2.1E-02	n		
				5.00E-04	I					1	0.1		Ethion	563-12-2	3.2E+01	n	4.1E+02	n					4.3E+00	n		8.5E-03	n		
				1.00E-01	P	6.00E-02	P	V		1		2.38E+04	Ethoxyethanol Acetate, 2-	111-15-9	2.6E+03	n	1.4E+04	n	6.3E+01	n	2.6E+02	n	1.2E+02	n		2.5E-02	n		
				9.00E-02	P	4.00E-02	P	V		1		1.06E+05	Ethoxyethanol, 2-	110-80-5	2.6E+03	n	1.5E+04	n	4.2E+01	n	1.8E+02	n	8.0E+01	n		1.6E-02	n		
				7.00E-01	P	7.00E-02	P	V		1		1.08E+04	Ethyl Acetate	141-78-6	6.2E+02	n	2.6E+03	n	7.3E+01	n	3.1E+02	n	1.4E+02	n		3.1E-02	n		
				5.00E-03	P	8.00E-03	P	V		1		2.50E+03	Ethyl Acrylate	140-88-5	4.7E+01	n	2.1E+02	n	8.3E+00	n	3.5E+01	n	1.4E+01	n		3.2E-03	n		
						4.00E+00	P	V		1		2.12E+03	Ethyl Chloride (Chloroethane)	75-00-3	5.4E+03	ns	2.3E+04	ns	4.2E+03	n	1.8E+04	n	8.3E+03	n		2.4E+00	n		
				2.00E-01	I			V		1		1.01E+04	Ethyl Ether	60-29-7	1.6E+04	ns	2.3E+05	nms					3.9E+03	n		8.8E-01	n		
						3.00E-01	P	V		1		1.10E+03	Ethyl Methacrylate	97-63-2	1.8E+03	ns	7.6E+03	ns	3.1E+02	n	1.3E+03	n	6.3E+02	n		1.5E-01	n		
		8.00E-08	I	1.00E+00	I	4.00E+01	I	V		1		2.87E+03	Ethyl Tertiary Butyl Ether (ETBE)	637-92-3	1.3E+02	c	5.6E+02	c	3.5E+01	c	1.5E+02	c	7.0E+01	c		1.7E-02	c		
				1.00E-05	I					1	0.1		Ethyl-p-nitrophenyl Phosphonate	2104-64-5	6.3E-01	n	8.2E+00	n					8.9E-02	n		2.8E-03	n		

TR=1E-06
THQ=1.0

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; T = ATSDR DRAFT; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; D = OW; R = ORD; N = WI; W = TEF applied; E = RPF applied; G = see user's guide; c = cancer; n = noncancer; * = where: nc SL < 100X ca SL; ** = where nc SL < 10X ca SL; SSL values are based on DAF=1; m = ceiling limit exceeded; s = Csat exceeded; V = volatile; M = mutagen.

Toxicity and Chemical-specific Information													Contaminant		Screening Levels												Protection of Groundwater SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	mutagen	GIABS	ABS_d	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tap Water (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
1.10E-02	C	2.50E-06	C	5.00E-02	P	1.00E+00	I	V		1		4.80E+02	Ethylbenzene	100-41-4	5.8E+00	c	2.5E+01	c	1.1E+00	c	4.9E+00	c	1.5E+00	c	7.0E+02	1.7E-03	c	7.8E-01
				7.00E-02	P					1	0.1		Ethylene Cyanohydrin	109-78-4	4.4E+03	n	5.7E+04	n					1.4E+03	n		2.8E-01	n	
				9.00E-02	P			V		1		1.89E+05	Ethylene Diamine	107-15-3	7.0E+03	n	1.1E+05	nm					1.8E+03	n		4.1E-01	n	
				8.00E-01	A	4.00E-01	C			1	0.1		Ethylene Glycol	107-21-1	5.1E+04	n	6.6E+05	nm	4.2E+02	n	1.8E+03	n	1.6E+04	n		3.2E+00	n	
				1.00E-01	I	1.60E+00	I			1	0.1		Ethylene Glycol Monobutyl Ether	111-76-2	6.3E+03	n	8.2E+04	n	1.7E+03	n	7.0E+03	n	2.0E+03	n		4.1E-01	n	
3.10E-01	C	3.00E-03	I			3.00E-02	C	V	M	1		1.21E+05	Ethylene Oxide	75-21-8	2.0E-03	c	2.5E-02	c	3.4E-04	c	4.1E-03	c	6.7E-04	c		1.4E-07	c	
4.50E-02	C	1.30E-05	C	8.00E-05	I					1	0.1		Ethylene Thiourea	96-45-7	5.1E+00	n	5.1E+01	c**	2.2E-01	c	9.4E-01	c	1.6E+00	n		3.6E-04	n	
6.50E+01	C	1.90E-02	C					V		1		1.54E+05	Ethyleneimine	151-56-4	2.7E-03	c	1.2E-02	c	1.5E-04	c	6.5E-04	c	2.4E-04	c		5.2E-08	c	
				3.00E+00	I					1	0.1		Ethylphthalyl Ethyl Glycolate	84-72-0	1.9E+05	nm	2.5E+06	nm					5.8E+04	n		1.3E+02	n	
				2.50E-04	I					1	0.1		Fenamiphos	22224-92-6	1.6E+01	n	2.1E+02	n					4.4E+00	n		4.3E-03	n	
				2.50E-02	I					1	0.1		Fenpropathrin	39515-41-8	1.6E+03	n	2.1E+04	n					6.4E+01	n		2.9E+00	n	
				2.50E-02	I					1	0.1		Fenvalerate	51630-58-1	1.6E+03	n	2.1E+04	n					5.0E+02	n		3.2E+02	n	
				1.30E-02	I					1	0.1		Fluometuron	2164-17-2	8.2E+02	n	1.1E+04	n					2.4E+02	n		1.9E-01	n	
				4.00E-02	C	1.30E-02	C			1			Fluoride	16984-48-8	3.1E+03	n	4.7E+04	n	1.4E+01	n	5.7E+01	n	8.0E+02	n	4.0E+03	1.2E+02	n	6.0E+02
				6.00E-02	I	1.30E-02	C			1			Fluorine (Soluble Fluoride)	7782-41-4	4.7E+03	n	7.0E+04	n	1.4E+01	n	5.7E+01	n	1.2E+03	n	4.0E+03	1.8E+02	n	6.0E+02
				8.00E-02	I					1	0.1		Fluridone	59756-60-4	5.1E+03	n	6.6E+04	n					1.4E+03	n		1.6E+02	n	
				4.00E-02	O					1	0.1		Flurprimidol	56425-91-3	2.5E+03	n	3.3E+04	n					6.9E+02	n		3.1E+00	n	
				2.00E-03	O					1	0.1		Flusilazole	85509-19-9	1.3E+02	n	1.6E+03	n					3.1E+01	n		5.1E+00	n	
				5.00E-01	O					1	0.1		Flutolanil	66332-96-5	3.2E+04	n	4.1E+05	nm					7.9E+03	n		4.2E+01	n	
				1.00E-02	I					1	0.1		Fluvalinate	69409-94-5	6.3E+02	n	8.2E+03	n					2.0E+02	n		2.9E+02	n	
				9.00E-02	O					1	0.1		Folpet	133-07-3	5.7E+03	n	7.4E+04	n					1.6E+03	n		3.9E-01	n	
				1.00E-02	O					1	0.1		Fomesafen	72178-02-0	6.3E+02	n	8.2E+03	n					1.9E+02	n		6.3E-01	n	
				2.00E-03	I					1	0.1		Fonofos	944-22-9	1.3E+02	n	1.6E+03	n					2.4E+01	n		4.7E-02	n	
2.10E-02	C	7.40E-06	I	2.00E-01	I	7.00E-03	I	V	M	1		4.24E+04	Formaldehyde	50-00-0	4.3E+00	c	7.0E+01	c*	1.4E-01	c*	1.7E+00	c*	2.2E-01	c*		4.5E-05	c*	
				9.00E-01	P	3.00E-04	X	V		1		1.06E+05	Formic Acid	64-18-6	2.9E+01	n	1.2E+02	n	3.1E-01	n	1.3E+00	n	6.3E-01	n		1.3E-04	n	
				2.50E+00	O					1	0.1		Fosetyl-AL	39148-24-8	1.6E+05	nm	2.1E+06	nm					5.0E+04	n		6.6E+02	n	
													Furans																
				1.00E-03	X			V		1			~Dibenzofuran	132-64-9	7.8E+01	n	1.2E+03	n					7.9E+00	n		1.5E-01	n	
				1.00E-03	I			V		1		6.22E+03	~Furan	110-00-9	7.8E+01	n	1.2E+03	n					1.9E+01	n		7.3E-03	n	
				9.00E-01	I	2.00E+00	I	V		1		1.65E+05	~Tetrahydrofuran	109-99-9	1.8E+04	n	9.5E+04	n	2.1E+03	n	8.8E+03	n	3.4E+03	n		7.5E-01	n	
3.80E+00	H									1	0.1		Furazolidone	67-45-8	1.4E-01	c	6.0E-01	c					2.0E-02	c		3.9E-05	c	
				3.00E-03	I	5.00E-02	H	V		1		1.01E+04	Furfural	98-01-1	2.1E+02	n	2.6E+03	n	5.2E+01	n	2.2E+02	n	3.8E+01	n		8.1E-03	n	
1.50E+00	C	4.30E-04	C							1	0.1		Furium	531-82-8	3.6E-01	c	1.5E+00	c	6.5E-03	c	2.9E-02	c	5.1E-02	c		6.8E-05	c	
3.00E-02	I	8.60E-06	C							1	0.1		Furmecyclox	60568-05-0	1.8E+01	c	7.7E+01	c	3.3E-01	c	1.4E+00	c	1.1E+00	c		1.2E-03	c	
				6.00E-03	O					1	0.1		Glufosinate, Ammonium	77182-82-2	3.8E+02	n	4.9E+03	n					1.2E+02	n		2.6E-02	n	
				1.00E-01	A	8.00E-05	C			1	0.1		Glutaraldehyde	111-30-8	6.0E+03	n	7.0E+04	n	8.3E-02	n	3.5E-01	n	2.0E+03	n		4.0E-01	n	
				4.00E-04	I	1.00E-03	X	V		1		1.06E+05	Glycidaldehyde	765-34-4	2.3E+01	n	2.1E+02	n	1.0E+00	n	4.4E+00	n	1.7E+00	n		3.3E-04	n	
				1.00E-01	I					1	0.1		Glyphosate	1071-83-6	6.3E+03	n	8.2E+04	n					2.0E+03	n	7.0E+02	8.8E+00	n	3.1E+00
				1.00E-02	X			V		1			Guanidine	113-00-8	7.8E+02	n	1.2E+04	n					2.0E+02	n		4.5E-02	n	
				2.00E-02	P					1	0.1		Guanidine Chloride	50-01-1	1.3E+03	n	1.6E+04	n					4.0E+02	n				
				3.00E-02	X					1	0.1		Guanidine Nitrate	506-93-4	1.9E+03	n	2.5E+04	n					6.0E+02	n		1.5E-01	n	
				5.00E-05	I					1	0.1		Haloxyfop, Methyl	69806-40-2	3.2E+00	n	4.1E+01	n					7.6E-01	n		8.4E-03	n	
4.50E+00	I	1.30E-03	I	1.00E-04	A			V		1			Heptachlor	76-44-8	1.3E-01	c*	6.3E-01	c	2.2E-03	c	9.4E-03	c	1.4E-03	c	4.0E-01	1.2E-04	c	3.3E-02
9.10E+00	I	2.60E-03	I	1.30E-05	I			V		1			Heptachlor Epoxide	1024-57-3	7.0E-02	c*	3.3E-01	c*	1.1E-03	c	4.7E-03	c	1.4E-03	c*	2.0E-01	2.8E-05	c*	4.1E-03
						3.00E-03	X	V		1		2.09E+02	Heptanal, n-	111-71-7	2.4E+01	n	1.0E+02	n	3.1E+00	n	1.3E+01	n	6.3E+00	n		1.4E-03	n	
				3.00E-04	X	4.00E-01	P	V		1		5.79E+01	Heptane, N-	142-82-5	2.2E+01	n	2.9E+02	ns	4.2E+02	n	1.8E+03	n	6.0E+00	n		4.8E-02	n	
				2.00E-03	I			V		1			Hexabromobenzene	87-82-1	1.6E+02	n	2.3E+03	n					4.0E+01	n		2.3E-01	n	
				2.00E-04	I					1	0.1		Hexabromodiphenyl ether, 2,2',4,4',5,5'- (BDE-153)	68631-49-2	1.3E+01	n	1.6E+02	n					4.0E+00	n				
1.60E+00	I	4.60E-04	I	1.00E-05	P			V		1			Hexachlorobenzene	118-74-1	2.1E-01	c**	9.6E-01	c*	6.1E-03	c	2.7E-02	c	9.8E-03	c*	1.0E+00	1.2E-04	c*	1.3E-02
7.80E-02	I	2.20E-05	I	1.00E-03	P			V		1		1.68E+01	Hexachlorobutadiene	87-68-3	1.2E+00	c*	5.3E+00	c	1.3E-01	c	5.6E-01	c	1.4E-01	c*		2.7E-04	c*	
6.30E+00	I	1.80E-03	I	9.00E-04	A					1	0.1		Hexachlorocyclohexane, Alpha-	319-84-6	8.6E-02	c	3.6E-01	c	1.6E-03	c	6.8E-03	c	7.2E-03	c		4.2E-05	c	
1.80E+00	I	5.30E-04	I							1	0.1		Hexachlorocyclohexane, Beta-	319-85-7	3.0E-01	c	1.3E+00	c	5.3E-03	c	2.3E-02	c	2.5E-02	c		1.5E-04	c	
				6.00E-08	X					1	0.1		Hexachlorocyclohexane, Delta-	319-86-8	3.8E-03	n	4.9E-02	n					7.3E-04	n		4.2E-06	n	
1.10E+00	C	3.10E-04	C	8.00E-07	A					1	0.04		Hexachlorocyclohexane, Gamma- (Lindane)	58-89-9	5.7E-02	n	8.0E-01	n	9.1E-03	c	4.0E-02	c	9.7E-03	n	2.0E-01	5.7E-05	n	1.2E-03
1.80E+00	I	5.10E-04	I							1	0.1		Hexachlorocyclohexane, Technical	608-73-1	3.0E-01	c	1.3E+00	c	5.5E-03	c	2.4E-02	c	2.5E-02	c		1.5E-04	c	
				6.00E-03	I	2.00E-04	I	V		1		1.57E+01	Hexachlorocyclopentadiene	77-47-4	1.8E+00	n	7.5E+00	n	2.1E-01	n	8.8E-01	n	4.1E-01	n	5.0E+01	1.3E-03	n	1.6E-01
4.00E-02	I	1.10E-05	C	7.00E-04	I	3.00E-02	I	V		1			Hexachloroethane	67-72-1	1.8E+00	c*	8.0E+00	c*	2.6E-01	c	1.1E+00	c	3.3E-01	c*		2.0E-04	c*	
				3.00E-04	I					1	0.1		Hexachlorophene	70-30-4	1.9E+01	n	2.5E+02	n					6.0E+00	n		8.0E+00	n	
8.00E-02	I			4.00E-03	I					1	0.015		Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	8.3E+00	c*	3.8E+01	c					9.7E-01	c*		3.7E-04	c*	
						1.00E-05	I	V		1		3.39E+03	Hexamethylene Diisocyanate, 1,6-	822-06-0	3.1E+00	n	1.3E+01	n	1.0E-02	n	4.4E-02	n	2.1E-02	n		2.1E-04	n	
						4.00E-04	C			1	0.1		Hexamethylene diisocyanate biuret	4035-89-6	5.7E+05	nm	2.4E+06	nm	4.2E-01	n	1.8E+00	n						
						4.00E-04	C			1	0.1		Hexamethylene diisocyanate isocyanurate	3779-63-3	5.7E+05	nm	2.4E+06	nm	4.2E-01	n	1.8E+00	n						
				4.00E-04	P					1	0.1		Hexamethylphosphoramide	680-31-9	2.5E+01	n	3.3E+02	n					8.0E+00	n		1.8E-03	n	
		2.00E-07	X			6.00E-01	P	V		1		1.41E+02	Hexane, Commercial	E5241997	1.2E+01	c*	5.1E+01	c*	1.4E+01	c*	6.1E+01	c*	2.8E+01	c*		2.0E-01	c*	
						7.00E-01	I	V		1		1.41E+02	Hexane, N-	110-54-3	6.1E+02	ns	2.5E+03	ns	7.3E+02	n	3.1E+03	n	1.5E+03	n		1.0E+01	n	
				2.00E+00	P					1	0.1		Hexanedioic Acid	124-04-9	1.3E+05	nm	1.6E+06	nm					4.0E+04	n		9.9E+00	n	
9.50E-03	P			7.00E-02	P	4.00E-04	P	V		1		2.74E+02	Hexanol, 1-,2-ethyl- (2-Ethyl-1-hexanol)	104-76-7	1.5E+01	n	6.3E+01	n	4.2E-01	n	1.8E+00	n	8.3E-01	n		2.3E-04	n	
				5.00E-03	I	3.00E-02	I	V		1		3.28E+03	Hexanone, 2-	591-78-6	2.0E+02	n	1.3E+03	n	3.1E+01	n	1.3E+02	n	3.8E+01	n		8.8E-03	n	
				3.30E-02	I					1	0.1		Hexazinone	51235-04-2	2.1E+03	n	2.7E+04	n					6.4E+02	n		3.0E-01	n	
				2.50E-02	I					1	0.1		Hexythiazox	78587-05-0	1.6E+03	n	2.1E+04	n					1.1E+02	n		5.0E-01	n	
				1.70E-02	O					1	0.1		Hydramethylnon	67485-29-4	1.1E+03	n	1.4E+04	n					3.4E+02	n		1.2E+05	n	
3.00E+00	I	4.90E-03	I			3.00E-05	P	V		1		1.12E+05	Hydrazine	302-01-2	3.2E-02	c*	1.4E-01	c*	5.7E-04	c*	2.5E-03	c*	1.1E-03	c*		2.2E-07	c*	
3.00E+00	I	4.90E-03	I							1			Hydrazine Sulfate	10034-93-2	2.3E-01	c	1.1E+00	c	5.7E-04	c	2.5E-03	c	2.6E-02	c				
						2.00E-02	I	V		1			Hydrogen Chloride	7647-01-0	2.8E+07	nm	1.2E+08	nm	2.1E+01	n	8.8E+01	n	4.2E+01	n				
				4.00E-02	C	1.40E-02	C	V		1			Hydrogen Fluoride	7664-39-3	3.1E+03	n	4.7E+04	n	1.5E+01	n	6.1E+01	n	2.8E+01	n				
						2.00E-03	I	V		1			Hydrogen Sulfide	7783-06-4	2.8E+06	nm	1.2E+07	nm	2.1E+00	n	8.8E+00	n	4.2E+00	n				
6.00E-02	P			4.00E-02	P					1	0.1		Hydroquinone	123-31-9	9.0E+00	c	3.8E+01	c					1.3E+00	c		8.7E-04	c	
6.11E-02	O			1.08E-01	O					1	0.1		Imazalil	35554-44-0	8.9E+00	c	3.8E+01	c					9.0E-01	c		1.5E-02	c	
				2.50E-01	I					1	0.1		Imazaquin	81335-37-7	1.6E+04	n	2.1E+05	nm					4.9E+03	n		2.4E+01	n	
				2.50E+00	O					1	0.1		Imazethapyr	81335-77-5	1.6E+05	nm	2.1E+06	nm					4.7E+04	n		4.1E+01	n	

TR=1E-06
THQ=1

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; T = ATSDR DRAFT; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; D = OW; R = ORD; N = WI; W = TEF applied; E = RPF applied; G = see user's guide; c = cancer; n = noncancer; * = where: nc SL < 100X ca SL; ** = where nc SL < 10X ca SL; SSL values are based on DAF=1; m = ceiling limit exceeded; s = Csat exceeded; V = volatile; M = mutagen.

Toxicity and Chemical-specific Information													Contaminant		Screening Levels												Protection of Groundwater SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	mutagen	GIABS	ABS_d	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tap Water (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
				1.00E-02	A					1			Iodine	7553-56-2	7.8E+02	n	1.2E+04	n					2.0E+02	n		1.2E+01	n	
				4.00E-02	I					1	0.1		Iprodione	36734-19-7	2.5E+03	n	3.3E+04	n					7.4E+02	n		2.2E-01	n	
				7.00E-01	P					1			Iron	7439-89-6	5.5E+04	n	8.2E+05	nm					1.4E+04	n		3.5E+02	n	
				3.00E-01	I	4.00E-01	X	V		1		1.00E+04	Isobutyl Alcohol	78-83-1	7.8E+03	n	4.3E+04	ns	4.2E+02	n	1.8E+03	n	7.3E+02	n		1.5E-01	n	
9.50E-04	I			2.00E-01	I	2.00E+00	C			1	0.1		Isophorone	78-59-1	5.7E+02	c*	2.4E+03	c*	2.1E+03	n	8.8E+03	n	7.8E+01	c*		2.6E-02	c*	
				1.50E-02	I			V		1			Isopropalin	33820-53-0	1.2E+03	n	1.8E+04	n					4.0E+01	n		9.2E-01	n	
				2.00E+00	P	2.00E-01	P	V		1		1.09E+05	Isopropanol	67-63-0	5.6E+03	n	2.4E+04	n	2.1E+02	n	8.8E+02	n	4.1E+02	n		8.4E-02	n	
				1.00E-01	I					1	0.1		Isopropyl Methyl Phosphonic Acid	1832-54-8	6.3E+03	n	8.2E+04	n					2.0E+03	n		4.3E-01	n	
				4.00E-03	X	4.00E-02	X	V		1		1.62E+02	Isopropyltoluene, p-	99-87-6	1.7E+02	ns	1.1E+03	ns	4.2E+01	n	1.8E+02	n	2.1E+01	n		5.2E-02	n	
				5.00E-02	I					1	0.1		Isoxaben	82558-50-7	3.2E+03	n	4.1E+04	n					7.3E+02	n		2.0E+00	n	
						3.00E-01	A	V		1			Jet propulsion fuel 7 (JP-7)	E1737665	4.3E+08	nm	1.8E+09	nm	3.1E+02	n	1.3E+03	n	6.3E+02	n				
				8.00E-03	O					1	0.1		Lactofen	77501-63-4	5.1E+02	n	6.6E+03	n					1.0E+02	n		4.6E+00	n	
				2.00E-04	X					1	0.1		Lactonitrile	78-97-7	1.3E+01	n	1.6E+02	n					4.0E+00	n		8.1E-04	n	
				5.00E-05	P					1			Lanthanum	7439-91-0	3.9E+00	n	5.8E+01	n					1.0E+00	n				
				2.08E-05	P					1	0.1		Lanthanum Acetate Hydrate	100587-90-4	1.3E+00	n	1.7E+01	n					4.2E-01	n				
				1.87E-05	P					1			Lanthanum Chloride Heptahydrate	10025-84-0	1.5E+00	n	2.2E+01	n					3.7E-01	n				
				2.83E-05	P					1			Lanthanum Chloride, Anhydrous	10099-58-8	2.2E+00	n	3.3E+01	n					5.7E-01	n				
				1.60E-05	P					1			Lanthanum Nitrate Hexahydrate	10277-43-7	1.3E+00	n	1.9E+01	n					3.2E-01	n				
													Lead Compounds																
8.50E-03	C	1.20E-05	C							1			~Lead Phosphate	7446-27-7	8.2E+01	c	3.8E+02	c	2.3E-01	c	1.0E+00	c	9.1E+00	c				
2.10E-01	C	8.00E-05	C							1	0.1		~Lead acetate	301-04-2	2.6E+00	c	1.1E+01	c	3.5E-02	c	1.5E-01	c	3.7E-01	c		7.5E-05	c	
										1			~Lead and Compounds	7439-92-1	2.0E+02	G	8.0E+02	G	1.5E-01	G			1.0E+01	G	1.0E+01			9.0E+00
										1			~Lead and Compounds (with other sources of lead present, see Guidance)	7439-92-1	1.0E+02	G												
3.80E-02	C	1.10E-05	C							1	0.1		~Lead subacetate	1335-32-6	1.4E+01	c	6.0E+01	c	2.6E-01	c	1.1E+00	c	2.1E+00	c		4.5E-04	c	
				1.00E-07	I			V		1		2.43E+00	~Tetraethyl Lead	78-00-2	7.8E-03	n	1.2E-01	n					1.3E-03	n		4.7E-06	n	
				5.00E-06	P			V		1		3.83E+02	Lewisite	541-25-3	3.9E-01	n	5.8E+00	n					9.0E-02	n		3.8E-05	n	
				7.70E-03	O					1	0.1		Linuron	330-55-2	4.9E+02	n	6.3E+03	n					1.3E+02	n		1.1E-01	n	
				2.00E-03	P					1			Lithium	7439-93-2	1.6E+02	n	2.3E+03	n					4.0E+01	n		1.2E+01	n	
				5.00E-04	I					1	0.1		MCPA	94-74-6	3.2E+01	n	4.1E+02	n					7.5E+00	n		2.0E-03	n	
				4.40E-02	O					1	0.1		MCPB	94-81-5	2.8E+03	n	3.6E+04	n					6.5E+02	n		2.6E-01	n	
				1.00E-03	I					1	0.1		MCPP	93-65-2	6.3E+01	n	8.2E+02	n					1.6E+01	n		4.7E-03	n	
				2.00E-02	I					1	0.1		Malathion	121-75-5	1.3E+03	n	1.6E+04	n					3.9E+02	n		1.0E-01	n	
				1.00E-01	I	7.00E-04	C			1	0.1		Maleic Anhydride	108-31-6	6.3E+03	n	8.0E+04	n	7.3E-01	n	3.1E+00	n	1.9E+03	n		3.8E-01	n	
				5.00E-01	I					1	0.1		Maleic Hydrazide	123-33-1	3.2E+04	n	4.1E+05	nm					1.0E+04	n		2.1E+00	n	
				1.00E-04	P					1	0.1		Malononitrile	109-77-3	6.3E+00	n	8.2E+01	n					2.0E+00	n		4.1E-04	n	
				3.00E-02	H					1	0.1		Mancozeb	8018-01-7	1.9E+03	n	2.5E+04	n					5.4E+02	n		7.6E-01	n	
				5.00E-03	I					1	0.1		Maneb	12427-38-2	3.2E+02	n	4.1E+03	n					9.8E+01	n		1.4E-01	n	
				1.40E-01	I	5.00E-05	I			1			Manganese (Diet)	7439-96-5					5.2E-02	n	2.2E-01	n						
				2.40E-02	G	5.00E-05	I			0.04			Manganese (Non-diet)	7439-96-5	1.8E+03	n	2.6E+04	n	5.2E-02	n	2.2E-01	n	4.3E+02	n		2.8E+01	n	
				9.00E-05	H					1	0.1		Mephosfolan	950-10-7	5.7E+00	n	7.4E+01	n					1.8E+00	n		2.6E-03	n	
				3.00E-02	I					1	0.1		Mepiquat Chloride	24307-26-4	1.9E+03	n	2.5E+04	n					6.0E+02	n		2.0E-01	n	
1.10E-02	P			4.00E-03	P					1	0.1		Mercaptobenzothiazole, 2-	149-30-4	4.9E+01	c**	2.1E+02	c*					6.3E+00	c*		1.8E-02	c*	
													Mercury Compounds																
				3.00E-04	I	3.00E-04	G			0.07			~Mercuric Chloride (and other Mercury salts)	7487-94-7	2.3E+01	n	3.5E+02	n	3.1E-01	n	1.3E+00	n	5.7E+00	n	2.0E+00			
						3.00E-04	I	V		1		3.13E+00	~Mercury (elemental)	7439-97-6	7.1E+00	ns	3.0E+01	ns	3.1E-01	n	1.3E+00	n	6.3E-01	n	2.0E+00	3.3E-02	n	1.0E-01
				1.00E-04	I					1			~Methyl Mercury	22967-92-6	7.8E+00	n	1.2E+02	n					2.0E+00	n		1.4E+01	n	
				8.00E-05	I					1	0.1		~Phenylmercuric Acetate	62-38-4	5.1E+00	n	6.6E+01	n					1.6E+00	n		5.0E-04	n	
				3.00E-05	I			V		1			Merphos	150-50-5	2.3E+00	n	3.5E+01	n					6.0E-01	n		5.9E-02	n	
				6.00E-02	I					1	0.1		Metalaxyl	57837-19-1	3.8E+03	n	4.9E+04	n					1.2E+03	n		3.3E-01	n	
				1.00E-04	I	3.00E-02	P	V		1		4.58E+03	Methacrylonitrile	126-98-7	7.5E+00	n	1.0E+02	n	3.1E+01	n	1.3E+02	n	1.9E+00	n		4.3E-04	n	
				5.00E-05	I					1	0.1		Methamidophos	10265-92-6	3.2E+00	n	4.1E+01	n					1.0E+00	n		2.1E-04	n	
				2.00E+00	I	2.00E+01	I	V		1		1.06E+05	Methanol	67-56-1	1.2E+05	nms	1.2E+06	nms	2.1E+04	n	8.8E+04	n	2.0E+04	n		4.1E+00	n	
				1.50E-03	O					1	0.1		Methidathion	950-37-8	9.5E+01	n	1.2E+03	n					2.9E+01	n		7.1E-03	n	
				2.50E-02	I					1	0.1		Methomyl	16752-77-5	1.6E+03	n	2.1E+04	n					5.0E+02	n		1.1E-01	n	
4.90E-02	C									1	0.1		Methoxy-5-nitroaniline, 2-	99-59-2	1.1E+01	c	4.7E+01	c					1.5E+00	c		5.3E-04	c	
				5.00E-03	I					1	0.1		Methoxychlor	72-43-5	3.2E+02	n	4.1E+03	n					3.7E+01	n	4.0E+01	2.0E+00	n	2.2E+00
				8.00E-03	P	1.00E-03	P	V		1		1.15E+05	Methoxyethanol Acetate, 2-	110-49-6	1.1E+02	n	5.1E+02	n	1.0E+00	n	4.4E+00	n	2.1E+00	n		4.2E-04	n	
				5.00E-03	P	7.00E-03	P	V		1		1.06E+05	Methoxyethanol, 2-	109-86-4	2.6E+02	n	2.0E+03	n	7.3E+00	n	3.1E+01	n	1.3E+01	n		2.6E-03	n	
				1.00E+00	X			V		1		2.90E+04	Methyl Acetate	79-20-9	7.8E+04	ns	1.2E+06	nms					2.0E+04	n		4.1E+00	n	
						2.00E-02	P	V		1		6.75E+03	Methyl Acrylate	96-33-3	1.5E+02	n	6.1E+02	n	2.1E+01	n	8.8E+01	n	4.2E+01	n		8.9E-03	n	
				6.00E-01	I	5.00E+00	I	V		1		2.84E+04	Methyl Ethyl Ketone (2-Butanone)	78-93-3	2.7E+04	n	1.9E+05	nms	5.2E+03	n	2.2E+04	n	5.6E+03	n		1.2E+00	n	
		1.00E-03	X	1.00E-03	P	2.00E-05	X	V		1		1.80E+05	Methyl Hydrazine	60-34-4	1.4E-01	c**	6.2E-01	c**	2.8E-03	c**	1.2E-02	c**	5.6E-03	c**		1.3E-06	c**	
						3.00E+00	I	V		1		3.36E+03	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	108-10-1	3.3E+04	ns	1.4E+05	nms	3.1E+03	n	1.3E+04	n	6.3E+03	n		1.4E+00	n	
						1.00E-03	C	V		1		1.01E+04	Methyl Isocyanate	624-83-9	4.6E+00	n	1.9E+01	n	1.0E+00	n	4.4E+00	n	2.1E+00	n		5.9E-04	n	
				1.40E+00	I	7.00E-01	I	V		1		2.36E+03	Methyl Methacrylate	80-62-6	4.4E+03	ns	1.9E+04	ns	7.3E+02	n	3.1E+03	n	1.4E+03	n		3.0E-01	n	
				2.50E-04	I					1	0.1		Methyl Parathion	298-00-0	1.6E+01	n	2.1E+02	n					4.5E+00	n		7.4E-03	n	
				6.00E-02	X					1	0.1		Methyl Phosphonic Acid	993-13-5	3.8E+03	n	4.9E+04	n					1.2E+03	n		2.4E-01	n	
				6.00E-03	H	4.00E-02	H	V		1		3.93E+02	Methyl Styrene (Mixed Isomers)	25013-15-4	3.2E+02	n	2.6E+03	ns	4.2E+01	n	1.8E+02	n	2.3E+01	n		3.8E-02	n	
9.90E-02	C	2.80E-05	C							1	0.1		Methyl methanesulfonate	66-27-3	5.5E+00	c	2.3E+01	c	1.0E-01	c	4.4E-01	c	7.9E-01	c		1.6E-04	c	
1.80E-03	C	2.60E-07	C			3.00E+00	I	V		1		8.87E+03	Methyl tert-Butyl Ether (MTBE)	1634-04-4	4.7E+01	c	2.1E+02	c	1.1E+01	c	4.7E+01	c	1.4E+01	c		3.2E-03	c	
				3.00E-04	X					1	0.1		Methyl-1,4-benzenediamine dihydrochloride, 2-	615-45-2	1.9E+01	n	2.5E+02	n					6.0E+00	n		3.6E-03	n	
						3.00E+00	X	V		1		2.45E+03	Methyl-2-Pentanol, 4-	108-11-2	5.4E+04	ns	2.3E+05	nms	3.1E+03	n	1.3E+04	n	6.3E+03	n		1.4E+00	n	
9.00E-03	P			2.00E-02	X					1	0.1		Methyl-5-Nitroaniline, 2-	99-55-8	6.0E+01	c*	2.6E+02	c*					8.2E+00	c*		4.6E-03	c*	
8.30E+00	C	2.40E-03	C							1	0.1		Methyl-N-nitro-N-nitrosoguanidine, N-	70-25-7	6.5E-02	c	2.8E-01	c	1.2E-03	c	5.1E-03	c	9.4E-03	c		3.2E-06	c	
1.30E-01	C	3.70E-05	C							1	0.1		Methylaniline Hydrochloride, 2-	636-21-5	4.2E+00	c	1.8E+01	c	7.6E-02	c	3.3E-01	c	6.0E-01	c		2.6E-04	c	
				1.00E-02	A					1	0.1		Methylarsonic acid	124-58-3	6.3E+02	n	8.2E+03	n					2.0E+02	n		5.8E-02	n	
				2.00E-04	X					1	0.1		Methylbenzene,1-4-diamine monohydrochloride, 2-	74612-12-7	1.3E+01	n	1.6E+02	n					4.0E+00	n				
1.00E-01	X			3.00E-04	X					1	0.1		Methylbenzene-1,4-diamine sulfate, 2-	615-50-9	5.4E+00	c**	2.3E+01	c*					7.8E-01	c**				
2.20E+01	C	6.30E-03	C						M	1	0.1		Methylcholanthrene, 3-	56-49-5	5.5E-03	c	1.0E-01	c	1.6E-04	c	1.9E-03	c	1.1E-03	c		2.2E-03	c	
						9.50E-02	X	V		1		6.76E+01	Methylcyclohexane	108-87-2	9.8E+01	ns	4.1E+02	ns	9.9E+01	n	4.2E+02	n	2.0E+02	n		4.4E-01	n	

TR=1E-06
THQ=1

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; T = ATSDR DRAFT; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; D = OW; R = ORD; N = WI; W = TEF applied; E = RPF applied; G = see user's guide; c = cancer; n = noncancer; * = where: nc SL < 100X ca SL; ** = where nc SL < 10X ca SL; SSL values are based on DAF=1; m = ceiling limit exceeded; s = Csat exceeded; V = volatile; M = mutagen.

Toxicity and Chemical-specific Information													Contaminant		Screening Levels										Protection of Groundwater SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	mutagen	GIABS	ABS_d	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tap Water (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
2.00E-03	I	1.00E-08	I	6.00E-03	I	6.00E-01	I	V	M	1		3.32E+03	Methylene Chloride	75-09-2	5.7E+01	c**	1.0E+03	c**	1.0E+02	c**	1.2E+03	c**	1.1E+01	c**	5.0E+00	2.9E-03	c**	1.3E-03
1.00E-01	P	4.30E-04	C	2.00E-03	P				M	1	0.1		Methylene-bis(2-chloroaniline), 4,4'-	101-14-4	1.2E+00	c	2.3E+01	c*	2.4E-03	c	2.9E-02	c	1.6E-01	c		1.8E-03	c		
4.60E-02	I	1.30E-05	C							1	0.1		Methylene-bis(N,N-dimethyl) Aniline, 4,4'-	101-61-1	1.2E+01	c	5.0E+01	c	2.2E-01	c	9.4E-01	c	7.0E-01	c		3.9E-03	c		
1.60E+00	C	4.60E-04	C			2.00E-02	C			1	0.1		Methylenebisbenzenamine, 4,4'-	101-77-9	3.4E-01	c	1.4E+00	c	6.1E-03	c	2.7E-02	c	4.7E-02	c		2.1E-04	c		
						6.00E-04	I			1	0.1		Methylenediphenyl Diisocyanate	101-68-8	8.5E+05	nm	3.6E+06	nm	6.3E-01	n	2.6E+00	n							
				7.00E-02	H			V		1		5.00E+02	Methylstyrene, Alpha-	98-83-9	5.5E+03	ns	8.2E+04	ns					7.8E+02	n		1.2E+00	n		
				1.50E-01	I					1	0.1		Metolachlor	51218-45-2	9.5E+03	n	1.2E+05	nm					2.7E+03	n		3.2E+00	n		
				2.50E-02	I					1	0.1		Metribuzin	21087-64-9	1.6E+03	n	2.1E+04	n					4.9E+02	n		1.5E-01	n		
				2.50E-01	I					1	0.1		Metsulfuron-methyl	74223-64-6	1.6E+04	n	2.1E+05	nm					4.9E+03	n		1.9E+00	n		
		4.50E-06	X	1.00E-02	X	1.00E-01	P	V		1		6.86E+00	Midrange Aliphatic Hydrocarbon Streams	E1790669	6.5E-01	c	2.8E+00	c	6.2E-01	c	2.7E+00	c	1.2E+00	c*		1.8E-02	c*		
				3.00E+00	P			V		1		3.42E-01	Mineral oils	8012-95-1	2.3E+05	nms	3.5E+06	nms					6.0E+04	n		2.4E+03	n		
1.80E+01	C	5.10E-03	C	2.00E-04	I			V		1			Mirex	2385-85-5	3.6E-02	c	1.7E-01	c	5.5E-04	c	2.4E-03	c	8.8E-04	c		6.3E-04	c		
				2.00E-03	I					1	0.1		Molinate	2212-67-1	1.3E+02	n	1.6E+03	n					3.0E+01	n		1.7E-02	n		
				5.00E-03	I	2.00E-03	A			1			Molybdenum	7439-98-7	3.9E+02	n	5.8E+03	n	2.1E+00	n	8.8E+00	n	1.0E+02	n		2.0E+00	n		
				1.00E-01	I					1			Monochloramine	10599-90-3	7.8E+03	n	1.2E+05	nm					2.0E+03	n	4.0E+03(G)				
				2.00E-03	P					1	0.1		Monomethylaniline	100-61-8	1.3E+02	n	1.6E+03	n					3.8E+01	n		1.4E-02	n		
				2.50E-02	I					1	0.1		Myclobutanil	88671-89-0	1.6E+03	n	2.1E+04	n					4.5E+02	n		5.6E+00	n		
				3.00E-04	X					1	0.1		N,N'-Diphenyl-1,4-benzenediamine	74-31-7	1.9E+01	n	2.5E+02	n					3.6E+00	n		3.7E-01	n		
				2.00E-03	I			V		1			Naled	300-76-5	1.6E+02	n	2.3E+03	n					4.0E+01	n		1.8E-02	n		
				3.00E-02	X	1.00E-01	P	V		1			Naphtha, High Flash Aromatic (HFAN)	64742-95-6	2.3E+03	n	3.5E+04	n	1.0E+02	n	4.4E+02	n	1.5E+02	n					
1.80E+00	C	0.00E+00	C							1	0.1		Naphthylamine, 2-	91-59-8	3.0E-01	c	1.3E+00	c					3.9E-02	c		2.0E-04	c		
				1.20E-01	O					1	0.1		Napropamide	15299-99-7	7.6E+03	n	9.8E+04	n					2.0E+03	n		1.3E+01	n		
		2.60E-04	C	1.10E-02	C	1.40E-05	C			1	0.1		Nickel Acetate	373-02-4	6.7E+02	n	8.1E+03	n	1.1E-02	c**	4.7E-02	c**	2.2E+02	n		4.5E-02	n		
		2.60E-04	C	1.10E-02	C	1.40E-05	C			1	0.1		Nickel Carbonate	3333-67-3	6.7E+02	n	8.1E+03	n	1.1E-02	c**	4.7E-02	c**	2.2E+02	n					
		2.60E-04	C	1.10E-02	C	1.40E-05	C	V		1			Nickel Carbonyl	13463-39-3	8.2E+02	n	1.1E+04	n	1.1E-02	c**	4.7E-02	c**	2.2E-02	c**					
		2.60E-04	C	1.10E-02	C	1.40E-05	C			0.04			Nickel Hydroxide	12054-48-7	8.2E+02	n	1.1E+04	n	1.1E-02	c**	4.7E-02	c**	2.0E+02	n					
		2.60E-04	C	1.10E-02	C	2.00E-05	C			0.04			Nickel Oxide	1313-99-1	8.4E+02	n	1.2E+04	n	1.1E-02	c**	4.7E-02	c**	2.0E+02	n					
		2.40E-04	I	1.10E-02	C	1.40E-05	C			0.04			Nickel Refinery Dust	E715532	8.2E+02	n	1.1E+04	n	1.2E-02	c**	5.1E-02	c**	2.2E+02	n		3.2E+01	n		
		2.60E-04	C	2.00E-02	I	1.00E-05	T			0.04			Nickel Soluble Salts	7440-02-0	1.4E+03	n	1.7E+04	n	1.0E-02	n	4.4E-02	n	3.9E+02	n		2.6E+01	n		
1.70E+00	C	4.80E-04	I	1.10E-02	C	1.40E-05	C			0.04			Nickel Subsulfide	12035-72-2	4.1E-01	c	1.9E+00	c	5.8E-03	c**	2.6E-02	c**	4.5E-02	c					
9.10E-01	C	2.60E-04	C	1.10E-02	C	1.40E-05	C			1	0.1		Nickelocene	1271-28-9	6.0E-01	c	2.5E+00	c	1.1E-02	c**	4.7E-02	c**	8.6E-02	c					
				1.60E+00	I					1			Nitrate (measured as nitrogen)	14797-55-8	1.3E+05	nm	1.9E+06	nm					3.2E+04	n	1.0E+04				
										1			Nitrate + Nitrite (measured as nitrogen)	E701177											1.0E+04				
				1.00E-01	I					1			Nitrite (measured as nitrogen)	14797-65-0	7.8E+03	n	1.2E+05	nm					2.0E+03	n	1.0E+03				
				1.00E-02	X	5.00E-05	X			1	0.1		Nitroaniline, 2-	88-74-4	6.3E+02	n	8.0E+03	n	5.2E-02	n	2.2E-01	n	1.9E+02	n		8.0E-02	n		
2.00E-02	P			4.00E-03	P	6.00E-03	P			1	0.1		Nitroaniline, 4-	100-01-6	2.7E+01	c**	1.1E+02	c*	6.3E+00	n	2.6E+01	n	3.8E+00	c*		1.6E-03	c*		
		4.00E-05	I	2.00E-03	I	9.00E-03	I	V		1		3.05E+03	Nitrobenzene	98-95-3	5.1E+00	c*	2.2E+01	c*	7.0E-02	c	3.1E-01	c	1.4E-01	c*		9.2E-05	c*		
				3.00E+03	P					1	0.1		Nitrocellulose	9004-70-0	1.9E+08	nm	2.5E+09	nm					6.0E+07	n		1.3E+04	n		
				7.00E-02	H					1	0.1		Nitrofurantoin	67-20-9	4.4E+03	n	5.7E+04	n					1.4E+03	n		6.1E-01	n		
1.30E+00	C	3.70E-04	C							1	0.1		Nitrofurazone	59-87-0	4.2E-01	c	1.8E+00	c	7.6E-03	c	3.3E-02	c	6.0E-02	c		5.4E-05	c		
1.70E-02	P			1.00E-04	P					1	0.1		Nitroglycerin	55-63-0	6.3E+00	n	8.2E+01	n					2.0E+00	n		8.5E-04	n		
				1.00E-01	I					1	0.1		Nitroguanidine	556-88-7	6.3E+03	n	8.2E+04	n					2.0E+03	n		4.8E-01	n		
		8.80E-06	P			5.00E-03	P	V		1		1.80E+04	Nitromethane	75-52-5	5.4E+00	c*	2.4E+01	c*	3.2E-01	c*	1.4E+00	c*	6.4E-01	c*		1.4E-04	c*		
		5.80E-04	X			2.00E-02	I	V		1		4.86E+03	Nitropropane, 2-	79-46-9	6.4E-02	c	2.8E-01	c	4.8E-03	c	2.1E-02	c	9.7E-03	c		2.5E-06	c		
2.70E+01	C	7.70E-03	C						M	1	0.1		Nitroso-N-ethylurea, N-	759-73-9	4.5E-03	c	8.5E-02	c	1.3E-04	c	1.6E-03	c	9.2E-04	c		2.2E-07	c		
1.20E+02	C	3.40E-02	C						M	1	0.1		Nitroso-N-methylurea, N-	684-93-5	1.0E-03	c	1.9E-02	c	3.0E-05	c	3.6E-04	c	2.1E-04	c		4.6E-08	c		
5.40E+00	I	1.60E-03	I					V		1			Nitrosodibutylamine, N-	924-16-3	9.9E-02	c	4.6E-01	c	1.8E-03	c	7.7E-03	c	2.7E-03	c		5.5E-06	c		
2.80E+00	I	8.00E-04	C							1	0.1		Nitrosodiethanolamine, N-	1116-54-7	1.9E-01	c	8.2E-01	c	3.5E-03	c	1.5E-02	c	2.8E-02	c		5.6E-06	c		
1.50E+02	I	4.30E-02	I						M	1	0.1		Nitrosodiethylamine, N-	55-18-5	8.1E-04	c	1.5E-02	c	2.4E-05	c	2.9E-04	c	1.7E-04	c		6.1E-08	c		
5.10E+01	I	1.40E-02	I	8.00E-06	P	4.00E-05	X	V	M	1		2.37E+05	Nitrosodimethylamine, N-	62-75-9	2.0E-03	c	3.4E-02	c	7.2E-05	c	8.8E-04	c	1.1E-04	c		2.7E-08	c		
4.90E-03	I	2.60E-06	C							1	0.1		Nitrosodiphenylamine, N-	86-30-6	1.1E+02	c	4.7E+02	c	1.1E+00	c	4.7E+00	c	1.2E+01	c		6.7E-02	c		
7.00E+00	I	2.00E-03	C							1	0.1		Nitrosodipropylamine, N-	621-64-7	7.8E-02	c	3.3E-01	c	1.4E-03	c	6.1E-03	c	1.1E-02	c		8.1E-06	c		
2.20E+01	I	6.30E-03	C					V		1		1.08E+05	Nitrosomethylethylamine, N-	10595-95-6	2.0E-02	c	9.1E-02	c	4.5E-04	c	1.9E-03	c	7.1E-04	c		2.0E-07	c		
6.70E+00	C	1.90E-03	C							1	0.1		Nitrosomorpholine [N-]	59-89-2	8.1E-02	c	3.4E-01	c	1.5E-03	c	6.5E-03	c	1.2E-02	c		2.8E-06	c		
9.40E+00	C	2.70E-03	C							1	0.1		Nitrosopiperidine [N-]	100-75-4	5.8E-02	c	2.4E-01	c	1.0E-03	c	4.5E-03	c	8.2E-03	c		4.4E-06	c		
2.10E+00	I	6.10E-04	I							1	0.1		Nitrosopyrrolidine, N-	930-55-2	2.6E-01	c	1.1E+00	c	4.6E-03	c	2.0E-02	c	3.7E-02	c		1.4E-05	c		
				1.00E-04	X					1	0.1		Nitrotoluene, m-	99-08-1	6.3E+00	n	8.2E+01	n					1.7E+00	n		1.6E-03	n		
2.20E-01	P			9.00E-04	P			V		1		1.51E+03	Nitrotoluene, o-	88-72-2	3.2E+00	c*	1.5E+01	c*					3.1E-01	c*		3.0E-04	c*		
1.60E-02	P			4.00E-03	P					1	0.1		Nitrotoluene, p-	99-99-0	3.4E+01	c**	1.4E+02	c*					4.3E+00	c*		4.0E-03	c*		
				3.00E-04	X	2.00E-02	P	V		1		6.86E+00	Nonane, n-	111-84-2	1.1E+01	ns	7.2E+01	ns	2.1E+01	n	8.8E+01	n	5.3E+00	n		7.5E-02	n		
				1.50E-03	O					1	0.1		Norflurazon	27314-13-2	9.5E+01	n	1.2E+03	n					2.9E+01	n		1.9E-01	n		
				3.00E-03	I					1	0.1		Octabromodiphenyl Ether	32536-52-0	1.9E+02	n	2.5E+03	n					6.0E+01	n		1.2E+01	n		
				5.00E-02	I					1	0.006		Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	3.9E+03	n	5.7E+04	n					1.0E+03	n		1.3E+00	n		
				2.00E-03	H					1	0.1		Octamethylpyrophosphoramide	152-16-9	1.3E+02	n	1.6E+03	n					4.0E+01	n		9.6E-03	n		
7.79E-03	O			1.90E-01	O					1	0.1		Oryzalin	19044-88-3	7.0E+01	c	2.9E+02	c					7.9E+00	c		1.5E-02	c		
				5.00E-03	I					1	0.1		Oxadiazon	19666-30-9	3.2E+02	n	4.1E+03	n					4.7E+01	n		4.8E-01	n		
				2.50E-02	I					1	0.1		Oxamyl	23135-22-0	1.6E+03	n	2.1E+04	n					5.0E+02	n	2.0E+02	1.1E-01	n	4.4E-02	
7.32E-02	O			4.00E-02	O					1	0.1		Oxyfluorfen	42874-03-3	7.4E+00	c	3.1E+01	c					5.4E-01	c		4.3E-02	c		
				1.30E-02	I					1	0.1		Paclobutrazol	76738-62-0	8.2E+02	n	1.1E+04	n					2.3E+02	n		4.6E-01	n		
				4.50E-03	I					1	0.1		Paraquat Dichloride	1910-42-5	2.8E+02	n	3.7E+03	n					9.0E+01	n		1.2E+00	n		
				6.00E-03	H					1	0.1		Parathion	56-38-2	3.8E+02	n	4.9E+03	n					8.6E+01	n		4.3E-01	n		
				5.00E-02	H			V		1			Pebulate	1114-71-2	3.9E+03	n	5.8E+04	n					5.6E+02	n		4.5E-01	n		
				3.00E-01	O					1	0.1		Pendimethalin	40487-42-1	1.9E+04	n	2.5E+05	nm					1.4E+03	n		1.6E+01	n		
				2.00E-03	I			V		1		3.12E-01	Pentabromodiphenyl Ether	32534-81-9	1.6E+02	ns	2.3E+03	ns					4.0E+01	n		1.7E+00	n		
				1.00E-04	I					1	0.1		Pentabromodiphenyl ether, 2,2',4,4',5- (BDE-99)	60348-60-9	6.3E+00	n	8.2E+01	n					2.0E+00	n		8.7E-02	n		
				8.00E-04	I			V		1			Pentachlorobenzene	608-93-5	6.3E+01	n	9.3E+02	n					3.2E+00	n		2.4E-02	n		
9.00E-02	P							V		1		4.57E+02	Pentachloroethane	76-01-7	7.7E+00	c	3.6E+01	c					6.5E-01	c		3.1E-04	c		
2.60E-01	H			3.00E-03	I			V		1			Pentachloronitrobenzene	82-68-8	2.7E+00	c*	1.3E+01	c					1.2E-01	c		1.5E-03	c		
4.00E-01	I	5.10E-06	C	5.00E-03	I					1	0.25		Pentachlorophenol	87-86-5	1.0E+00	c	4.0E+00	c	5.5E-01	c	2.4E+00	c	4.1E-02	c	1.0E+00	5.7E-05	c	1.4E-03	
4.30E-03	X			9.00E-03	P					1	0.1		Pentaerythritol tetranitrate (PETN)	78-11-5	1.3E+02	c**	5.3E+02	c*					1.7E+01	c**		2.6E-02	c**		

TR=1E-06
THQ=1.0

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; T = ATSDR DRAFT; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; D = OW; R = ORD; N = WI; W = TEF applied; E = RPF applied; G = see user's guide; c = cancer; n = noncancer; * = where: nc SL < 100X ca SL; ** = where nc SL < 10X ca SL; SSL values are based on DAF=1; m = ceiling limit exceeded; s = Csat exceeded; V = volatile; M = mutagen.

Toxicity and Chemical-specific Information													Contaminant		Screening Levels												Protection of Groundwater SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	mutagen	GIABS	ABS_d	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tap Water (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
				1.00E-04	X					1	0.1		Pentamethylphosphoramide (PMPA)	10159-46-3	6.3E+00	n	8.2E+01	n					2.0E+00	n		4.1E-04	n	
						1.00E+00	P	V		1		3.88E+02	Pentane, n-	109-66-0	8.1E+02	ns	3.4E+03	ns	1.0E+03	n	4.4E+03	n	2.1E+03	n		1.0E+01	n	
													Per- and Polyfluoroalkyl Substances (PFAS)																
				3.00E-06	D					1	0.1		~Ammonium perfluoro-2-methyl-3-oxahexanoate	62037-80-3	1.9E-01	n	2.5E+00	n					2.1E-02	n		2.2E-05	n	
				1.00E-03	I			V		1		2.68E+02	~Ammonium perfluorobutanoate	10495-86-0	7.8E+01	n	1.2E+03	ns					1.9E+01	n		6.8E-03	n	
				2.07E-09	I					1	0.1		~Ammonium perfluorodecanoate	3108-42-7	1.3E-04	n	1.7E-03	n					4.2E-05	n		4.1E-08	n	
				5.00E-04	I					1	0.1		~Ammonium perfluorohexanoate	21615-47-4	3.2E+01	n	4.1E+02	n					7.2E+00	n		1.7E-03	n	
2.93E+04	D			3.00E-08	D					1	0.1		~Ammonium perfluorooctanoate	3825-26-1	1.9E-05	c	7.8E-05	c					2.7E-06	c		4.0E-08	c	
				3.00E-04	R			V		1			~Bis(trifluoromethylsulfonyl)amine (TFSI)	82113-65-3	2.3E+01	n	3.5E+02	n					5.9E+00	n		1.9E-03	n	
				3.00E-06	D			V		1		1.92E+06	~Hexafluoropropylene oxide dimer acid (HFPO-DA)	13252-13-6	2.3E-01	n	3.5E+00	n					1.5E-02	n	1.0E-02(G)	1.5E-05	n	1.0E-05
				3.00E-04	R			V		1			~Lithium bis[(trifluoromethyl)sulfonyl]azanide	90076-65-6	2.3E+01	n	3.5E+02	n					6.0E+00	n		1.9E-03	n	
				3.00E-06	D			V		1		1.92E+06	~Perfluoro(2-propoxypropanoate)	122499-17-6	2.3E-01	n	3.5E+00	n					6.0E-02	n	1.0E-02(G)	6.1E-05	n	1.0E-05
				3.00E-04	P					1	0.1		~Perfluorobutanesulfonate	45187-15-3	1.9E+01	n	2.5E+02	n					6.0E+00	n	(G)	3.0E-03	n	
				3.00E-04	P					1	0.1		~Perfluorobutanesulfonic acid (PFBS)	375-73-5	1.9E+01	n	2.5E+02	n					6.0E+00	n	(G)	3.0E-03	n	
				1.00E-03	I			V		1		2.56E+03	~Perfluorobutanoate	45048-62-2	7.8E+01	n	1.2E+03	n					1.8E+01	n		6.3E-03	n	
				1.00E-03	I			V		1		2.57E+03	~Perfluorobutanoic acid (PFBA)	375-22-4	7.8E+01	n	1.2E+03	n					1.8E+01	n		6.5E-03	n	
				2.00E-09	I					1	0.1		~Perfluorodecanoate	73829-36-4	1.3E-04	n	1.6E-03	n					4.0E-05	n		4.0E-08	n	
				2.00E-09	I					1	0.1		~Perfluorodecanoic acid (PFDA)	335-76-2	1.3E-04	n	1.6E-03	n					4.0E-05	n		8.1E-08	n	
				5.00E-05	N					1	0.1		~Perfluorododecanoic acid (PFDoDA)	307-55-1	3.2E+00	n	4.1E+01	n					1.0E+00	n		1.7E-01	n	
				2.00E-05	A					1	0.1		~Perfluorohexanesulfonate	108427-53-8	1.3E+00	n	1.6E+01	n					3.9E-01	n	1.0E-02(G)	1.7E-04	n	4.2E-06
				2.00E-05	A					1	0.1		~Perfluorohexanesulfonic acid (PFHxS)	355-46-4	1.3E+00	n	1.6E+01	n					3.9E-01	n	1.0E-02(G)	1.7E-04	n	4.2E-06
				5.00E-04	I					1	0.1		~Perfluorohexanoate	92612-52-7	3.2E+01	n	4.1E+02	n					6.1E+00	n		1.5E-03	n	
				5.00E-04	I					1	0.1		~Perfluorohexanoic acid (PFHxA)	307-24-4	3.2E+01	n	4.1E+02	n					9.9E+00	n		2.4E-03	n	
				3.00E-06	A					1	0.1		~Perfluorononanoate	72007-68-2	1.9E-01	n	2.5E+00	n					5.9E-02	n	1.0E-02(G)	2.5E-04	n	4.2E-05
				3.00E-06	A					1	0.1		~Perfluorononanoic acid (PFNA)	375-95-1	1.9E-01	n	2.5E+00	n					5.9E-02	n	1.0E-02(G)	2.5E-04	n	4.2E-05
				4.00E-02	N					1	0.1		~Perfluorooctadecanoic acid (PFODA)	16517-11-6	2.5E+03	n	3.3E+04	n					8.0E+02	n		2.2E+02	n	
3.95E+01	D			1.00E-07	D					1	0.1		~Perfluorooctanesulfonate	45298-90-6	6.3E-03	n	5.8E-02	c**					2.0E-03	c**	4.0E-03	1.5E-05	c**	3.0E-05
3.95E+01	D			1.00E-07	D					1	0.1		~Perfluorooctanesulfonic acid (PFOS)	1763-23-1	6.3E-03	n	5.8E-02	c**					2.0E-03	c**	4.0E-03	1.5E-05	c**	3.0E-05
2.93E+04	D			3.00E-08	D					1	0.1		~Perfluorooctanoate	45285-51-6	1.9E-05	c	7.8E-05	c					2.7E-06	c	4.0E-03	4.0E-08	c	6.1E-05
2.93E+04	D			3.00E-08	D					1	0.1		~Perfluorooctanoic acid (PFOA)	335-67-1	1.9E-05	c	7.8E-05	c					2.7E-06	c	4.0E-03	4.0E-08	c	6.1E-05
				5.00E-04	R			V		1		1.36E+04	~Perfluoropropanoic acid (PFPrA)	422-64-0	3.9E+01	n	5.8E+02	n					9.8E+00	n		2.1E-03	n	
				1.00E-03	N					1	0.1		~Perfluorotetradecanoic acid (PFTetDA)	376-06-7	6.3E+01	n	8.2E+02	n					2.0E+01	n		9.4E+00	n	
				3.00E-04	N					1	0.1		~Perfluoroundecanoic acid (PFUDA)	2058-94-8	1.9E+01	n	2.5E+02	n					6.0E+00	n		4.5E-02	n	
				3.00E-04	P					1	0.1		~Potassium perfluorobutanesulfonate	29420-49-3	1.9E+01	n	2.5E+02	n					6.0E+00	n		3.0E-03	n	
				2.00E-03	I			V		1		9.61E+04	~Potassium perfluorobutanoate	2966-54-3	1.6E+02	n	2.3E+03	n					3.8E+01	n		1.3E-02	n	
				2.15E-09	I					1	0.1		~Potassium perfluorodecanoate	51604-85-4	1.4E-04	n	1.8E-03	n					4.3E-05	n		4.3E-08	n	
3.95E+01	D			1.00E-07	D					1	0.1		~Potassium perfluorooctanesulfonate	2795-39-3	6.3E-03	n	5.8E-02	c**					2.0E-03	c**		1.5E-05	c**	
				1.00E-03	I			V		1		8.99E+04	~Sodium perfluorobutanoate	2218-54-4	7.8E+01	n	1.2E+03	n					1.8E+01	n		6.4E-03	n	
				2.09E-09	I					1	0.1		~Sodium perfluorodecanoate	3830-45-3	1.3E-04	n	1.7E-03	n					4.2E-05	n		4.2E-08	n	
				5.00E-04	I					1	0.1		~Sodium perfluorohexanoate	2923-26-4	3.2E+01	n	4.1E+02	n					1.0E+01	n		2.4E-03	n	
													Perchlorates																
				7.00E-04	I					1			~Ammonium Perchlorate	7790-98-9	5.5E+01	n	8.2E+02	n					1.4E+01	n				
				7.00E-04	I					1			~Lithium Perchlorate	7791-03-9	5.5E+01	n	8.2E+02	n					1.4E+01	n				
				7.00E-04	I					1			~Perchlorate and Perchlorate Salts	14797-73-0	5.5E+01	n	8.2E+02	n					1.4E+01	n	1.5E+01(G)			
				7.00E-04	I					1			~Potassium Perchlorate	7778-74-7	5.5E+01	n	8.2E+02	n					1.4E+01	n				
				7.00E-04	I					1			~Sodium Perchlorate	7601-89-0	5.5E+01	n	8.2E+02	n					1.4E+01	n				
				5.00E-02	I					1	0.1		Permethrin	52645-53-1	3.2E+03	n	4.1E+04	n					1.0E+03	n		2.4E+02	n	
2.20E-03	C	6.30E-07	C							1	0.1		Phenacetin	62-44-2	2.5E+02	c	1.0E+03	c	4.5E+00	c	1.9E+01	c	3.4E+01	c		9.7E-03	c	
				2.40E-01	O					1	0.1		Phenmedipham	13684-63-4	1.5E+04	n	2.0E+05	nm					3.8E+03	n		2.1E+01	n	
				3.00E-01	I	2.00E-01	C			1	0.1		Phenol	108-95-2	1.9E+04	n	2.5E+05	nm	2.1E+02	n	8.8E+02	n	5.8E+03	n		3.3E+00	n	
				4.00E-03	I					1	0.1		Phenol, 2-(1-methylethoxy)-, methylcarbamate	114-26-1	2.5E+02	n	3.3E+03	n					7.8E+01	n		2.5E-02	n	
				5.00E-04	X					1	0.1		Phenothiazine	92-84-2	3.2E+01	n	4.1E+02	n					4.3E+00	n		1.4E-02	n	
				2.00E-04	X			V		1		1.29E+02	Phenyl Isothiocyanate	103-72-0	1.6E+01	n	2.3E+02	ns					2.6E+00	n		1.7E-03	n	
				6.00E-03	I					1	0.1		Phenylenediamine, m-	108-45-2	3.8E+02	n	4.9E+03	n					1.2E+02	n		3.2E-02	n	
1.20E-01	P			4.00E-03	P				M	1	0.1		Phenylenediamine, o-	95-54-5	1.0E+00	c	1.9E+01	c					2.1E-01	c		5.6E-05	c	
				1.00E-03	X					1	0.1		Phenylenediamine, p-	106-50-3	6.3E+01	n	8.2E+02	n					2.0E+01	n		5.4E-03	n	
1.94E-03	H									1	0.1		Phenylphenol, 2-	90-43-7	2.8E+02	c	1.2E+03	c					3.0E+01	c		4.1E-01	c	
				2.00E-04	H					1	0.1		Phorate	298-02-2	1.3E+01	n	1.6E+02	n					3.0E+00	n		3.4E-03	n	
						3.00E-04	I	V		1		1.61E+03	Phosgene	75-44-5	3.1E-01	n	1.3E+00	n	3.1E-01	n	1.3E+00	n	6.3E-01	n		1.6E-04	n	
				2.00E-02	I					1	0.1		Phosmet	732-11-6	1.3E+03	n	1.6E+04	n					3.7E+02	n		8.2E-02	n	
													Phosphates, Inorganic																
				2.93E+00	X					1			~Aluminum metaphosphate	13776-88-0	2.3E+05	nm	3.4E+06	nm					5.9E+04	n				
				3.00E-01	X					1			~Aluminum salts of inorganic phosphates	E524680405	2.3E+04	n	3.5E+05	nm					6.0E+03	n				
				1.00E+00	P					1			~Dipotassium phosphate	7758-11-4	7.8E+04	n	1.2E+06	nm					2.0E+04	n				
				1.00E+00	P					1			~Disodium phosphate	7558-79-4	7.8E+04	n	1.2E+06	nm					2.0E+04	n				
				3.54E+00	X					1			~Monoaluminum phosphate	13530-50-2	2.8E+05	nm	4.1E+06	nm					7.1E+04	n				
				1.00E+00	P					1			~Monopotassium phosphate	7778-77-0	7.8E+04	n	1.2E+06	nm					2.0E+04	n				
				1.00E+00	P					1			~Monosodium phosphate	7558-80-7	7.8E+04	n	1.2E+06	nm					2.0E+04	n				
				1.00E+00	P	1.00E-02	I			1			~Phosphoric Acid	7664-38-2	7.8E+04	n	1.1E+06	nm	1.0E+01	n	4.4E+01	n	2.0E+04	n				
				1.36E+00	X					1	0.1		~Phosphoric acid, aluminum salt (1:1) [aluminum phosphate]	7784-30-7	8.6E+04	n	1.1E+06	nm					2.7E+04	n				
				4.26E+00	X					1			~Phosphoric acid, aluminum sodium salt (1:X:X) [sodium aluminum phosphate acidic (acidic SALP)]	7785-88-8	3.3E+05	nm	5.0E+06	nm					8.5E+04	n				
				1.00E+00	P					1			~Polyphosphoric acid	8017-16-1	7.8E+04	n	1.2E+06	nm					2.0E+04	n				
				1.00E+00	P					1			~Potassium salts of inorganic phosphates	E524680403	7.8E+04	n	1.2E+06	nm					2.0E+04	n				
				1.00E+00	P					1			~Potassium tripolyphosphate	13845-36-8	7.8E+04	n	1.2E+06	nm					2.0E+04	n				
				4.99E+00	X					1			~Sodium aluminum phosphate (anhydrous)	10279-59-1	3.9E+05	nm	5.8E+06	nm					1.0E+05	n				
				3.52E+00	X					1			~Sodium aluminum phosphate (tetrahydrate)	10305-76-7	2.8E+05	nm	4.1E+06	nm					7.0E+04	n				
				1.00E+00	P					1			~Sodium hexametaphosphate	10124-56-8	7.8E+04	n	1.2E+06	nm					2.0E+04	n				
				1.00E+00	P					1			~Sodium polyphosphate	68915-31-1	7.8E+04	n	1.2E+06	nm					2.0E+04	n				
				1.00E+00	P					1			~Sodium pyrophosphate	7758-16-9	7.8E+04	n	1.2E+06	nm					2.0E+04	n				
				1.00E+00	P					1			~Sodium salts of inorganic phosphates	E524680404	7.8E+04	n	1.2E+06	nm					2.0E+04	n				

TR=1E-06
THQ=1

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; T = ATSDR DRAFT; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; D = OW; R = ORD; N = WI; W = TEF applied; E = RPF applied; G = see user's guide; c = cancer; n = noncancer; * = where: nc SL < 100X ca SL; ** = where nc SL < 10X ca SL; SSL values are based on DAF=1; m = ceiling limit exceeded; s = Csat exceeded; V = volatile; M = mutagen.

Toxicity and Chemical-specific Information														Contaminant		Screening Levels												Protection of Groundwater SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	mutagen	GIABS	ABS_d	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tap Water (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
				1.00E+00	P					1			~Sodium trimetaphosphate	7785-84-4	7.8E+04	n	1.2E+06	nm					2.0E+04	n				
				1.00E+00	P					1			~Sodium tripolyphosphate	7758-29-4	7.8E+04	n	1.2E+06	nm					2.0E+04	n				
				1.00E+00	P					1			~Tetrapotassium phosphate	7320-34-5	7.8E+04	n	1.2E+06	nm					2.0E+04	n				
				1.00E+00	P					1			~Tetrasodium pyrophosphate	7722-88-5	7.8E+04	n	1.2E+06	nm					2.0E+04	n				
				3.25E+00	X					1			~Trialuminum sodium tetra decahydrogenoctaorthophosphate (dihydrate)	15136-87-5	2.5E+05	nm	3.8E+06	nm					6.5E+04	n				
				3.13E+00	X					1	0.1		~Triphosphoric acid, aluminum salt (1:1) [aluminum triphosphate]	13939-25-8	2.0E+05	nm	2.6E+06	nm					6.2E+04	n				
				1.00E+00	P					1			~Tripotassium phosphate	7778-53-2	7.8E+04	n	1.2E+06	nm					2.0E+04	n				
				1.00E+00	P					1			~Trisodium phosphate	7601-54-9	7.8E+04	n	1.2E+06	nm					2.0E+04	n				
				3.00E-04	I	3.00E-04	I	V		1			Phosphine	7803-51-2	2.3E+01	n	3.5E+02	n	3.1E-01	n	1.3E+00	n	5.7E-01	n				
				2.00E-05	I			V		1			Phosphorus	7723-14-0	1.6E+00	n	2.3E+01	n					4.0E-01	n		1.5E-03	n	
				2.00E-05	G			V		1			Phosphorus, white	12185-10-3	1.6E+00	n	2.3E+01	n					4.0E-01	n		1.5E-03	n	
													Phthalates																
1.40E-02	I	2.40E-06	C	2.00E-02	I					1	0.1		~Bis(2-ethylhexyl)phthalate	117-81-7	3.9E+01	c*	1.6E+02	c	1.2E+00	c	5.1E+00	c	5.6E+00	c*	6.0E+00	1.3E+00	c*	1.4E+00
1.90E-03	P			2.00E-01	I					1	0.1		~Butyl Benzyl Phthalate	85-68-7	2.9E+02	c*	1.2E+03	c					1.6E+01	c		2.4E-01	c	
				1.00E+00	I					1	0.1		~Butylphthalyl Butylglycolate	85-70-1	6.3E+04	n	8.2E+05	nm					1.3E+04	n		3.1E+02	n	
				1.00E-01	I					1	0.1		~Dibutyl Phthalate	84-74-2	6.3E+03	n	8.2E+04	n					9.0E+02	n		2.3E+00	n	
				8.00E-01	I					1	0.1		~Diethyl Phthalate	84-66-2	5.1E+04	n	6.6E+05	nm					1.5E+04	n		6.1E+00	n	
				1.00E-01	I			V		1			~Dimethylterephthalate	120-61-6	7.8E+03	n	1.2E+05	nm					1.9E+03	n		4.9E-01	n	
				1.00E-02	P					1	0.1		~Octyl Phthalate, di-N-	117-84-0	6.3E+02	n	8.2E+03	n					2.0E+02	n		5.7E+01	n	
				5.00E-01	X					1	0.1		~Phthalic Acid, p-	100-21-0	3.2E+04	n	4.1E+05	nm					9.4E+03	n		3.4E+00	n	
				2.00E+00	I	2.00E-02	C			1	0.1		~Phthalic Anhydride	85-44-9	1.3E+05	nm	1.6E+06	nm	2.1E+01	n	8.8E+01	n	3.9E+04	n		8.5E+00	n	
				7.00E-02	I					1	0.1		Picloram	1918-02-1	4.4E+03	n	5.7E+04	n					1.4E+03	n	5.0E+02	3.8E-01	n	1.4E-01
				1.00E-04	X					1	0.1		Picramic Acid (2-Amino-4,6-dinitrophenol)	96-91-3	6.3E+00	n	8.2E+01	n					2.0E+00	n		1.3E-03	n	
				2.00E-03	X					1	0.1		Picric Acid (2,4,6-Trinitrophenol)	88-89-1	1.3E+02	n	1.6E+03	n					4.0E+01	n		1.9E-01	n	
				7.30E-04	O					1	0.1		Pirimiphos, Methyl	29232-93-7	4.6E+01	n	6.0E+02	n					8.9E+00	n		8.4E-03	n	
3.00E+01	C	8.60E-03	C	7.00E-06	H					1	0.1		Polybrominated Biphenyls	36355-01-8	1.8E-02	c*	7.7E-02	c*	3.3E-04	c	1.4E-03	c	2.6E-03	c*				
													Polychlorinated Biphenyls (PCBs)																
7.00E-02	G	2.00E-05	G	7.00E-05	I			V		1	0.14		~Aroclor 1016	12674-11-2	4.1E+00	n	2.7E+01	c**	1.4E-01	c	6.1E-01	c	2.2E-01	c**		2.1E-02	c**	
2.00E+00	G	5.71E-04	G					V		1	0.14		~Aroclor 1221	11104-28-2	2.0E-01	c	8.3E-01	c	4.9E-03	c	2.1E-02	c	4.7E-03	c		8.0E-05	c	
2.00E+00	G	5.71E-04	G					V		1	0.14		~Aroclor 1232	11141-16-5	1.7E-01	c	7.2E-01	c	4.9E-03	c	2.1E-02	c	4.7E-03	c		8.0E-05	c	
2.00E+00	G	5.71E-04	G					V		1	0.14		~Aroclor 1242	53469-21-9	2.3E-01	c	9.5E-01	c	4.9E-03	c	2.1E-02	c	7.8E-03	c		1.2E-03	c	
2.00E+00	G	5.71E-04	G					V		1	0.14		~Aroclor 1248	12672-29-6	2.3E-01	c	9.4E-01	c	4.9E-03	c	2.1E-02	c	7.8E-03	c		1.2E-03	c	
2.00E+00	G	5.71E-04	G	2.00E-05	I			V		1	0.14		~Aroclor 1254	11097-69-1	2.4E-01	c**	9.7E-01	c*	4.9E-03	c	2.1E-02	c	7.8E-03	c*		2.0E-03	c*	
2.00E+00	G	5.71E-04	G					V		1	0.14		~Aroclor 1260	11096-82-5	2.4E-01	c	9.9E-01	c	4.9E-03	c	2.1E-02	c	7.8E-03	c		5.5E-03	c	
				6.00E-04	X			V		1	0.14		~Aroclor 5460	11126-42-4	3.5E+01	n	4.4E+02	n					1.2E+01	n		2.0E+00	n	
3.90E+00	W	1.14E-03	W	2.33E-05	W	1.33E-03	W	V		1	0.14		~Heptachlorobiphenyl, 2,3,3',4,4',5,5'- (PCB 189)	39635-31-9	1.3E-01	c*	5.2E-01	c*	2.5E-03	c	1.1E-02	c	4.0E-03	c		2.8E-03	c	
3.90E+00	W	1.14E-03	W	2.33E-05	W	1.33E-03	W	V		1	0.14		~Hexachlorobiphenyl, 2,3',4,4',5,5'- (PCB 167)	52663-72-6	1.2E-01	c*	5.1E-01	c*	2.5E-03	c	1.1E-02	c	4.0E-03	c		1.7E-03	c	
3.90E+00	W	1.14E-03	W	2.33E-05	W	1.33E-03	W	V		1	0.14		~Hexachlorobiphenyl, 2,3,3',4,4',5'- (PCB 157)	69782-90-7	1.2E-01	c*	5.0E-01	c*	2.5E-03	c	1.1E-02	c	4.0E-03	c		1.7E-03	c	
3.90E+00	W	1.14E-03	W	2.33E-05	W	1.33E-03	W	V		1	0.14		~Hexachlorobiphenyl, 2,3,3',4,4',5- (PCB 156)	38380-08-4	1.2E-01	c*	5.0E-01	c*	2.5E-03	c	1.1E-02	c	4.0E-03	c		1.7E-03	c	
3.90E+03	W	1.14E+00	W	2.33E-08	W	1.33E-06	W	V		1	0.14		~Hexachlorobiphenyl, 3,3',4,4',5,5'- (PCB 169)	32774-16-6	1.2E-04	c*	5.1E-04	c*	2.5E-06	c	1.1E-05	c	4.0E-06	c		1.7E-06	c	
3.90E+00	W	1.14E-03	W	2.33E-05	W	1.33E-03	W	V		1	0.14		~Pentachlorobiphenyl, 2',3,4,4',5- (PCB 123)	65510-44-3	1.2E-01	c*	4.9E-01	c*	2.5E-03	c	1.1E-02	c	4.0E-03	c		1.0E-03	c	
3.90E+00	W	1.14E-03	W	2.33E-05	W	1.33E-03	W	V		1	0.14		~Pentachlorobiphenyl, 2,3',4,4',5- (PCB 118)	31508-00-6	1.2E-01	c*	4.9E-01	c*	2.5E-03	c	1.1E-02	c	4.0E-03	c		1.0E-03	c	
3.90E+00	W	1.14E-03	W	2.33E-05	W	1.33E-03	W	V		1	0.14		~Pentachlorobiphenyl, 2,3,3',4,4'- (PCB 105)	32598-14-4	1.2E-01	c*	4.9E-01	c*	2.5E-03	c	1.1E-02	c	4.0E-03	c		1.0E-03	c	
3.90E+00	W	1.14E-03	W	2.33E-05	W	1.33E-03	W	V		1	0.14		~Pentachlorobiphenyl, 2,3,4,4',5- (PCB 114)	74472-37-0	1.2E-01	c*	5.0E-01	c*	2.5E-03	c	1.1E-02	c	4.0E-03	c		1.0E-03	c	
1.30E+04	W	3.80E+00	W	7.00E-09	W	4.00E-07	W	V		1	0.14		~Pentachlorobiphenyl, 3,3',4,4',5- (PCB 126)	57465-28-8	3.6E-05	c*	1.5E-04	c*	7.4E-07	c	3.2E-06	c	1.2E-06	c		3.0E-07	c	
2.00E+00	I	5.71E-04	I					V		1	0.14		~Polychlorinated Biphenyls (high risk)	1336-36-3	2.3E-01	c	9.4E-01	c	4.9E-03	c	2.1E-02	c			5.0E-01			
4.00E-01	I	1.00E-04	I					V		1	0.14		~Polychlorinated Biphenyls (low risk)	1336-36-3					2.8E-02	c	1.2E-01	c	4.4E-02	c	5.0E-01	6.8E-03	c	7.8E-02
7.00E-02	I	2.00E-05	I					V		1	0.14		~Polychlorinated Biphenyls (lowest risk)	1336-36-3					1.4E-01	c	6.1E-01	c			5.0E-01			
1.30E+01	W	3.80E-03	W	7.00E-06	W	4.00E-04	W			1	0.14		~Tetrachlorobiphenyl, 3,3',4,4'- (PCB 77)	32598-13-3	3.8E-02	c*	1.6E-01	c*	7.4E-04	c	3.2E-03	c	6.0E-03	c*		9.4E-04	c*	
3.90E+01	W	1.14E-02	W	2.33E-06	W	1.33E-04	W	V		1	0.14		~Tetrachlorobiphenyl, 3,4,4',5- (PCB 81)	70362-50-4	1.2E-02	c*	4.8E-02	c*	2.5E-04	c	1.1E-03	c	4.0E-04	c		6.2E-05	c	
						6.00E-04	I			1	0.1		Polymeric Methylene Diphenyl Diisocyanate (PMDI)	9016-87-9	8.5E+05	nm	3.6E+06	nm	6.3E-01	n	2.6E+00	n						
													Polynuclear Aromatic Hydrocarbons (PAHs)																
				6.00E-02	I			V		1	0.13		~Acenaphthene	83-32-9	3.6E+03	n	4.5E+04	n					5.3E+02	n		5.5E+00	n	
				3.00E-01	I			V		1	0.13		~Anthracene	120-12-7	1.8E+04	n	2.3E+05	nm					1.8E+03	n		5.8E+01	n	
1.00E-01	E	6.00E-05	E					V	M	1	0.13		~Benz[a]anthracene	56-55-3	1.1E+00	c	2.1E+01	c	1.7E-02	c	2.0E-01	c	3.0E-02	c		1.1E-02	c	
1.00E+00	I	6.00E-04	I	3.00E-04	I	2.00E-06	I		M	1	0.13		~Benzo[a]pyrene	50-32-8	1.1E-01	c	2.1E+00	c	1.7E-03	c**	8.8E-03	n	2.5E-02	c	2.0E-01	2.9E-02	c	2.4E-01
1.00E-01	E	6.00E-05	E						M	1	0.13		~Benzo[b]fluoranthene	205-99-2	1.1E+00	c	2.1E+01	c	1.7E-02	c	2.0E-01	c	2.5E-01	c		3.0E-01	c	
				9.00E-05	X	2.00E-06	X			1	0.1		~Benzo[e]pyrene	192-97-2	5.7E+00	n	7.3E+01	n	2.1E-03	n	8.8E-03	n	1.8E+00	n		2.2E+00	n	
1.20E+00	C	1.10E-04	C							1	0.13		~Benzo[j]fluoranthene	205-82-3	4.2E-01	c	1.8E+00	c	2.6E-02	c	1.1E-01	c	6.5E-02	c		7.8E-02	c	
1.00E-02	E	6.00E-06	E						M	1	0.13		~Benzo[k]fluoranthene	207-08-9	1.1E+01	c	2.1E+02	c	1.7E-01	c	2.0E+00	c	2.5E+00	c		2.9E+00	c	
				5.00E-03	X					1	0.1		~Benzofluorene, 2,3-	243-17-4	3.2E+02	n	4.1E+03	n					1.0E+02	n		1.9E+01	n	
				8.00E-02	I			V		1	0.13		~Chloronaphthalene, Beta-	91-58-7	4.8E+03	n	6.0E+04	n					7.5E+02	n		3.9E+00	n	
1.00E-03	E	6.00E-07	E						M	1	0.13		~Chrysene	218-01-9	1.1E+02	c	2.1E+03	c	1.7E+00	c	2.0E+01	c	2.5E+01	c		9.0E+00	c	
1.00E+00	E	6.00E-04	E						M	1	0.13		~Dibenz[a,h]anthracene	53-70-3	1.1E-01	c	2.1E+00	c	1.7E-03	c	2.0E-02	c	2.5E-02	c		9.6E-02	c	
1.20E+01	C	1.10E-03	C							1	0.13		~Dibenzo[a,e]pyrene	192-65-4	4.2E-02	c	1.8E-01	c	2.6E-03	c	1.1E-02	c	6.5E-03	c		8.4E-02	c	
2.50E+02	C	7.10E-02	C						M	1	0.13		~Dimethylbenz[a]anthracene, 7,12-	57-97-6	4.6E-04	c	8.4E-03	c	1.4E-05	c	1.7E-04	c	1.0E-04	c		9.9E-05	c	
				4.00E-02	I					1	0.13		~Fluoranthene	206-44-0	2.4E+03	n	3.0E+04	n					8.0E+02	n		8.9E+01	n	
				4.00E-02	I			V		1	0.13		~Fluorene	86-73-7	2.4E+03	n	3.0E+04	n					2.9E+02	n		5.4E+00	n	
1.00E-01	E	6.00E-05	E						M	1	0.13		~Indeno[1,2,3-cd]pyrene	193-39-5	1.1E+00	c	2.1E+01	c	1.7E-02	c	2.0E-01	c	2.5E-01	c		9.8E-01	c	
5.10E-02	X			7.00E-02	T	3.00E-06	P	V		1	0.13	3.94E+02	~Methylnaphthalene, 1-	90-12-0	1.8E-01	n	7.7E-01	n	3.1E-03	n	1.3E-02	n	6.3E-03	n		3.3E-05	n	
				4.00E-03	I			V		1	0.13		~Methylnaphthalene, 2-	91-57-6	2.4E+02	n	3.0E+03	n					3.6E+01	n		1.9E-01	n	
1.20E-01	C	3.40E-05	C	2.00E-02	I	3.00E-03	I	V		1	0.13		~Naphthalene	91-20-3	2.0E+00	c*	8.6E+00	c*	8.3E-02	c*	3.6E-01	c*	1.2E-01	c*		3.8E-04	c*	
1.20E+00	C	1.10E-04	C							1	0.13		~Nitropyrene, 4-	57835-92-4	4.2E-01	c	1.8E+00	c	2.6E-02	c	1.1E-01	c	1.9E-02	c		3.3E-03	c	
				9.00E-05	X	2.00E-06	X			1	0.13		~Perylene	198-55-0	5.4E+00	n	6.7E+01	n	2.1E-03	n	8.8E-03	n	1.8E+00	n		2.2E+00	n	
				3.00E-02	I			V		1	0.13		~Pyrene	129-00-0	1.8E+03	n	2.3E+04	n					1.2E+02	n		1.3E+01	n	
1.50E-01	I			9.00E-03	I					1	0.1		Prochloraz	67747-09-5	3.6E+00	c	1.5E+01	c					3.8E-01	c		1.9E-03	c	
				6.00E-03	H			V		1			Profluralin	26399-36-0	4.7E+02	n	7.0E+03	n					2.6E+01	n		1.6E+00	n	
				1.50E-02	I					1	0.1		Prometon	1610-18-0	9.5E+02	n	1.2E+04	n					2.5E+02	n		1.2E-01	n	
				4.00E-02	O					1	0.1		Prometryn	7287-19-6	2.5E+03	n	3.3E+04	n					6.0E+02	n		9.0E-01	n	
				7.50E-02	I					1	0.1		Pronamide	23950-58-5	4.7E+03	n	6.2E+04	n					1.2E+03	n		1.2E+00	n	

THQ=1 TR=1E-06

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; T = ATSDR DRAFT; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; D = OW; R = ORD; N = WI; W = TEF applied; E = RPF applied; G = see user's guide; c = cancer; n = noncancer; * = where: nc SL < 100X ca SL; ** = where nc SL < 10X ca SL; SSL values are based on DAF=1; m = ceiling limit exceeded; s = Csat exceeded; V = volatile; M = mutagen.

Toxicity and Chemical-specific Information													Contaminant		Screening Levels												Protection of Groundwater SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	mutagen	GIABS	ABS_d	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tap Water (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
				1.30E-02	I					1	0.1		Propachlor	1918-16-7	8.2E+02	n	1.1E+04	n					2.5E+02	n		1.5E-01	n	
				5.00E-03	I					1	0.1		Propanil	709-98-8	3.2E+02	n	4.1E+03	n					8.2E+01	n		4.5E-02	n	
1.92E-01	O			4.00E-02	O					1	0.1		Propargite	2312-35-8	2.8E+00	c	1.2E+01	c					1.6E-01	c		1.1E-02	c	
				2.00E-03	I			V		1		1.11E+05	Propargyl Alcohol	107-19-7	1.6E+02	n	2.3E+03	n					4.0E+01	n		8.1E-03	n	
				2.00E-02	I					1	0.1		Propazine	139-40-2	1.3E+03	n	1.6E+04	n					3.4E+02	n		3.0E-01	n	
				2.00E-02	I					1	0.1		Propham	122-42-9	1.3E+03	n	1.6E+04	n					3.5E+02	n		2.2E-01	n	
				1.00E-01	O					1	0.1		Propiconazole	60207-90-1	6.3E+03	n	8.2E+04	n					1.6E+03	n		5.3E+00	n	
						8.00E-03	I	V		1		3.26E+04	Propionaldehyde	123-38-6	7.5E+01	n	3.1E+02	n	8.3E+00	n	3.5E+01	n	1.7E+01	n		3.4E-03	n	
				1.00E-01	X	1.00E+00	X	V		1		2.64E+02	Propyl benzene	103-65-1	3.8E+03	ns	2.4E+04	ns	1.0E+03	n	4.4E+03	n	6.6E+02	n		1.2E+00	n	
						3.00E+00	C	V		1		3.49E+02	Propylene	115-07-1	2.2E+03	ns	9.3E+03	ns	3.1E+03	n	1.3E+04	n	6.3E+03	n		6.0E+00	n	
				2.00E+01	P					1	0.1		Propylene Glycol	57-55-6	1.3E+06	nm	1.6E+07	nm					4.0E+05	n		8.1E+01	n	
						2.72E-04	A			1	0.1		Propylene Glycol Dinitrate	6423-43-4	3.9E+05	nm	1.6E+06	nm	2.8E-01	n	1.2E+00	n							
				7.00E-01	H	2.00E+00	I	V		1		1.06E+05	Propylene Glycol Monomethyl Ether	107-98-2	4.1E+04	n	3.7E+05	nms	2.1E+03	n	8.8E+03	n	3.2E+03	n		6.5E-01	n	
2.40E-01	I	3.70E-06	I			3.00E-02	I	V		1		7.77E+04	Propylene Oxide	75-56-9	2.1E+00	c	9.7E+00	c	7.6E-01	c*	3.3E+00	c*	2.7E-01	c		5.6E-05	c	
				1.00E-03	I			V		1		5.30E+05	Pyridine	110-86-1	7.8E+01	n	1.2E+03	n					2.0E+01	n		6.8E-03	n	
				5.00E-04	I					1	0.1		Quinalphos	13593-03-8	3.2E+01	n	4.1E+02	n					5.1E+00	n		4.3E-02	n	
3.00E+00	I									1	0.1		Quinoline	91-22-5	1.8E-01	c	7.7E-01	c					2.4E-02	c		7.8E-05	c	
				9.00E-03	I					1	0.1		Quizalofop-ethyl	76578-14-8	5.7E+02	n	7.4E+03	n					1.2E+02	n		1.9E+00	n	
						3.00E+04	A			1			Refractory Ceramic Fibers (units in fibers)	E715557					3.1E+04	G	1.3E+05	G							
				3.00E-02	I					1	0.1		Resmethrin	10453-86-8	1.9E+03	n	2.5E+04	n					6.7E+01	n		4.2E+01	n	
				5.00E-02	H			V		1			Ronnel	299-84-3	3.9E+03	n	5.8E+04	n					4.1E+02	n		3.7E+00	n	
				4.00E-03	I					1	0.1		Rotenone	83-79-4	2.5E+02	n	3.3E+03	n					6.1E+01	n		3.2E+01	n	
2.20E-01	C	6.30E-05	C						M	1	0.1		Safrole	94-59-7	5.5E-01	c	1.0E+01	c	1.6E-02	c	1.9E-01	c	9.6E-02	c		5.9E-05	c	
				5.00E-03	I					1			Selenious Acid	7783-00-8	3.9E+02	n	5.8E+03	n					1.0E+02	n				
				5.00E-03	I	2.00E-02	C			1			Selenium	7782-49-2	3.9E+02	n	5.8E+03	n	2.1E+01	n	8.8E+01	n	1.0E+02	n	5.0E+01	5.2E-01	n	2.6E-01
				5.00E-03	C	2.00E-02	C			1			Selenium Sulfide	7446-34-6	3.9E+02	n	5.8E+03	n	2.1E+01	n	8.8E+01	n	1.0E+02	n				
				1.40E-01	O					1	0.1		Sethoxydim	74051-80-2	8.8E+03	n	1.1E+05	nm					1.6E+03	n		1.4E+01	n	
						3.00E-03	C			1			Silica (crystalline, respirable)	7631-86-9	4.3E+06	nm	1.8E+07	nm	3.1E+00	n	1.3E+01	n						
				5.00E-03	I					0.04			Silver	7440-22-4	3.9E+02	n	5.8E+03	n					9.4E+01	n		8.0E-01	n	
1.20E-01	H			5.00E-03	I					1	0.1		Simazine	122-34-9	4.5E+00	c*	1.9E+01	c					6.1E-01	c	4.0E+00	3.0E-04	c	2.0E-03
				1.30E-02	I					1	0.1		Sodium Acifluorfen	62476-59-9	8.2E+02	n	1.1E+04	n					2.6E+02	n		2.1E+00	n	
				4.00E-03	I					1			Sodium Azide	26628-22-8	3.1E+02	n	4.7E+03	n					8.0E+01	n				
2.70E-01	H			3.00E-02	I					1	0.1		Sodium Diethyldithiocarbamate	148-18-5	2.0E+00	c	8.5E+00	c					2.9E-01	c		1.8E-04	c	
				5.00E-02	A	1.40E-02	C			1			Sodium Fluoride	7681-49-4	3.9E+03	n	5.8E+04	n	1.5E+01	n	6.1E+01	n	1.0E+03	n	4.0E+03	1.5E+02	n	6.0E+02
				2.00E-05	I					1	0.1		Sodium Fluoroacetate	62-74-8	1.3E+00	n	1.6E+01	n					4.0E-01	n		8.1E-05	n	
				1.00E-03	H					1			Sodium Metavanadate	13718-26-8	7.8E+01	n	1.2E+03	n					2.0E+01	n				
				8.00E-04	P					1			Sodium Tungstate	13472-45-2	6.3E+01	n	9.3E+02	n					1.6E+01	n				
				8.00E-04	P					1			Sodium Tungstate Dihydrate	10213-10-2	6.3E+01	n	9.3E+02	n					1.6E+01	n				
2.40E-02	H			3.00E-02	I					1	0.1		Stirofos (Tetrachlorovinphos)	961-11-5	2.3E+01	c*	9.6E+01	c					2.8E+00	c		8.2E-03	c	
				6.00E-01	I					1			Strontium, Stable	7440-24-6	4.7E+04	n	7.0E+05	nm					1.2E+04	n		4.2E+02	n	
				3.00E-04	I					1	0.1		Strychnine	57-24-9	1.9E+01	n	2.5E+02	n					5.9E+00	n		6.5E-02	n	
				2.00E-01	I	1.00E+00	I	V		1		8.67E+02	Styrene	100-42-5	6.0E+03	ns	3.5E+04	ns	1.0E+03	n	4.4E+03	n	1.2E+03	n	1.0E+02	1.3E+00	n	1.1E-01
				3.00E-03	P					1	0.1		Styrene-Acrylonitrile (SAN) Trimer (THNA isomer)	57964-39-3	1.9E+02	n	2.5E+03	n					4.8E+01	n				
				3.00E-03	P					1	0.1		Styrene-Acrylonitrile (SAN) Trimer (THNP isomer)	57964-40-6	1.9E+02	n	2.5E+03	n					4.8E+01	n				
				1.00E-03	P	2.00E-03	X			1	0.1		Sulfolane	126-33-0	6.3E+01	n	8.2E+02	n	2.1E+00	n	8.8E+00	n	2.0E+01	n		4.4E-03	n	
				8.00E-04	P					1	0.1		Sulfonylbis(4-chlorobenzene), 1,1'-	80-07-9	5.1E+01	n	6.6E+02	n					1.1E+01	n		6.5E-02	n	
						1.00E-03	C	V		1			Sulfur Trioxide	7446-11-9	1.4E+06	nm	6.0E+06	nm	1.0E+00	n	4.4E+00	n	2.1E+00	n				
						1.00E-03	C			1			Sulfuric Acid	7664-93-9	1.4E+06	nm	6.0E+06	nm	1.0E+00	n	4.4E+00	n						
2.50E-02	I	7.10E-06	I	5.00E-02	H					1	0.1		Sulfurous acid, 2-chloroethyl 2-[4-(1,1-dimethylethyl)phenoxy]-1-methylethyl ester	140-57-8	2.2E+01	c	9.2E+01	c	4.0E-01	c	1.7E+00	c	1.3E+00	c		1.5E-02	c	
				7.00E-02	I					1	0.1		Tebuthiuron	34014-18-1	4.4E+03	n	5.7E+04	n					1.4E+03	n		3.9E-01	n	
				2.00E-02	H					1	0.1		Temephos	3383-96-8	1.3E+03	n	1.6E+04	n					4.0E+02	n		7.6E+01	n	
				1.30E-02	I					1	0.1		Terbacil	5902-51-2	8.2E+02	n	1.1E+04	n					2.5E+02	n		7.5E-02	n	
				2.50E-05	H			V		1		3.09E+01	Terbufos	13071-79-9	2.0E+00	n	2.9E+01	n					2.4E-01	n		5.2E-04	n	
				1.00E-03	I					1	0.1		Terbutryn	886-50-0	6.3E+01	n	8.2E+02	n					1.3E+01	n		1.9E-02	n	
5.00E-03	C	1.30E-06	C					V		1			Tert-Butyl Acetate	540-88-5	8.1E+00	c	3.6E+01	c	2.2E+00	c	9.4E+00	c	3.3E+00	c		7.6E-04	c	
				1.00E-04	I					1	0.1		Tetrabromodiphenyl ether, 2,2',4,4'- (BDE-47)	5436-43-1	6.3E+00	n	8.2E+01	n					2.0E+00	n		5.3E-02	n	
				3.00E-05	P			V		1			Tetrachlorobenzene, 1,2,4,5-	95-94-3	2.3E+00	n	3.5E+01	n					1.7E-01	n		7.9E-04	n	
2.60E-02	I	7.40E-06	I	3.00E-02	I			V		1		6.80E+02	Tetrachloroethane, 1,1,1,2-	630-20-6	2.0E+00	c	8.8E+00	c	3.8E-01	c	1.7E+00	c	5.7E-01	c		2.2E-04	c	
2.00E-01	I	5.80E-05	C	2.00E-02	I			V		1		1.90E+03	Tetrachloroethane, 1,1,2,2-	79-34-5	6.0E-01	c	2.7E+00	c	4.8E-02	c	2.1E-01	c	7.6E-02	c		3.0E-05	c	
2.10E-03	I	2.60E-07	I	6.00E-03	I	4.00E-02	I	V		1		1.66E+02	Tetrachloroethylene	127-18-4	2.4E+01	c**	1.0E+02	c**	1.1E+01	c**	4.7E+01	c**	1.1E+01	c**	5.0E+00	5.1E-03	c**	2.3E-03
				3.00E-02	I					1	0.1		Tetrachlorophenol, 2,3,4,6-	58-90-2	1.9E+03	n	2.5E+04	n					2.4E+02	n		1.8E-01	n	
1.60E+01	X			6.00E-05	X			V		1			Tetrachlorotoluene, p- alpha, alpha, alpha-	5216-25-1	4.3E-02	c	2.0E-01	c					1.7E-03	c		5.7E-06	c	
				5.00E-04	I					1	0.1		Tetraethyl Dithiopyrophosphate	3689-24-5	3.2E+01	n	4.1E+02	n					7.1E+00	n		5.2E-03	n	
						8.00E-01	I	V		1		2.05E+03	Tetrafluoroethane, 1,1,1,2-	811-97-2	1.0E+05	nms	4.3E+05	nms	8.3E+04	n	3.5E+05	n	1.7E+05	n		9.3E+01	n	
				1.00E-04	X					1	0.1		Tetramethylphosphoramide, -N,N,N',N" (TMPA)	16853-36-4	6.3E+00	n	8.2E+01	n					2.0E+00	n				
				2.00E-03	P					1	0.00065		Tetryl (Trinitrophenylmethylnitramine)	479-45-8	1.6E+02	n	2.3E+03	n					3.9E+01	n		3.7E-01	n	
				2.00E-05	G					1			Thallic Oxide	1314-32-5	1.6E+00	n	2.3E+01	n					4.0E-01	n				
				1.00E-05	X					1			Thallium (I) Nitrate	10102-45-1	7.8E-01	n	1.2E+01	n					2.0E-01	n				
				1.00E-05	X					1			Thallium (Soluble Salts)	7440-28-0	7.8E-01	n	1.2E+01	n					2.0E-01	n	2.0E+00	1.4E-02	n	1.4E-01
				1.00E-05	X			V		1			Thallium Acetate	563-68-8	7.8E-01	n	1.2E+01	n					2.0E-01	n		4.1E-05	n	
				2.00E-05	X					1	0.1		Thallium Carbonate	6533-73-9	1.3E+00	n	1.6E+01	n					4.0E-01	n		8.3E-05	n	
				1.00E-05	X					1			Thallium Chloride	7791-12-0	7.8E-01	n	1.2E+01	n					2.0E-01	n				
				1.00E-05	G					1			Thallium Selenite	12039-52-0	7.8E-01	n	1.2E+01	n					2.0E-01	n				
				2.00E-05	X					1			Thallium Sulfate	7446-18-6	1.6E+00	n	2.3E+01	n					4.0E-01	n				
				4.30E-02	O					1	0.1		Thifensulfuron-methyl	79277-27-3	2.7E+03	n	3.5E+04	n					8.6E+02	n		2.6E-01	n	
				1.00E-02	I					1	0.1		Thiobencarb	28249-77-6	6.3E+02	n	8.2E+03	n					1.6E+02	n		5.5E-01	n	
				2.00E-04	P					1			Thiocyanates	E1790665	1.6E+01	n	2.3E+02	n					4.0E+00	n				
				2.00E-04	X			V		1			Thiocyanic Acid	463-56-9	1.6E+01	n	2.3E+02	n					4.0E+00	n				
				3.00E-02	H					1	0.1		Thiocyanic acid, (2-benzothiazolylthio)methyl ester (TCMTB)	21564-17-0	1.9E+03	n	2.5E+04	n					4.8E+02	n		3.3E+00	n	
				7.00E-02	X					1	0.0075		Thiodiglycol	111-48-8	5.4E+03	n	7.9E+04	n					1.4E+03	n		2.8E-01	n	

TR=1E-06
THQ=1

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; T = ATSDR DRAFT; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; D = OW; R = ORD; N = WI; W = TEF applied; E = RPF applied; G = see user's guide; c = cancer; n = noncancer; * = where: nc SL < 100X ca SL; ** = where nc SL < 10X ca SL; SSL values are based on DAF=1; m = ceiling limit exceeded; s = Csat exceeded; V = volatile; M = mutagen.

Toxicity and Chemical-specific Information													Contaminant		Screening Levels										Protection of Groundwater SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	mutagen	GIABS	ABS_d	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tap Water (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
				3.00E-04	H					1	0.1		Thiofanox	39196-18-4	1.9E+01	n	2.5E+02	n					5.3E+00	n		1.8E-03	n	
1.16E-02	O			1.60E-01	O					1	0.1		Thiophanate, Methyl	23564-05-8	4.7E+01	c	2.0E+02	c					6.7E+00	c		5.7E-03	c	
				1.50E-02	O					1	0.1		Thiram	137-26-8	9.5E+02	n	1.2E+04	n					2.9E+02	n		4.2E-01	n	
				6.00E-01	H					1			Tin	7440-31-5	4.7E+04	n	7.0E+05	nm					1.2E+04	n		3.0E+03	n	
						1.00E-04	A	V		1			Titanium Tetrachloride	7550-45-0	1.4E+05	nm	6.0E+05	nm	1.0E-01	n	4.4E-01	n	2.1E-01	n				
				8.00E-02	I	5.00E+00	I	V		1		8.18E+02	Toluene	108-88-3	4.9E+03	ns	4.7E+04	ns	5.2E+03	n	2.2E+04	n	1.1E+03	n	1.0E+03	7.6E-01	n	6.9E-01
3.90E-02	C	1.10E-05	C			8.00E-06	C	V		1			Toluene-2,4-diisocyanate	584-84-9	6.4E+00	n	2.7E+01	n	8.3E-03	n	3.5E-02	n	1.7E-02	n		2.5E-04	n	
3.90E-02	C	1.10E-05	C			8.00E-06	C	V		1		1.71E+03	Toluene-2,6-diisocyanate	91-08-7	5.3E+00	n	2.2E+01	n	8.3E-03	n	3.5E-02	n	1.7E-02	n		2.6E-04	n	
				1.00E-04	X					1	0.1		Toluenediamine, 2,3-	2687-25-4	6.3E+00	n	8.2E+01	n					2.0E+00	n		6.2E-04	n	
1.80E-01	X			2.00E-04	X					1	0.1		Toluenediamine, 2,5-	95-70-5	3.0E+00	c**	1.3E+01	c*					4.3E-01	c**		1.3E-04	c**	
				1.00E-04	X					1	0.1		Toluenediamine, 3,4-	496-72-0	6.3E+00	n	8.2E+01	n					2.0E+00	n		6.2E-04	n	
				5.00E-03	P					1	0.1		Toluic Acid, p-	99-94-5	3.2E+02	n	4.1E+03	n					9.0E+01	n		2.3E-02	n	
1.60E-02	P	5.10E-05	C							1	0.1		Toluidine, o- (Methylaniline, 2-)	95-53-4	3.4E+01	c	1.4E+02	c	5.5E-02	c	2.4E-01	c	4.7E+00	c		2.0E-03	c	
3.00E-02	P			4.00E-03	X					1	0.1		Toluidine, p-	106-49-0	1.8E+01	c*	7.7E+01	c*					2.5E+00	c*		1.1E-03	c*	
				3.00E+00	P			V		1		3.42E-01	Total Petroleum Hydrocarbons (Aliphatic High)	E1790670	2.3E+05	nms	3.5E+06	nms					6.0E+04	n		2.4E+03	n	
				5.00E-03	P	4.00E-01	P	V		1		1.12E+02	Total Petroleum Hydrocarbons (Aliphatic Low)	E1790666	2.5E+02	ns	1.9E+03	ns	4.2E+02	n	1.8E+03	n	2.8E+01	n		2.0E-02	n	
				1.00E-02	X	1.00E-01	P	V		1		6.86E+00	Total Petroleum Hydrocarbons (Aliphatic Medium)	E1790668	9.6E+01	ns	4.4E+02	ns	1.0E+02	n	4.4E+02	n	1.0E+02	n		1.5E+00	n	
				3.00E-04	P	2.00E-06	P		M	1	0.13		Total Petroleum Hydrocarbons (Aromatic High)	E1790676	1.8E+01	n	2.2E+02	n	2.1E-03	n	8.8E-03	n	6.0E+00	n		7.1E+00	n	
				1.00E-02	P	6.00E-02	P	V		1		2.31E+02	Total Petroleum Hydrocarbons (Aromatic Medium)	E1790674	3.0E+02	ns	1.7E+03	ns	6.3E+01	n	2.6E+02	n	5.7E+01	n		8.3E-02	n	
1.10E+00	I	3.20E-04	I	9.00E-05	P					1	0.1		Toxaphene	8001-35-2	4.9E-01	c*	2.1E+00	c*	8.8E-03	c	3.8E-02	c	7.1E-02	c*	3.0E+00	1.1E-02	c*	4.6E-01
				3.00E-05	X					1	0.1		Toxaphene, Weathered	E1841606	1.9E+00	n	2.5E+01	n					6.0E-01	n		9.3E-02	n	
				7.50E-03	I					1	0.1		Tralomethrin	66841-25-6	4.7E+02	n	6.2E+03	n					1.5E+02	n		5.8E+01	n	
				3.00E-04	A			V		1			Tri-n-butyltin	688-73-3	2.3E+01	n	3.5E+02	n					3.7E+00	n		8.2E-02	n	
				8.00E+01	X					1	0.1		Triacetin	102-76-1	5.1E+06	nm	6.6E+07	nm					1.6E+06	n		4.5E+02	n	
				3.40E-02	O					1	0.1		Triadimefon	43121-43-3	2.1E+03	n	2.8E+04	n					6.3E+02	n		5.0E-01	n	
7.17E-02	O			2.50E-02	O			V		1			Triallate	2303-17-5	9.7E+00	c	4.6E+01	c					4.7E-01	c		1.0E-03	c	
				1.00E-02	I					1	0.1		Triasulfuron	82097-50-5	6.3E+02	n	8.2E+03	n					2.0E+02	n		2.1E-01	n	
				8.00E-03	I					1	0.1		Tribenuron-methyl	101200-48-0	5.1E+02	n	6.6E+03	n					1.6E+02	n		6.1E-02	n	
				5.00E-03	I			V		1			Tribromobenzene, 1,2,4-	615-54-3	3.9E+02	n	5.8E+03	n					4.5E+01	n		6.4E-02	n	
				9.00E-03	X					1	0.1		Tribromophenol, 2,4,6-	118-79-6	5.7E+02	n	7.4E+03	n					1.2E+02	n		2.2E-01	n	
				2.00E-04	O					1	0.1		Tribufos	78-48-8	1.3E+01	n	1.6E+02	n					5.7E-01	n		2.8E-03	n	
9.00E-03	P			1.00E-02	P					1	0.1		Tributyl Phosphate	126-73-8	6.0E+01	c*	2.6E+02	c*					5.2E+00	c*		2.5E-02	c*	
				3.00E-04	P					1	0.1		Tributyltin Compounds	E1790679	1.9E+01	n	2.5E+02	n					6.0E+00	n				
				3.00E-04	I					1	0.1		Tributyltin Oxide	56-35-9	1.9E+01	n	2.5E+02	n					5.7E+00	n		2.9E+02	n	
										1	0.1		Trichloramine	10025-85-1											4.0E+03(G)			
				3.00E+01	I	5.00E+00	P	V		1		9.10E+02	Trichloro-1,2,2-trifluoroethane, 1,1,2-	76-13-1	6.7E+03	ns	2.8E+04	ns	5.2E+03	n	2.2E+04	n	1.0E+04	n		2.6E+01	n	
7.00E-02	I			2.00E-02	I					1	0.1		Trichloroacetic Acid	76-03-9	7.8E+00	c	3.3E+01	c					1.1E+00	c	6.0E+01(G)	2.2E-04	c	1.2E-02
2.90E-02	H									1	0.1		Trichloroaniline HCl, 2,4,6-	33663-50-2	1.9E+01	c	7.9E+01	c					2.7E+00	c		7.4E-03	c	
7.00E-03	X			3.00E-05	X					1	0.1		Trichloroaniline, 2,4,6-	634-93-5	1.9E+00	n	2.5E+01	n					4.0E-01	n		3.6E-03	n	
				8.00E-04	X			V		1			Trichlorobenzene, 1,2,3-	87-61-6	6.3E+01	n	9.3E+02	n					7.0E+00	n		2.1E-02	n	
2.90E-02	P			1.00E-02	I	2.00E-03	P	V		1		4.04E+02	Trichlorobenzene, 1,2,4-	120-82-1	2.4E+01	c**	1.1E+02	c**	2.1E+00	n	8.8E+00	n	1.2E+00	c**	7.0E+01	3.4E-03	c**	2.0E-01
				2.00E+00	I	5.00E+00	I	V		1		6.40E+02	Trichloroethane, 1,1,1-	71-55-6	8.1E+03	ns	3.6E+04	ns	5.2E+03	n	2.2E+04	n	8.0E+03	n	2.0E+02	2.8E+00	n	7.0E-02
5.70E-02	I	1.60E-05	I	4.00E-03	I	2.00E-04	X	V		1		2.16E+03	Trichloroethane, 1,1,2-	79-00-5	1.1E+00	c**	5.0E+00	c**	1.8E-01	c**	7.7E-01	c**	2.8E-01	c**	5.0E+00	8.9E-05	c**	1.6E-03
4.60E-02	I	4.10E-06	I	5.00E-04	I	2.00E-03	I	V	M	1		6.92E+02	Trichloroethylene	79-01-6	9.4E-01	c**	6.0E+00	c**	4.8E-01	c**	3.0E+00	c**	4.9E-01	c**	5.0E+00	1.8E-04	c**	1.8E-03
				3.00E-01	I			V		1		1.23E+03	Trichlorofluoromethane	75-69-4	2.3E+04	ns	3.5E+05	nms					5.2E+03	n		3.3E+00	n	
				1.00E-01	I					1	0.1		Trichlorophenol, 2,4,5-	95-95-4	6.3E+03	n	8.2E+04	n					1.2E+03	n		4.0E+00	n	
1.10E-02	I	3.10E-06	I	1.00E-03	P					1	0.1		Trichlorophenol, 2,4,6-	88-06-2	4.9E+01	c**	2.1E+02	c**	9.1E-01	c	4.0E+00	c	4.1E+00	c**		4.0E-03	c**	
				1.00E-02	I					1	0.1		Trichlorophenoxyacetic Acid, 2,4,5-	93-76-5	6.3E+02	n	8.2E+03	n					1.6E+02	n		6.8E-02	n	
				8.00E-03	I					1	0.1		Trichlorophenoxypropionic acid, -2,4,5	93-72-1	5.1E+02	n	6.6E+03	n					1.1E+02	n	5.0E+01	6.1E-02	n	2.8E-02
				5.00E-03	I			V		1		1.28E+03	Trichloropropane, 1,1,2-	598-77-6	3.9E+02	n	5.8E+03	ns					8.8E+01	n		3.5E-02	n	
3.00E+01	I			4.00E-03	I	3.00E-04	I	V	M	1		1.40E+03	Trichloropropane, 1,2,3-	96-18-4	5.1E-03	c	1.1E-01	c	3.1E-01	n	1.3E+00	n	7.5E-04	c		3.2E-07	c	
				3.00E-03	X	3.00E-04	P	V		1		3.11E+02	Trichloropropene, 1,2,3-	96-19-5	7.3E-01	n	3.1E+00	n	3.1E-01	n	1.3E+00	n	6.2E-01	n		3.1E-04	n	
				2.00E-02	A					1	0.1		Tricresyl Phosphate (TCP)	1330-78-5	1.3E+03	n	1.6E+04	n					1.6E+02	n		1.5E+01	n	
				3.00E-03	I					1	0.1		Tridiphane	58138-08-2	1.9E+02	n	2.5E+03	n					1.8E+01	n		1.3E-01	n	
						7.00E-03	I	V		1		2.79E+04	Triethylamine	121-44-8	1.2E+02	n	4.8E+02	n	7.3E+00	n	3.1E+01	n	1.5E+01	n		4.4E-03	n	
				2.00E+00	P					1	0.1		Triethylene Glycol	112-27-6	1.3E+05	nm	1.6E+06	nm					4.0E+04	n		8.8E+00	n	
						2.00E+01	P	V		1		4.81E+03	Trifluoroethane, 1,1,1-	420-46-2	1.5E+04	ns	6.2E+04	ns	2.1E+04	n	8.8E+04	n	4.2E+04	n		1.3E+02	n	
7.70E-03	I			7.50E-03	I			V		1			Trifluralin	1582-09-8	9.0E+01	c**	4.2E+02	c*					2.6E+00	c*		8.4E-02	c*	
2.00E-02	P			1.00E-02	P					1	0.1		Trimethyl Phosphate	512-56-1	2.7E+01	c*	1.1E+02	c*					3.9E+00	c*		8.6E-04	c*	
				1.00E-02	I	6.00E-02	I	V		1		2.93E+02	Trimethylbenzene, 1,2,3-	526-73-8	3.4E+02	ns	2.0E+03	ns	6.3E+01	n	2.6E+02	n	5.5E+01	n		8.1E-02	n	
				1.00E-02	I	6.00E-02	I	V		1		2.19E+02	Trimethylbenzene, 1,2,4-	95-63-6	3.0E+02	ns	1.8E+03	ns	6.3E+01	n	2.6E+02	n	5.6E+01	n		8.1E-02	n	
				1.00E-02	I	6.00E-02	I	V		1		1.82E+02	Trimethylbenzene, 1,3,5-	108-67-8	2.7E+02	ns	1.5E+03	ns	6.3E+01	n	2.6E+02	n	6.0E+01	n		8.7E-02	n	
				1.00E-02	X			V		1		2.96E+01	Trimethylpentene, 2,4,4-	25167-70-8	7.8E+02	ns	1.2E+04	ns					3.8E+01	n		1.3E-01	n	
				3.00E-02	I					1	0.019		Trinitrobenzene, 1,3,5-	99-35-4	2.2E+03	n	3.2E+04	n					5.9E+02	n		2.1E+00	n	
3.00E-02	I			5.00E-04	I					1	0.032		Trinitrotoluene, 2,4,6-	118-96-7	2.1E+01	c**	9.6E+01	c**					2.5E+00	c**		1.5E-02	c**	
				2.00E-02	P					1	0.1		Triphenylphosphine Oxide	791-28-6	1.3E+03	n	1.6E+04	n					3.6E+02	n		1.5E+00	n	
				2.00E-02	A					1	0.1		Tris(1,3-Dichloro-2-propyl) Phosphate	13674-87-8	1.3E+03	n	1.6E+04	n					3.6E+02	n		8.0E+00	n	
				1.00E-02	X					1	0.1		Tris(1-chloro-2-propyl)phosphate	13674-84-5	6.3E+02	n	8.2E+03	n					1.9E+02	n		6.5E-01	n	
2.30E+00	C	6.60E-04	C					V		1		4.67E+02	Tris(2,3-dibromopropyl)phosphate	126-72-7	2.8E-01	c	1.3E+00	c	4.3E-03	c	1.9E-02	c	6.8E-03	c		1.3E-04	c	
2.00E-02	P			7.00E-03	P					1	0.1		Tris(2-chloroethyl)phosphate	115-96-8	2.7E+01	c*	1.1E+02	c*					3.8E+00	c*		3.8E-03	c*	
3.20E-03	P			1.00E-01	P					1	0.1		Tris(2-ethylhexyl)phosphate	78-42-2	1.7E+02	c*	7.2E+02	c					2.4E+01	c*		1.2E+02	c*	
				8.00E-04	P					1			Tungsten	7440-33-7	6.3E+01	n	9.3E+02	n					1.6E+01	n		2.4E+00	n	
				2.00E-04	A	4.00E-05	A			1			Uranium	7440-61-1	1.6E+01	n	2.3E+02	n	4.2E-02	n	1.8E-01	n	4.0E+00	n	3.0E+01	1.8E+00	n	1.4E+01
1.00E+00	C	2.90E-04	C						M	1	0.1		Urethane	51-79-6	1.2E-01	c	2.3E+00	c	3.5E-03	c	4.2E-02	c	2.5E-02	c		5.6E-06	c	
		8.30E-03	P	9.00E-03	I	7.00E-06	P			0.026			Vanadium Pentoxide	1314-62-1	4.6E+02	c**	2.0E+03	c**	3.4E-04	c*	1.5E-03	c*	1.5E+02	n				
				5.04E-03	G	1.00E-04	A			0.026			Vanadium and Compounds	7440-62-2	3.9E+02	n	5.8E+03	n	1.0E-01	n	4.4E-01	n	8.6E+01	n		8.6E+01	n	
				1.00E-03	I			V		1			Vernolate	1929-77-7	7.8E+01	n	1.2E+03	n					1.1E+01	n		8.9E-03	n	
				1.20E-03	O					1	0.1		Vinclozolin	50471-44-8	7.6E+01	n	9.8E+02	n					2.1E+01	n		1.6E-02	n	
				1.00E+00	H	2.00E-01	I	V		1		2.75E+03	Vinyl Acetate	108-05-4	9.1E+02	n	3.8E+03	ns	2.1E+02	n	8.8E+02	n	4.1E+02	n		8.7E-02	n	
		1.50E-05	P			3.00E-03	I	V		1		2.47E+03	Vinyl Bromide	593-60-2	2.6E-01	c*	1.1E+00	c*	1.9E-01	c*	8.2E-01	c*	3.7E-01	c*		1.1E-04	c*	

TR=1E-06
THQ=1.0

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; T = ATSDR DRAFT; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; D = OW; R = ORD; N = WI; W = TEF applied; E = RPF applied; G = see user's guide; c = cancer; n = noncancer; * = where: nc SL < 100X ca SL; ** = where nc SL < 10X ca SL; SSL values are based on DAF=1; m = ceiling limit exceeded; s = Csat exceeded; V = volatile; M = mutagen.

Toxicity and Chemical-specific Information												Contaminant		Screening Levels										Protection of Groundwater SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	mutagen	GIABS	ABS_d	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tap Water (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
7.20E-01	I	4.40E-06	I	3.00E-03	I	5.11E-02	A	V	M	1		3.92E+03	Vinyl Chloride	75-01-4	5.9E-02	c	1.7E+00	c	1.7E-01	c	2.8E+00	c*	1.9E-02	c	2.0E+00	6.5E-06	c	6.9E-04
				3.00E-04	I					1	0.1		Warfarin	81-81-2	1.9E+01	n	2.5E+02	n					5.6E+00	n		5.9E-03	n	
				2.00E-01	G	1.00E-01	G	V		1		3.88E+02	Xylene, m-	108-38-3	5.5E+02	ns	2.4E+03	ns	1.0E+02	n	4.4E+02	n	1.9E+02	n		1.9E-01	n	
				2.00E-01	G	1.00E-01	G	V		1		4.34E+02	Xylene, o-	95-47-6	6.4E+02	ns	2.8E+03	ns	1.0E+02	n	4.4E+02	n	1.9E+02	n		1.9E-01	n	
				2.00E-01	G	1.00E-01	G	V		1		3.90E+02	Xylene, p-	106-42-3	5.6E+02	ns	2.4E+03	ns	1.0E+02	n	4.4E+02	n	1.9E+02	n		1.9E-01	n	
				2.00E-01	I	1.00E-01	I	V		1		2.60E+02	Xylenes	1330-20-7	5.8E+02	ns	2.5E+03	ns	1.0E+02	n	4.4E+02	n	1.9E+02	n	1.0E+04	1.9E-01	n	9.9E+00
				3.00E-04	I					1			Zinc Phosphide	1314-84-7	2.3E+01	n	3.5E+02	n					6.0E+00	n				
				3.00E-01	I					1			Zinc and Compounds	7440-66-6	2.3E+04	n	3.5E+05	nm					6.0E+03	n		3.7E+02	n	
				5.00E-02	I					1	0.1		Zineb	12122-67-7	3.2E+03	n	4.1E+04	n					9.9E+02	n		2.9E+00	n	
				8.00E-05	X					1			Zirconium	7440-67-7	6.3E+00	n	9.3E+01	n					1.6E+00	n		4.8E+00	n	

TR=1E-06
THQ=1.0

Appendix K-1
Human Health and Ecological Risk Assessment

HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT
SUBPART X PERMIT APPLICATION
MILAN ARMY AMMUNITION PLANT

MILAN, TENNESSEE

EnSafe Project Code
0888811338

Prepared for:

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LIST OF ACRONYMS

µg/m^2	Micrograms per cubic meter
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm	Centimeter
COPC	Constituents of potential concern
COPEC	Chemicals of potential ecological concern
ERAGS	Ecological Risk Assessment Guidance for Superfund
ESQ	Ecological screening hazard quotient
ESV	Ecological screening value
ft.	Feet
HEI	High Explosive Incendiary
HHRA	Human Health Risk Assessment
HHRAP	Human Health Risk Assessment Protocol
INRMP	Integrated Natural Resource Management Plan
IRP	Installation Restoration Program
km	Kilometer
LOAEL	Lowest observed adverse effect level
MET	Meteorological
mg/day	Milligrams per day
MLAAP	Milan Army Ammunition Plant
mm	Millimeter
MTTU	Miscellaneous thermal treatment units
NOAEL	No observed adverse effect level
NWS	National Weather Service
OB/OD	Open burning/open detonation
OBODM	OB/OD Dispersion Model
RAGS	Risk Assessment Guidance for Superfund
RDX	Research Department Explosive
RSL	Risk-based screening levels
SLERA	Screening-Level Ecological Risk Assessment
SPCC/ISC-	Spill Prevention, Control, and Countermeasures/Installation Spill Contingency
TDEC	Tennessee Department of Environment and Conservation
TNT	Trinitrotoluene
USEPA	United States Environmental Protection Agency

1.0 OVERVIEW

Milan Army Ammunition Plant (MLAPP) submitted a Part B, Subpart X Permit Application in accordance with Title 40 Code of Federal Regulations 264 Subpart X (Miscellaneous Units) in January 2011, to reflect their intent to permit two miscellaneous thermal treatment units currently operating under interim status. As part of the permitting process, MLAPP must conduct a risk assessment to evaluate the potential impact to human health and the environment potentially associated with activities at the open burning/open detonation (OB/OD) units.

1.1 Objective

The objective of the risk assessment is to assess the potential risks to human health and the environment based on the actions proposed in the Part B, Subpart X Permit Application.

1.2 Project Background

In accordance with the U.S. Environmental Protection Agency (USEPA) Human Health and Ecological Risk Assessment Guidance for Combustion Facilities, this risk assessment has been prepared as part of the Subpart X Permit Application.

1.3 Facility Information

MLAAP is a government-owned, contractor-operated military installation currently operated by American Ordnance that has been in operation since 1941. The facility encompasses approximately 22,436 acres of land in both Gibson and Carroll Counties of western Tennessee.

1.3.1 Site History

MLAAP was constructed between January 1941 and January 1942 and has been in operation for 70 years. MLAAP's general mission has been the manufacture, storage, and shipment of explosive ordnance, including both small and medium caliber military ammunition. Numerous studies and major investigations have been and are currently being conducted to determine environmental contamination due to historical operational and disposal practices. These past waste management practices are being addressed under an agreement among the USEPA Region 4, Tennessee Department of Environment and Conservation (TDEC), and U.S. Department of the Army titled *Federal Facilities Agreement* under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 120 and Resource Conservation and Recovery Act Sections 3008(H), 3004(U), and 3004(V) for MLAAP. This agreement addresses all known environmental impacted locations at the MLAAP and names CERCLA as the lead agency in these cases.

CERCLA investigations have resulted in three areas being identified as Solid Waste Management Units that are slated for further investigation and remediation: the former OD Unit, the current OB Unit, and the current OD Unit. Any future investigation and remediation activities will be conducted under CERCLA as outlined in the *Federal Facilities Agreement* and defined in MLAAP's Interagency Agreement with the USEPA and TDEC. MLAAP has numerous active CERCLA investigation monitoring wells in and around the waste management area.

1.3.2 Current Operations

MLAAP is assigned the following general responsibilities:

- Load, assemble, and pack ammunition items
- Handle and store strategic and critical materials
- Production quality assurance functions in support of procurement and production
- Operation and maintenance of active facilities in support of current operations
- Maintenance and/or lay-a-way of standby facilities (including machinery and package lines received from industry or other government installations) in condition to permit rehabilitation and resumption of production within prescribed time limitations
- Receipt, surveillance, maintenance, renovation, storage, physical inventory, issue, demilitarization and salvage of field service stocks, items of industrial stocks, and international logistics requirements stocks
- Procurement, receipt, storage and issue of necessary supplies, equipment, components, and essential materials
- Industrial readiness planning and emergency mobilization planning, including preparation, review, and revision of prescribed plans
- Production engineering and process engineering
- Support service for tenants

- Custodial maintenance and administrative functions of sub-installations

Hazardous wastes generated at MLAAP include waste propellants, explosives, pyrotechnics, munitions, explosive components, explosive-contaminated solvents and rags from clean-up of manufacturing equipment, spent carbon from the treatment of wastewater containing explosives, contaminated ash from the thermal treatment of waste explosives and explosive contaminated materials, and wastewater treatment sludge from the processing of ammunition.

Waste propellants, explosives, pyrotechnics and munitions components, all of which are defined in 40 Code of Federal Regulations Part 260.10 as military munitions, and treated at MLAAP via miscellaneous thermal treatment, is the subject of the previously submitted Part B Permit Application.

Currently, MLAAP is permitted to receive, store, and/or treat hazardous waste generated onsite or from other Department of Defense facilities or Department of Defense contractor offsite generators. The waste generated from those facilities and sent to MLAAP for thermal treatment are limited to non-chemical waste military munitions, and must meet the Department of Transportation definition of explosive and Tennessee Hazardous Waste Management Regulations definition of reactivity.

Hazardous waste is treated at the waste management area at two units: an OB Unit and an OD Unit. Treatment at the OB Unit occurs in elevated burn pans.

Treatment at the OD Unit occurs both aboveground and in subsurface configurations. Subsurface thermal treatment is for bulk military high explosives, completed large-caliber military ammunition, and munitions components. Aboveground thermal treatment associated with the OD Unit is for treatment of machine-damaged, dropped, and other dangerous rounds. Aboveground OD is only used on munitions items that are too dangerous to manage via standard subsurface treatment. The OD Unit is approximately 40 acres with two adjacent shooting fields (referred to as the East Shooting Field and West Shooting Field) containing earthen pits.

2.0 DEVELOPMENT OF RISK ASSESSMENT DATA SET

This section presents an overview of the strategy that will be used to develop a data set for the risk assessment. Recommendations from the 2005 Human Health Risk Assessment Protocol (HHRAP) are used when possible.

2.1 Dispersion Modeling

For the modeling of OB/OD ordnance, the USEPA model, OB/OD Dispersion Model (OBODM) is used as recommended by the TDEC and USEPA Region 4. This model was developed by the U.S. Army for use in evaluating the potential air quality and depositional impacts of the OB/OD of obsolete munitions and solid propellants.

2.1.1 Meteorological Data

Air Dispersion Modeling requires using meteorological (met) data to predict dispersion. Several National Weather Service (NWS) stations were evaluated based on distance, elevation, and surface roughness to determine the most representative source for hourly met data. The surface roughness values were calculated using the USEPA AERSURFACE program (version 08009). AERSURFACE utilizes surface roughness calculation methodology similar to the 2005 HHRAP. Based on the comparison, Paducah, Kentucky, was chosen as the most representative NWS station for the Milan facility. The comparison is shown in Table 1.

Although the 2005 HHRAP recommends five years of met data, this is not applicable to, or feasible with the OBODM, which only requires one year of met data. The nearest upper air station is in Nashville, Tennessee, and the most recent complete year of data available is 2008. Missing mixing heights are replaced using USEPA recommended procedures. Thus, 2008 hourly surface data from Paducah, Kentucky, and mixing heights from Nashville, Tennessee, were processed using the USEPA program Meteorological Processor for Regulatory Models (version 99349) in the Industrial Source Complex Short Term Model format and used in this analysis.

Meteorological parameters used in the OBODM were set to match the first hour of the processed hourly met data where applicable. The surface roughness value was set to match the source of surface met data, which is the NWS station in Paducah, Kentucky. All meteorological parameters used in the OBODM are shown in Table 2.

Table 1
NWS Meteorological Station Comparison
Milan Army Ammunition Plant — Milan, Tennessee

Station	Location	Approx. Distance from Milan (km)	Surface Elevation (ft)	Surface Roughness (m)
Milan Army Ammunition Plant	Milan, TN		**492.6**	**0.436**
Jackson McKellar Airport	Jackson, TN	37.6	433	0.036
Memphis International Airport	Memphis, TN	149.8	254	0.067
Clarksville Outlaw Airport	Clarksville, TN	140.0	560	0.062
Nashville International Airport	Nashville, TN	182.0	600	0.048
Paducah Barkley Regional Airport	**Paducah, KY**	**130.1**	**413**	**0.145**

Notes:
km = Kilometer
ft = Feet
m = Meter
TN = Tennessee
KY = Kentucky

Table 2
Meteorological Parameters 1[1]

Year [1900-2099]	2008
Month [1-12]	1
Day [1-31]	1
Hour (STD) [00-23]	0000
Minute	0
Julian day [1-1]	1
Surface pressure (mb) [600.0-1100.0]	1007.00
Cloud cover (8ths) [0-8]	.00
Cloud ceiling (m) [.0-20000.0]	9999.00
Net radiation index [-2-4]	-2.
Pasquill stability category [A-F]	F
Wind speed reference height (m)	10.00
Surface roughness length (m) [.00-1.00]	.145
Vertical grad. of pot. temp. (C/m) [-5.000-5.000]	.02
Reference wind speed (m/s) [1.0-50.0]	3.087
Minimum (at 2m) wind speed (m/s)	2.064
Air temperature (K) [213.1-333.1]	273.1
Standard dev. of wind direction angle (d) [1.0000-80.0000]	7.0000
Standard dev. wind elevation angle (d) [1.0000-50.0000]	5.0000
Longitudinal turbulence intensity (d) [1.0000-106.4000]	9.3100
Measurement time for std. dev. wind dir. angle (s) [2.5-3600.0]	600.00
Air humidity (%) (.0-100.0)	65.6
Surface mixing layer height (m) [1.0-20000.0]	200.00
Wind direction (From) (deg) [.0-360.0]	91.0
Wind-direction shear (d/m) [-45.0-45.0]	.00
Wind-speed power law exponent [.000-5.000]	.25
Wind-speed shear (m/s) [.00-20.00]	Compute

[1] Meteorological Data from Open Burning / Open Detonation Dispersion Model

2.1.2 Emission Rates

OBODM contains emission factors for approximately 40 different classes of ordnances. Calendar year 2006 was selected as the baseline disposal year for the disposal inventory, based on a subjective assessment of the inventory as representative of a typical year of disposal at MLAAP. This baseline data was evaluated to determine the best fit of the various ordnance types into one of the predefined classes within OBODM. The ordnance was classified iteratively by first comparing the specific ordnance to the OBODM classes and classifying the ordnance that readily conformed to a specific class. The remaining ordnance was then assessed based on similarity to a specific OBODM class and lastly by a comparison of the chemical constituents of the disposed ordnance to the constituents of the OBODM classes. This process resulted in using 13 of the OBODM classes. In order to accurately depict a worse-case hourly quantity to use in the modeling, the maximum amount was derived for each disposal type.

For OB, a total of 11 burn pans can be used in an hour: nine pans with a maximum capacity of 300 pounds each and two pans with a maximum capacity of 500 pounds each. Due to safety reasons, the burn pans are not typically filled to capacity; therefore, in the modeling, a burn amount of 300 pounds was used for each of the nine burn pans and 500 pounds was used for the remaining two pans. The resulting maximum amount burned per hour 3,700 pounds. The lesser of the maximum per hour and the annual inventory quantity is used in the modeling.

MLAAP is currently permitted for 10,000 pounds per day for OD. The typical operating schedule is 10 hours per day, which results in an average detonated amount of 1,000 pounds per hour. As a worst-case for OD, the amount detonated per hour used in the modeling is 1,400 pounds. The lesser of the maximum per hour and the annual inventory quantity is used in the modeling. The 2006 annual disposal inventory, selected OBODM classes, and the OBOD modeled quantities are shown in Table 3.

Table 3
Disposal Inventory and Modeled Quantities

Ordnance	2006 Disposal Inventory (pounds) Exploded	Burned	OBODM Quantities (pounds) Exploded	Burned
40 mm Cartridges (HEI)	21,591	0	1,400	0
Composition B	21,011.5	0	1,400	0
Flare, Countermeasure, Aircraft, M206	0	56,858	0	3,700
Fuzes	330.19	0	330.19	0
M-1 Nitrocellulose	0	487,065	0	3,700
Propellant M-9	468	1,264,179	468	3,700
Propellant, M31A1E1	0	30,229	0	3,700
RDX	158,535	0	1,400	0
Signal Illuminators	0	1,237	0	1,237
TNT	5,342	0	1,400	0
Propellant, Ammonium Perchlorate	0	531	0	531
HBX	6,366	0	1,400	0
Black (smokeless) Powder	1,322	0	1,322	0

Notes:
HEI = High Explosive Incendiary
mm = Millimeter
RDX = Research Department Explosive
TNT = Trinitrotoluene

The ordnance categorized as 40 mm HEI cartridge includes explosive cartridges, cartridges with explosive components, and components thereof, for a variety of cartridge sizes ranging from 20 mm through 155 mm.

The composition B category includes composition explosives with TNT. Other categories of composite explosives such as Composition A, Composition C, CH6, A-3, A-5, etc., are categorized as RDX because the high percentage of RDX in the compound is usually greater than 98%. The same rule applies to other munitions that have HMX as the energetic material.

Classes categorized as a single explosive or propellant component such as TNT, RDX, M-1, and M-9 are waste materials that are either the specific explosive, contain the explosive or component as the main energetic component, or are a material contaminated with that component.

Propellants are grouped into four categories that best fit either single-base, double-base, and triple base or ammonium perchlorate based propellants. Single-base being described as having nitrocellulose as the main energetic material, double-base as having a combination of nitrocellulose/nitroglycerin as the main energetic material, triple base as containing nitroguanidine and ammonium perchlorate based propellant having ammonium perchlorate as the oxidizer. The

fuse category includes all types of fuses disposed of at the facility as well as primers. Primers are grouped with fuses because all fuses have a primer composition as a component of the fuse. The signal illuminator category includes illuminating flares and other pyrotechnic compositions. The Flare Countermeasure M206 category represents all Infrared Countermeasure Flare compositions based on a magnesium/Teflon/binder composition.

The remaining categories contain essentially only the specified ordnance.

MLAPP's disposal operations have unique conditions, in that they have restrictions on the hours of operation and can only operate when the met data meet certain criteria. Thus, ordnance-specific hourly emission rate files were used. All hours were set to zero emission rates unless the time and met data met the following criteria:

- Operating hours of 6:00 a.m. to 7:30 p.m.
- No precipitation was recorded.
- The wind speed is more than 1 mile per hour, but less than 15 miles per hour.
- Not an extremely cloudy day, as defined as more than 80% cloud cover with a ceiling of less than 2,000 feet.

If the criteria were met, then the OBOD modeled quantity was used for that hour.

2.1.3 Model Input

There are three run types that can be used for each ordnance: volatile concentration, metal concentration, and metal deposition. The settings that are unique for these run types are shown in Table 4. The OBODM determines the chemicals that are possibly emitted from each ordnance class, and the run type is determined from the nature of each chemical. The settings that are unique for OB/OD are shown in Table 5.

Table 4
Run Type Settings

Volatile Concentration Run	Metal Concentration Run	Metal Deposition Run
Concentration	Concentration with depletion due to gravitational deposition	Gravitational Deposition
Time-average concentration (1-hour)	Time-average concentration with depletion due to gravitational deposition (1-hour)	1-hour Deposition
Complex Terrain	Flat Terrain (Complex not allowed)	Flat Terrain (Complex not allowed)
Met Tower Elevation: 120.1 m (above ground surface)	Met Tower Elevation: n/a	Met Tower Elevation: n/a

Notes:
m = Meter
n/a = Not Applicable

Table 5
OB/OD Settings

Parameter	Open Burn	Open Detonation*
Emission Type	Quasi-continuous	Instantaneous
Release Height	1 m	0 m
Source Location UTM-X	348,452.4 m NAD27	347,983.8 m NAD27
Source Location UTM-Y	3,971,996.7 m NAD27	3,970,800.2 m NAD27
Open Burn Source Dimensions — Horizontal	10 ft x 5 ft, 90° Orientation from North	n/a
Open Burn Source Dimension — Vertical	1 ft	n/a
Source Elevation (volatile runs only)	148.3 m	151.9 m

Notes:
UTM = Universal Transverse Mercator
m = Meter
NAD = North American Datum
* The OBODM considers OD to be at ground level with the center of the fireball above ground. This is conservative since MLAAP actually buries the ordnance in an excavation, covers the ordnance with soil, and detonates the ordnance.

All model runs in the analysis use a volume source type, final cloud rise height for all calculated distances, a highest maximum concentration, and a 1-hour averaging time for concentration. Also, instantaneous sources can use both stable and adiabatic plume rise. The defaults are used for all remaining parameters.

2.1.4 Particle Size Distribution

For OBODM runs that utilize deposition or concentration with depletion due to deposition, a particle size distribution is required. The particle distribution is auto-generated within OBODM using the following components: the number of categories is set to 20, the mass median diameter

is 200 microns, the geometric standard deviation of the distribution is 1.2, and the ratio of Lagrangian to Eularian time scales is set to 1.0. These parameters were used and approved in previous OBOD modeling of the MLAAP, and are shown in Table 6 along with the OBODM calculated settling velocities.

2.2 Modeling Results

In total, 380 individual OBODM runs were made to reflect all combinations of ordnance, chemical, receptor grid, concentration, and deposition modeling. The results of the OBOD modeling are described in the following section.

2.2.1 Converting the Results Data

The modeling results for all runs represent an hourly value. These results can be used for short-term, acute risk assessment if required. In order to convert the hourly concentrations to an annual value, the maximum hourly concentration at each receptor is multiplied by the number of events per year, and divided by the number of hours in a year, or 8,760. The number of events per year is calculated by dividing the total 2006 inventory for the ordnance by the maximum hourly quantity used in the analysis. The calculated events per year are shown in Appendix A.

For deposition runs, results must be scaled to convert hourly deposition to the amount accumulated annually. The deposition value at each receptor is multiplied by the total number of events per year. Maximum hourly and annual modeled concentrations and depositions are shown in Appendix B.

2.3 Constituent Evaluation

After the categories of munitions and their respective emission factors were categorized, constituents for evaluation were selected based on the guidelines set forth in the following documents:

- USEPA, 1999. *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities*. USEPA530-D-99-001A. August 1999. Peer Review Draft. ("SLERA Protocol")

- USEPA, 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*. USEPA530-R-05-006. September 2005. Final. ("HHRA Protocol")

Table 6
OBODM Particle Size Distribution and Deposition Velocities

	Particle Category Description			Settling (Deposition) Velocities						
Category No.	**Upper limit diam (µm)**	**Lower limit diam (µm)**	**Fraction (unitless)**	**Aluminum (m/s)**	**Antimony (m/s)**	**Barium (m/s)**	**Cadmium (m/s)**	**Copper (m/s)**	**Lead (m/s)**	**Zinc (m/s)**
1	304.19	291.70	0.00869	2.2431	4.0099	2.6554	4.7507	4.8582	5.7576	4.1829
2	291.70	279.72	0.01396	2.1568	3.8583	2.5533	4.5476	4.6406	5.4935	4.0247
3	279.72	268.23	0.02127	2.0739	3.7124	2.4551	4.3756	4.4651	5.2414	3.8725
4	268.23	257.22	0.03075	1.9857	3.5721	2.3607	4.2102	4.2963	5.0104	3.7261
5	257.22	246.65	0.04218	1.8814	3.4370	2.2699	4.0510	4.1339	4.8210	3.5852
6	246.65	236.52	0.05489	1.7826	3.3068	2.1760	3.8977	3.9775	4.6386	3.4496
7	236.52	226.81	0.06776	1.6889	3.1797	2.0617	3.7504	3.8271	4.4633	3.3179
8	226.81	217.50	0.07936	1.6003	3.0575	1.9534	3.6085	3.6825	4.2946	3.1904
9	217.50	208.57	0.08818	1.5162	2.9399	1.8509	3.4698	3.5414	4.1322	3.0678
10	208.57	200.00	0.09295	1.4366	2.8269	1.7536	3.3364	3.4052	3.9760	2.9498
11	200.00	191.79	0.09295	1.3619	2.7147	1.6615	3.2081	3.2743	3.8234	2.8364
12	191.79	183.91	0.08818	1.3034	2.5721	1.5742	3.0847	3.1484	3.6764	2.7048
13	183.91	176.36	0.07936	1.2474	2.4370	1.4915	2.9641	3.0273	3.5350	2.5627
14	176.36	169.12	0.06776	1.1939	2.3090	1.4272	2.8085	2.8771	3.3991	2.4281
15	169.12	162.17	0.05489	1.1426	2.1877	1.3659	2.6610	2.7260	3.2684	2.3006
16	162.17	155.51	0.04218	1.0935	2.0728	1.3072	2.5211	2.5827	3.1020	2.1797
17	155.51	149.12	0.03075	1.0465	1.9639	1.2510	2.3887	2.4470	2.9390	2.0652
18	149.12	143.00	0.02127	1.0016	1.8607	1.1973	2.2632	2.3185	2.7847	1.9567
19	143.00	137.13	0.01396	0.9586	1.7783	1.1459	2.1444	2.1968	2.6385	1.8602
20	137.13	131.50	0.00869	0.8988	1.7020	1.0967	2.0318	2.0814	2.4999	1.7803
		Weighted Average (m/s):		**1.446**	**2.760**	**1.748**	**3.286**	**3.356**	**3.936**	**2.888**
		Weighted Average (cm/s):		**144.6**	**276.0**	**174.8**	**328.6**	**335.6**	**393.6**	**288.8**

Notes:
Diam = Diameter
µm = Micro Meter
m/s = Meters per Second
cm/s = Centimeters per Second

The 1999 ecological protocol guidance document is under review; therefore, USEPA may revise their ecological protocol which could require an update to this report.

Consistent with current USEPA policy (USEPA 1989) and EnSafe's March 2008 *Human Health and Ecological Risk Assessment for a Subpart X Permit Application Work Plan* (2008 work plan), inorganic constituents have been excluded from further consideration if the maximum estimated concentration is consistent with concentrations in the surrounding area that would be unaffected by the facility.

Chemical concentrations in soil were calculated by summing the vapor phase and particle phase deposition of chemicals to the soil. Only dry deposition of particles and vapors were considered since the facility cannot treat wastes when there is precipitation. The dry deposition of vapors was calculated from the vapor air concentration and the dry deposition velocity. The calculation of soil concentration also incorporated the loss of constituents of potential concern (COPCs) via leaching, erosion, runoff, degradation, and volatilization as directed by the guidance using site-specific numbers or default values as appropriate (USEPA, 1999; USEPA, 2005). Equations 1 and 2 were used to calculate the cumulative soil concentration. Equation derivations can be found in Appendix C.

Due to the use of air dispersion modeling protocol requested by TDEC and Tech Law the initial equations in the HHRAP protocol to develop soil concentrations were modified to provide accurate results for the soil concentration (USEPA, 2005; EnSafe, 2008). To obtain a conservative value for screening, the soil constant due to all process (Ks) was deleted from the equation. By eliminating the soil loss constant, the annual maximum concentration for the MLAAP was used for air and soil screenings. This is a conservative method because maximum contributions from various emissions were combined regardless of location. Deposition (Ds) was calcuated based on the original data units given from the MLAAP of micrograms per cubic meter ($\mu g/m^2$).

Equation 1:: $$Cs = \frac{0.0001 * Dydp}{Z_s * BD} * t_D$$

Dydp	=	Unitized yearly average dry deposition from particle phase ($\mu g/m^2$)
Zs	=	Soil mixing zone depth (cm) (2 cm for untilled soil, 20 cm for tilled soil)
BD	=	Soil bulk density (g/cm^3)(default = 1.5 g/cm^3)
0.0001	=	Conversion factor (m^2-g-mg)/(cm^2-kg-µg)
t_D	=	Time period over which deposition occurs (yr)
$\mu g/m^2$	=	Microgram per square meter
cm	=	centimeter
g/cm^3	=	grams per cubic centimeter

Due to a revised modeling protocol used to obtain raw data from onsite, the conversion factors and units in the 2005 HHRAP were not valid. Therefore, a revised version of the equation was developed to provide accurate results and correct units.

As discussed in Section 2.2, MLAAP's disposal operations have unique conditions and can only operate when the met data meets certain criteria. The facility cannot treat wastes when there is precipitation; therefore, all wet deposition values were assumed to have a value of zero.

Metals were the only constituents being screened. Therefore, some equation parameters were considered to have values of zero since these pertain to only vapor phases. For example, the original conversion factors were no longer applicable since they were specific to the original equation described in Appendix C. Therefore, a new unit conversion was assigned to equalize units. The revised model incorporated the COPC emission rate and other values into the equation, as described in Appendix C. The following is the final equation used to obtain deposition.

Equation 2: $$Ds = \frac{0.0001 * Dydp}{Z_s * BD}$$

Ds	=	Deposition term (mg/kg/yr)
Dydp	=	Unitized yearly average dry deposition from particle phase (µg/m^2)
Zs	=	Soil mixing zone depth (cm) (2 cm for untilled soil)
BD	=	Soil bulk density (g/cm^3)(default = 1.5 g/cm^3)
0.0001	=	Conversion factor (m^2-g-mg)/(cm^2-kg-µg)

The deposition results for each constituent are in Appendix C.

3.0 BASELINE HUMAN HEALTH RISK ASSESSMENT

3.1 Guidance

The overall methodology for the baseline human health risk assessment (HHRA) is based on the following guidance documents and references:

- USEPA. (1989, December). *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual. Part A. Interim Final.* USEPA/540/1-89/002. ("RAGS, Part A").

- USEPA. (1992b, February 26). *Guidance on Risk Characterization for Risk Managers and Risk Assessors*. Memorandum from F. Henry Habicht II, Deputy Administrator, to Assistant Administrators. Regional Administrators.

- USEPA. (1996, April). *Soil Screening Guidance: User's Guide*. USEPA/540/R-96/018.

- USEPA. (1997, August). *Exposure Factors Handbook*. USEPA/600/P-95/002F.

- USEPA. (2003). *Human Health Toxicity Values in Superfund Risk Assessments.* USEPA Office of Solid Waste and Emergency Response (OSWER) Directive 9285.7-53.

- USEPA. (2005, September). *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*. USEPA530-R-05-006. Final.

- Additional Risk Assessment Guidance for Superfund (RAGS) documents, OSWER directives, and other guidance will be cited in the risk assessment as appropriate.

3.2 Data Compilation

The results from air modeling were reviewed to (1) organize data that are of acceptable quality for their use in the detailed HHRA; and (2) calculate concentrations in various media to be further evaluated in the baseline HHRA. Detailed information regarding the methodology used to estimate concentration terms in the risk assessment is presented in Section 2.3 and Appendix C.

3.3 Exposure Assessment

The objective of the exposure assessment is to use uptake models to estimate the type and magnitude of exposures to the COPCs present at, or migrating from, the miscellaneous thermal treatment units (MTTUs) included in the baseline HHRA identified in the conceptual site model.

The results of the exposure assessment were integrated with chemical-specific toxicity information to characterize human health risks potentially associated with these sites.

3.3.1 Site Characterization

The first step in the exposure assessment is to characterize areas in the vicinity of the MTTUs according to their physical characteristics as well as those of the human population on or near these units. Information gathered in this step was used to support the identification and selection of exposure pathways that warrant further evaluation in the HHRA.

Information related to the physical setting such as climate, geologic and hydrogeological setting, surface water feature and soil type were collected from several sources, including findings of the previous investigations, published regional data, and county soil surveys. The physical setting of areas in the vicinity of the thermal treatment units based on information presented in *the Part B Permit Application for Milan Army Ammunition Plant* (Revision 10, dated January 2011) is summarized below.

Physical Setting and Land Use

MLAAP covers approximately 22,436 acres in a rural area. Except for Lavinia, Tennessee, the north, south, and east property boundaries are sparsely populated. The west boundary, which parallels U.S Highway 45, is more heavily populated with numerous small communities and the city of Milan. These communities and the city of Milan are four to five miles from the thermal treatment units. The MTTUs are located in the east-central portion of the property. Types of land use at MLAAP and the number of acres are listed below:

- Leased for agricultural purpose 7,828
- Production facilities (active and inactive) 548
- Storage facilities 7,930
- Field service areas 9,897
- Administrative, shop, housing, other 1,395

Land use within 1,000 feet of the MTTUs consists of wooded lots, a permitted solid waste landfill (northwest of the burning ground), and magazines used to store explosives and finished munitions. The land around the storage magazine is used for domestic livestock grazing.

Distance to Nearest Residential Receptors

The private residence or commercial dwelling closest to the MTTUs is more than one mile away (approximately 7,125 feet) to the east and south. Risk screening of air and estimated soil concentrations was used to determine if residential land use was applicable.

Decision point — Deposition concentrations indicate no residential COPCs were identified. Therefore, residential land use was not evaluated.

Surface Water Features

Several small intermittent streams are present in the MTTUs. These streams drain to perennial streams more than 1,000 feet from the MTTUs. A single small pond is located approximately 2,000 feet upgradient of the ammunition destruction area boundary. This pond is dry during the summer. Figure 1 shows the pond on the topographic map.

Decision point — Deposition concentrations indicate no residential COPCs were identified. Therefore, stream use was not evaluated.

3.3.2 Conceptual Site Model

Exposure pathways describe the movement of chemicals from sources such as air or soil to exposure points where receptors (i.e., potentially exposed populations) may come in contact with the chemicals.

An exposure pathway is typically defined by the following components (USEPA, 1989):

- A source and mechanism of chemical release to the environment
- An environmental transport medium (e.g., air, water) for the released chemicals
- A point of potential contact with the contaminated medium (i.e., point of exposure)
- An exposure route (e.g., inhalation, ingestion, dermal contact) at the point of exposure

An exposure pathway is considered complete only if all four components are present. In conducting a risk assessment, only complete exposure pathways are evaluated quantitatively. Described below are the procedures that were used to formulate a conceptual site model for MLAAP, which was used to screen and evaluate risks.

Residential Location Nearest to Burning Grounds

Residential Location Nearest to ADA

Nearest Pond to ADA

ADA

ADA
Burn Area
Pond
Residence
Facility Roadways
Drainage Ditch
Streams
Operable Unit Boundary
PropertyBoundary
1,000 Ft Buffer

N

0 1,0002,000 4,000 Feet

USGS Topographic Map: National Geographic TOPO! - ArcGIS Online

ENSAFE

Figure 1
USGS Topographic Map
Milan Army Ammunition Plant
Milan, Tennessee

4/25/2012 D:\projects\milan\Milan AAP\Map\property_topo.mxd

3.3.2.1 Known and Suspected Sources of Contamination

Information regarding known or suspected sources of contamination was obtained from existing information previously discussed in Section 1.3 of this report. The primary sources of contamination are expected to be associated with emissions from the various thermal treatment units.

3.3.2.2 Receiving Media

The environmental medium directly impacted by activities associated with the MTTUs is air. The nature and extent of impact (including secondary impact to other media) were delineated based on modeling analysis protocols for estimating indirect exposure.

3.3.2.3 Release Mechanisms and Transport Pathways

Based on the 2008 work plan, the following potential cross-media transfer mechanisms could be complete for COPCs:

- COPCs in the air may be deposited onto soil surface.
- COPCs in surface soil may be transported to subsurface via percolation.
- COPCs in subsurface soil may enter groundwater underlying the facility.
- COPCs in surface soil may be transported to surface water and sediments through surface runoff.
- COPCs in groundwater may be transported to surface water and sediments through groundwater recharge.
- COPCs in surface soil may be transported to the atmosphere via volatilization or fugitive dust emission.
- COPCs in the air, surface soil, and subsurface soil may be incorporated into plants via root uptake and subsequently incorporated into animals feed on contaminated plant tissues.

As part of the risk assessment, the process of screening data and identifying COPCs was performed in accordance with USEPA RAGS subsequent to the exposure assessment and data compilation. Air concentrations were modeled, and soil concentrations were estimated based

on deposition models. Consequently, risk screening is discussed following the land use, air model and deposition discussions.

3.3.2.4 Receptors and Exposure Pathways

Current Land Use: MLAAP is an active installation with restricted public access. The surrounding area is rural and sparsely populated. The facility currently leases approximately 13,600 acres for agricultural purposes such as beef cattle, and growing crops (corn, soybean, cotton, and winter wheat). In addition, the facility also issues hunting and fishing permits to site employees.

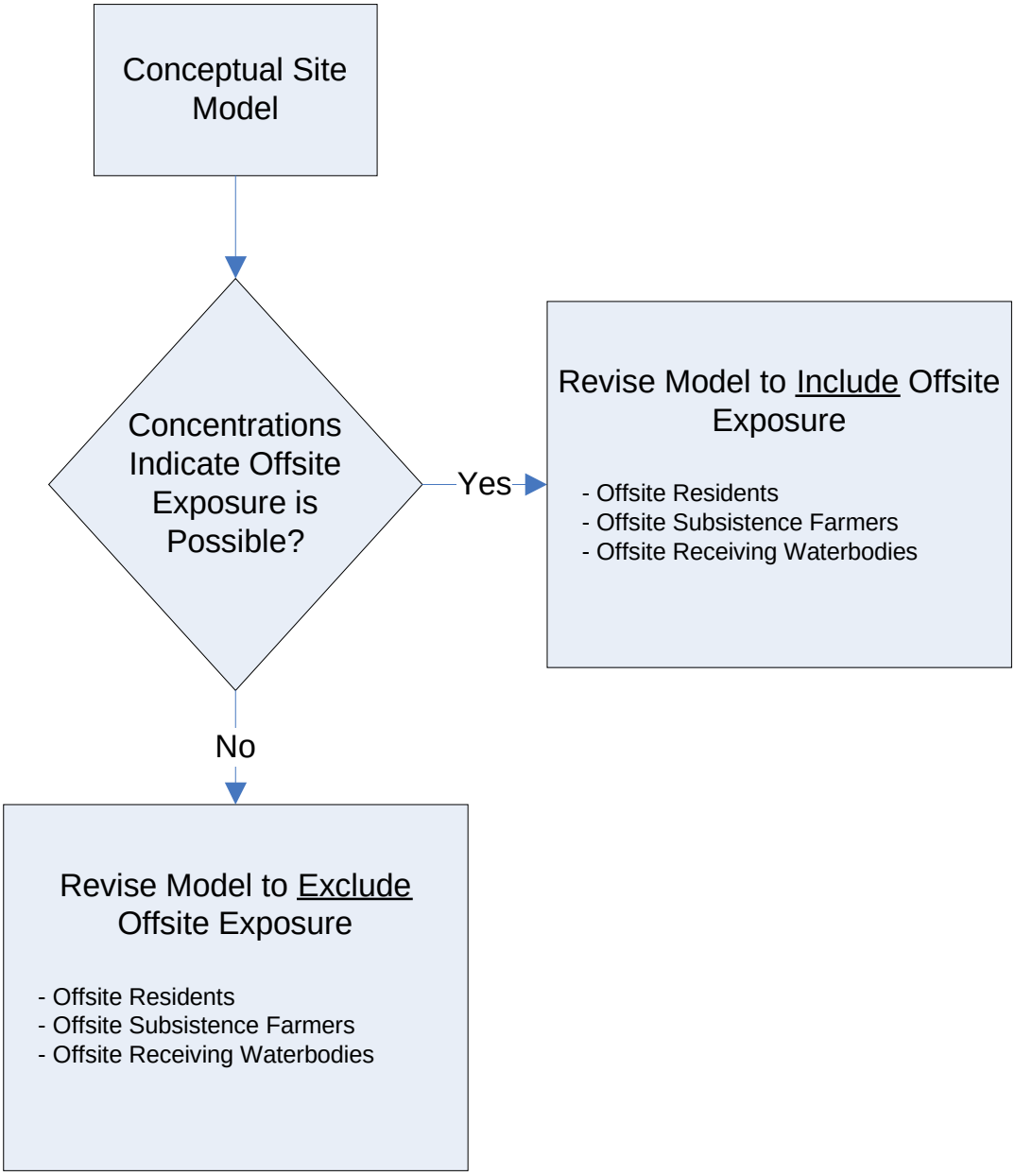
Anticipated Future Land Use: MLAAP will maintain manufacturing capability; however, current manufacturing operations will be transferred to another facility. Waste treatment operations in the MTTUs will continue. The demand for additional housing within the area is not increasing because the population did not increase during the census period 1980 to 1990. Therefore, the current industrial use was anticipated to continue. As discussed in the approved 2008 work plan, the U.S. Census is queried to update the information using 2000 census data, and the 2000 population slightly increased from 1990 figures (increasing from 7,512 to 7,664). Anticipated future land use is industrial. Based on the current and anticipated future industrial use of the property, known or potential human receptors includes two categories:

Onsite Receptors	Offsite Receptors
Workers	Subsistence farmers
Visitors/hunters	Residents

The conceptual site model (Figure 2) illustrates the exposure pathways and receptors to be considered in the baseline HHRA.

Surrounding land use, property boundaries, and the conceptual site model were reviewed and updated after deposition concentrations were available to determine the evaluation warranted for offsite receptors. The 2008 work plan indicated that the conceptual site model (Figure 2) would be used to determine the need to include offsite exposure. If deposition concentrations indicated offsite receptors could be exposed to site materials, offsite receptors would be evaluated in the risk assessment using methods outlined in the 2008 work plan. Otherwise, offsite receptors would be eliminated from the risk assessment.

Figure 2
Conceptual Site Model



Deposition concentrations did not indicate offsite receptors would be exposed to site materials at concentrations greater than corresponding screening values. Consequently, offsite receptors were not evaluated in the risk assessment, and many aspects of the 2008 work plan are no longer applicable.

The 2008 work plan indicated several pathways and scenarios may be included based on the results of risk screening and identification of COPCs. Some pathways were eliminated based on the air dispersion modeling and risk screening results. The exposure pathways considered are listed below. If no COPCs are identified, the pathway was not evaluated further. Consequently, pathways indicated with "Yes" were evaluated by risk screening and/or risk modeling, contingent upon the risk screening results.

Onsite Receptors

Receptors	Medium	Pathways	Evaluated in the HHRA?
Site Workers	Surface soil	Incidental ingestion of COPCs in surface soil	**Yes**. It is possible for workers to be exposed to COPCs in surface soil via incidental ingestion.
		Inhalation of airborne COPCs (both in vapor and particulate) from the soil	**Yes**. It is possible for workers to be exposed to COPCs in surface soil via inhalation of COPCs in the air.
		Dermal contact with COPCs in the soil	**No**. This decision is based on guidance provided in USEPA 2005.
Site Visitors/ Hunters	Surface Soil	Incidental ingestion of COPCs in the soil	**Yes**. It is possible for site visitors/hunters to be exposed to COPCs in surface soil via incidental ingestion.
		Inhalation of airborne COPCs (both in vapor and particulate) from the soil	**Yes**. It is possible for site visitors/hunters to be exposed to COPCs in surface soil via inhalation of COPCs in the air.
		Dermal contact with COPCs in the soil	**No**. This decision is based on guidance provided in USEPA 2005.
	Surface Water	Incidental ingestion of COPCs in the surface water	**No**. The only surface water features near thermal treatment units are small intermittent streams.
		Dermal contact with COPCs in the surface water	**No**. The only surface water features near thermal treatment units are small intermittent streams.

Receptors	Medium	Pathways	Evaluated in the HHRA?
Site Visitors/ Hunters (continued)	Sediment	Incidental ingestion of COPCs in the sediment	**No**. The only surface water features near thermal treatment units are small intermittent streams.
		Dermal contact with COPCs in the sediment	**No**. The only surface water features near thermal treatment units are small intermittent streams.
	Game and Fish	Ingestion of COPCs in game or fish collected from the facility	**Yes**. The facility issues hunting permits to employees.

Offsite Receptors

Receptors	Medium	Pathways	Evaluated in the HHRA
Residents (including adults and children)	Surface Soil	Incidental ingestion of COPCs in surface soil	**Yes**. It is possible for residents to be exposed to COPCs in surface soil via incidental ingestion.
		Inhalation of airborne COPCs (both in vapor and particulate) from the soil	**Yes**. It is possible for residents to be exposed to COPCs in surface soil via inhalation of COPCs in the air.
		Dermal contact with COPCs in the soil	**No**. This decision is based on guidance provided in USEPA 2005.
Subsistence Farmers	Foodstuff (produce, beef, and milk)	Ingestion of COPCs in the foodstuff	**Yes**. It is possible for offsite subsistence farmers to be exposed to COPCs via indirect exposure to home-produced produce, beef, and milk.

The term, "Evaluated in the HHRA" indicates that the exposure pathway was evaluated by screening as described in Section 3.4 in this report.

3.3.3 Calculation of Concentrations in Air and Soil

Concentrations in air and soil were calculated as described in Section 2.0 of this report. Many of the 2008 work plan calculations are no longer applicable, as described in Section 2.0 and in Appendix C.

3.4 Risk Screening and Identification of COPCs

The identification of COPCs follows a systematic screening process in accordance with USEPA recommendations, regarding the June 2011 Regional RSL tables and users guide, to reduce the number of chemicals addressed in the risk assessment by initially identifying COPCs and media most likely to contribute to unacceptable risk. In accordance with USEPA, Table 7 and Table 8 summarize the data used to screen air and soil for risk and summarize the risk screening results.

Table 7
Human Health Risk Screening — Air

Chemical	Open Detonation Annual Modeled Concentration Results (µg/m^3)	Open Burning Annual Modeled Concentration Results (µg/m^3)	Totals (µg/m^3)	Resident Air RSL (µg/m^3)	key	Industrial Air RSL (µg/m^3)	key	Resident COPC	Industrial COPC
1,3-Butadiene	3.97E-05	5.49E-08	3.98E-05	0.081	c*	0.41	c*	—	—
1-Hexane	2.27E-09	7.88E-08	8.11E-08	730	n	3100	n	—	—
1-Hexene	7.89E-09	1.23E-07	1.30E-07	NA		NA		—	—
2,4-Dinitrotoluene	—	1.71E-10	1.71E-10	0.027	c	0.14	c	—	—
Allyl Chloride	5.68E-09	3.45E-07	3.50E-07	0.41	c**	2	c**	—	—
Aluminum	1.13E-04	6.58E-04	7.72E-04	5.2	n	22	n	—	—
Antimony	1.64E-07	—	1.64E-07	NA		NA		—	—
Barium	1.01E-05	1.05E-05	2.06E-05	0.52	n	2.2	n	—	—
Benzene	5.30E-07	2.72E-06	3.25E-06	0.31	c	1.6	c*	—	—
Cadmium	1.99E-06	1.52E-06	3.51E-06	$1.4e^{-3}$	c*	$6.8e^{-3}$	c*	—	—
Carbon Tetrachloride	6.44E-09	8.63E-08	9.27E-08	0.41	c	2	c	—	—
Chloroform	1.34E-10	—	1.34E-10	0.11	c	0.53	c	—	—
Chromium	6.72E-07	6.93E-06	7.60E-06	$1.1e^{-5}$	c	$1.5e^{-4}$	c	—	—
CL2	—	1.43E-05	1.43E-05	NA		NA		—	—
Copper	6.48E-05	6.43E-06	7.12E-05	NA		NA		—	—
Diethyl Phthalate	2.84E-07	1.57E-11	2.84E-07	NA		NA		—	—
Ethylbenzene	6.33E-09	4.15E-08	4.79E-08	0.97	c	4.9	c	—	—
HCL	—	8.04E-04	8.04E-04	NA		NA		—	—
Lead	3.56E-06	3.38E-07	3.90E-06	0.2	c	1	c	—	—
Methyl Chloride	1.13E-09	7.71E-08	7.82E-08	NA		NA		—	—
Methyl Chloroform	3.16E-09	—	3.16E-09	NA		NA		—	—
Methylcyclohexane	9.01E-09	5.74E-09	1.47E-08	NA		NA		—	—
Methylene Chloride	1.36E-06	6.94E-06	8.30E-06	$3.9e^{-4}$	c	$1.9e^{-3}$	c	—	—
Naphthalene	—	2.70E-09	2.70E-09	0.072	c*	0.36	c*	—	—
n-Hexane	3.20E-08	1.33E-08	4.53E-08	730	n	3100	n	—	—
Phenol	—	4.88E-10	4.88E-10	210	n	880	n	—	—
RDX	7.02E-06	1.44E-06	8.46E-06	NA		NA		—	—
Styrene	1.14E-06	3.06E-07	1.44E-06	1000	n	4400	n	—	—

Table 7
Human Health Risk Screening — Air

Chemical	Open Detonation Annual Modeled Concentration Results (µg/m^3)	Open Burning Annual Modeled Concentration Results (µg/m^3)	Totals (µg/m^3)	Resident Air RSL (µg/m^3)	key	Industrial Air RSL (µg/m^3)	key	Resident COPC	Industrial COPC
Toluene	3.71E-06	5.41E-07	4.25E-06	0.1	n	0.44	n	—	—
Vinyl Chloride	3.41E-10	3.05E-08	3.09E-08	0.16	c	2.8	c	—	—
Zinc	4.74E-05	1.39E-06	4.88E-05	NA		NA		—	—

Notes:

HHRA	=	Human Health Risk Assessment
µg/m3	=	Micrograms per cubic meter
COPC	=	Chemical of potential concern
C	=	Cancer
c*	=	Where: n SL < 100X c SL
c**	=	Where n SL < 10X c SL; n = noncancer
n	=	Noncancer; adjusted for a target hazard quotient of 0.1
NA	=	Indicates Not Applicable/Not Available
Chromium	=	Total chromium data were screened using hexavalent chromium RSLs
—	=	Indicates the chemical is not a COPC
RSL	=	USEPA Regional Screening Level; downloaded from: http://www.epa.gov/region9/superfund/prg/
Residential Air RSL	=	USEPA June 2011 Regional Air Screening Levels for residential land use
Industrial Air RSL	=	USEPA June 2011 Regional Air Screening Levels for industrial land use

Table 8
Human Health Risk Screening — Soil

Chemical	Maximum Total (mg/kg)	Residential Soil RSL (mg/kg)	key	Industrial Soil RSL (mg/kg)	key	Resident COPC	Industrial COPC
Aluminum D	5.69E+01	7700	n	99000	nm	—	—
Antimony D	2.37E-02	3.1	n	41	n	—	—
Barium D	1.95E+00	1500	n	19000	nm	—	—
Cadmium D	5.98E-01	7	n	80	n	—	—
Chromium D	1.23E+01	1.20E+04	n	1.00E+05	n	—	—
Copper D	7.96E-01	310	n	4100	n	—	—
Lead D	7.96E-01	40	n	80	n	—	—
Zinc D	1.98E+00	2.3	n	31	n	—	—

Notes:

HHRA	=	Human Health Risk Assessment
mg/kg	=	Milligram per kilogram
COPC	=	Chemical of potential concern
D	=	Indicates a modeled soil deposition concentration
n	=	Noncancer; adjusted to a hazard quotient of 0.1
m	=	Concentration may exceed ceiling limit
Chromium	=	Total chromium data were screened using trivalent chromium RSLs
—	=	Indicates the chemical is not a COPC
RSL	=	U.S. Environmental Protection Agency (USEPA) Regional Screening Level; downloaded from: http://www.epa.gov/region9/superfund/prg/
Residential Soil RSL	=	USEPA June 2011 Regional Soil Screening Levels for residential land use Industrial Soil RSL
	=	USEPA June 2011 Regional Soil Screening Levels for industrial land use

Annual air and estimated soil concentrations were compared to risk-based screening levels (RSLs) from USEPA's June 2011 Regional RSL tables. RSLs are chemical- specific concentrations that are calculated by USEPA using conservative assumptions for various exposure media. USEPA RSLs are based on a target cancer risk of 1E-6, or one-in-a-million, or a hazard quotient of 1.0. Thus, maximum concentrations in soil were screened against a risk level of 1E-06 or a hazard quotient of 1.0 to identify COPCs. Analytes considered to be essential nutrients (calcium, magnesium, sodium, and potassium) were eliminated as COPCs in accordance with RAGS Volume 1, Part A (USEPA, 1989). Additionally, USEPA's RSL User Guide indicates that screening values are provided for multiple exposure pathways and for chemicals with both carcinogenic and non-carcinogenic effects to either identify chemicals of potential concern or focus risk assessment efforts on sites or portions of sites which warrant no further action. Residential soil screening values were assumed to be protective of typical residential land use scenarios because they are recommended for use in making initial screening decisions by USEPA. USEPA's User's Guide indicates that indirect consumption of fish is addressed in groundwater screening values. However, this consumption of fish pathway is not applicable to the risk assessment because it was determined to be incomplete.

3.4.1 Air Screening

The potential exposure pathway for air was screened using modeled annual air concentrations (previously discussed) and USEPA ambient air RSLs for residential land use. As indicated in Table 7, no COPCs were identified based on air concentrations provided by OBODM.

3.4.2 Soil Screening

Deposition data were compiled as previously discussed to estimate soil concentrations using 50 year annual deposition data as described in Section 2.2. Estimated soil concentrations were compared to USEPA soil RSLs for residential land use. As indicated in Table 8, no COPCs were identified based on estimated soil concentrations provided by OBODM.

COPCs are used to characterize risks by integrating exposure and toxicity information. No COPCs were identified based on air concentrations. Consequently, air dispersion modeling results were not characterized further. No COPCs were identified based on estimated soil concentrations due to deposition. Consequently, estimated soil concentrations were not characterized further.

3.5 Uncertainty Discussion

The objective of uncertainty analysis is to evaluate the assumptions and uncertainties inherent in the risk assessment to place the risk estimate in proper perspective. The potential for uncertainty and variability is introduced throughout the risk assessment process. Sources of uncertainty and variability are those that are inherent in the risk assessment process as well as site-specific sources. Uncertainties in the HHRA could arise from the following sources:

- Use of standard assumptions instead of site-specific data selected on the basis of best professional judgment.
- Selection of a value from a wide range reported in published literature to represent the site.
- The degree of protectiveness or conservatism inherent in the current risk assessment guidance.
- Modeling bias to identify contamination.
- Lack of sufficient data and necessary assumptions to complete the quantitative risk assessment for some compounds.

- If the site is developed as a residential area in the future, surface soil conditions would likely change and soils could be disturbed and/or covered with landscaping soil, a house, or a parking lot. Consequently, exposure to soil conditions as represented by samples collected during this assessment would differ from those under a future residential scenario. These factors indicate that exposure pathways assessed in this HHRA could over- or under-estimate the risk and hazard posed to current industrial workers and future site residents.

- Hypothetical scenarios used by USEPA to develop risk-screening values. USEPA excludes vegetable uptake and human consumption of game due when developing soil RSLs, which could be a source of uncertainty with respect to screening comparisons.

- Use of annual maximum concentrations for risk screening.

- Assumed exposure populations could simultaneously be exposed to multiple chemicals and locations to avoid underestimating potential site risks.

- 50th and 95th percentile child ingestion rates in the Exposure Factors Handbook (USEPA, 1997b) are 16 milligrams per day (mg/day) and 110 mg/day, respectively. Therefore, the USEPA default soil ingestion rate of 200 mg/day for residential children used by USEPA to calculate risk-screening values is conservative.

- A soil ingestion rate of 50 mg/day for adults in a commercial/industrial setting is recommended as a standard default value (USEPA, 1991a) based on a preliminary adult soil ingestion study by Calabrese, et al., (1991). However, Calabrese and Stanek (1991) have since determined that the soil ingestion rates reported in their preliminary study were invalid and that their previous ingestion rate of 50 mg/day is an overestimation, which was used by USEPA to calculate RSLs.

- The current USEPA position that absorption of soil-bound organics under realistic exposure conditions constitutes a complete pathway is described in RAGS Part E and other RAGS documents. This position is not supported by epidemiological data and was not included in the deposition calculations in accordance with the approved modeling protocol. Thus, risk could be underestimated for organic compounds that are distributed through deposition. Maximum annual estimates were used for screening to address this source of uncertainty.

- Air dispersion modeling analyses have inherent uncertainties and limitations, and the concentrations/depositions predicted in this analysis may be higher or lower than the actual impacts that occurred at Milan during normal operation. This analysis uses OBODM, which is the only atmospheric dispersion model on EPA's Support Center for Regulatory Air Models designed specifically to characterize concentrations and depositions of explosion by-products. The OBODM and emission factors are believed to be the best information currently available, and arguably the most widely used basis, for estimating air concentrations and depositions from detonations of high explosives.

- The generally recognized uncertainty in human toxicological risk values developed from experimental data is primarily because of the uncertainty of data extrapolated from high-to low dose exposure and animal-to-human exposure. The uncertainty factors assigned to these values account for acute to chronic dose extrapolation, study inadequacies, and sensitive subpopulations, among other factors. Although uncertainty factors for a specific compound may be 1,000 or higher, USEPA applies these safety factors to help ensure a conservative overall assessment for human health concerns as part of their RSL calculations.

- In the presence of such uncertainty, the USEPA and the risk assessor are obligated to make conservative assumptions to ensure the actual health risk is less than what is determined through a risk assessment, such as the use of theoretical annual maximum soil concentrations for soil risk screening.

The potential for high bias is introduced through the exposure setting and pathway selection due to the conservative assumptions (i.e., future residential use) recommended by USEPA when assessing potential future and current exposure. The exposure assumptions made in the industrial site worker and construction worker scenarios are conservative and would tend to overestimate exposure.

Soil Ingestion Rate:

In accordance with USEPA guidance (USEPA, 1991a), the following combined soil and dust ingestion rates were used by USEPA to develop the RSLs used in the HHRA: 200 mg/day for children 1 to 6 years old and 100 mg/day for adults. An evaluation of child ingestion rates in the Exposure Factors Handbook (USEPA, 1997b) indicated that the 50th and 95th percentile of the distribution are 16 mg/day and 110 mg/day, respectively. Therefore, the USEPA default soil ingestion rate of 200 mg/day for residential children is conservative and not supported by existing data.

No reliable data are available to estimate adult soil ingestion rates. The USEPA standard default soil ingestion rate of 100 mg/day for the residential scenario is based primarily on a soil ingestion rate of 65 mg/day, as reported in Hawley (1985). A soil ingestion rate of 50 mg/day for adults in a commercial/industrial setting is recommended as a standard default value (USEPA, 1991a) based on a preliminary adult soil ingestion study by Calabrese et al. (1991). However, Calabrese and Stanek have since determined that the soil ingestion rates reported in their preliminary study were invalid and that their previous ingestion rate of 50 mg/day is an overestimation (Calabrese et al., 1991). The adult soil ingestion rate of 100 mg/day for adults was used, which could overestimate exposure for industrial workers.

In summary, the soil ingestion rates currently recommended by USEPA are conservative, and using the default soil ingestion rates in this risk assessment is expected to avoid underestimating risk.

There are no epidemiological data to support the current USEPA position that absorption of soil-bound organics under realistic exposure conditions constitutes a complete pathway. Information is available concerning dermal absorption of chemicals from contaminated soil under realistic environmental conditions as part of RAGS Part E and other RAGS documents, which is evidence that the pathway could be complete. Oak Ridge National Labs and USEPA RAGS Part E compiled dermal absorption and other related factors, which were used by USEPA to calculate RSLs. Although there is some uncertainty with respect to the dermal contact pathway, its contribution is typically limited relative to the ingestion pathway. Both dermal contact and ingestion were evaluated and combined by USEPA to develop RSLs. Given the uncertainties regarding the dermal models, dermal contact could be over or underestimated.

Uncertainties in the data set influence the chemicals evaluated in the HHRA and the magnitude of risk and hazard estimated for those chemicals. In general, data uncertainties were associated with the type of data used, the sample number, and chemicals detected in site samples. In this risk evaluation, concentrations were modeled. Chemicals can be adequately identified, but their concentrations are estimates only. Variability in analytical data are often +/- 25% based on the functional guidelines for data validation, which imparts variability in exposure estimates and corresponding risks, and modeled data may contain additional variability. Uncertainty and variability in data can over- or under-estimate exposure and risk. Modeling and concentrations used for screening were conservative. Development of the data used was discussed in Section 2.2.

The generally recognized uncertainty in human toxicological risk values developed from experimental data is primarily because of the uncertainty of data extrapolated from (1) high- to

low dose exposure and (2) animal-to-human exposure. The uncertainty factors assigned to these values account for acute to chronic dose extrapolation, study inadequacies, and sensitive subpopulations, among other factors. Although uncertainty factors for a specific compound may be 1,000 or higher, USEPA applies these safety factors to help guarantee a conservative overall assessment for human health concerns. In the presence of such uncertainty, the USEPA and the risk assessor are obligated to make conservative assumptions to ensure the actual health risk is less than what is determined through a risk assessment. Additionally, the use of provisional toxicity values adds uncertainty to the risk estimates. For example, aluminum, cobalt, iron, and copper reference doses are not available in USEPA's Integrated Risk Information System. Consequently, the use of provisional values to estimate risks increases the uncertainty in the estimates.

Overall, risk screening was conservative and was performed in accordance with RAGS. Specific characterization was not warranted because no air or soil COPCs were identified.

4.0 SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT

As part of the MLAAP risk assessment, a screening-level ecological risk assessment (SLERA) was conducted to evaluate the potential hazards to the environment that are attributable to site-related emissions and also to support permitting of hazardous waste burning combustion facilities.

4.1 Guidance

The SLERA was performed in accordance with the 2008 work plan for MLAAP as well as guidelines in *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities* (USEPA, 1999) ("SLERA Protocol") and USEPA's *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (ERAGS) (USEPA, 1997). The SLERA approach for assessing risk at MLAAP facilities, along with any deviations from SLERA Protocol will be discussed in the following sections.

4.2 Screening-Level Problem Formulation

The first step in the SLERA process is problem formulation. ERAGS indicates that this initial step is to decide which components of an ecosystem should be protected and should be the focus of the ecological risk assessment (USEPA, 1997). In accordance with ERAGs, problem formulation at MLAAP includes characterization of the exposure setting for identification of potentially exposed habitats in the assessment area and a screening level effects evaluation.

4.2.1 Exposure Setting Characterization

The Department of the Army purchased land from individual landowners in 1940 to construct an ammunition production and storage facility. MLAAP was constructed during 1940-1941 for use as a Field Service Depot and Ammunition Production Plant. Most of the land prior to construction was used for agricultural purposes, but also included several churches, cemeteries, and a small community. This SLERA considered habitats, water bodies, and associated watersheds potentially impacted by facility emissions of COPCs. Habitats in the assessment area, which support ecological receptors that may be impacted, were characterized.

Potentially impacted receptors were evaluated through consideration of the combination of exposure pathways to which ecological receptors representing a habitat-specific food web may be exposed to a compound.

Habitats evaluated at MLAAP were selected based on existing habitats in the area. Consideration of ecological receptors representative of habitats also provides the basis for selecting

measurement receptors, as well as supports the demonstration of the presence or absence of federal and state species of special interest.

Valuable ecological setting and exposure information was available in previously prepared documents, including the *Integrated Natural Resource Management Plan, Revision II: 2009-2013* prepared for MLAAP by Dr. Michael Kennedy at the University of Memphis (INRMP 2009). Other historical documents were considered and were identified in the approved 2008 work plan. However, the most current ecological setting information was available in the INRMP.

Characterization of the exposure setting focuses on the assessment area surrounding the facilities that is impacted from facility emissions as predicted by air dispersion modeling. A 50 km radius is generally the recognized limit of typical air dispersion models. As previously discussed, receptors, water bodies, and their associated watersheds within and outside the facility property boundary were considered for evaluation. Modeled soil deposition concentrations and estimated concentrations were used to determine which habitats could be affected by site activities.

Land not utilized for industrial activities at MLAAP is comprised of 97% of upland hardwood forest interspersed with agricultural crop and pasture fields. Bottomland hardwood forest and wetlands occupy the remaining 3%. Forestland at MLAAP consists of upland hardwood (86%), planted pine (10%), and a small area of bottomland hardwood (4%). Forested area totals 6,796 acres. There is one historic property and approximately 1,500 acres of potential historic sites that significantly affect land and forest management programs. Approximately 7,828 acres of land are comprised of 51 agricultural leases; 29 leases are for crop production, 18 are for pasture and hay, and 4 are combination units of crops and pasture (INRMP 2009).

Forest inventories were performed on MLAAP during 1965, 1976, 1986, 1998, and 2008. Approximately 2,000 acres of land was forested when purchased in the 1940s. Stands that could not be logged at that time were left to reach older age classes and have provided MLAAP with mature stands. Fields removed from the agricultural leasing program were usually planted to pine or in flood plains with bald cypress, green ash, and yellow poplar with wide spacing to allow natural regeneration of bottomland species between seeding. Agricultural leases require at least one mow per year to prevent woody species from reclaiming fallow fields.

Land use within the boundary of the MLAAP often overlap and include munitions production area, munitions storage areas, ammunition destruction areas, test areas, cantonement area, landfills, domestic wastewater irrigation spray fields, and buffer zones, which are managed as agricultural

and grazing out leases or managed forest areas (INRMP 2009). Most of the boundary neighbors are private citizens in a rural setting. The northwestern boundary of MLAAP is shared by the city of Milan and the University of Tennessee Research and Education Center at Milan. The Tennessee National Guard shares approximately 70% of the eastern boundary and a small portion of the northern, southern and western boundaries. According to the INRMP, Safety and Quantity Distance requirements are the only current land uses that affect neighbors' land use (INRMP 2009).

Groundwater contamination affects neighbors on the western and northwestern boundaries (water use only). Most groundwater utilized on the MLAAP and drinking water is obtained from the sands in Clairborne and Wilcox groups. Depth to groundwater ranges from 10 to 100 feet below land surface, depending on topography and hydraulic location. The direction of groundwater flow is generally from the southeast to the north-northwest related to elevation ranging from approximately 590 feet at the southern facility boundary to approximately 320 feet at the northern boundary (INRMP 2009). The gradient of the groundwater flow is estimated at about 7.5-11.0 feet per mile to the northwest within the northern portion (INRMP 2009). Contamination of those water-bearing sands is the result of past release contaminants from ammunition production.

MLAAP is actively involved in an Installation Restoration Program (IRP) to identify and remediate explosives-contaminated soil and groundwater from past activities at the facility. One groundwater-extraction, treatment, and re-injection system and two groundwater extraction, treatment, and surface discharge systems are currently in operation. There is an effective Spill Prevention, Control and Countermeasures/Installation Spill Contingency (SPCC/ISC) Program to prevent contaminants from entering surface draining and groundwater. Surface waters are protected from contamination at MLAAP by proper response to cleanup of spills and leaks as well as inspections of potential spill sources and hazardous waste.

The National Pollutant Discharge Elimination System Permit, SPCC/ISC Program, and IRPs have direct impact on water quality off the installation. National Pollutant Discharge Elimination System Storm water Outfalls flow in a northerly direction off the installation and eventually enter the Rutherford Fork of the Obion River. The concentration of contaminants discharged through these outfalls directly impacts the quality of water in the Rutherford Fork.

The SPCC/ISC Program also impacts water quality off the installation by preventing contaminants from being transported to rivers and streams by storm water. The primary focus of the IRP is to

stop migration of explosives-contaminated groundwater at the installation boundary and to remediate contaminated groundwater that has already migrated off the facility.

MLAAP has a public water supply (Community System #1, PWSID #0000789) that consists of three water wells, one of which is currently used as a backup. Chlorine is used as a disinfectant, and Aquadene 7101 is used for corrosion control. Sodium hydroxide is used for pH adjustment.

MLAAP is drained by numerous perennial and ephemeral surface water features that flow to the north-northwest. Wolf Creek, the largest interior drainage body, originates as the East Fork of Wolf Creek near Pine Lake at the southeastern boundary. Along with two other tributaries (Dry Creek and West Fork of Wolf Creek), Wolf Creek drains the southern and central portions of the installation. It exits along the northwestern boundary and empties into the Rutherford Fork of the Obion River. The extreme southern portion of the installation drains south to the Middle Fork of the Forked Deer River. The northeastern portion of the installation drains to Halls Branch, Johns Creek, and the Rutherford Fork of the Obion River. The northern portion of MLAAP contains several well-developed, ephemeral, natural drainage bodies that join the Rutherford Fork along the northern boundary of the installation. The two parent streams, the Forked Deer River and Obion River, empty into the Mississippi River about 50 miles west of MLAAP.

A wetland inventory, contracted with the U.S. Fish and Wildlife Service, was completed in 1997-1998. The largest wetland, approximately 277 acres of 342.1 total acres, is located on the extreme northern portion of the installation in the river bottom along the Rutherford Fork of the Obion River. This wetland is one of the natural plant communities in the MLAAP flora survey and is an identified site for one uncommon fauna species, mole salamander. Forestry operations in wetlands have more stringent forest best management practices. The importance of forested wetlands is providing wildlife habitat, filtering silt, recharging groundwater, and reducing flooding downstream. The remaining wetlands occur in narrow bands along creek bottoms throughout the Site.

Wildlife at MLAAP depends on naturally occurring ponds, swamps, intermittent streams, and constructed livestock ponds and watering stations for water at MLAAP. All streams on MLAAP are intermittent wet-weather conveyances that flow only following heavy rainfall events or as a result of the surface discharge of treated groundwater. Treated groundwater from MLAAP's Operable Unit (OU)-4 Groundwater Treatment Plant maintains flow in Wolf Creek at the northwestern boundary as long as the Groundwater Treatment Plant is in operation.

Table 9 lists vascular plant species identified at MLAAP. All areas on MLAAP leased for grazing have constructed livestock watering ponds. Wildlife utilizes these ponds and watering stations for water sources. Seventeen ponds are stocked with fish for the wildlife program. An inventory of reptiles and amphibians and fish are listed in Tables 10 and 11. There are no federal endangered, threatened or candidate species at MLAAP. No state endangered species occur on or near the MLAAP boundary; however, state species with listings other than endangered occur within the MLAAP boundary. Mammalian species identified during surveys at MLAAP are identified in Table 12 and birds are identified in Table 13. Species deemed in need of management include: Southeastern shrew (*Sorex longirostris*), Southeastern myotis (*Myotis austroriparius*), Meadow jumping mouse (*Zapus hudsonius*), Eastern woodrat (*Neotoma floridana*), Sharp-shinned Hawk (*Accipiter striatus*), Great Egret (*Ardea alba*), Northern Harrier (*Circus cyaneus*), Loggerhead Shrike (*Lanius ludovicianus*), Barn Owl (*Tyto alba*), Yellow-bellied Sapsucker (*Sphyrapicus varius*), and Barking treefrog (*Hyla gratiosa*). Cattle are the only livestock found on MLAAP year-round. There are horses that graze temporarily on some grazing leases.

Potential ecological receptors, food webs, and habitats specific to potentially impacted receptors were evaluated in the Screening Level Effects Evaluation. Receptors and representative ecological screening values for each potentially impacted habitat were identified to ensure plant and animal communities representative of the habitat were represented by the habitat-specific food web, and potentially complete exposure pathways were identified.

4.2.2 Screening Level Effects Evaluation

In accordance with ERAGS (USEPA, 1997), information obtained during exposure setting characterization was used to develop screening comparisons that would be protective of communities and guilds of receptors potentially exposed to emissions from facility sources.

Food webs and exposure pathways were assumed generally complete for screening purposes to represent communities and receptor guilds. Compiling additional information regarding food webs and habitats was not warranted based on screening comparisons. Preferred toxicity data and other factors were considered when choosing and establishing a hierarchy of sources for specific ecological screening values.

Table 9
Vascular Plant Species Identified from Select Natural Areas and Other Areas on MLAAP

Scientific Name	Common Name
Plants identified in 1993:	
Trees	
Acer negundo	Box elder
Acer rubrum	Red maple
Acer saccharinum	Silver maple
Aesculus pavia	Red buckeye
Alnus serrulata	Alder
Amelanchier arborea	Downy serviceberry
Betula nigra	River birch
Carpinus caroliniana	American hornbeam
Carya cordiformis	Bitternut hickory
Carya glabra	Pignut hickory
Carya ovata	Shagbark hickory
Carya tomentosa	Mockernut hickory
Celtis laevigata	Sugarberry
Cornus florida	Flowering dogwood
Fagus grandifolia	American beech
Fraxinus americana	White ash
Gleditsia triacanthos	Honeylocust
Ilex opaca	American holly
Juglans nigra	Black walnut
Juniperus virginiana	Red cedar
Liriodendron tulipfera	Tulip poplar
Morus rubra	Red mulberry
Nyssa aquatica	Water tupelo
Nyssa sylvatica	Black gum
Pinus echinata	Shortleaf pine
Pinus taeda	Loblolly pine
Pinus virginiana	Virginia pine
Platanus occidentalis	Sycamore
Prunus angustifolia	Chickasaw plum
Prunus serotina	Black cherry
Quercus alba	White oak
Quercus coccinea	Scarlet oak
Quercus falcata	Southern red oak
Quercus marilandica	Blackjack oak
Quercus nigra	Water oak
Quercus pagoda	Cherrybark oak
Quercus rubra	Northern red oak
Quercus stellata	Post oak
Quercus velutina	Black oak
Robinia pseudoacacia	Black locust
Salix nigra	Black willow
Sassafras albidum	Sassafras
Taxodium distichum	Bald cypress
Ulmus alata	Winged elm
Ulmus americana	American elm
Ulmus rubra	Slippery elm

Table 9
Vascular Plant Species Identified from Select Natural Areas and Other Areas on MLAAP

Scientific Name	Common Name
Shrubs and Vines	
Aralia spinosa	Hercule's club
Asimina triloba	Pawpaw
Cephalanthus occidentalis	Buttonbush
Hydrangea arborescens	Hydrangea
Hypericum hypericoides	St. John's Wort
Lonicera japonica	Japanese honeysuckle
Parthenocissus quinquefolia	Virginia creeper
Rhus copallinum	Winged sumac
Rhus glabra	Smooth sumac
Rosa carolina	Wild rose
Rubus sp.	Blackberry
Sambucus canadensis	Elderberry
Smilax glauca	Greenbrier
Toxicodendron radicans	Poison ivy
Vaccinium corymbosum	Highbush blueberry
Vinca minor	Periwinkle
Vitis aestivalis var. aestivalis	Summer grapevine
Vitis rotundifolia	Muscadine
Yucca sp.	Yucca
Herbaceous Plants	
Achillea millefolium	Yarrow
Agrimonia sp.	Agrimony
Allium canadense	Wild onion
Ambrosia artemisiifolia	Ragweed
Ambrosia trifida	Ragweed
Andropogon virginicus	Broomsedge
Anemonella thalictroides	Rue anemone
Arisaema dracontium	Green dragon
Arisaema triphyllum	Jack-in-the-pulpit
Aristolochia serpentaria	Birthwort
Asclepias tuberosa	Butterfly weed
Asplenium platyneuron	Ebony spleenwort
Baptisia alba	Baptisia
Boehmeria cylindrica	False nettle
Botrychium dissectum v. obliquum	Dissected grapefern
Carex grayi	Carex
Carex intumescens	Carex
Carex vulpinoidea	Carex
Cassia fasciculate	Partridge pea
Cerastium glomeratum	Mouse-ear chickweed
Chasmanthium latifolium	Chasmanthium
Chimaphila maculata	Spotted wintergreen
Chrysanthemum leucanthelium	Ox-eye daisy
Cicuta maculata	Water hemlock
Cinna arundinacea	Wood reed
Claytonia virginica	Spring beauty

Table 9
Vascular Plant Species Identified from Select Natural Areas and Other Areas on MLAAP

Scientific Name	Common Name
Cynodon dactylon	Bermuda grass
Cyperus pseudovegetus	Cyperus
Dactylis glomerata	Orchard grass
Daucus carota	Queen Anne's lace
Dentaria laciniata	Toothwort
Dianthus armeria	Pink
Dioscorea villosa	Wild yam
Duchesnea indica	Indian strawberry
Elephantopus sp.	Elephant's foot
Elymus villosus	Wild ryegrass
Erianthus alopecuroides	Plume grass
Erigon strigosus	Fleabane
Eupatorium coelestinum	Mistflower
Eupatorium fistulosum	Joe-pye weed
Galium aparine	Bedstraw
Geranium carolinianum	Geranium
Geum canadense	Avens
Gratiola neglecta	Hedge hyssop
Hedyotis crassifolia	Bluet
Impatiens capensis	Jewelweed
Iris virginica	Blue flag
Juncus sp.	Rush
Krigia virginica	Dwarf dandelion
Lathyrus hirsutus	Lathyrus
Leersia sp.	Cutgrass
Lobelia cardinalis	Cardinal flower
Lobelia inflate	Indian tobacco
Lolium multiflorum	Rye grass
Ludwigia peploides	Ludwigia
Matalea carolinensis	Matalea
Microstegium vimineum	Microstegium
Onoclea sensibilis	Sensitive fern
Oxalis stricta	Yellow wood sorrel
Oxalis violacea	Violet wood sorrel
Panicum boscii	Panic grass
Panicum sp.	Panic grass
Perilla frutescens	Perilla
Phryma leptostachya	Lop-seed
Phlox sp.	Phlox
Phytolacca americana	Pokeweed
Plantago aristata	Plantain
Plantago lanceolata	Plantain
Plantago rugelii	Plantain
Podophyllum peltatum	Mayapple
Polygonatum biflorum	Solomon's seal
Polygonum lapathifolium	Knotweed
Polygonum pennsylvanicum	Knotweed
Polystichum acrostichoides	Christmas fern

Table 9
Vascular Plant Species Identified from Select Natural Areas and Other Areas on MLAAP

Scientific Name	Common Name
Potentilla canadensis	Dwarf cinquefoil
Potentilla simplex	Five fingers
Ranunculus abortivus	Kidney leaf buttercup
Rumex crispus	Curled dock
Sagittaria sp.	Arrowhead
Salvia lyrata	Lyre leaved sage
Sanicula canadensis	Snakeroot
Scuttelaria lateriflora	Skullcap
Senecio glabellus	Butterweed
Setaria sp.	Bristle grass
Silene virginica	Fire pink
Silphium laciniatum	Compass plant
Silphium trifoliatum	Silphium
Sisyrinchium albidum	Blue eyed grass
Smilacina racemosa	False Solomon's seal
Spirodela polyrhiza	Duckweed
Stellaria media	Chickweed
Tipularia discolor	Crane fly orchid
Tovara virginiana	Jumpseed
Trichostema dichotomum	Blue curls
Trifolium pratense	Red clover
Trillium recurvatum	Prairie trillium
Triodanis perfoliata	Venus' looking glass
Uniola latifolia	Broad leaf uniola
Valerianella radiate	Corn salad
Verbascum blattaria	Mullein
Verbena simplex	Verbena
Viola canadensis	Canada violet
Viola palmata v. triloba	Violet
Viola papilionacea var. priceana	Confederate violet
Viola rafinesquii	Violet
Woodsia obtuse	Blunt-lobed woodsia
Zizia sp.	Meadow parsnip
Additional plants identified in 2006:	
Acalypha rhomboidea	Virginia threeseed mercury, copperleaf
Acalypha virginica	Virginia threeseed mercury, copperleaf
Acer drummondii	Drummond red maple
Agrimonia pubescens	Soft agrimony
Agrimonia rostellata	Beaked agrimony
Agrostis scabra	Rough bent grass
Alisma subcordatum	American water plantain
Allium sp.	Garlic
Allium vineale	Wild garlic
Alopecurus carolinianus	Carolina foxtail
Amphicarpaea bracteata	American hog peanut
Apios americana	Groundnut
Aplectrum hyemale	Adam and Eve

Table 9
Vascular Plant Species Identified from Select Natural Areas and Other Areas on MLAAP

Scientific Name	Common Name
Arundinaria gigantea spp. gigantea	Giant cane
Asclepias viridiflora	Green comet milkweed
Athyrium filix-femina spp. aspleniones	Asplenium lady fern
Azolla caroliniana	Carolina mosquito fern
Bidens frondosa	Devil's beggar tick
Botrychium virginianum	Rattlesnake fern
Brunnichia ovata	American buckwheat vine, ladies' eardrops
Calystegia sp.	Bindweed
Campsis radicans	Trumpet creeper, trumpet vine
Cardamine hirsuta	Hairy bitter cress
Carex albolutescens	Greenwhite sedge
Carex amphibola	Eastern narrowleaf sedge
Carex aureolensis	
Carex basiantha	Willdenow's sedge
Carex blanda	Eastern woodland sedge
Carex cephalophora	Oval-leaf sedge
Carex communis	Fibrousroot sedge
Carex crebriflora	Coastalplain sedge
Carex debilis	White edge sedge
Carex flaccosperma	Thinfruit sedge
Carex gigantea	Giant sedge
Carex hirsutella	Fuzzy wuzzy sedge
Carex kraliana	
Carex laxiflora	Broad looseflower sedge
Carex lupulina	Hop sedge
Carex mesochorea	Midland sedge
Carex oxylepis var. oxylepis	Sharpscale sedge
Carex planispicata	
Carex rosea	Rosy sedge
Carex socialis	Low woodland sedge
Carex sp. section ovales	
Carex squarrosa	Squarrose sedge
Carex swanii	Swan's sedge
Carex texensis	Texas sedge
Carex tribuloides	Blunt broom sedge
Carya laciniosa	Big shellbark hickory, kingnut
Carya ovata var. australis	Carolina hickory
Carya ovata var. ovata	Shagbark hickory
Celastrus scandens	American bittersweet
Cercis canadensis	Eastern redbud
Chaerophyllum tainturieri	Hairyfruit chervil
Chasmanthium latifolium	Indian woodoats
Cirsium discolor	Field thistle
Commelina communis	Asiatic dayflower
Conium maculatum	Poison hemlock
Conoclinium coelestinum	Mistflower
Coreopsis tinctoria	Golden tickseed
Coreopsis tripteris	Tall tickseed

Table 9
Vascular Plant Species Identified from Select Natural Areas and Other Areas on MLAAP

Scientific Name	Common Name
Cornus amomum	Silky dogwood
Cornus formina	Stiff dogwood
Corydalis flavula	Yellow fumewort
Corylus americana	American hazelnut
Crataegus viridis	Green hawthorn
Crotalaria sagittalis	Arrowhead rattlebox
Croton capitatus	Hogwort
Croton monanthogynus	Prairie tea
Cryptotaenia canadensis	Canadian honewort
Cynoglossum virginianum	Wild comfrey
Cyperus echinatus	Globe flat sedge
Cyperus iria	Ricefield flat sedge
Cyperus refractus	Reflexed flat sedge
Cystopteris protrusa	Lowland bladder fern
Danthonia spicata	Poverty oat grass
Desmodium rotundifolium	Prostate tick trefoil
Desmodium viridiflorum	Velvetleaf tick trefoil
Desmodium spp.	Trefoil
Dichanthelium aciculare	Needleleaf rosette grass
Dichanthelium acuminatum var. lindheimeri	Llindheimer panic grass
Dichanthelium boscii	Bosc's panic grass
Dichanthelium commutatum	Variable panic grass
Dichanthelium dichotomum var. dichotomum	Cypress panic grass
Dichanthelium scoparium	Velvet panicum
Dichanthelium sphaerocarpon var. isophyllum	Roundseed panic grass
Dichanthelium villosissimum	Whitehair rosette grass
Digitaria ischaemum	Smooth crab grass
Diodia teres	Poorjoe
Dioscorea oppositifolia	Chinese yam
Diospyros virginiana	Persimmon
Draba verna	Spring draba
Dulichium arundinaceum	Threeway sedge
Echinochloa colona	Jungle rice
Echinochloa muricata var. muricata	Rough barnyard grass
Eleagnus sp.	Olive
Eleocharis obtuse	Blunt spike rush
Elephantopus tomentosus	Devil's grandmother
Elymus hystrix	Eastern bottlebrush grass
Eragrostis cilianensis	Stink grass
Erechtites hieraciifolia	American burnweed
Erigeron philadelphicus	Philadelphia fleabane
Euonymus americanus	Strawberry bush, heart's a bustin
Euonymus fortunei	Winter creeper
Eupatorium altissimum	Tall thoroughwort
Eupatorium capillifolium	Dog fennel
Eupatorium perfoliatum	Common boneset
Eupatorium rotundifolium ssp. ovatum	Roundleaf thoroughwort
Fleischmannia incarnata	Pink thoroughwort

Table 9
Vascular Plant Species Identified from Select Natural Areas and Other Areas on MLAAP

Scientific Name	Common Name
Fragaria virginiana	Virginia strawberry
Fraxinus pennsylvanica	Green ash
Galium circaezans	Licorice bedstraw
Gamochaeta argyrinea	Silvery cudweed
Gnaphalium sp.	
Gratiola virginiana	Roundfruit hedge hyssop
Helenium amarum	Yellowdicks
Helenium autumnale	Common sneezeweed
Helenium flexuosum	Purplehead sneezeweed
Helianthus mollis	Ashy sunflower
Helianthus sp.	
Hemerocallis fulva	Orange daylily
Hibiscus moscheutos spp. moscheutos	Crimsoneyed rose mallow, hibiscus
Houstonia pusilla	Tiny bluet
Hydrangea cinerea	Ashy hydrangea
Hydrolea uniflora	Oneflower false fiddleleaf
Hymenocallis caroliniana	Carolina spiderlily
Hypericum mutilum	Dwarf St. Johnswort
Hypericum prolificum	Shrubby St. Johnswort
Hypericum punctatum	Spotted St. Johnswort
Hypericum stragulum	St. Andrew's cross
Ilex decidua var. decidua	Possum haw
Juncus marginatus	Grassleaf rush
Juncus tenuis	Path rush
Krigia caespitosa	Weedy dwarf dandelion
Lactuca sp.	
Lamium amplexicaule	Henbit
Lamium purpureum	Dead nettle
Lechea mucronata	Hairy pinweed
Leersia oryzoides	Rice cut grass
Leersia virginica	White grass
Lepidium virginicum	Virginia pepperweed
Leptochloa panacea spp. brachiata	Mucronate sprangeltop
Lespedeza cuneata	Chinese lespedeza
Leucanthemum vulgare	Oxeye daisy
Ligustrum sinense	Chinese privet
Linaria canadensis	Canada toadflax
Lindera benzoin	Spicebush
Liquidambar stryaciflua	Sweet gum
Lobelia puberula	Downy lobelia
Ludwigia decurrens	Wingleaf primrose willow
Ludwigia palustris	Marsh seedbox
Lycopus americanus	American water horehound
Lysimachia nummularia	Creeping jenny
Lysimachia radicans	Trailing yellow loosestrife
Maclura pomifera	Osage orange, hedge apple, horse apple, bodock
Macrothelypteris torresiana	Sword fern
Magnolia grandiflora	Evergreen magnolia, southern magnolia

Table 9
Vascular Plant Species Identified from Select Natural Areas and Other Areas on MLAAP

Scientific Name	Common Name
Malus pumila	Common apple
Matelea obliqua	Climbing milkvine
Mecardonia acuminata	Axilflower
Medicago lupulina	Black medic
Melica mutica	Twoflower melic grass
Morus alba	White mulberry
Muhlenbergia schreberi	Nimblewill
Myosotis macrosperma	Largeseed forget-me-not
Myosotis verna	Spring forget-me-not
Nemophila aphylla	Smallflower baby blue eyes
Nyssa sylvatica var. biflora	Swamp tupelo, swamp gum
Nyssa sylvatica var. sylvatica	Black gum, black tupelo
Opuntia humifusa	Prickly pear, cactus
Ornithogalum umbellatum	Star of Bethlehem
Osmunda regalis var. spectabilis	Royal fern
Ostrya virginiana	Hophornbeam, ironweed
Panicum anceps	Beaked panic grass
Paspalum setaceum	Thin paspalum
Passiflora incarnata	Purple passion flower, maypops
Passiflora lutea	Yellow passion flower, maypops
Peltandra virginica	Green arrow arum
Penthorum sedoides	Ditch stonecrop
Phegopteris hexagonoptera	Broad beech fern
Philadelphus sp. [inodorus?]	Mock orange
Phytolacca americana	American pokeweed
Pilea pumila	Canadian clearweed
Plantago sp.	
Poa sylvestris	Woodland blue grass
Polygala sanguinea	Purple milkwort
Polygonum caespitosum var. longisetum	Oriental ladysthumb
Polygonum hydropiperoides	Swamp smartweed
Polygonum persicaria	Spotted ladysthumb
Polygonum sagittatum	Arrowleaf tearthumb
Polygonum scandens	Climbing false buckwheat
Polygonum virginianum	Jumpseed
Populus deltoides	Eastern cottowood
Ptilimnium capillaceum	Herb william
Pueraria montana var. lobata	Kudzu
Pycnanthemum spp.	Mountain mint
Pycnanthemum tenuifolium	Narrowleaf mountain mint
Pycnanthemum verticillatum var. pilosum	Whorled mountain mint
Pyrrhopappus carolinianus	False dandelion, Carolina false dandelion
Pyrus calleryana	Bradford pear
Quercus imbricaria	Shingle oak
Quercus lyrata	Overcup oak
Quercus macrocarpa	Bur oak, mossycup oak
Quercus michauxii	Swamp chestnut oak, basket oak, cow oak
Quercus phellos	Willow oak

Table 9
Vascular Plant Species Identified from Select Natural Areas and Other Areas on MLAAP

Scientific Name	Common Name
Quercus x guadalupensis (macrocarpa x stellata)	Hybrid oak
Quercus x vaga (palustris x velutina)	Hybrid oak
Ranunculus bulbosus	St. Anthony's turnip
Ranunculus micranthus	Rock buttercup
Ranunculus recurvatus	Blisterwort
Rhamnus caroliniana	Carolina buckthorn
Rhexia virginica	Meadow beauty
Rhynchospora sp. [chalarocephala?]	
Rosa multiflora	Multiflora rose
Rosa palustris	Swamp rose
Rubus flagellaris	Northern dewberry
Rudbeckia hirta	Black-eyed susan
Rudbeckia laciniata var. laciniata	Cutleaf coneflower
Ruellia caroliniensis	Carolina wild petunia
Rumex acetosella	Common sheep sorrel
Rumex verticillatus	Swamp dock
Sabatia angularis	Rose pink
Saccharum alopecuroidum	Silver plume grass
Sagittaria latifolia	Broadleaf arrowhead
Saururus cernuus	Lizard's tail
Scirpus cyperinus	Wool grass
Scirpus georgianus	Georgia bulrush
Scleria pauciflora	Fewflower nut rush
Scrophularia marilandica	Carpenter's square, figwort
Scutellaria incana var. incana	Hoary skullcap
Sedum ternatum	Woodland stonecrop
Senna marilandica	Maryland senna
Silene stellata	Widowsfrill
Silphium asteriscus var. latifolium	Whorled rosinweed
Smallanthus uvedalius	Hairy heafcup
Smilax bona-nox	Saw greenbrier
Smilax herbacea var. herbacea	Smooth carrion flower
Smilax rotundifolia	Roundleaf greenbrier
Solanum carolinense	Carolina horsenettle
Solidago juncea	Early goldenrod
Spiranthes tuberosa	Little ladies'-tresses
Spirodela polyrhiza	Duckmeat
Stellaria media ssp. media	Common chickweed
Stylosanthes biflora	Sidebeak pencil flower
Symphoricarpos orbiculatus	Coralberry, snowberry
Teucrium canadense	Canada germander
Thalictrum dioicum	Early meadow-rue
Thalictrum revolutum	Waxyleaf meadow-rue
Thelypteris noveboracensis	New York fern, maiden fern
Trachelospermum difforme	Climbing dogbane
Tradescantia sp.	Spiderwort
Triadenum walteri	Greater marsh St. Johnswort
Triodanis perfoliata var. perfoliata	Clasping Venus' looking glass

Table 9
Vascular Plant Species Identified from Select Natural Areas and Other Areas on MLAAP

Scientific Name	Common Name
Typha latifolia	Broadleaf cattail
Utrica dioica	Stinging nettle
Vaccinium arboreum	Farkleberry
Vaccinium stamineum	Deerberry
Valerianella umbilicata	Navel corn salad
Verbascum thapsus	Common mullein
Verbena urticifolia	White vervain
Verbesina virginica	White crownbeard
Veronica hederifolia	Ivyleaf speedwell
Viburnum rufidulum	Rusty black haw
Vicia sativa ssp. nigra	Garden vetch
Viola arvensis	European field pansy
Viola bicolor	Field pansy
Viola cucullata	Marsh blue violet
Vitis cinerea var. cinerea	Downy grape, sweet winter grape
Xanthium strumarium	Rough cockleburr
Yucca filamentosa	Adam's needle, beargrass, yucca
Zizia aurea	Golden zizia

Table 10
Amphibians and Reptiles Collected at MLAAP (2004-2009)

Scientific Name	Common Name
Amphibians	
Frogs	
Acris crepitans	Northern cricket frog
Anaxyrus americanus	American toad
Anaxyrus fowleri	Fowler's toad
Gastrophryne carolinensis	Eastern narrow-mouthed toad
Hyla chrysocelis/versicolor	Gray treefrog complex
Hyla cinerea	Green treefrog
Hyla gratiosa	Barking treefrog
Lithobates catesbeiana	American bullfrog
Lithobates clamitans	Green frog
Lithobates spenocephata	Southern leopard frog
Pseudacris crucifer	Spring peeper
Pseudacris feriarum	Upland chorus frog
Scaphiopus holbrookii	Eastern spadefoot
Salamanders	
Ambystoma maculatum	Spotted salamander
Ambystoma opacum	Marbled salamander
Ambystoma talpoideum	Mole salamander
Ambystoma texanum	Small-mouthed salamander
Ambystoma tigrinum	Eastern tiger salamander
Eurycea longicauda	Long-tailed salamander
Plethodon mississippi	Mississippi slimy salamander
Notophthalmus viridescens	Eastern newt
Siren intermedia	Lesser siren

Table 10
Amphibians and Reptiles Collected at MLAAP (2004-2009)

Scientific Name	Common Name
Reptiles	
Lizards	
Cnemidophorus sexlineatus	Six-lined racerunner
Plestiodon fasciatus	Common five-lined skink
Plestiodon laticeps	Broad-headed skink
Sceloporus undulatus	Eastern fence lizard
Scincella lateralis	Little brownskink
Snakes	
Agkistrodon contortrix	Copperhead
Agkistrodon piscivorus	Cottonmouth
Carphophis amoenus	Eastern worm snake
Coluber constrictor	North American racer
Diadophis punctatus	Ring-necked snake
Lampropeltis calligaster	Yellow-bellied king snake
Nerodia erythrogaster	Plain-bellied water snake
Nerodia sipedon	Northern water snake
Pantherophis spiloides	Gray rat snake
Storeria dekayi	DeKay's brown snake
Thamnophis sirtalis	Common garter snake
Virginiabaleriae elegans	Western smooth earth snake
Turtles	
Chelydra serpentina	Snapping turtle
Chrysemys picta	Painted turtle
Kinosternon subrubrum	Eastern mud turtle
Sternotherus odoratus	Eastern musk turtle
Terrapene carolina	Eastern box turtle
Trachemys scripta	Pond slider

Note:
* Scientific names and common names follow Crother (2008)

Table 11
Fish Collected at MLAAP

Scientific Name	Common Name
Amia calva	Bowfin
Ameiurus natalis	Yellow bullhead
Aphredoderus sayanus	Pirate Perch
Centrarchus macropterus	Flier
Cyprinella venusta	Blacktail shiner
Cyprinella camura	Bluntface shiner
Erimyzon oblongus	Creek chubsucker
Erimyzon sucetta	Lake chubsucker
Esox americanus	Grass pickerel
Etheostoma lynceum	Brighteye darter
Etheostoma nigrum	Johnny darter
Etheostoma parripinne	Goldenstripe darter
Fundulus olivaceus	Blackspotted topminnow
Gambusia affinis	Mosquito fish
Ictalurus punctatus	Channel catfish
Lampetra aepytera	Least brook lamprey
Lepomis cyanellus	Green sunfish
Lepomis gulosus	Warmouth
Lepomis macrochirus	Bluegill
Lepomis microlophus	Redear sunfish
Lepisosteus osseus	Longnose gar
Lythrurus fumeus	Ribbon shiner
Micropterus punctulatus	Spotted bass
Micropterus salmoides	Largemouth bass
Notemigonus crysoleucas	Golden shiner
Notropis atherinoides	Emerald shiner
Noturus phaeus	Brown madtom
Percina sciera	Dusky darter
Pimephales notatus	Bluntnose minnow
Semotilus atromaculatus	Creek chub
Umbra limi	Central mudminnow

Table 12
Mammalian Species* Identified During Surveys on MLAAP*

Scientific Name	Common Name
1999-2008	
Blarina carolinensis	Southern short-tailed shrew
Canis latrans	Coyote
Castor canadensis	American beaver
Cryptotis parva	North American least shrew
Dasypus novemcinctus	Nine-banded armadillo
Didelphis virginiana	Virginia opossum
Eptesicus fuscus	Big brown bat
Glaucomys volans	Southern flying squirrel
Lasiurus borealis	Eastern red bat
Lasiurus cinereus	Hoary bat
Lasiurus seminolus	Seminole bat
Lontra canadensis	North American river otter
Lynx rufus	Bobcat
Marmota monax	Woodchuck
Mephitis mephitis	Striped skunk
Microtus pinetorum	Woodland vole
Microtus ochrogaster	Prairie vole
Mus musculus	House mouse
Myotis austroriparius	Southeastern myotis
*Myotis grisescens***	Gray myotis
Neotoma floridana	Eastern woodrat
Neovison vison	American mink
Nycticeius humeralis	Evening bat
Ochrotomys nuttalli	Golden mouse
Odocoileus virginianus	White-tailed deer
Ondatra zibethicus	Common muskrat
Oryzomys palustris	Marsh oryzomys
Perimyotis subflavus	Eastern pipistrelle
Peromyscus maniculatus	North American deer mouse
Peromyscus gossypinus	Cotton deer mouse
Peromyscus leucopus	White-footed deer mouse
Procyon lotor	Raccoon
Rattus norvegicus	Brown rat
Reithrodontomys humulis	Eastern harvest mouse
Scalopus aquaticus	Eastern mole
Sciurus carolinensis	Eastern gray squirrel
Sciurus niger	Eastern fox squirrel
Sigmodon hispidus	Hispid cotton rat
Sorex longirostris	Southeastern shrew
Sylvilagus aquaticus	Swamp rabbit
Sylvilagus floridanus	Eastern cottontail
Tamias striatus	Eastern chipmunk
Urocyon cinereoargenteus	Gray fox
Vulpes vulpes	Red fox
Zapus hudsonius	Meadow jumping mouse

Notes:

* Scientific names and common names follow Wilson and Reeder (2005).

** Because of extensive effort and no additional capture, this species is not considered to utilize MLAAP. The single specimen (captured, identified, and released) is taken to represent an extremely rare incidental occurrence of this species in this area of Tennessee (see Exhibit 21).

Table 13
Bird Species Identified on MLAAP*

Scientific Name	Common Name
1999-2008	
Accipiter cooperii	Cooper's Hawk
Agelaius phoeniceus	Red-winged Blackbird
Aix sponsa	Wood Duck
Ammodramus savannarum	Grasshopper Sparrow
Anas platyrhynchos	Mallard
Archilochus colubris	Ruby-throated Hummingbird
Ardea alba	Great Egret
Ardea herodias	Great Blue Heron
Baeolophus bicolor	Tufted Titmouse
Bombycilla cedrorum	Cedar Waxwing
Bubulcus ibis	Cattle Egret
Buteo jamaicensis	Red-tailed Hawk
Buteo lineatus	Red-shouldered Hawk
Buteo platypterus	Broad-winged Hawk
Butoridesvirescens	Green Heron
Caprimulgus carolinensis	Chuck-will's-widow
Caprimulgus vociferus	Whip-poor-will
Carduelis tristis	American Goldfinch
Cardinalis cardinalis	Northern Cardinal
Cathartes aura	Turkey Vulture
Catharus fuscescens	Veery
Catharus guttatus	Hermit Thrush
Chaetura pelagica	Chimney Swift
Charadrius vociferous	Killdeer
Chordeiles minor	Common Nighthawk
Coccyzus americanus	Yellow-billed Cuckoo
Coccyzus erythropthalmus	Black-billed Cuckoo
Colaptes auratus	Northern Flicker
Colinus virginianus	Northern Bobwhite
Columba livia	Rock Pigeon
Contopus virens	Eastern Wood-pewee
Coragyps atratus	Black Vulture
Corvus brachyrhynchos	American Crow
Corvus ossifragus	Fish Crow
Cyanocitta cristata	Blue Jay
Dendroica discolor	Prairie Warbler
Dendroica petechia	Yellow Warbler
Dendroica pinus	Pine Warbler
Dryocopus pileatus	Pileated Woodpecker
Dumetella carolinensis	Gray Catbird
Empidonax virescens	Acadian Flycatcher
Eremophila alpestris	Horned Lark
Falco sparverius	American Kestrel
Geothlypis trichas	Common Yellowthroat
Helmitheros vermivorum	Worm-eating Warbler
Hirundo rustica	Barn Swallow
Hylocichla mustelina	Wood Thrush
Icterus galbula	Baltimore Oriole
Icterus spurius	Orchard Oriole
Icteria virens	Yellow-breasted Chat
Lanius ludovicianus	Loggerhead Shrike
Megaceryle alcoyon	Belted Kingfisher

Table 13
Bird Species Identified on MLAAP*

Scientific Name	Common Name
Megascops asio	Eastern Screech-owl
Meleagris gallopavo	Wild Turkey
Melanerpes carolinus	Red-bellied Woodpecker
Melanerpes erythrocephalus	Red-headed Woodpecker
Mimus polyglottos	Northern Mockingbird
Mniotilta varia	Black and White Warbler
Molothrus ater	Brown-headed Cowbird
Myiarchus crinitus	Great Crested Flycatcher
Opororonis formosus	Kentucky Warbler
Parula americana	Northern Parula
Passer domesticus	House Sparrow
Passerculus sandwichensis	Savannah Sparrow
Passerina caerulea	Blue Grosbeak
Passerina cyanea	Indigo Bunting
Petrochelidon pyrrhonota	Cliff Swallow
Picoides pubescens	Downy Woodpecker
Picoides villosus	Hairy Woodpecker
Pipilo erythrophthalmus	Eastern Towhee
Piranga olivacea	Scarlet Tanager
Piranga rubra	Summer Tanager
Poecile carolinensis	Carolina Chickadee
Polioptila caerulea	Blue-gray Gnatcatcher
Progne subis	Purple Martin
Protonotaria citrea	Prothonotary Warbler
Quiscalus quiscula	Common Grackle
Riparia riparia	Bank Swallow
Sayornis phoebe	Eastern Phoebe
Scolopax minor	American Woodcock
Seiurus aurocapillus	Ovenbird
Setophaga ruticilla	American Redstart
Sialia sialis	Eastern Bluebird
Sitta carolinensis	White-breasted Nuthatch
Spiza americana	Dickcissel
Spizella arborea	American Tree Sparrow
Spizella passerina	Chipping Sparrow
Spizella pusilla	Field Sparrow
Stelgidteryx serripennis	Rough-winged Swallow
Strix varia	Barred Owl
Sturnus vulgaris	European Starling
Sturnella magna	Eastern Meadowlark
Tachycineta bicolor	Tree Swallow
Thryothrorus ludovicianus	Carolina Wren
Toxostoma rufum	Brown Thrasher
Turdus migratorius	American Robin
Tryrannus tyrannus	Eastern Kingbird
Tyto alba	Barn Owl
Vireo flavifrons	Yellow-throated Vireo
Vireo griseus	White-eyed Vireo
Vireo olicaceus	Red-eyed Vireo
Zenaida macroura	Mourning Dove

Table 13
Bird Species Identified on MLAAP*

Scientific Name	Common Name
Not observed during 1999-2008 but reported in 1994-1995	
Accipiter striatus	Sharp-shinned Hawk
Circus cyaneus	Northern Harrier
Dendroica coronata	Yellow-rumped Warbler
Dendroica magnolia	Magnolia Warbler
Euphagus cyanocephalus	Brewer's Blackbird
Junco hyemalis	Dark-eyed Junco
Melospiza georgiana	Swamp Sparrow
Melospiza melodia	Song Sparrow
Regulugs satrapa	Golden-crowned Kinglet
Sphyrapicus varius	Yellow-bellied Sapsucker
Zonotricha albicollis	White-throated Sparrow

Note:
* Scientific names and common names follow the Checklist of North American Birds, 7th edition, as published by the North American Ornithologists' Union.

Toxicity data refers to information about how and at what levels chemicals affect a plant or animal in a harmful way; this information can be used to compare to contaminant concentrations found at a site to determine if there is the possibility for risk to the environment.

Modeled data were screened to identify chemicals of potential ecological concern (COPECs) in this SLERA by comparing modeled concentrations to corresponding ecological screening values (ESVs).

1. USEPA Ecological Soil Screening Levels, OSWER Directive #9285.7-55, including approximate background values, obtained from Attachment 1-4, Figure 3.1

2. Oak Ridge National Laboratories Ecological Preliminary Remediation Goals

3. USEPA Region 4 ESVs

4. National Oceanic and Atmospheric Administration ESVs

5. USEPA Region 5 ESVs

4.2.3 Generic Problem Statement

The following generic problem statement has been developed for MLAAP: "Adverse effects could occur to ecological receptors, where receptors are plant and animal populations and communities, habitats, and sensitive environments." Initial assessment endpoints relevant to supporting these decisions include the following, which are generally addressed by the hierarchy of ESV sources:

- Diversity and productivity of terrestrial plant communities

- Productivity of soil microbial and invertebrate communities

- Survival, growth, and reproduction of terrestrial wildlife and aquatic species relative to community or population level effects

4.3 Screening Level Risk Calculations

In accordance with ERAGS, Step 2 of the SLERA process is the Screening Level Exposure Estimate and Risk Calculations (USEPA, 1997). These calculations are developed herein by comparing maximum contaminant concentrations to screening numbers, which result in ecological screening hazard quotients (ESQs). ESQs were calculated by dividing estimated soil concentrations by corresponding ESVs. Estimated soil concentrations based on annual maximum dispersion estimates described in Section 2.2 were used to develop the risk calculations. Soil concentrations were estimated using deposition model results as documented in Section 2.2 of his report. Estimated soil concentrations, ESVs, calculations, and ESQs are presented in Table 14.

4.4 Risk Discussion

The risk discussion integrates the exposure assessment and screening level risk calculations to determine the potential risk to a community or guild from exposure to a COPEC and to describe the risks identified. The process concludes with a Scientific-Management Decision Point as part of the risk discussion, where one of three determinations is made:

1. Ecological threats are almost, or entirely, absent and therefore no further work is needed;

2. The ecological risk assessment should continue to determine whether risk exists; or

3. There is the possibility of adverse ecological effects, and a more detailed ecological risk assessment, with more information about the site, is needed.

As previously discussed, ESQs were calculated by dividing estimated soil concentrations by corresponding ESVs, in accordance with ERAGS (USEPA, 1997). ERAGS indicates an ESQ less than 1.0 indicates that ecological threats are almost, or entirely, absent and therefore no further work is needed (USEPA, 1997). An ESQ greater than 1.0 indicates either the ecological risk assessment should continue to determine whether risk exists; or there is the possibility of adverse ecological

effects, and a more detailed ecological risk assessment, with more information about the site, is needed (ERAGS, 1997).

As shown in Table 14 ESQs were less than 1.0, indicating that ecological threats are almost or entirely, absent; therefore, no further work is warranted based on ecological risk, and the estimated concentrations used to develop the screening level ecological risk calculations in this SLERA (USEPA, 1997). Because this conclusion could be reached using SLERA screening comparisons, detailed food webs descriptions, exposure estimates, and other information outlined in the 2008 work plan for MLAAP were not required.

Table 14
Ecological Risk Screening and ESQs — Soil

Chemical	Maximum Total (mg/kg)	Ecological Screening Value for Soil (mg/kg)	Key	ESQ	Ecological COPEC
Aluminum	5.69E+01	—	b	—	No
Antimony	2.37E-02	1	c	2.365E-02	No
Barium	1.95E+00	650	c	3.005E-03	No
Cadmium	5.98E-01	0.6	c	9.972E-01	No
Chromium	1.23E+01	60	c	2.055E-01	No
Copper	7.96E-01	28	d	2.841E-02	No
Lead	7.96E-01	25	c	3.182E-02	No
Zinc	1.98E+00	75	c	2.634E-02	No

Notes:
mg/kg = Milligrams per Kilogram
COPEC = Indicates a chemical of potential ecological concern
b = Indicates aluminum is not a COPEC in accordance with U.S. Environmental Protection Agency (USEPA) OSWER Directive #9285.7-60
c = Indicates an approximate background value, obtained from USEPA Ecological Soil Screening Levels Attachment 1-4, Figure 3.1
d = Indicates an ecological soil screening level, obtained from USEPA OSWER Directive #9285.7-55 (ECO SSL)
ESQ = Ecological Screening Hazard Quotient
— = Indicates no screening value is applicable; see note b

4.5 Uncertainty and Limitations

Uncertainties that understate or overstate risk are an inherent part of the risk assessment process. Some uncertainties are sources of variability, which could under- or overstate risk, and the actual effect may be unknown. Conservative assumptions are used in the risk assessment process to address sources of uncertainty, with the goal of not understating risk. Consequently, conclusions regarding ecological risks are expected to reflect considerable uncertainty. Uncertainty can be introduced into a risk assessment at every step of the process. Uncertainty occurs because risk assessment is a complex process, requiring the integration of the following:

- Release of pollutants into the environment

- Fate and transport of pollutants, in a variety of different and variable environments, by processes that are often poorly understood or too complex to quantify accurately

- Potential for adverse effects in receptors, as extrapolated from studies of differing species

- Probability of adverse effects in functionality of food web that is made up of species that are highly variable

Uncertainty is inherent in the process even if the most accurate data with the most sophisticated models are used. The methodology outlined in the SLERA Protocol relies on a combination of point values — some conservative and some typical — yielding a point estimate of exposure and risk that falls at an unknown percentile of the full distribution of exposure and risk. Therefore, the degree of conservatism in risk estimates cannot be known; instead, it is known that the values combine many conservative factors and are likely to overstate actual risk. For this reason, a formal uncertainty analysis is required to determine the degree of conservatism.

As a screening tool, the SLERA also has several inherent limitations. The approach used to select the measurement receptors is based, in part, on the premise that if key components of the ecosystem are protected, protection will be conferred to populations, and by extension, communities, and the ecosystem. Although this approach is reasonable given the nature of the analysis and the availability of data, protection of measurement receptors may not adequately protect all ecologically significant assessment endpoints. Similarly, the selection process for ecological receptors relies on a modified trophic element approach. As a result, representative species may not be the most sensitive to particular compounds, but may have been chosen as a function of their ecological significance and the availability of natural resource information. USEPA used this approach in their development of Ecological Soil Screening Levels (OSWER Directive #9285.7-55) that were used to screen data in this SLERA.

Screening to identify COPECs was performed to provide a conservative representation of those compounds in hazardous waste combustion emissions that have the highest potential to result in adverse ecological effects. Due to a lack of data on adverse ecological effects associated with combustion emissions through all exposure pathways, this list may not be all inclusive.

The toxicity of compounds varies with the measurement receptors and with the availability and form of a given compound. If a compound is more bioavailable to an organism for adsorption or uptake, then the toxic potential of the compound increases. Availability and chemical form are affected by factors such as pH, temperature, alkalinity, seasonal variation, microbial activity, organic carbon content, and complexation with other compounds. In the SLERA, the bioavailability of COPECs is assumed to be similar to that observed in the toxicity studies reported in literature and the ESVs derived based on those toxicity studies. Thus, toxicity may be over- or under-estimated, depending in part on the extent to which site-specific compound availability differs from those in studies reported in literature.

A SLERA is typically performed using at least some default parameter values in place of site-specific empirical data, incorporating assumptions as a result of data gaps. The absence of site-specific information and the need to use these assumptions may result in uncertainty associated with the calculation of ESQs. An understanding of the uncertainties associated with the ESQs is necessary for understanding the significance of the ESQs. After identifying the major uncertainties associated with the SLERA results, their significance was evaluated with respect to the computed ESQs below. Sources of uncertainty for a combustion facility include the following:

- Change in future COPEC emissions compared with modeled emission rates used in the risk assessment
- The site-specific representativeness of food web(s) used to develop ESVs
- The exposure potential of the measurement receptors
- The representativeness of equal and exclusive diet assumptions for measurement receptors used by USEPA and others in developing ESVs
- The effect of COPEC physicochemical properties pertaining to fate and bioavailability
- The effect of site-specific environmental conditions affecting the fate, transport, and bioavailability of the COPECs
- The assumption that once exposed, a measurement receptor does not metabolize or eliminate a COPEC

- The potential risk to measurement receptors of COPECs for which no toxicological reference values or ESVs are available

- The modeling described in Section 2.0 incorporated some bias toward locations by using annual maximum concentrations. As a result, screening is expected to be biased high.

- In accordance with the approved modeling protocol, absorption of soil-bound organics under realistic exposure conditions is an incomplete pathway based on epidemiological data. Thus, it was not included in the deposition calculations, and risk could be underestimated for organic compounds that are distributed through deposition. Maximum annual estimates were used for screening to address this source of uncertainty.

- Air dispersion modeling analyses have inherent uncertainties and limitations, and the depositions predicted in this analysis may be higher or lower than the actual impacts that occurred at Milan during normal operation. This analysis uses OBODM, which is the only atmospheric dispersion model on EPA's Support Center for Regulatory Air Models designed specifically to characterize depositions of explosion by-products. The OBODM and emission factors are believed to be the best information currently available, and arguably the most widely used basis, for estimating depositions from detonations of high explosives.

- Land use is primarily light industrial/commercial, and that is not expected to change in the future. Human activity would limit the use by ecological receptors.

- Subsurface samples were not used based on general practices for ecological risk assessment and the 2008 work plan. Most exposure would occur in the top six (6) inches of soil, in accordance with USEPA's ERAGs. This could understate risk to burrowing organisms.

- ESVs obtained from multiple sources were used for their derivation (No Observed Adverse Effect Level/ Lowest Observed Adverse Effect Level [NOAEL/LOAEL], specific effects), which could add variability to the risk assessment in the time of exposure, exposure route, field studies as opposed to laboratory studies, data conversions, and use of uncertainty factors.

- Time of exposure: The NOAEL should be from scientific studies that exposed the plants or animals to the chemical for a long time (chronic). Short- or medium-time exposure studies are less desirable than long time studies because it might take a long period of exposure to a chemical in order for there to be any adverse effects. However, time should be measured

relative to the life span of the plant or animal being studied. In other words, for a plant or animal with a short life span, it might be only necessary to have a relatively short study (i.e., a few days); but for a plant or animal with a long life span, it might be necessary to have a long term study (i.e., weeks or months) to discover any problems.

— Exposure route: The risk assessor should determine how plants or animals on the site could become exposed to the contaminant. The study from which the NOAEL comes should use the same type of exposure. For example, if a fish on the site is exposed to the contaminants at the site directly from the water it is swimming in, then the NOAEL study should have looked at this type of water exposure, as opposed to a fish eating contaminated food.

— Field vs. laboratory: The risk assessor should determine if the scientific study was performed in the laboratory or in the field. Either type of study can be used, but because they are different, the differences must be accounted for when selecting or calculating the NOAEL.

— Data conversions: In some cases, the data from a study might need to be modified to allow the data to be used for species other than those in the study. For example, the scientific study might have looked at brown trout, but on the Superfund site, there are no brown trout, only lake trout. The brown trout data might have to be converted to lake trout data.

— Uncertainty assessment: Professional judgment is needed to determine how accurate the scientific literature data are. USEPA and other regulatory agencies incorporate uncertainty factors into NOAELs and LOAELs to account for known uncertainties, making the values used more conservative.

- Habitat evaluation is typically a large portion of the discussion in a SLERA. Habitat at MLAAP includes human activity and OB/OD.

- Temporal and seasonal variability is unknown, which adds uncertainty to this evaluation.

- The ESQ approach to risk characterization does not consider synergistic or antagonistic effects or bioavailability. It is not known if the mixture of compounds in this report is antagonistic or synergistic upon exposure to terrestrial or aquatic organisms (USEPA, 2008).

These factors could lead to over- or underestimating risk. Risks were evaluated separately in accordance with USEPA guidance (USEPA, 1999).

- ESVs used are conservative, as are the endpoints used by USEPA and others to develop them.
- No ESVs were available for some compounds. As a result, those compounds were not evaluated, which could underestimate risk.
- ESVs for individual organisms and compounds were used to develop ESQs. Risk to an individual organism does not always result in community level risks, and risks based on individual organisms could overestimate risks. This uncertainty was addressed by using annual maximum concentrations for risk screening.

Uncertainties are inherent in the risk assessment process. This is evident based on the uncertainties outlined above. With so many conservative assumptions inherent in the risk assessment process, the cumulative effect of uncertainties in this SLERA would not be expected to understate risks.

4.6 Ecological Risk Summary

The purpose of the SLERA is to provide risk-based interpretations of site data and conservative estimates of risk from chemicals present in site media. The SLERA was performed in accordance with the process outlined in the 2008 work plan and ERAGS as well as the latest recommendations and guidance available from USEPA (USEPA, 1999).

The SLERA was performed assuming that terrestrial biota would be directly exposed to concentrations of chemicals in surface water, sediment, and/or soil that were measured during various investigation activities. In addition, it was assumed that wildlife could use soil, surface water, and sediment near MLAAP.

ESQs were less than 1.0, indicating that ecological threats are almost, or entirely, absent and therefore no further work is warranted based on ecological risk and the estimated concentrations used to develop the screening level ecological risk calculations in this SLERA (USEPA, 1997). Because this conclusion could be reached using SLERA screening comparisons, detailed food webs descriptions, exposure estimates, and other information outlined in the work plan for MLAAP were not required.

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Appendix A
Disposal Inventory and Modeled Quantities

Appendix A
Disposal Inventory and Modeled Quantities

	2006 Disposal Inventory (pounds)		OBODM Quantities (pounds)	
Ordnance	**Exploded**	**Burned**	**Exploded**	**Burned**
40 mm Cartridges (HEI)	21,591	0	1,400	0
Composition B	21,011.5	0	1,400	0
Flare, Countermeasure, Aircraft, M206	0	56,858	0	3,700
Fuzes	330.19	0	330.19	0
M-1 Nitrocellulose	0	487,065	0	3,700
Propellant M-9	468	1,264,179	468	3,700
Propellant, M31A1E1	0	30,229	0	3,700
RDX	158,535	0	1,400	0
Signal Illuminators	0	1,237	0	1,237
TNT	5,342	0	1,400	0
Propellant, Ammonium Perchlorate	0	531	0	531
HBX	6,366	0	1,400	0
Black (smokeless) Powder	1,322	0	1,322	0

Notes:

HEI = High Explosive Incendiary
mm = Millimeter
RDX = Research Department Explosive
TNT = Trinitrotoluene

Appendix B
Maximum Concentrations and Depositions

Maximum Modeled Hourly Concentrations / Depositions

Ordnance	1,3 Butadiene Concentration (µg/m³)	1-Hexene Concentration (µg/m³)	2,4-Dinitro-toluene Concentration (µg/m³)	Allyl Chloride Concentration (µg/m³)	Aluminum Concentration (µg/m³)	Aluminum Deposition (µg/m²)	Antimony Concentration (µg/m³)	Antimony Deposition (µg/m²)
40 mm Cartridge	3.49E-06	3.01E-06	n/a	n/a	4.25E-02	2.22E+02	n/a	n/a
Composition B	n/a	9.07E-07	n/a	n/a	n/a	n/a	n/a	n/a
Flare, ..., M206	2.88E-05	5.76E-05	n/a	1.73E-04	3.00E-01	1.51E+03	n/a	n/a
Fuze...Tail FMU 139A/B	3.48E-05	1.44E-05	n/a	4.97E-05	2.12E-01	1.10E+03	1.43E-03	1.41E+01
M-1 Nitrocellulose	n/a	n/a	1.14E-08	n/a	n/a	n/a	n/a	n/a
Propellant M-9 — Expld	n/a	2.86E-07	n/a	n/a	n/a	n/a	n/a	n/a
Propellant M-9 — Burn	n/a	2.02E-06	n/a	n/a	n/a	n/a	n/a	n/a
Propellant M31A1E1	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
RDX	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Signal Illuminators	3.77E-05	1.88E-04	n/a	3.57E-04	3.81E-01	1.91E+03	n/a	n/a
TNT	1.22E-06	1.58E-06	n/a	n/a	3.81E-03	1.97E+01	2.37E-06	2.41E-02
Propell, Am Perc, Al	n/a	n/a	n/a	n/a	7.62E-01	3.80E+03	n/a	n/a
HBX	7.59E-07	1.46E-06	n/a	n/a	1.98E-02	1.07E+02	n/a	n/a
Black (smokeless) Powder	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Ordnance	Barium Concentration (µg/m³)	Barium Deposition (µg/m²)	Benzene Concentration (µg/m³)	Cadmium Concentration (µg/m³)	Cadmium Deposition (µg/m²)	Carbon Tetrachloride Concentration (µg/m³)	Cl2 Concentration (µg/m³)	Chloroform Concentration (µg/m³)
40 mm Cartridge	n/a	n/a	1.91E-05	1.09E-04	1.27E+00	3.08E-06	n/a	n/a
Composition B	n/a	n/a	1.47E-06	n/a	n/a	2.04E-07	n/a	n/a
Flare, ..., M206	5.59E-03	3.70E+01	4.32E-04	7.16E-04	8.27E+00	n/a	n/a	n/a
Fuze...Tail FMU 139A/B	n/a	n/a	1.99E-04	1.53E-02	1.81E+02	4.47E-06	n/a	n/a
M-1 Nitrocellulose	n/a	n/a	4.55E-05	n/a	n/a	n/a	n/a	n/a
Propellant M-9 — Expld	n/a	n/a	4.36E-06	n/a	n/a	3.13E-07	n/a	n/a
Propellant M-9 — Burn	n/a	n/a	3.08E-05	n/a	n/a	2.21E-06	n/a	n/a
Propellant M31A1E1	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
RDX	n/a	n/a	3.61E-05	n/a	n/a	n/a	n/a	n/a
Signal Illuminators	5.35E-03	3.23E+01	6.74E-04	2.26E-03	2.53E+01	n/a	n/a	n/a
TNT	2.32E-02	1.49E+02	2.95E-06	1.39E-04	1.61E+00	n/a	n/a	n/a
Propell, Am Perc, Al	5.78E-04	3.52E+00	n/a	n/a	n/a	n/a	1.25E-01	n/a
HBX	n/a	n/a	3.91E-06	n/a	n/a	2.12E-07	n/a	2.06E-07
Black (smokeless) Powder	n/a	n/a	8.53E-07	n/a	n/a	n/a	n/a	n/a

Notes:

mm = millimeter
µg/m³ = Microgram per cubic meter
µg/m² = Microgram per meter squared
TNT = Trinitrotoluene
Cl2 = Chlorine
HCl = Hydrochloric acid
n/a = not applicable

Maximum Modeled Hourly Concentrations/ Depositions

Ordnance	Chromium Concentration (µg/m³)	Chromium Deposition (µg/m²)	Copper Concentration (µg/m³)	Copper Deposition (µg/m²)	Diethyl phthalate Concentration (µg/m³)	Diphenyl-amine Concentration (µg/m³)	Ethylbenzene Concentration (µg/m³)	HCL Concentration (µg/m³)
40mm Cartridge	3.04E-04	3.23E+00	3.00E-02	3.54E+02	n/a	n/a	1.71E-06	n/a
Composition B	n/a	n/a	n/a	n/a	n/a	n/a	1.13E-06	n/a
Flare, ..., M206	3.80E-03	3.93E+01	n/a	n/a	n/a	n/a	2.30E-05	n/a
Fuze...Tail FMU 139A/B	8.90E-04	9.59E+00	4.50E-02	5.40E+02	2.49E-03	n/a	5.30E-06	n/a
M-1 Nitrocellulose	n/a	n/a	n/a	n/a	n/a	1.04E-09	n/a	n/a
Propellant M-9 — Expld	n/a	n/a	3.47E-05	4.28E-01	n/a	n/a	n/a	n/a
Propellant M-9 — Burn	n/a	n/a	1.33E-04	1.60E+00	n/a	n/a	n/a	n/a
Propellant M31A1E1	n/a	n/a	2.05E-04	2.46E+00	n/a	n/a	n/a	n/a
RDX	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Signal Illuminators	1.72E-03	1.75E+01	9.14E-03	1.06E+02	n/a	n/a	9.12E-06	n/a
TNT	8.29E-05	8.76E-01	1.70E-03	2.00E+01	n/a	n/a	3.38E-07	n/a
Propell, Am Perc, Al	4.57E-04	4.65E+00	n/a	n/a	n/a	n/a	n/a	7.05E+00
HBX	n/a	n/a	9.50E-03	1.16E+02	n/a	n/a	9.76E-07	n/a
Black (smokeless) Powder	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Ordnance	Lead Concentration (µg/m³)	Lead Deposition (µg/m²)	Methyl Chloride Concentration (µg/m³)	Methyl Chloroform Concentration (µg/m³)	Methylcyclo- hexane Concentration (µg/m³)	Methylene chloride Concentration (µg/m³)	Naphthtalene Concentration (µg/m³)	Phenol Concentration (µg/m³)
40mm Cartridge	1.07E-03	1.54E+01	n/a	n/a	1.71E-06	5.95E-04	n/a	n/a
Composition B	n/a	n/a	n/a	n/a	1.30E-06	7.93E-05	n/a	n/a
Flare, ..., M206	n/a	n/a	9.60E-06	n/a	3.27E-06	3.94E-03	n/a	n/a
Fuze...Tail FMU 139A/B	1.46E-02	1.98E+02	7.79E-06	2.65E-05	n/a	1.82E-04	n/a	n/a
M-1 Nitrocellulose	n/a	n/a	n/a	n/a	n/a	n/a	1.80E-07	3.25E-08
Propellant M-9 - Expld	n/a	n/a	2.04E-07	n/a	n/a	n/a	n/a	n/a
Propellant M-9 – Burn	n/a	n/a	1.44E-06	n/a	n/a	n/a	n/a	n/a
Propellant M31A1E1	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
RDX	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Signal Illuminators	1.59E-03	2.25E+01	3.37E-05	n/a	n/a	1.61E-04	n/a	n/a
TNT	2.75E-05	3.95E-01	n/a	n/a	3.67E-06	1.30E-04	n/a	n/a
Propell, Am Perc, Al	1.38-03	1.83E+01	n/a	n/a	n/a	n/a	n/a	n/a
HBX	n/a	n/a	3.42E-07	2.06E-07	3.31E-06	1.46E-04	n/a	n/a
Black (smokeless) Powder	n/a	n/a	n/a	n/a	3.41E-07	5.12E-07	n/a	n/a

Ordnance	RDX Concentration (µg/m³)	Styrene Concentration (µg/m³)	Toluene Concentration (µg/m³)	Vinyl Chloride Concentration (µg/m³)	Zinc Concentration (µg/m³)	Zinc Deposition (µg/m²)	n-Hexane Concentration (µg/m³)
40mm Cartridge	2.53E-05	2.87E-05	1.78E-05	n/a	3.79E-03	4.01E+01	1.30E-05
Composition B	n/a	n/a	3.40E-06	n/a	n/a	n/a	3.11E-07
Flare, ..., M206	5.76E-04	6.82E-05	2.69E-04	1.44E-05	n/a	n/a	6.53E-06
Fuze...Tail FMU 139A/B	5.63E-04	4.81E-05	3.81E-05	2.98E-06	3.94E-02	4.21E+02	1.08E-06
M-1 Nitrocellulose	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Propellant M-9 — Expld	n/a	6.40E-07	n/a	n/a	n/a	n/a	n/a
Propellant M-9 — Burn	n/a	4.52E-06	n/a	n/a	n/a	n/a	n/a
Propellant M31A1E1	n/a	n/a	n/a	n/a	n/a	n/a	n/a
RDX	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Signal Illuminators	3.77E-03	8.93E-05	5.95E-04	4.56E-05	1.03E-02	1.05E+02	1.61E-05
TNT	6.91E-06	1.08E-06	3.67E-06	n/a	3.60E-05	3.79E-01	6.69E-07
Propell, Am Perc, Al	n/a	n/a	n/a	n/a	1.83E-03	1.86E+00	n/a
HBX	n/a	n/a	1.79E-06	n/a	3.76E-04	4.07E+00	2.98E-07
Black (smokeless) Powder	n/a	n/a	2.42E-06	n/a	n/a	n/a	6.82E-07

Maximum Annual Concentrations/ Depositions

Ordnance	1,3 Butadiene Concentration[1] (µg/m³)	1-Hexene Concentration[1] (µg/m³)	2,4-Dinitro-toluene Concentration[1] (µg/m³)	Allyl Chloride Concentration[1] (µg/m³)	Aluminum Concentration[1] (µg/m³)	Aluminum Deposition[2] (µg/m²)	Antimony Concentration[1] (µg/m³)	Antimony Deposition[2] (µg/m²)
40mm Cartridge	6.13E-09	5.29E-09	n/a	n/a	7.47E-05	3.42E+03	n/a	n/a
Composition B	n/a	1.55E-09	n/a	n/a	n/a	n/a	n/a	n/a
Flare, ..., M206	5.06E-08	1.01E-07	n/a	3.04E-07	5.28E-04	2.32E+04	n/a	n/a
Fuze...Tail FMU 139A/B	3.97E-09	1.65E-09	n/a	5.68E-09	2.42E-05	1.10E+03	1.63E-07	1.41E+01
M-1 Nitrocellulose	n/a	n/a	1.71E-10	n/a	n/a	n/a	n/a	n/a
Propellant M-9 - Expld	n/a	3.26E-11	n/a	n/a	n/a	n/a	n/a	n/a
Propellant M-9 – Burn	n/a	7.88E-08	n/a	n/a	n/a	n/a	n/a	n/a
Propellant M31A1E1	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
RDX	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Signal Illuminators	4.30E-09	2.15E-08	n/a	4.08E-08	4.34E-05	1.91E+03	n/a	n/a
TNT	5.31E-10	6.87E-10	n/a	n/a	1.65E-06	7.50E+01	1.03E-09	9.15E-02
Propell, Am Perc, Al	n/a	n/a	n/a	n/a	8.75E-05	3.80E+03	n/a	n/a
HBX	4.94-10	9.53E-10	n/a	n/a	1.29E-05	6.10E+02	n/a	n/a
Black (smokeless) Powder	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Ordnance	Barium Concentration[1] (µg/m³)	Barium Deposition[2] (µg/m²)	Benzene Concentration[1] (µg/m³)	Cadmium Concentration[1] (µg/m³)	Cadmium Deposition[2] (µg/m²)	Carbon Tetrachloride Concentration[1] (µg/m³)	Cl2 Concentration[1] (µg/m³)	Chloroform Concentration[1] (µg/m³)
40mm Cartridge	n/a	n/a	3.36E-08	1.92E-07	1.96E+01	5.41E-09	n/a	n/a
Composition B	n/a	n/a	2.52E-09	n/a	n/a	3.49E-10	n/a	n/a
Flare, ..., M206	9.82E-06	5.70E+02	7.60E-07	1.26E-06	1.27E+02	n/a	n/a	n/a
Fuze...Tail FMU 139A/B	n/a	n/a	2.27E-08	1.74E-06	1.81E+02	5.11E-10	n/a	n/a
M-1 Nitrocellulose	n/a	n/a	6.83E-07	n/a	n/a	n/a	n/a	n/a
Propellant M-9 — Expld	n/a	n/a	4.97E-10	n/a	n/a	3.58E-11	n/a	n/a
Propellant M-9 — Burn	n/a	n/a	1.20E-06	n/a	n/a	8.63E-08	n/a	n/a
Propellant M31A1E1	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
RDX	n/a	n/a	4.67E-07	n/a	n/a	n/a	n/a	n/a
Signal Illuminators	6.11E-07	3.23E+01	7.70E-08	2.58E-07	2.53E+01	n/a	n/a	n/a
TNT	1.01E-05	5.66E+02	1.28E-09	6.03E-08	6.10E+00	n/a	n/a	n/a
Propell, Am Perc, Al	6.60E-08	3.52E+00	n/a	n/a	n/a	n/a	1.43E-05	n/a
HBX	n/a	n/a	2541E-09	n/a	n/a	1.38E-10	n/a	1.34E-10
Smokeless (Blk) Powder	n/a	n/a	9.73E-11	n/a	n/a	n/a	n/a	n/a

Ordnance	Chromium Concentration[1] (µg/m³)	Chromium Deposition[2] (µg/m²)	Copper Concentration[1] (µg/m³)	Copper Deposition[2] (µg/m²)	Diethyl phthalate Concentration[1] (µg/m³)	Diphenyl-amine Concentration[1] (µg/m³)	Ethylbenzene Concentration[1] (µg/m³)	HCL Concentration[1] (µg/m³)
40mm Cartridge	5.34E-07	4.97E+01	5.27E-05	5.45E+03	n/a	n/a	3.00E-09	n/a
Composition B	n/a	n/a	n/a	n/a	n/a	n/a	1.94E-09	n/a
Flare, ..., M206	6.68E-06	6.06E+02	n/a	n/a	n/a	n/a	4.05E-08	n/a
Fuze...Tail FMU 139A/B	1.02E-07	9.59E+00	5.14E-06	5.40E+02	2.84E-07	n/a	6.05E-10	n/a
M-1 Nitrocellulose	n/a	n/a	n/a	n/a	n/a	1.57E-11	n/a	n/a
Propellant M-9 — Expld	n/a	n/a	3.97E-09	4.28E-01	n/a	n/a	n/a	n/a
Propellant M-9 — Burn	n/a	n/a	5.20E-06	5.46E+02	n/a	n/a	n/a	n/a
Propellant M31A1E1	n/a	n/a	1.92E-07	2.01E+01	n/a	n/a	n/a	n/a
RDX	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Signal Illuminators	1.97E-07	1.75E+01	1.04E-06	1.06E+02	n/a	n/a	1.04E-09	n/a
TNT	3.60E-08	3.33E+00	7.39E-07	7.59E+01	n/a	n/a	1.47E-10	n/a
Propell, Am Perc, Al	5.21E-08	4.65E+00	n/a	n/a	n/a	n/a	n/a	8.04E-04
HBX	n/a	n/a	6.18-06	6.59E+02	n/a	n/a	6.35-10	n/a
Smokeless (Blk) Powder	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Maximum Annual Concentrations/ Depositions

Ordnance	Lead Concentration[1] (µg/m³)	Lead Deposition[2] (µg/m²)	Methyl Chloride Concentration[1] (µg/m³)	Methyl Chloroform Concentration[1] (µg/m³)	Methylcyclo- hexane Concentration[1] (µg/m³)	Methylene chloride Concentration[1] (µg/m³)	Naphthtalene Concentration[1] (µg/m³)	Phenol Concentration[1] (µg/m³)
40mm Cartridge	1.88E-06	2.37E+02	n/a	n/a	3.00E-09	1.05E-06	n/a	n/a
Composition B	n/a	n/a	n/a	n/a	2.23E-09	1.36E-07	n/a	n/a
Flare, ..., M206	n/a	n/a	1.69E-08	n/a	5.74E-09	6.92E-06	n/a	n/a
Fuze...Tail FMU 139A/B	1.67E-06	1.98E+02	8.89E-10	3.03E-09	n/a	2.08E-08	n/a	n/a
M-1 Nitrocellulose	n/a	n/a	n/a	n/a	n/a	n/a	2.70E-09	4.88E-10
Propellant M-9 — Expld	n/a	n/a	2.33E-11	n/a	n/a	n/a	n/a	n/a
Propellant M-9 — Burn	n/a	n/a	5.63E-08	n/a	n/a	n/a	n/a	n/a
Propellant M31A1E1	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
RDX	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Signal Illuminators	1.81E-07	2.25E+01	3.85E-09	n/a	n/a	1.83E-08	n/a	n/a
TNT	1.19E-08	1.50E+00	n/a	n/a	1.59E-09	5.62E-08	n/a	n/a
Propell, Am Perc, Al	1.57E-07	1.83E+01	n/a	n/a	n/a	n/a	n/a	n/a
HBX	n/a	n/a	2.22E-10	1.34E-10	2.15E-09	9.53E-08	n/a	n/a
Smokeless (Blk) Powder	n/a	n/a	n/a	n/a	3.89E-11	5.84E-11	n/a	n/a

Ordnance	RDX Concentration[1] (µg/m³)	Styrene Concentration[1] (µg/m³)	Toluene Concentration[1] (µg/m³)	Vinyl Chloride Concentration[1] (µg/m³)	Zinc Concentration[1] (µg/m³)	Zinc Deposition[2] (µg/m²)	n-Hexane Concentration[1] (µg/m³)
40mm Cartridge	4.45E-08	5.05E-08	3.12E-08	n/a	6.66E-06	6.17E+02	2.28E-08
Composition B	n/a	n/a	5.82E-09	n/a	n/a	n/a	5.33E-10
Flare, ..., M206	1.01E-06	1.20E-07	4.73E-07	2.53E-08	n/a	n/a	1.15E-08
Fuze...Tail FMU 139A/B	6.43E-08	5.49E-09	4.35E-09	3.41E-10	4.50E-06	4.21E+02	1.23E-10
M-1 Nitrocellulose	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Propellant M-9 — Expld	n/a	7.31E-11	n/a	n/a	n/a	n/a	n/a
Propellant M-9 — Burn	n/a	1.76E-07	n/a	n/a	n/a	n/a	n/a
Propellant M31A1E1	n/a	n/a	n/a	n/a	n/a	n/a	n/a
RDX	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Signal Illuminators	4.30E-07	1.02E-08	6.79E-08	5.21E-09	1.18E-06	1.05E+02	1.83E-09
TNT	3.00E-09	4.68E-10	1.59E-09	n/a	1.56E-08	1.44E+00	2.90E-10
Propell, Am Perc, Al	n/a	n/a	n/a	n/a	2.09E-07	1.86E+01	n/a
HBX	n/a	n/a	1.16E-9	n/a	2.45E-07	2.32E+01	1.94E-10
Smokeless (Blk) Powder	n/a	n/a	2.76E-10	n/a	n/a	n/a	7.79E-11

1. Annual concentration results are calculated using: (1-hr result) x (No. of Events per Year)/ 8760 hours/year.
2. Annual deposition results are calculated using: (1-hr results) x (No. of Events per Year).

Notes:

mm	=	millimeter
µg/m³	=	Microgram per cubic meter
µg/m²	=	Microgram per meter squared
TNT	=	Trinitrotoluene
Cl2	=	Chlorine
HCl	=	Hydrochloric acid
n/a	=	not applicable

Appendix C
Equation Derivations

Equation Derivations

Initial Equation 1: $$Cs_{t_D} = \frac{Ds*[1-e^{(-ks*t_D)}]}{ks}$$

Cs = Average soil concentration over exposure duration (mg/kg)

Ds = Deposition term (mg/kg/yr)

Ks = COPC soil loss constant due to all processes (yr^{-1})

t_D = Time period over which deposition occurs (yr)

Cs_{tD} = Soil concentration at time t_D

Above is the initial equation used to calculate the average soil concentration over exposure duration from the HHRAP, 2005 edition. Due to calculations based upon the original data provided by the MLAAP, this equation was not valid. Therefore, a revised version was developed to give accurate results for the soil concentration.

To gain a conservative value for screening, the COPC soil constant due to all process (Ks) was deleted from the equation. By eliminating the soil loss constant, the highest concentration possible for the MLAAP was used for air and soil concentration screenings. Deposition (Ds) was calcuated based on the original data units given from the MLAAP of (µg/m^2).

Final Equation 1:: $$Cs = \frac{0.0001*Dydp}{Z_s*BD} * t_D$$

Dydp = Unitized yearly average dry deposition from particle phase (µg/m^2)

Zs = Soil mixing zone depth (cm) (2 cm for untilled soil, 20 cm for tilled soil)

BD = Soil bulk density (g/cm^3)(default = 1.5 g/cm^3)

0.0001 = Conversion factor (m^2-g-mg)/(cm^2-kg-µg)

t_D = Time period over which deposition occurs (yr)

Initial Equation 2:

$$Ds = \frac{100 * Q}{Zs * BD} * [Fv * (0.31536 * Vdv * Cyv + Dywv) + (Dydp + Dywp) * (1 - Fv)]$$

Ds = Deposition term (mg/kg/yr)

100 = Units conversion factor (mg-m^2/kg-cm^2)

Q = COPC emission rate (g/s)

Zs = Soil mixing zone depth (cm) (2 cm for untilled soil)

BD = Soil bulk density (g/cm^3) (default = 1.5 g/cm^3)

Fv = Fraction of COPC air concentration in vapor phase (unitless)

0.31536 = Units conversion factor

Vdv = Dry deposition velocity (cm/s) (site-specific value obtained from air dispersion modeling)

Cyv = Unitized yearly average air concentration from vapor phase (mg-s/g-m^3) (site-specific value obtained from air dispersion modeling)

Dywv = Unitized yearly average wet deposition from particle phase (s/m^2-yr) (site-specific value obtained from air dispersion modeling)

Dydp = Unitized yearly average dry deposition from particle phase (s/m^2-yr)(site specific value obtained from air dispersion modeling)

Above is the initial equation used to calculate the deposition term from the HHRAP, 2005 edition. Due to a new program from which the raw data was collected from onsite, the original units were not valid with what was required for this risk assessment. Therefore, a revised version was developed to give accurate results with correct units.

Wet deposition was not collect on-site. Therefore, all wet deposition values were considered to have a value of zero. Metals were the only parameters being screen. Therefore, Cyv and Fv were considered to have values of zero since they pertained to only vapor phases. The original conversion factors were no longer applicable since they were specific to the original equation. Dydp was not given in units of s/m2-yr. Therefore, a new unit conversion was assigned to equalize units. COPC emission rate “Q” and the “ Vdv” values were incorporated into the Cyv value. Therefore “Q” and “Vdv” were deleted from the final equation.

The following is the final equation used to obtain deposition.

Final Equation 2: $$Ds = \frac{0.0001 * Dydp}{Z_S * BD}$$

Ds	=	Deposition term (mg/kg/yr)
Dydp	=	Unitized yearly average dry deposition from particle phase (µg/m^2)
Zs	=	Soil mixing zone depth (cm) (2 cm for untilled soil)
BD	=	Soil bulk density (g/cm^3)(default = 1.5 g/cm^3)
0.0001	=	Conversion factor (m^2-g-mg)/(cm^2-kg-µg)

HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT
SUBPART X PERMIT APPLICATION
MILAN ARMY AMMUNITION PLANT
MILAN, TENNESSEE

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MILAN, TENNESSEE

Appendix K-2
Air Dispersion Modeling Report

DISPERSION MODELING REPORT

MILAN ARMY AMMUNITION PLANT
MILAN, TENNESSEE

EnSafe Project Number:
0888811338/PH01

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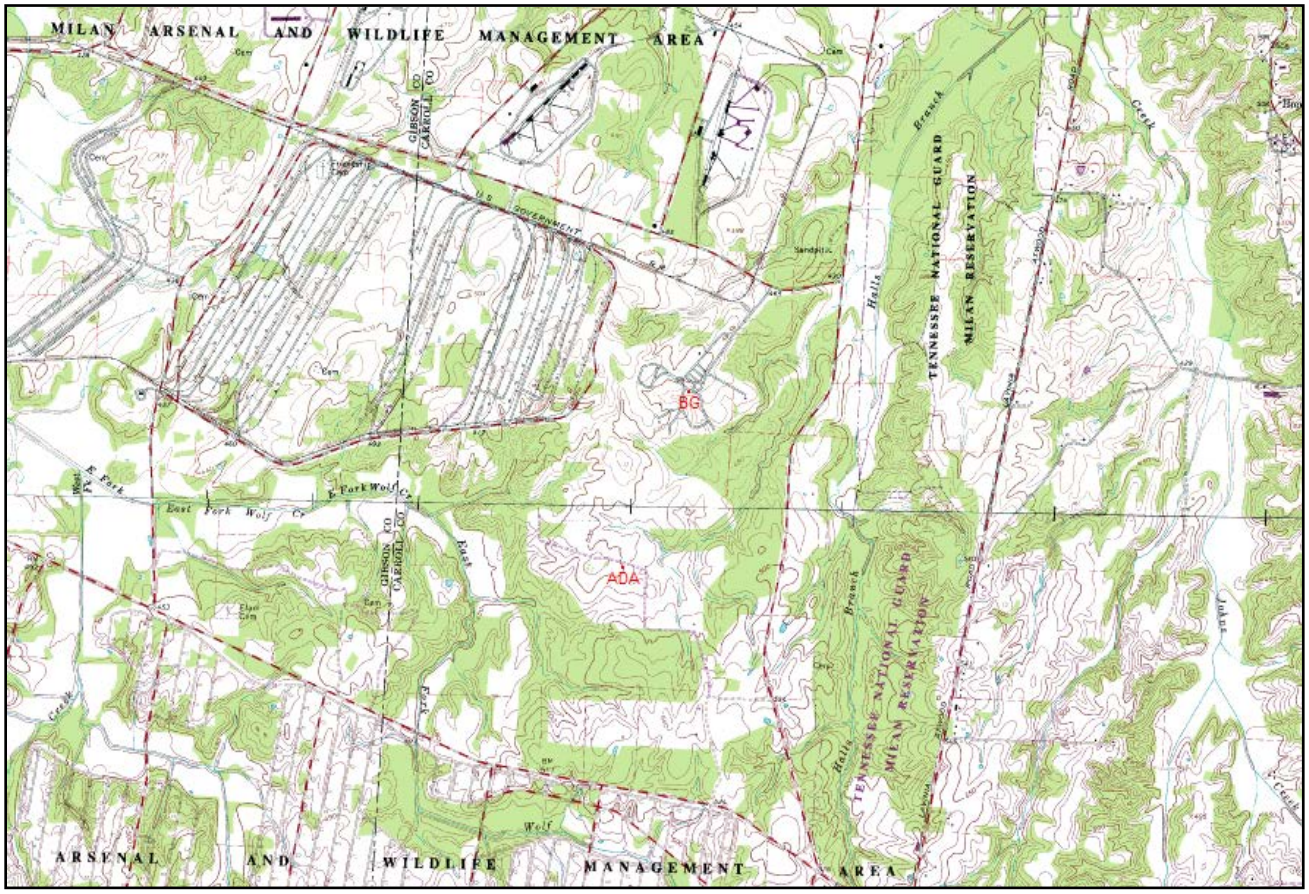
Appendix A Modeling Files and Descriptions

1.0 INTRODUCTION

Milan Army Ammunition Plant (MLAPP) submitted a Part B Permit Application in accordance with Title 40 Code of Federal Regulations 264 Subpart X (Miscellaneous Units) in January 2011, to reflect their intent to permit two miscellaneous thermal treatment units currently operating under interim status. As part of the permitting process, MLAPP must conduct a risk assessment to show protection of human health and the environment in the surrounding areas. The enclosed modeling report and results are being submitted in support of the risk assessment for the facility.

The facility is located to the southeast of Milan, Tennessee. The facility location is shown on a U.S. Geological Survey topographic map in Figure 1.

Figure 1
Facility Location



Scale: 1 in = 1000m
7.5min Topographic Map: Atwood, Tennessee
NAD27

2.0 BACKGROUND

MLAAP is a government-owned, contractor-operated military industrial installation currently operated by American Ordnance LLC, with a mission that includes loading, assembling, packaging, storing, and shipping small and medium caliber ammunition, as well as reconditioning and demolition of munitions.

Currently, MLAAP is permitted to receive, store, and/or treat hazardous waste from onsite or other Department of Defense (DOD) facilities or DOD contractor offsite generators. The wastes generated from those facilities, and sent to MLAAP for thermal treatment, are limited to non-chemical waste military munitions and must meet the Department of Transportation definition of explosive and the Tennessee Hazardous Waste Management Regulations definition of reactivity.

For safety reasons, the vast majority of these materials cannot be disassembled or recycled, they must be destroyed. There are two miscellaneous thermal treatment units located within the Waste Management Area (Area W) that treat the waste: an Open Burn (OB) Unit and an Open Detonation (OD) Unit. The modeling analysis will depict the conditions of the OB/OD and estimate ground level concentrations to be used in the risk assessment.

This report will outline the disposal methods, emission rates, the modeling protocol, and scaling of the results of the modeling analysis.

3.0 DISPOSAL METHODS

OB is used for ordnance such as propellant, bulk explosives, or various incendiary mixes and is performed using "burn pans." There are 11 burn pans at the facility, of which nine have a capacity of approximately 333.33 pounds of explosive weight, and the remaining two have a capacity of approximately 500 pounds of explosive weight. Due to safety reasons, the burn pans are not typically filled to capacity; therefore, in the modeling, a burn amount of 300 pounds was used for each of the nine burn pans and 500 pounds was used for the remaining two pans.

OD is used for complete cartridges, cartridge components, bulk explosives, and bulk primers. The ordnance is assembled with donor charges, buried in an excavation, covered with up to 15 feet of soil and detonated.

4.0 DISPERSION MODELING

4.1 Methodology

The following sections describe the methodology used in this analysis. Recommendations from the 2005 Human Health Risk Assessment Protocol (HHRAP) are used when possible.

4.1.1 General Modeling Approach

For the modeling of OB/OD ordnance, the U.S. Environmental Protection Agency (EPA) model, OB/OD Dispersion Model (OBODM) is used as recommended by the Tennessee Department of Environment and Conservation and EPA Region 4. This model was developed by the U.S. Army for use in evaluating the potential air quality and depositional impacts of the OB/OD of obsolete munitions and solid propellants.

4.1.2 Meteorological Data

Air Dispersion Modeling requires using meteorological (met) data to predict dispersion. Several National Weather Service (NWS) stations were evaluated based on distance, elevation, and surface roughness to determine the most representative source for hourly meteorological data. The surface roughness values were calculated using the EPA AERSURFACE program (version 08009). AERSURFACE utilizes surface roughness calculation methodology similar to the 2005 HHRAP. Based on the comparison, Paducah, Kentucky, was chosen as the most representative NWS station for the Milan facility. The comparison is shown in Table 1.

Although the 2005 HHRAP recommends five years of met data, this is not applicable to, or feasible with the OBODM model, which only requires one year of met data. The nearest upper air station is Nashville, Tennessee, and the most recent complete year of data available is 2008. Missing mixing heights are replaced using EPA recommended procedures. Thus, 2008 hourly surface data from Paducah, Kentucky, and mixing heights from Nashville, Tennessee, were processed using the EPA program Meteorological Processor for Regulatory Models (version 99349) in the Industrial Source Complex Short Term Model format and used in this analysis.

Meteorological parameters used in the OBODM model were set to match the first hour of the processed hourly meteorological data where applicable. The surface roughness value was set to match the source of surface meteorological data, which is the NWS station in Paducah, Kentucky. All meteorological parameters used in the OBODM model are shown in Table 2.

Table 1
NWS Meteorological Station Comparison
Milan Army Ammunition Plant — Milan, Tennessee

Station	Location	Approx. Distance from Milan (km)	Surface Elevation (ft)	Surface Roughness (m)
Milan Army Ammunition Plant	Milan, TN		**492.6**	**0.436**
Jackson McKellar Airport	Jackson, TN	37.6	433	0.036
Memphis International Airport	Memphis, TN	149.8	254	0.067
Clarksville Outlaw Airport	Clarksville, TN	140.0	560	0.062
Nashville International Airport	Nashville, TN	182.0	600	0.048
Paducah Barkley Regional Airport	**Paducah, KY**	**130.1**	**413**	**0.145**

Notes:
km = Kilometer
ft = Feet
m = Meter
TN = Tennessee
KY = Kentucky

Table 2
Meteorological Parameters[1]

Year [1900-2099]	2008
Month [1-12]	1
Day [1-31]	1
Hour (STD) [00-23]	0000
Minute	0
Julian day [1-1]	1
Surface pressure (mb) [600.0-1100.0]	1007.00
Cloud cover (8ths) [0-8]	.00
Cloud ceiling (m) [.0-20000.0]	9999.00
Net radiation index [-2-4]	-2.
Pasquill stability category [A-F]	F
Wind speed reference height (m)	10.00
Surface roughness length (m) [.00-1.00]	.145
Vertical grad. of pot. temp. (C/m) [-5.000-5.000]	.02
Reference wind speed (m/s) [1.0-50.0]	3.087
Minimum (at 2m) wind speed (m/s)	2.064
Air temperature (K) [213.1-333.1]	273.1
Standard dev. of wind direction angle (d) [1.0000-80.0000]	7.0000
Standard dev. wind elevation angle (d) [1.0000-50.0000]	5.0000
Longitudinal turbulence intensity (d) [1.0000-106.4000]	9.3100
Measurement time for std. dev. wind dir. angle (s) [2.5-3600.0]	600.00
Air humidity (%) (.0-100.0)	65.6
Surface mixing layer height (m) [1.0-20000.0]	200.00
Wind direction (From) (deg) [.0-360.0]	91.0
Wind-direction shear (d/m) [-45.0-45.0]	.00
Wind-speed power law exponent [.000-5.000]	.25
Wind-speed shear (m/s) [.00-20.00]	Compute

[1] Meteorological Data from Open Burning / Open Detonation Dispersion Model

4.1.3 Emission Rates

OBODM contains emission factors for approximately 40 different classes of ordnances. Calendar year 2006 was selected as the baseline disposal year for the disposal inventory, based on a subjective assessment of the inventory as representative of a typical year of disposal at Milan. This baseline data was evaluated to determine the best fit of the various ordnance types into one of the predefined classes within OBODM. The ordnance was classified iteratively by first comparing the specific ordnance to the OBODM classes and classifying the ordnance that readily conformed to a specific class. The remaining ordnance was then assessed based on similarity to a specific OBODM class and lastly by a comparison of the chemical constituents of the disposed ordnance to the constituents of the OBODM classes. This process resulted in using 13 of the OBODM classes. In order to accurately depict a worse-case hourly quantity to use in the modeling, the maximum amount was derived for each disposal type.

For open burning, a total of 11 burn pans can be used in an hour: nine pans with a maximum capacity of 333.33 pounds each and two pans with a maximum capacity of 500 pounds each. Due to safety reasons, the burn pans are not typically filled to capacity; therefore, in the modeling, a burn amount of 300 pounds was used for each of the nine burn pans and 500 pounds was used for the remaining two pans. The resulting maximum amount burned per hour 3,700 pounds. The lesser of the maximum per hour and the annual inventory quantity is used in the modeling.

MLAAP is currently permitted for 10,000 pounds per day for OD. The typical operating schedule is 10 hours per day, which results in an actual detonated amount of 1,000 pounds per hour. As a worst-case for OD, the amount detonated per hour used in the modeling is 1,400 pounds. The lesser of the maximum per hour and the annual inventory quantity is used in the modeling. The 2006 annual disposal inventory, selected OBODM classes, and the OBODM modeled quantities are shown in Table 3.

Table 3
Disposal Inventory and Modeled Quantities

	2006 Disposal Inventory (pounds)		OBODM Quantities (pounds)	
Ordnance	**Exploded**	**Burned**	**Exploded**	**Burned**
40 mm Cartridges (HEI)	21,591	0	1,400	0
Composition B	21,011.5	0	1,400	0
Flare, Countermeasure, Aircraft, M206	0	56,858	0	3,700
Fuzes	330.19	0	330.19	0
M-1 Nitrocellulose	0	487,065	0	3,700
Propellant M-9	468	1,264,179	468	3,700
Propellant, M31A1E1	0	30,229	0	3,700
RDX	158,535	0	1,400	0
Signal Illuminators	0	1,237	0	1,237
TNT	5,342	0	1,400	0
Propellant, Ammonium Perchlorate	0	531	0	531
HBX	6,366	0	1,400	0
Black (smokeless) Powder	1,322	0	1,322	0

Notes:
HEI = High Explosive Incendiary
mm = Millimeter
RDX = Research Department Explosive
TNT = Trinitrotoluene

The ordnance categorized as 40 millimeter (mm) High Explosive Incendiary (HEI) cartridge includes explosive cartridges, cartridges with explosive components, and components thereof, for a variety of cartridge sizes ranging from 20 mm through 155 mm.

The composition B category includes composition explosives with TNT. Other categories of composite explosives such as Composition A, Composition C, CH6, A-3, A-5, etc., are categorized as RDX because of the high percentage of RDX in the compound is usually greater than 98%. The same rule applies to other munitions that have HMX as the energetic material.

Classes categorized as a single explosive or propellant component such as TNT, RDX, M-1, and M-9 are waste materials that are either the specific explosive, contain the explosive or component as the main energetic component, or are a material contaminated with that component.

Propellants are grouped into four categories that best fit either single-base, double-base, and triple base or ammonium perchlorate based propellants. Single-base being described as having nitrocellulose as the main energetic material, double-base as having a combination of

nitrocellulose/nitroglycerin as the main energetic material, triple base as containing nitroguanidine and ammonium perchlorate (AP) based propellant having AP as the oxidizer.

The fuze category includes all types of fuzes disposed of at the facility and includes primers. Primers are grouped with fuzes because all fuzes have a primer composition as a component of the fuze. The signal illuminator category includes illuminating flares and other pyrotechnic compositions. The Flare Countermeasure M206 category represents all Infrared Countermeasure Flare compositions based on a magnesium/Teflon/binder composition.

The remaining categories contain essentially only the specified ordnance.

MLAPP's disposal operations have unique conditions, in that they have restrictions on the hours of operation and can only operate when the meteorological data meet certain criteria. Thus, ordnance-specific hourly emission rate files were used. All hours were set to zero emission rates unless the time and meteorological data met the following criteria:

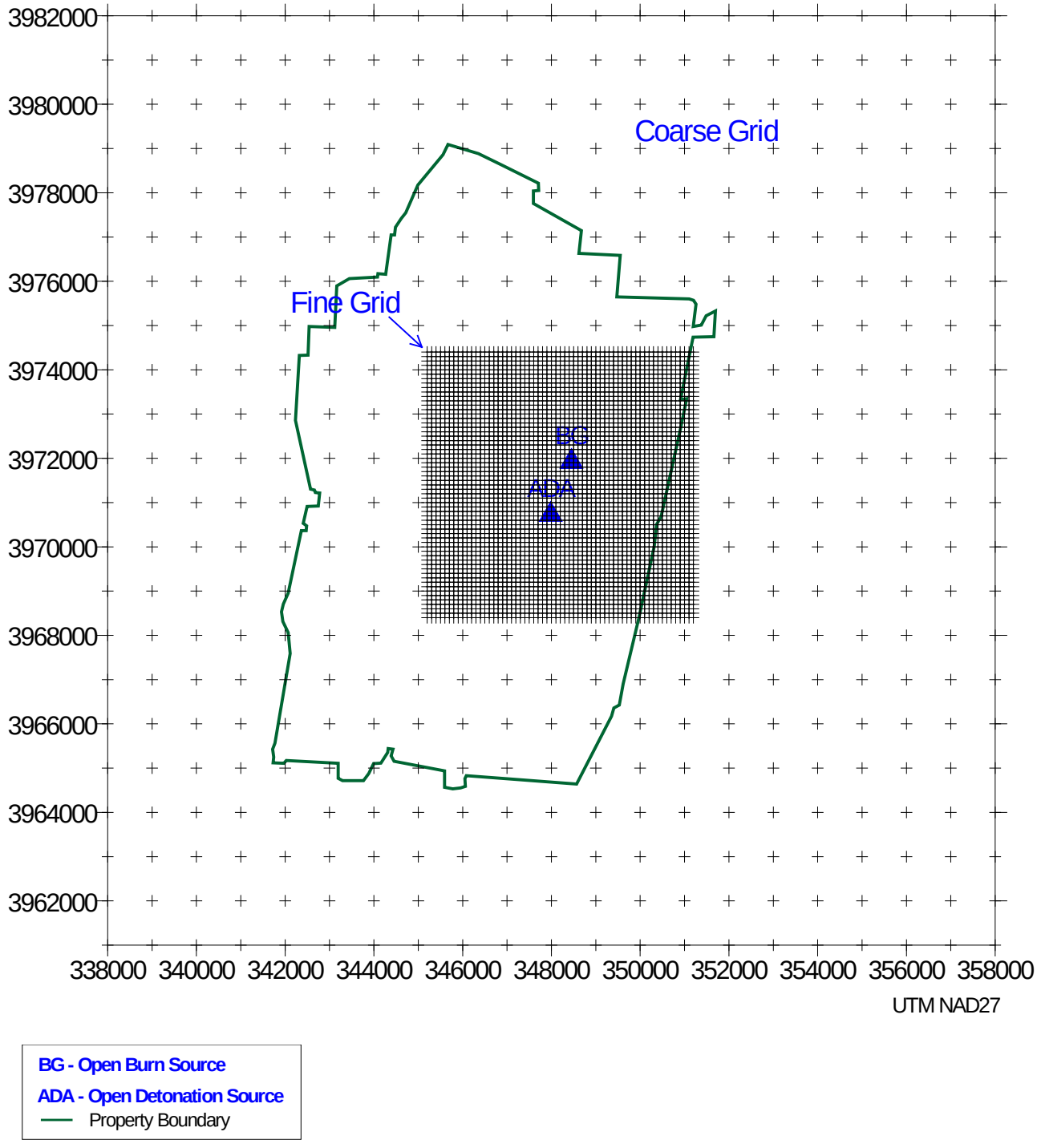
- Operating hours of 6:00 a.m. to 7:30 p.m.
- No precipitation was recorded
- The wind speed is more than 1 mph, but less than 15 mph
- Not an extremely cloudy day, as defined as more than 80 percent cloud cover with a ceiling of less than 2,000 feet

If the criteria were met, then the OBODM modeled quantity was used for that hour.

4.1.4 Receptors and Terrain

A Cartesian receptor grid is used in this analysis. As recommended in the HHRAP, a 100 m spaced grid is used out to 3 kms and a 1 km spaced grid is used out to 10 kms. Universal Transverse Mercator (UTM) coordinates in North American Datum (NAD) 27 are used for both grids and are centered on the centroid of the two source locations. Due to requirements in the OBODM model, each grid was modeled separately for each ordnance/chemical combination. All receptor grid locations are shown in Figure 2.

Figure 2
Milan OBODM Receptor Grids



The immediate vicinity of the disposal areas does not include any intervening terrain; however, there are some terrain features further away from the facility. Therefore, terrain is used for this modeling analysis. The OBODM model has a limitation that does not allow complex terrain and deposition to be modeled simultaneously; therefore, complex terrain is used for all volatile chemicals but not used for the metal runs that utilize deposition.

4.1.5 Model Input

There are three run types that can be used for each ordnance: volatile concentration, metal concentration, and metal deposition. The settings that are unique for these run types are shown in Table 4. The OBODM model determines the chemicals that are possibly emitted from each ordnance class, and the run type is determined from the nature of each chemical. The settings that are unique for OB/OD are shown in Table 5.

All model runs in the analysis use a volume source type, final cloud rise height for all calculated distances, a highest maximum concentration, and a 1-hour averaging time for concentration. Also, instantaneous sources can use both stable and adiabatic plume rise. The defaults are used for all remaining parameters.

4.1.6 Particle Size Distribution

For OBODM runs that utilize deposition or concentration with depletion due to deposition, a particle size distribution is required. The particle distribution is auto-generated within OBODM using the following components: the number of categories is set to 20, the mass median diameter is 200 microns, the geometric standard deviation of the distribution is 1.2, and the ratio of Lagrangian to Eularian time scales is set to 1.0. These parameters were used and approved in previous OBODM modeling of the MLAAP, and are shown in Table 6 along with the OBODM calculated settling velocities.

Table 4
Run Type Settings

Volatile Concentration Run	Metal Concentration Run	Metal Deposition Run
Concentration	Concentration with depletion due to gravitational deposition	Gravitational Deposition
Time-average concentration (1-hour)	Time-average concentration with depletion due to gravitational deposition (1-hour)	1-hour Deposition
Complex Terrain	Flat Terrain (Complex not allowed)	Flat Terrain (Complex not allowed)
Met Tower Elevation: 120.1 m (above ground surface)	Met Tower Elevation: n/a	Met Tower Elevation: n/a

Notes:
m = Meter
n/a = Not Applicable

Table 5
OB/OD Settings

Parameter	Open Burn	Open Detonation*
Emission Type	Quasi-continuous	Instantaneous
Release Height	1 meter	0 meters
Source Location UTM-X	348,452.4 m NAD27	347,983.8 m NAD27
Source Location UTM-Y	3,971,996.7 m NAD27	3,970,800.2 m NAD27
Open Burn Source Dimensions - Horizontal	10 ft x 5 ft, 90° Orientation from North	n/a
Open Burn Source Dimension - Vertical	1 ft	n/a
Source Elevation (volatile runs only)	148.3 m	151.9 m

* Note that the OBODM model considers OD to be at ground level with the center of the fire ball above ground. MLAAP buries the ordnance in an excavation, covers the ordnance with soil and detonates the ordnance. Ground level OD is the only approach available in OBODM at this time.

Notes:
UTM = Universal Transverse Mercator
m = Meter
NAD = North American Datum
ft = Foot
n/a = Not Applicable

Table 6
OBODM Particle Size Distribution and Deposition Velocities

	Particle Category Description			Settling (Deposition) Velocities						
Category No.	Upper limit diam (µm)	Lower limit diam (µm)	Fraction (unitless)	Aluminum (m/s)	Antimony (m/s)	Barium (m/s)	Cadmium (m/s)	Copper (m/s)	Lead (m/s)	Zinc (m/s)
1	304.19	291.70	0.00869	2.2431	4.0099	2.6554	4.7507	4.8582	5.7576	4.1829
2	291.70	279.72	0.01396	2.1568	3.8583	2.5533	4.5476	4.6406	5.4935	4.0247
3	279.72	268.23	0.02127	2.0739	3.7124	2.4551	4.3756	4.4651	5.2414	3.8725
4	268.23	257.22	0.03075	1.9857	3.5721	2.3607	4.2102	4.2963	5.0104	3.7261
5	257.22	246.65	0.04218	1.8814	3.4370	2.2699	4.0510	4.1339	4.8210	3.5852
6	246.65	236.52	0.05489	1.7826	3.3068	2.1760	3.8977	3.9775	4.6386	3.4496
7	236.52	226.81	0.06776	1.6889	3.1797	2.0617	3.7504	3.8271	4.4633	3.3179
8	226.81	217.50	0.07936	1.6003	3.0575	1.9534	3.6085	3.6825	4.2946	3.1904
9	217.50	208.57	0.08818	1.5162	2.9399	1.8509	3.4698	3.5414	4.1322	3.0678
10	208.57	200.00	0.09295	1.4366	2.8269	1.7536	3.3364	3.4052	3.9760	2.9498
11	200.00	191.79	0.09295	1.3619	2.7147	1.6615	3.2081	3.2743	3.8234	2.8364
12	191.79	183.91	0.08818	1.3034	2.5721	1.5742	3.0847	3.1484	3.6764	2.7048
13	183.91	176.36	0.07936	1.2474	2.4370	1.4915	2.9641	3.0273	3.5350	2.5627
14	176.36	169.12	0.06776	1.1939	2.3090	1.4272	2.8085	2.8771	3.3991	2.4281
15	169.12	162.17	0.05489	1.1426	2.1877	1.3659	2.6610	2.7260	3.2684	2.3006
16	162.17	155.51	0.04218	1.0935	2.0728	1.3072	2.5211	2.5827	3.1020	2.1797
17	155.51	149.12	0.03075	1.0465	1.9639	1.2510	2.3887	2.4470	2.9390	2.0652
18	149.12	143.00	0.02127	1.0016	1.8607	1.1973	2.2632	2.3185	2.7847	1.9567
19	143.00	137.13	0.01396	0.9586	1.7783	1.1459	2.1444	2.1968	2.6385	1.8602
20	137.13	131.50	0.00869	0.8988	1.7020	1.0967	2.0318	2.0814	2.4999	1.7803
		Weighted Average (m/s):		**1.446**	**2.760**	**1.748**	**3.286**	**3.356**	**3.936**	**2.888**
		Weighted Average (cm/s):		**144.6**	**276.0**	**174.8**	**328.6**	**335.6**	**393.6**	**288.8**

Notes:
Diam = Diameter
µm = Micro Meter
m/s = Meters per Second
cm/s = Centimeters per Second

4.2 Modeling Results

In total, 380 individual OBODM model runs were made to reflect all combinations of ordnance, chemical, receptor grid, concentration, and deposition modeling. The results of the OBODM modeling are described in the following section. The CD ROM in Appendix A contains the individual modeling runs.

4.2.1 Converting the Results Data

The modeling results for all runs represent an hourly value. These results can be used for short-term, acute risk assessment if required. In order to convert the hourly concentrations to an annual value, the maximum hourly concentration at each receptor is multiplied by the number of events per year, and divided by the number of hours in a year, or 8,760. The number of events per year is calculated by dividing the total 2006 inventory for the ordnance by the maximum hourly quantity used in the analysis. The calculated events per year are shown in Table 7.

For deposition runs, results must be scaled to convert hourly deposition to the amount accumulated annually. The deposition value at each receptor is multiplied by the total number of events per year. Maximum hourly modeled concentrations and depositions are shown in Table 8. Maximum annual modeled concentrations and depositions are shown in Table 9.

Table 7
Calculated Events per Year

Ordnance	Exploded or Burned	2006 Disposal Inventory (pounds)	OBODM Quantities (pounds)	Events per Year
40 mm Cartridges (HEI)	Exploded	21,591	1,400	16
Composition B	Exploded	21,011.5	1,400	15
Flare, Countermeasure, Aircraft, M206	Burned	56,858	3,700	16
Fuzes	Exploded	330.19	330.19	1
M-1 Nitrocellulose	Burned	487,065	3,700	132
Propellant M-9	Exploded	468	468	1
Propellant M-9	Burned	1,264,179	3,700	342
Propellant, M31A1E1	Burned	30,229	3,700	9
RDX	Exploded	158,535	1,400	114
Signal Illuminators	Burned	1,237	1,237	1
TNT	Exploded	5,342	1,400	4
Propellant, Ammonium Perchlorate	Burned	531	531	1
HBX	Exploded	8,000	1,400	6
Black (smokeless) Powder	Burned	1,322	1,322	1

Notes:
HEI = High Explosive Incendiary
mm = Millimeter
RDX = Research Department Explosive
TNT = Trinitrotoluene

Table 8
Maximum Modeled Hourly Concentrations/ Depositions

Ordnance	1,3 Butadiene Concentration (µg/m³)	1-Hexene Concentration (µg/m³)	2,4-Dinitro-toluene Concentration (µg/m³)	Allyl Chloride Concentration (µg/m³)	Aluminum Concentration (µg/m³)	Aluminum Deposition (µg/m²)	Antimony Concentration (µg/m³)	Antimony Deposition (µg/m²)
40 mm Cartridge	3.49E-06	3.01E-06	n/a	n/a	4.25E-02	2.22E+02	n/a	n/a
Composition B	n/a	9.07E-07	n/a	n/a	n/a	n/a	n/a	n/a
Flare, ..., M206	2.88E-05	5.76E-05	n/a	1.73E-04	3.00E-01	1.51E+03	n/a	n/a
Fuze...Tail FMU 139A/B	3.48E-05	1.44E-05	n/a	4.97E-05	2.12E-01	1.10E+03	1.43E-03	1.41E+01
M-1 Nitrocellulose	n/a	n/a	1.14E-08	n/a	n/a	n/a	n/a	n/a
Propellant M-9 — Expld	n/a	2.86E-07	n/a	n/a	n/a	n/a	n/a	n/a
Propellant M-9 — Burn	n/a	2.02E-06	n/a	n/a	n/a	n/a	n/a	n/a
Propellant M31A1E1	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
RDX	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Signal Illuminators	3.77E-05	1.88E-04	n/a	3.57E-04	3.81E-01	1.91E+03	n/a	n/a
TNT	1.22E-06	1.58E-06	n/a	n/a	3.81E-03	1.97E+01	2.37E-06	2.41E-02
Propell, Am Perc, Al	n/a	n/a	n/a	n/a	7.62E-01	3.80E+03	n/a	n/a
HBX	7.59E-07	1.46E-06	n/a	n/a	1.98E-02	1.07E+02	n/a	n/a
Black (smokeless) Powder	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Ordnance	Barium Concentration (µg/m³)	Barium Deposition (µg/m²)	Benzene Concentration (µg/m³)	Cadmium Concentration (µg/m³)	Cadmium Deposition (µg/m²)	Carbon Tetrachloride Concentration (µg/m³)	Cl2 Concentration (µg/m³)	Chloroform Concentration (µg/m³)
40 mm Cartridge	n/a	n/a	1.91E-05	1.09E-04	1.27E+00	3.08E-06	n/a	n/a
Composition B	n/a	n/a	1.47E-06	n/a	n/a	2.04E-07	n/a	n/a
Flare, ..., M206	5.59E-03	3.70E+01	4.32E-04	7.16E-04	8.27E+00	n/a	n/a	n/a
Fuze...Tail FMU 139A/B	n/a	n/a	1.99E-04	1.53E-02	1.81E+02	4.47E-06	n/a	n/a
M-1 Nitrocellulose	n/a	n/a	4.55E-05	n/a	n/a	n/a	n/a	n/a
Propellant M-9 — Expld	n/a	n/a	4.36E-06	n/a	n/a	3.13E-07	n/a	n/a
Propellant M-9 — Burn	n/a	n/a	3.08E-05	n/a	n/a	2.21E-06	n/a	n/a
Propellant M31A1E1	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
RDX	n/a	n/a	3.61E-05	n/a	n/a	n/a	n/a	n/a
Signal Illuminators	5.35E-03	3.23E+01	6.74E-04	2.26E-03	2.53E+01	n/a	n/a	n/a
TNT	2.32E-02	1.49E+02	2.95E-06	1.39E-04	1.61E+00	n/a	n/a	n/a
Propell, Am Perc, Al	5.78E-04	3.52E+00	n/a	n/a	n/a	n/a	1.25E-01	n/a
HBX	n/a	n/a	3.91E-06	n/a	n/a	2.12E-07	n/a	2.06E-07
Black (smokeless) Powder	n/a	n/a	8.53E-07	n/a	n/a	n/a	n/a	n/a

Notes:
mm = millimeter
µg/m³ = Microgram per cubic meter
µg/m² = Microgram per meter squared
TNT = Trinitrotoluene
Cl2 = Chlorine
HCl = Hydrochloric acid
n/a = not applicable

Table 8 (Continued)
Maximum Modeled Hourly Concentrations/ Depositions

Ordnance	Chromium Concentration (µg/m³)	Chromium Deposition (µg/m²)	Copper Concentration (µg/m³)	Copper Deposition (µg/m²)	Diethyl phthalate Concentration (µg/m³)	Diphenyl-amine Concentration (µg/m³)	Ethylbenzene Concentration (µg/m³)	HCL Concentration (µg/m³)
40mm Cartridge	3.04E-04	3.23E+00	3.00E-02	3.54E+02	n/a	n/a	1.71E-06	n/a
Composition B	n/a	n/a	n/a	n/a	n/a	n/a	1.13E-06	n/a
Flare, ..., M206	3.80E-03	3.93E+01	n/a	n/a	n/a	n/a	2.30E-05	n/a
Fuze...Tail FMU 139A/B	8.90E-04	9.59E+00	4.50E-02	5.40E+02	2.49E-03	n/a	5.30E-06	n/a
M-1 Nitrocellulose	n/a	n/a	n/a	n/a	n/a	1.04E-09	n/a	n/a
Propellant M-9 — Expld	n/a	n/a	3.47E-05	4.28E-01	n/a	n/a	n/a	n/a
Propellant M-9 — Burn	n/a	n/a	1.33E-04	1.60E+00	n/a	n/a	n/a	n/a
Propellant M31A1E1	n/a	n/a	2.05E-04	2.46E+00	n/a	n/a	n/a	n/a
RDX	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Signal Illuminators	1.72E-03	1.75E+01	9.14E-03	1.06E+02	n/a	n/a	9.12E-06	n/a
TNT	8.29E-05	8.76E-01	1.70E-03	2.00E+01	n/a	n/a	3.38E-07	n/a
Propell, Am Perc, Al	4.57E-04	4.65E+00	n/a	n/a	n/a	n/a	n/a	7.05E+00
HBX	n/a	n/a	9.50E-03	1.16E+02	n/a	n/a	9.76E-07	n/a
Black (smokeless) Powder	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Ordnance	Lead Concentration (µg/m³)	Lead Deposition (µg/m²)	Methyl Chloride Concentration (µg/m³)	Methyl Chloroform Concentration (µg/m³)	Methylcyclo- hexane Concentration (µg/m³)	Methylene chloride Concentration (µg/m³)	Naphthtalene Concentration (µg/m³)	Phenol Concentration (µg/m³)
40mm Cartridge	1.07E-03	1.54E+01	n/a	n/a	1.71E-06	5.95E-04	n/a	n/a
Composition B	n/a	n/a	n/a	n/a	1.30E-06	7.93E-05	n/a	n/a
Flare, ..., M206	n/a	n/a	9.60E-06	n/a	3.27E-06	3.94E-03	n/a	n/a
Fuze...Tail FMU 139A/B	1.46E-02	1.98E+02	7.79E-06	2.65E-05	n/a	1.82E-04	n/a	n/a
M-1 Nitrocellulose	n/a	n/a	n/a	n/a	n/a	n/a	1.80E-07	3.25E-08
Propellant M-9 - Expld	n/a	n/a	2.04E-07	n/a	n/a	n/a	n/a	n/a
Propellant M-9 – Burn	n/a	n/a	1.44E-06	n/a	n/a	n/a	n/a	n/a
Propellant M31A1E1	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
RDX	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Signal Illuminators	1.59E-03	2.25E+01	3.37E-05	n/a	n/a	1.61E-04	n/a	n/a
TNT	2.75E-05	3.95E-01	n/a	n/a	3.67E-06	1.30E-04	n/a	n/a
Propell, Am Perc, Al	1.38-03	1.83E+01	n/a	n/a	n/a	n/a	n/a	n/a
HBX	n/a	n/a	3.42E-07	2.06E-07	3.31E-06	1.46E-04	n/a	n/a
Black (smokeless) Powder	n/a	n/a	n/a	n/a	3.41E-07	5.12E-07	n/a	n/a

Ordnance	RDX Concentration (µg/m³)	Styrene Concentration (µg/m³)	Toluene Concentration (µg/m³)	Vinyl Chloride Concentration (µg/m³)	Zinc Concentration (µg/m³)	Zinc Deposition (µg/m²)	n-Hexane Concentration (µg/m³)
40mm Cartridge	2.53E-05	2.87E-05	1.78E-05	n/a	3.79E-03	4.01E+01	1.30E-05
Composition B	n/a	n/a	3.40E-06	n/a	n/a	n/a	3.11E-07
Flare, ..., M206	5.76E-04	6.82E-05	2.69E-04	1.44E-05	n/a	n/a	6.53E-06
Fuze...Tail FMU 139A/B	5.63E-04	4.81E-05	3.81E-05	2.98E-06	3.94E-02	4.21E+02	1.08E-06
M-1 Nitrocellulose	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Propellant M-9 — Expld	n/a	6.40E-07	n/a	n/a	n/a	n/a	n/a
Propellant M-9 — Burn	n/a	4.52E-06	n/a	n/a	n/a	n/a	n/a
Propellant M31A1E1	n/a	n/a	n/a	n/a	n/a	n/a	n/a
RDX	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Signal Illuminators	3.77E-03	8.93E-05	5.95E-04	4.56E-05	1.03E-02	1.05E+02	1.61E-05
TNT	6.91E-06	1.08E-06	3.67E-06	n/a	3.60E-05	3.79E-01	6.69E-07
Propell, Am Perc, Al	n/a	n/a	n/a	n/a	1.83E-03	1.86E+00	n/a
HBX	n/a	n/a	1.79E-06	n/a	3.76E-04	4.07E+00	2.98E-07
Black (smokeless) Powder	n/a	n/a	2.42E-06	n/a	n/a	n/a	6.82E-07

Table 9
Maximum Annual Concentrations/ Depositions

Ordnance	1,3 Butadiene Concentration[1] (µg/m³)	1-Hexene Concentration[1] (µg/m³)	2,4-Dinitro-toluene Concentration[1] (µg/m³)	Allyl Chloride Concentration[1] (µg/m³)	Aluminum Concentration[1] (µg/m³)	Aluminum Deposition[2] (µg/m²)	Antimony Concentration[1] (µg/m³)	Antimony Deposition[2] (µg/m²)
40mm Cartridge	6.37E-09	5.49E-09	n/a	n/a	7.76E-05	3.55E+03	n/a	n/a
Composition B	n/a	1.55E-09	n/a	n/a	n/a	n/a	n/a	n/a
Flare, ..., M206	5.26E-08	1.05E-07	n/a	3.16E-07	5.49E-04	2.41E+04	n/a	n/a
Fuze...Tail FMU 139A/B	3.97E-09	1.65E-09	n/a	5.68E-09	2.42E-05	1.10E+03	1.63E-07	1.41E+01
M-1 Nitrocellulose	n/a	n/a	1.71E-10	n/a	n/a	n/a	n/a	n/a
Propellant M-9 - Expld	n/a	3.26E-11	n/a	n/a	n/a	n/a	n/a	n/a
Propellant M-9 – Burn	n/a	7.88E-08	n/a	n/a	n/a	n/a	n/a	n/a
Propellant M31A1E1	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
RDX	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Signal Illuminators	4.30E-09	2.15E-08	n/a	4.08E-08	4.34E-05	1.91E+03	n/a	n/a
TNT	5.59E-10	7.23E-10	n/a	n/a	1.74E-06	7.90E+01	1.08E-09	9.63E-02
Propell, Am Perc, Al	n/a	n/a	n/a	n/a	8.70E-05	3.80E+03	n/a	n/a
HBX	5.20E-10	1.00E-09	n/a	n/a	1.36E-05	6.42E+02	n/a	n/a
Black (smokeless) Powder	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Ordnance	Barium Concentration[1] (µg/m³)	Barium Deposition[2] (µg/m²)	Benzene Concentration[1] (µg/m³)	Cadmium Concentration[1] (µg/m³)	Cadmium Deposition[2] (µg/m²)	Carbon Tetrachloride Concentration[1] (µg/m³)	Cl2 Concentration[1] (µg/m³)	Chloroform Concentration[1] (µg/m³)
40mm Cartridge	n/a	n/a	3.36E-08	2.00E-07	2.04E+01	5.62E-09	n/a	n/a
Composition B	n/a	n/a	2.52E-09	n/a	n/a	3.49E-10	n/a	n/a
Flare, ..., M206	1.02E-05	5.92E+02	7.89E-07	1.31E-06	1.32E+02	n/a	n/a	n/a
Fuze...Tail FMU 139A/B	n/a	n/a	2.27E-08	1.74E-06	1.81E+02	5.11E-10	n/a	n/a
M-1 Nitrocellulose	n/a	n/a	6.85E-07	n/a	n/a	n/a	n/a	n/a
Propellant M-9 — Expld	n/a	n/a	4.97E-10	n/a	n/a	3.58E-11	n/a	n/a
Propellant M-9 — Burn	n/a	n/a	1.20E-06	n/a	n/a	8.63E-08	n/a	n/a
Propellant M31A1E1	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
RDX	n/a	n/a	4.70E-07	n/a	n/a	n/a	n/a	n/a
Signal Illuminators	6.11E-07	3.23E+01	7.70E-08	2.58E-07	2.53E+01	n/a	n/a	n/a
TNT	1.06E-05	5.96E+02	1.35E-09	6.35E-08	6.42E+00	n/a	n/a	n/a
Propell, Am Perc, Al	6.60E-08	3.52E+00	n/a	n/a	n/a	n/a	1.43E-05	n/a
HBX	n/a	n/a	2.68E-09	n/a	n/a	1.45E-10	n/a	1.41E-10
Smokeless (Blk) Powder	n/a	n/a	9.73E-11	n/a	n/a	n/a	n/a	n/a

Ordnance	Chromium Concentration[1] (µg/m³)	Chromium Deposition[2] (µg/m²)	Copper Concentration[1] (µg/m³)	Copper Deposition[2] (µg/m²)	Diethyl phthalate Concentration[1] (µg/m³)	Diphenyl-amine Concentration[1] (µg/m³)	Ethylbenzene Concentration[1] (µg/m³)	HCL Concentration[1] (µg/m³)
40mm Cartridge	5.55E-07	5.17E+01	5.47E-05	5.66E+03	n/a	n/a	3.12E-09	n/a
Composition B	n/a	n/a	n/a	n/a	n/a	n/a	1.94E-09	n/a
Flare, ..., M206	6.94E-06	6.29E+02	n/a	n/a	n/a	n/a	4.21E-08	n/a
Fuze...Tail FMU 139A/B	1.02E-07	9.59E+00	5.14E-06	5.40E+02	2.84E-07	n/a	6.05E-10	n/a
M-1 Nitrocellulose	n/a	n/a	n/a	n/a	n/a	1.57E-11	n/a	n/a
Propellant M-9 — Expld	n/a	n/a	3.97E-09	4.28E-01	n/a	n/a	n/a	n/a
Propellant M-9 — Burn	n/a	n/a	5.21E-06	5.46E+02	n/a	n/a	n/a	n/a
Propellant M31A1E1	n/a	n/a	2.11E-07	2.21E+01	n/a	n/a	n/a	n/a
RDX	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Signal Illuminators	1.97E-07	1.75E+01	1.04E-06	1.06E+02	n/a	n/a	1.04E-09	n/a
TNT	3.78E-08	3.50E+00	7.78E-07	7.99E+01	n/a	n/a	1.54E-10	n/a
Propell, Am Perc, Al	5.21E-08	4.65E+00	n/a	n/a	n/a	n/a	n/a	8.04E-04
HBX	n/a	n/a	6.51E-06	6.94E+02	n/a	n/a	6.69E-10	n/a
Smokeless (Blk) Powder	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Table 9 (Continued)
Maximum Annual Concentrations/ Depositions

Ordnance	Lead Concentration[1] (µg/m³)	Lead Deposition[2] (µg/m²)	Methyl Chloride Concentration[1] (µg/m³)	Methyl Chloroform Concentration[1] (µg/m³)	Methylcyclo- hexane Concentration[1] (µg/m³)	Methylene chloride Concentration[1] (µg/m³)	Naphthtalene Concentration[1] (µg/m³)	Phenol Concentration[1] (µg/m³)
40mm Cartridge	1.95E-06	2.47E+02	n/a	n/a	3.12E-09	1.09E-06	n/a	n/a
Composition B	n/a	n/a	n/a	n/a	2.23E-09	1.36E-07	n/a	n/a
Flare, ..., M206	n/a	n/a	1.75E-08	n/a	5.96E-09	7.19E-06	n/a	n/a
Fuze...Tail FMU 139A/B	1.67E-06	1.98E+02	8.89E-10	3.03E-09	n/a	2.08E-08	n/a	n/a
M-1 Nitrocellulose	n/a	n/a	n/a	n/a	n/a	n/a	2.71E-09	4.90E-10
Propellant M-9 — Expld	n/a	n/a	2.33E-11	n/a	n/a	n/a	n/a	n/a
Propellant M-9 — Burn	n/a	n/a	5.63E-08	n/a	n/a	n/a	n/a	n/a
Propellant M31A1E1	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
RDX	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Signal Illuminators	1.81E-07	2.25E+01	3.85E-09	n/a	n/a	1.83E-08	n/a	n/a
TNT	1.26E-08	1.58E+00	n/a	n/a	1.68E-09	5.92E-08	n/a	n/a
Propell, Am Perc, Al	1.57E-07	1.83E+01	n/a	n/a	n/a	n/a	n/a	n/a
HBX	n/a	n/a	2.34E-10	1.41E-10	2.27E-09	1.00E-07	n/a	n/a
Smokeless (Blk) Powder	n/a	n/a	n/a	n/a	3.89E-11	5.84E-11	n/a	n/a

Ordnance	RDX Concentration[1] (µg/m³)	Styrene Concentration[1] (µg/m³)	Toluene Concentration[1] (µg/m³)	Vinyl Chloride Concentration[1] (µg/m³)	Zinc Concentration[1] (µg/m³)	Zinc Deposition[2] (µg/m²)	n-Hexane Concentration[1] (µg/m³)
40mm Cartridge	4.62E-08	5.24E-08	3.25E-08	n/a	6.92E-06	6.41E+02	2.37E-08
Composition B	n/a	n/a	5.82E-09	n/a	n/a	n/a	5.33E-10
Flare, ..., M206	1.05E-06	1.25E-07	4.91E-07	2.63E-08	n/a	n/a	1.19E-08
Fuze...Tail FMU 139A/B	6.43E-08	5.49E-09	4.35E-09	3.41E-10	4.50E-06	4.21E+02	1.23E-10
M-1 Nitrocellulose	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Propellant M-9 — Expld	n/a	7.31E-11	n/a	n/a	n/a	n/a	n/a
Propellant M-9 — Burn	n/a	1.76E-07	n/a	n/a	n/a	n/a	n/a
Propellant M31A1E1	n/a	n/a	n/a	n/a	n/a	n/a	n/a
RDX	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Signal Illuminators	4.30E-07	1.02E-08	6.79E-08	5.21E-09	1.18E-06	1.05E+02	1.83E-09
TNT	3.16E-09	4.93E-10	1.68E-09	n/a	1.64E-08	1.51E+00	3.06E-10
Propell, Am Perc, Al	n/a	n/a	n/a	n/a	2.09E-07	1.86E+01	n/a
HBX	n/a	n/a	1.23E-09	n/a	2.57E-07	2.44E+01	2.04E-10
Smokeless (Blk) Powder	n/a	n/a	2.76E-10	n/a	n/a	n/a	7.79E-11

1. Annual concentration results are calculated using: (1-hr result) x (No. of Events per Year)/ 8760 hours/year.
2. Annual deposition results are calculated using: (1-hr results) x (No. of Events per Year).

Notes:
mm = millimeter
µg/m³ = Microgram per cubic meter
µg/m² = Microgram per meter squared
TNT = Trinitrotoluene
Cl2 = Chlorine
HCl = Hydrochloric acid
n/a = not applicable

Appendix A
Modeling Files and Descriptions

Modeling Files and Descriptions				
40MM OBODM files.zip				
Run Name (inp, .out)	**Ordnance**	**Run Type**	**Exploded/Burned**	**Chemical**
40m1BUTc	40mm Crtridge-Grid1	conc only (volatile)	exploded	1,3-Butadiene
40m11HXc	40mm Crtridge-Grid1	conc only (volatile)	exploded	1-Hexene
40m1ALMc	40mm Crtridge-Grid1	conc w/ depletion	exploded	Aluminum
40m1ALMd	40mm Crtridge-Grid1	depos only	exploded	Aluminum
40m1BENc	40mm Crtridge-Grid1	conc only (volatile)	exploded	Benzene
40m1CADc	40mm Crtridge-Grid1	conc w/ depletion	exploded	Cadmium
40m1CADd	40mm Crtridge-Grid1	depos only	exploded	Cadmium
40m1CTCc	40mm Crtridge-Grid1	conc only (volatile)	exploded	Carbon Tetrachloride
40m1CHRc	40mm Crtridge-Grid1	conc w/ depletion	exploded	Chromium
40m1CHRd	40mm Crtridge-Grid1	depos only	exploded	Chromium
40m1COPc	40mm Crtridge-Grid1	conc w/ depletion	exploded	Copper
40m1COPd	40mm Crtridge-Grid1	depos only	exploded	Copper
40m1ETHc	40mm Crtridge-Grid1	conc only (volatile)	exploded	Ethylbenzene
40m1LEDc	40mm Crtridge-Grid1	conc w/ depletion	exploded	Lead
40m1LEDd	40mm Crtridge-Grid1	depos only	exploded	Lead
40m1MCYc	40mm Crtridge-Grid1	conc only (volatile)	exploded	Methylcyclohexane
40m1MCLc	40mm Crtridge-Grid1	conc only (volatile)	exploded	Methylenechloride
40m1RDXc	40mm Crtridge-Grid1	conc only (volatile)	exploded	RDX
40m1STYc	40mm Crtridge-Grid1	conc only (volatile)	exploded	Styrene
40m1TOLc	40mm Crtridge-Grid1	conc only (volatile)	exploded	Toluene
40m1ZNCc	40mm Crtridge-Grid1	conc w/ depletion	exploded	Zinc
40m1ZNCd	40mm Crtridge-Grid1	depos only	exploded	Zinc
40m1NHXc	40mm Crtridge-Grid1	conc only (volatile)	exploded	n-Hexane
40m2BUTc	40mm Crtridge-Grid2	conc only (volatile)	exploded	1,3-Butadiene
40m21HXc	40mm Crtridge-Grid2	conc only (volatile)	exploded	1-Hexene
40m2ALMc	40mm Crtridge-Grid2	conc w/ depletion	exploded	Aluminum
40m2ALMd	40mm Crtridge-Grid2	depos only	exploded	Aluminum
40m2BENc	40mm Crtridge-Grid2	conc only (volatile)	exploded	Benzene
40m2CADc	40mm Crtridge-Grid2	conc w/ depletion	exploded	Cadmium
40m2CADd	40mm Crtridge-Grid2	depos only	exploded	Cadmium
40m2CTCc	40mm Crtridge-Grid2	conc only (volatile)	exploded	Carbon Tetrachloride
40m2CHRc	40mm Crtridge-Grid2	conc w/ depletion	exploded	Chromium
40m2CHRd	40mm Crtridge-Grid2	depos only	exploded	Chromium
40m2COPc	40mm Crtridge-Grid2	conc w/ depletion	exploded	Copper
40m2COPd	40mm Crtridge-Grid2	depos only	exploded	Copper
40m2ETHc	40mm Crtridge-Grid2	conc only (volatile)	exploded	Ethylbenzene
40m2LEDc	40mm Crtridge-Grid2	conc w/ depletion	exploded	Lead
40m2LEDd	40mm Crtridge-Grid2	depos only	exploded	Lead
40m2MCYc	40mm Crtridge-Grid2	conc only (volatile)	exploded	Methylcyclohexane
40m2MCLc	40mm Crtridge-Grid2	conc only (volatile)	exploded	Methylenechloride
40m2RDXc	40mm Crtridge-Grid2	conc only (volatile)	exploded	RDX
40m2STYc	40mm Crtridge-Grid2	conc only (volatile)	exploded	Styrene
40m2TOLc	40mm Crtridge-Grid2	conc only (volatile)	exploded	Toluene
40m2ZNCc	40mm Crtridge-Grid2	conc w/ depletion	exploded	Zinc
40m2ZNCd	40mm Crtridge-Grid2	depos only	exploded	Zinc
40m2NHXc	40mm Crtridge-Grid2	conc only (volatile)	exploded	n-Hexane
40mm.txt	40mm Cartridge	Hourly source file		

Modeling Files and Descriptions				
CMPB OBODM files.zip				
Run Name (inp, .out)	**Ordnance**	**Run Type**	**Exploded/Burned**	**Chemical**
Cmp11HXc	Composition B-Grid1	conc only (volatile)	exploded	1-Hexane
Cmp1BENc	Composition B-Grid1	conc only (volatile)	exploded	Benzene
Cmp1CTCc	Composition B-Grid1	conc only (volatile)	exploded	Carbon Tetrachloride
Cmp1ETHc	Composition B-Grid1	conc only (volatile)	exploded	Ethylbenzene
Cmp1MCYc	Composition B-Grid1	conc only (volatile)	exploded	Methylcyclohexane
Cmp1MCLc	Composition B-Grid1	conc only (volatile)	exploded	Methylenechloride
Cmp1TOLc	Composition B-Grid1	conc only (volatile)	exploded	Toluene
Cmp1NHXc	Composition B-Grid1	conc only (volatile)	exploded	n-Hexane
Cmp21HXc	Composition B-Grid2	conc only (volatile)	exploded	1-Hexane
Cmp2BENc	Composition B-Grid2	conc only (volatile)	exploded	Benzene
Cmp2CTCc	Composition B-Grid2	conc only (volatile)	exploded	Carbon Tetrachloride
Cmp2ETHc	Composition B-Grid2	conc only (volatile)	exploded	Ethylbenzene
Cmp2MCYc	Composition B-Grid2	conc only (volatile)	exploded	Methylcyclohexane
Cmp2MCLc	Composition B-Grid2	conc only (volatile)	exploded	Methylenechloride
Cmp2TOLc	Composition B-Grid2	conc only (volatile)	exploded	Toluene
Cmp2NHXc	Composition B-Grid2	conc only (volatile)	exploded	n-Hexane
Cmpb.txt	Composition B	Hourly source file		
FLAR OBODM files.zip				
Fla1BUTc	Flare,... M206-Grid1	conc only (volatile)	burned	1,3-Butadiene
Fla11HXc	Flare,... M206-Grid1	conc only (volatile)	burned	1-Hexene
Fla1ALCc	Flare,... M206-Grid1	conc only (volatile)	burned	Allyl Chloride
Fla1ALMc	Flare,... M206-Grid1	conc w/ depletion	burned	Aluminum
Fla1ALMd	Flare,... M206-Grid1	depos only	burned	Aluminum
Fla1BARc	Flare,... M206-Grid1	conc w/ depletion	burned	Barium
Fla1BARd	Flare,... M206-Grid1	depos only	burned	Barium
Fla1BENc	Flare,... M206-Grid1	conc only (volatile)	burned	Benzene
Fla1CADc	Flare,... M206-Grid1	conc w/ depletion	burned	Cadmium
Fla1CADd	Flare,... M206-Grid1	depos only	burned	Cadmium
Fla1CHRc	Flare,... M206-Grid1	conc w/ depletion	burned	Chromium
Fla1CHRd	Flare,... M206-Grid1	depos only	burned	Chromium
Fla1ETHc	Flare,... M206-Grid1	conc only (volatile)	burned	Ethylbenzene
Fla1MCHc	Flare,... M206-Grid1	conc only (volatile)	burned	Methyl Chloride
Fla1MCYc	Flare,... M206-Grid1	conc only (volatile)	burned	Methylcyclohexane
Fla1MCLc	Flare,... M206-Grid1	conc only (volatile)	burned	Methylenechloride
Fla1RDXc	Flare,... M206-Grid1	conc only (volatile)	burned	RDX
Fla1STYc	Flare,... M206-Grid1	conc only (volatile)	burned	Styrene
Fla1TOLc	Flare,... M206-Grid1	conc only (volatile)	burned	Toluene
Fla1VCHc	Flare,... M206-Grid1	conc only (volatile)	burned	Vinyl Chloride
Fla1NHXc	Flare,... M206-Grid1	conc only (volatile)	burned	n-Hexane
Fla2BUTc	Flare,... M206-Grid2	conc only (volatile)	burned	1,3-Butadiene
Fla21HXc	Flare,... M206-Grid2	conc only (volatile)	burned	1-Hexene
Fla2ALCc	Flare,... M206-Grid2	conc only (volatile)	burned	Allyl Chloride
Fla2ALMc	Flare,... M206-Grid2	conc w/ depletion	burned	Aluminum
Fla2ALMd	Flare,... M206-Grid2	depos only	burned	Aluminum
Fla2BARc	Flare,... M206-Grid2	conc w/ depletion	burned	Barium
Fla2BARd	Flare,... M206-Grid2	depos only	burned	Barium
Fla2BENc	Flare,... M206-Grid2	conc only (volatile)	burned	Benzene
Fla2CADc	Flare,... M206-Grid2	conc w/ depletion	burned	Cadmium
Fla2CADd	Flare,... M206-Grid2	depos only	burned	Cadmium
Fla2CHRc	Flare,... M206-Grid2	conc w/ depletion	burned	Chromium

Modeling Files and Descriptions				
FLAR OBODM files.zip — (continued)				
Run Name (inp, .out)	**Ordnance**	**Run Type**	**Exploded/Burned**	**Chemical**
Fla2CHRd	Flare,... M206-Grid2	depos only	burned	Chromium
Fla2ETHc	Flare,... M206-Grid2	conc only (volatile)	burned	Ethylbenzene
Fla2MCHc	Flare,... M206-Grid2	conc only (volatile)	burned	Methyl Chloride
Fla1MCYc	Flare,... M206-Grid1	conc only (volatile)	burned	Methylcyclohexane
Fla2MCLc	Flare,... M206-Grid2	conc only (volatile)	burned	Methylenechloride
Fla2RDXc	Flare,... M206-Grid2	conc only (volatile)	burned	RDX
Fla2STYc	Flare,... M206-Grid2	conc only (volatile)	burned	Styrene
Fla2TOLc	Flare,... M206-Grid2	conc only (volatile)	burned	Toluene
Fla2VCHc	Flare,... M206-Grid2	conc only (volatile)	burned	Vinyl Chloride
Fla2NHXc	Flare,... M206-Grid2	conc only (volatile)	burned	n-Hexane
Flar.txt	Flare,... M206	Hourly source file		
FUZE OBODM files.zip				
Fuz1BUTc	Fuze,...139A/B-Grid1	conc only (volatile)	exploded	1,3-Butadiene
Fuz11HXc	Fuze,...139A/B-Grid1	conc only (volatile)	exploded	1-Hexene
Fuz1ALCc	Fuze,...139A/B-Grid1	conc only (volatile)	exploded	Allyl Chloride
Fuz1ALMc	Fuze,...139A/B-Grid1	conc w/ depletion	exploded	Aluminum
Fuz1ALMd	Fuze,...139A/B-Grid1	depos only	exploded	Aluminum
Fuz1ANTc	Fuze,...139A/B-Grid1	conc w/ depletion	exploded	Antimony
Fuz1ANTd	Fuze,...139A/B-Grid1	depos only	exploded	Antimony
Fuz1BENc	Fuze,...139A/B-Grid1	conc only (volatile)	exploded	Benzene
Fuz1CADc	Fuze,...139A/B-Grid1	conc w/ depletion	exploded	Cadmium
Fuz1CADd	Fuze,...139A/B-Grid1	depos only	exploded	Cadmium
Fuz1CTCc	Fuze,...139A/B-Grid1	conc only (volatile)	exploded	Carbon Tetrachloride
Fuz1CHRc	Fuze,...139A/B-Grid1	conc w/ depletion	exploded	Chromium
Fuz1CHRd	Fuze,...139A/B-Grid1	depos only	exploded	Chromium
Fuz1COPc	Fuze,...139A/B-Grid1	conc w/ depletion	exploded	Copper
Fuz1COPd	Fuze,...139A/B-Grid1	depos only	exploded	Copper
Fuz1DIPc	Fuze,...139A/B-Grid1	conc only (volatile)	exploded	Diethyl Phthalate
Fuz1ETHc	Fuze,...139A/B-Grid1	conc only (volatile)	exploded	Ethylbenzene
Fuz1LEDc	Fuze,...139A/B-Grid1	conc w/ depletion	exploded	Lead
Fuz1LEDd	Fuze,...139A/B-Grid1	depos only	exploded	Lead
Fuz1MCHc	Fuze,...139A/B-Grid1	conc only (volatile)	exploded	Methyl Chloride
Fuz1MCFc	Fuze,...139A/B-Grid1	conc only (volatile)	exploded	Methyl Chloroform
Fuz1MCLc	Fuze,...139A/B-Grid1	conc only (volatile)	exploded	Methylenechloride
Fuz1RDXc	Fuze,...139A/B-Grid1	conc only (volatile)	exploded	RDX
Fuz1STYc	Fuze,...139A/B-Grid1	conc only (volatile)	exploded	Styrene
Fuz1TOLc	Fuze,...139A/B-Grid1	conc only (volatile)	exploded	Toluene
Fuz1VCHc	Fuze,...139A/B-Grid1	conc only (volatile)	exploded	Vinyl Chloride
Fuz1ZNCc	Fuze,...139A/B-Grid1	conc w/ depletion	exploded	Zinc
Fuz1ZNCd	Fuze,...139A/B-Grid1	depos only	exploded	Zinc
Fuz1NHXc	Fuze,...139A/B-Grid1	conc only (volatile)	exploded	n-Hexane
Fuz2BUTc	Fuze,...139A/B-Grid2	conc only (volatile)	exploded	1,3-Butadiene
Fuz21HXc	Fuze,...139A/B-Grid2	conc only (volatile)	exploded	1-Hexene
Fuz2ALCc	Fuze,...139A/B-Grid2	conc only (volatile)	exploded	Allyl Chloride
Fuz2ALMc	Fuze,...139A/B-Grid2	conc w/ depletion	exploded	Aluminum
Fuz2ALMd	Fuze,...139A/B-Grid2	depos only	exploded	Aluminum
Fuz2ANTc	Fuze,...139A/B-Grid2	conc w/ depletion	exploded	Antimony
Fuz2ANTd	Fuze,...139A/B-Grid2	depos only	exploded	Antimony
Fuz2BENc	Fuze,...139A/B-Grid2	conc only (volatile)	exploded	Benzene
Fuz2CADc	Fuze,...139A/B-Grid2	conc w/ depletion	exploded	Cadmium

Modeling Files and Descriptions				
FUZE OBODM files.zip — (continued)				
Run Name (inp, .out)	**Ordnance**	**Run Type**	**Exploded/Burned**	**Chemical**
Fuz2CADd	Fuze,...139A/B-Grid2	depos only	exploded	Cadmium
Fuz2CTCc	Fuze,...139A/B-Grid2	conc only (volatile)	exploded	Carbon Tetrachloride
Fuz2CHRc	Fuze,...139A/B-Grid2	conc w/ depletion	exploded	Chromium
Fuz2CHRd	Fuze,...139A/B-Grid2	depos only	exploded	Chromium
Fuz2COPc	Fuze,...139A/B-Grid2	conc w/ depletion	exploded	Copper
Fuz2COPd	Fuze,...139A/B-Grid2	depos only	exploded	Copper
Fuz2DIPc	Fuze,...139A/B-Grid2	conc only (volatile)	exploded	Diethyl Phthalate
Fuz2ETHc	Fuze,...139A/B-Grid2	conc only (volatile)	exploded	Ethylbenzene
Fuz2LEDc	Fuze,...139A/B-Grid2	conc w/ depletion	exploded	Lead
Fuz2LEDd	Fuze,...139A/B-Grid2	depos only	exploded	Lead
Fuz2MCHc	Fuze,...139A/B-Grid2	conc only (volatile)	exploded	Methyl Chloride
Fuz2MCFc	Fuze,...139A/B-Grid2	conc only (volatile)	exploded	Methyl Chloroform
Fuz2MCLc	Fuze,...139A/B-Grid2	conc only (volatile)	exploded	Methylenechloride
Fuz2RDXc	Fuze,...139A/B-Grid2	conc only (volatile)	exploded	RDX
Fuz2STYc	Fuze,...139A/B-Grid2	conc only (volatile)	exploded	Styrene
Fuz2TOLc	Fuze,...139A/B-Grid2	conc only (volatile)	exploded	Toluene
Fuz2VCHc	Fuze,...139A/B-Grid2	conc only (volatile)	exploded	Vinyl Chloride
Fuz2ZNCc	Fuze,...139A/B-Grid2	conc w/ depletion	exploded	Zinc
Fuz2ZNCd	Fuze,...139A/B-Grid2	depos only	exploded	Zinc
Fuz2NHXc	Fuze,...139A/B-Grid2	conc only (volatile)	exploded	n-Hexane
Fuze.txt	Fuze,...139A/B	Hourly source file		
M1NI OBODM files.zip				
M1n1DINc	M-1 Nitro - Grid1	conc only (volatile)	burned	2,4-Dinitrotoluene
M1n1BENc	M-1 Nitro - Grid1	conc only (volatile)	burned	Benzene
M1n1DIPc	M-1 Nitro - Grid1	conc only (volatile)	burned	Diphenylamine
M1n1NAPc	M-1 Nitro - Grid1	conc only (volatile)	burned	Naphthalene
M1n1PHEc	M-1 Nitro - Grid1	conc only (volatile)	burned	Phenol
M1n2DINc	M-1 Nitro - Grid2	conc only (volatile)	burned	2,4-Dinitrotoluene
M1n2BENc	M-1 Nitro - Grid2	conc only (volatile)	burned	Benzene
M1n2DIPc	M-1 Nitro - Grid2	conc only (volatile)	burned	Diphenylamine
M1n2NAPc	M-1 Nitro - Grid2	conc only (volatile)	burned	Naphthalene
M1n2PHEc	M-1 Nitro - Grid2	conc only (volatile)	burned	Phenol
M1ni.txt	M-1 Nitro	Hourly source file		
PM9 OBODM files.zip				
P9e11HXc	Propellant M-9-Grid1	conc only (volatile)	exploded	1-Hexane
P9e1BENc	Propellant M-9-Grid1	conc only (volatile)	exploded	Benzene
P9e1CTCc	Propellant M-9-Grid1	conc only (volatile)	exploded	Carbon Tetrachloride
P9e1COPc	Propellant M-9-Grid1	conc w/ depletion	exploded	Copper
P9e1COPd	Propellant M-9-Grid1	depos only	exploded	Copper
P9e1MCHc	Propellant M-9-Grid1	conc only (volatile)	exploded	Methyl Chloride
P9e1STYc	Propellant M-9-Grid1	conc only (volatile)	exploded	Styrene
P9e21HXc	Propellant M-9-Grid2	conc only (volatile)	exploded	1-Hexane
P9e2BENc	Propellant M-9-Grid2	conc only (volatile)	exploded	Benzene
P9e2CTCc	Propellant M-9-Grid2	conc only (volatile)	exploded	Carbon Tetrachloride
P9e2COPc	Propellant M-9-Grid2	conc w/ depletion	exploded	Copper
P9e2COPd	Propellant M-9-Grid2	depos only	exploded	Copper
P9e2MCHc	Propellant M-9-Grid2	conc only (volatile)	exploded	Methyl Chloride
P9e2STYc	Propellant M-9-Grid2	conc only (volatile)	exploded	Styrene
Pm9e.txt	Propellant M-9	Hourly source file - exploded		
P9b11HXc	Propellant M-9-Grid1	conc only (volatile)	burned	1-Hexane

Modeling Files and Descriptions				
PM9 OBODM files.zip — (continued)				
Run Name (inp, .out)	**Ordnance**	**Run Type**	**Exploded/Burned**	**Chemical**
P9b1BENc	Propellant M-9-Grid1	conc only (volatile)	burned	Benzene
P9b1CTCc	Propellant M-9-Grid1	conc only (volatile)	burned	Carbon Tetrachloride
P9b1COPc	Propellant M-9-Grid1	conc w/ depletion	burned	Copper
P9b1COPd	Propellant M-9-Grid1	depos only	burned	Copper
P9b1MCHc	Propellant M-9-Grid1	conc only (volatile)	burned	Methyl Chloride
P9b1STYc	Propellant M-9-Grid1	conc only (volatile)	burned	Styrene
P9b21HXc	Propellant M-9-Grid2	conc only (volatile)	burned	1-Hexane
P9b2BENc	Propellant M-9-Grid2	conc only (volatile)	burned	Benzene
P9b2CTCc	Propellant M-9-Grid2	conc only (volatile)	burned	Carbon Tetrachloride
P9b2COPc	Propellant M-9-Grid2	conc w/ depletion	burned	Copper
P9b2COPd	Propellant M-9-Grid2	depos only	burned	Copper
P9b2MCHc	Propellant M-9-Grid2	conc only (volatile)	burned	Methyl Chloride
P9b2STYc	Propellant M-9-Grid2	conc only (volatile)	burned	Styrene
Pm9b.txt	Propellant M-9	Hourly source file - burned		
PM31 OBODM files.zip				
Pm31COPc	Propl M31A1E1-Grid1	conc w/ depletion	burned	Copper
Pm31COPd	Propl M31A1E1-Grid1	depos only	burned	Copper
Pm32COPc	Propl M31A1E1-Grid2	conc w/ depletion	burned	Copper
Pm32COPd	Propl M31A1E1-Grid2	depos only	burned	Copper
Pm31.txt	Propellant M31A1E1	Hourly source file		
RDX OBODM files.zip				
Rdx1BENc	RDX-Grid1	conc only (volatile)	exploded	Benzene
Rdx2BENc	RDX-Grid2	conc only (volatile)	exploded	Benzene
Rdx.txt	RDX	Hourly source file		
SIG OBODM files.zip				
Sig1BUTc	Signal Illum-Grid1	conc only (volatile)	burned	1,3-Butadiene
Sig11HXc	Signal Illum-Grid1	conc only (volatile)	burned	1-Hexene
Sig1ALCc	Signal Illum-Grid1	conc only (volatile)	burned	Allyl Chloride
Sig1ALMc	Signal Illum-Grid1	conc w/ depletion	burned	Aluminum
Sig1ALMd	Signal Illum-Grid1	depos only	burned	Aluminum
Sig1BARc	Signal Illum-Grid1	conc w/ depletion	burned	Barium
Sig1BARd	Signal Illum-Grid1	depos only	burned	Barium
Sig1BENc	Signal Illum-Grid1	conc only (volatile)	burned	Benzene
Sig1CADc	Signal Illum-Grid1	conc w/ depletion	burned	Cadmium
Sig1CADd	Signal Illum-Grid1	depos only	burned	Cadmium
Sig1CHRc	Signal Illum-Grid1	conc w/ depletion	burned	Chromium
Sig1CHRd	Signal Illum-Grid1	depos only	burned	Chromium
Sig1COPc	Signal Illum-Grid1	conc w/ depletion	burned	Copper
Sig1COPd	Signal Illum-Grid1	depos only	burned	Copper
Sig1ETHc	Signal Illum-Grid1	conc only (volatile)	burned	Ethylbenzene
Sig1LEDc	Signal Illum-Grid1	conc w/ depletion	burned	Lead
Sig1LEDd	Signal Illum-Grid1	depos only	burned	Lead
Sig1MCHc	Signal Illum-Grid1	conc only (volatile)	burned	Methyl Chloride
Sig1MCLc	Signal Illum-Grid1	conc only (volatile)	burned	Methylenechloride
Sig1RDXc	Signal Illum-Grid1	conc only (volatile)	burned	RDX
Sig1STYc	Signal Illum-Grid1	conc only (volatile)	burned	Styrene
Sig1TOLc	Signal Illum-Grid1	conc only (volatile)	burned	Toluene
Sig1VCHc	Signal Illum-Grid1	conc only (volatile)	burned	Vinyl Chloride
Sig1ZNCc	Signal Illum-Grid1	conc w/ depletion	burned	Zinc
Sig1ZNCd	Signal Illum-Grid1	depos only	burned	Zinc

Modeling Files and Descriptions				
SIG OBODM files.zip — (continued)				
Run Name (inp, .out)	**Ordnance**	**Run Type**	**Exploded/Burned**	**Chemical**
Sig1NHXc	Signal Illum-Grid1	conc only (volatile)	burned	n-Hexane
Sig2BUTc	Signal Illum-Grid2	conc only (volatile)	burned	1,3-Butadiene
Sig21HXc	Signal Illum-Grid2	conc only (volatile)	burned	1-Hexene
Sig2ALCc	Signal Illum-Grid2	conc only (volatile)	burned	Allyl Chloride
Sig2ALMc	Signal Illum-Grid2	conc w/ depletion	burned	Aluminum
Sig2ALMd	Signal Illum-Grid2	depos only	burned	Aluminum
Sig2BARc	Signal Illum-Grid2	conc w/ depletion	burned	Barium
Sig2BARd	Signal Illum-Grid2	depos only	burned	Barium
Sig2BENc	Signal Illum-Grid2	conc only (volatile)	burned	Benzene
Sig2CADc	Signal Illum-Grid2	conc w/ depletion	burned	Cadmium
Sig2CADd	Signal Illum-Grid2	depos only	burned	Cadmium
Sig2CHRc	Signal Illum-Grid2	conc w/ depletion	burned	Chromium
Sig2CHRd	Signal Illum-Grid2	depos only	burned	Chromium
Sig2COPc	Signal Illum-Grid2	conc w/ depletion	burned	Copper
Sig2COPd	Signal Illum-Grid2	depos only	burned	Copper
Sig2ETHc	Signal Illum-Grid2	conc only (volatile)	burned	Ethylbenzene
Sig2LEDc	Signal Illum-Grid2	conc w/ depletion	burned	Lead
Sig2LEDd	Signal Illum-Grid2	depos only	burned	Lead
Sig2MCHc	Signal Illum-Grid2	conc only (volatile)	burned	Methyl Chloride
Sig2MCLc	Signal Illum-Grid2	conc only (volatile)	burned	Methylenechloride
Sig2RDXc	Signal Illum-Grid2	conc only (volatile)	burned	RDX
Sig2STYc	Signal Illum-Grid2	conc only (volatile)	burned	Styrene
Sig2TOLc	Signal Illum-Grid2	conc only (volatile)	burned	Toluene
Sig2VCHc	Signal Illum-Grid2	conc only (volatile)	burned	Vinyl Chloride
Sig2ZNCc	Signal Illum-Grid2	conc w/ depletion	burned	Zinc
Sig2ZNCd	Signal Illum-Grid2	depos only	burned	Zinc
Sig2NHXc	Signal Illum-Grid2	conc only (volatile)	burned	n-Hexane
Sig.txt	Signal Illum	Hourly source file		
TNT OBODM files.zip				
Tnt1BUTc	TNT-Grid1	conc only (volatile)	exploded	1,3-Butadiene
Tnt11HXc	TNT-Grid1	conc only (volatile)	exploded	1-Hexane
Tnt1ALMc	TNT-Grid1	conc w/ depletion	exploded	Aluminum
Tnt1ALMd	TNT-Grid1	depos only	exploded	Aluminum
Tnt1ANTc	TNT-Grid1	conc w/ depletion	exploded	Antimony
Tnt1ANTd	TNT-Grid1	depos only	exploded	Antimony
Tnt1BARc	TNT-Grid1	conc w/ depletion	exploded	Barium
Tnt1BARd	TNT-Grid1	depos only	exploded	Barium
Tnt1BENc	TNT-Grid1	conc only (volatile)	exploded	Benzene
Tnt1CADc	TNT-Grid1	conc w/ depletion	exploded	Cadmium
Tnt1CADd	TNT-Grid1	depos only	exploded	Cadmium
Tnt1CHRc	TNT-Grid1	conc w/ depletion	exploded	Chromium
Tnt1CHRd	TNT-Grid1	depos only	exploded	Chromium
Tnt1COPc	TNT-Grid1	conc w/ depletion	exploded	Copper
Tnt1COPd	TNT-Grid1	depos only	exploded	Copper
Tnt1ETHc	TNT-Grid1	conc only (volatile)	exploded	Ethylbenzene
Tnt1LEDc	TNT-Grid1	conc w/ depletion	exploded	Lead
Tnt1LEDd	TNT-Grid1	depos only	exploded	Lead
Tnt1MCYc	TNT-Grid1	conc only (volatile)	exploded	Methylcyclohexane
Tnt1MCLc	TNT-Grid1	conc only (volatile)	exploded	Methylenechloride
Tnt1RDXc	TNT-Grid1	conc only (volatile)	exploded	RDX

Modeling Files and Descriptions				
TNT OBODM files.zip — (continued)				
Run Name (inp, .out)	**Ordnance**	**Run Type**	**Exploded/Burned**	**Chemical**
Tnt1STYc	TNT-Grid1	conc only (volatile)	exploded	Styrene
Tnt1TOLc	TNT-Grid1	conc only (volatile)	exploded	Toluene
Tnt1ZNCc	TNT-Grid1	conc w/ depletion	exploded	Zinc
Tnt1ZNCd	TNT-Grid1	depos only	exploded	Zinc
Tnt1NHXc	TNT-Grid1	conc only (volatile)	exploded	n-Hexane
Tnt2BUTc	TNT-Grid2	conc only (volatile)	exploded	1,3-Butadiene
Tnt21HXc	TNT-Grid2	conc only (volatile)	exploded	1-Hexane
Tnt2ALMc	TNT-Grid2	conc w/ depletion	exploded	Aluminum
Tnt2ALMd	TNT-Grid2	depos only	exploded	Aluminum
Tnt2ANTc	TNT-Grid2	conc w/ depletion	exploded	Antimony
Tnt2ANTd	TNT-Grid2	depos only	exploded	Antimony
Tnt2BARc	TNT-Grid2	conc w/ depletion	exploded	Barium
Tnt2BARd	TNT-Grid2	depos only	exploded	Barium
Tnt2BENc	TNT-Grid2	conc only (volatile)	exploded	Benzene
Tnt2CADc	TNT-Grid2	conc w/ depletion	exploded	Cadmium
Tnt2CADd	TNT-Grid2	depos only	exploded	Cadmium
Tnt2CHRc	TNT-Grid2	conc w/ depletion	exploded	Chromium
Tnt2CHRd	TNT-Grid2	depos only	exploded	Chromium
Tnt2COPc	TNT-Grid2	conc w/ depletion	exploded	Copper
Tnt2COPd	TNT-Grid2	depos only	exploded	Copper
Tnt2ETHc	TNT-Grid2	conc only (volatile)	exploded	Ethylbenzene
Tnt2LEDc	TNT-Grid2	conc w/ depletion	exploded	Lead
Tnt2LEDd	TNT-Grid2	depos only	exploded	Lead
Tnt2MCYc	TNT-Grid2	conc only (volatile)	exploded	Methylcyclohexane
Tnt2MCLc	TNT-Grid2	conc only (volatile)	exploded	Methylenechloride
Tnt2RDXc	TNT-Grid2	conc only (volatile)	exploded	RDX
Tnt2STYc	TNT-Grid2	conc only (volatile)	exploded	Styrene
Tnt2TOLc	TNT-Grid2	conc only (volatile)	exploded	Toluene
Tnt2ZNCc	TNT-Grid2	conc w/ depletion	exploded	Zinc
Tnt2ZNCd	TNT-Grid2	depos only	exploded	Zinc
Tnt2NHXc	TNT-Grid2	conc only (volatile)	exploded	n-Hexane
TNT.txt	TNT	Hourly source file		
PAPA OBODM files.zip				
Pap1ALMc	Prpl, AmPrc, Al-Grid1	conc w/ depletion	burned	Aluminum
Pap1ALMd	Prpl, AmPrc, Al-Grid1	depos only	burned	Aluminum
Pap1BARc	Prpl, AmPrc, Al-Grid1	conc w/ depletion	burned	Barium
Pap1BARd	Prpl, AmPrc, Al-Grid1	depos only	burned	Barium
Pap1CL2c	Prpl, AmPrc, Al-Grid1	conc only (volatile)	burned	Cl2
Pap1CHRc	Prpl, AmPrc, Al-Grid1	conc w/ depletion	burned	Chromium
Pap1CHRd	Prpl, AmPrc, Al-Grid1	depos only	burned	Chromium
Pap1HCLc	Prpl, AmPrc, Al-Grid1	conc only (volatile)	burned	HCL
Pap1LEDc	Prpl, AmPrc, Al-Grid1	conc w/ depletion	burned	Lead
Pap1LEDd	Prpl, AmPrc, Al-Grid1	depos only	burned	Lead
Pap1ZNCc	Prpl, AmPrc, Al-Grid1	conc w/ depletion	burned	Zinc
Pap1ZNCd	Prpl, AmPrc, Al-Grid1	depos only	burned	Zinc
Pap2ALMc	Prpl, AmPrc, Al-Grid2	conc w/ depletion	burned	Aluminum
Pap2ALMd	Prpl, AmPrc, Al-Grid2	depos only	burned	Aluminum
Pap2BARc	Prpl, AmPrc, Al-Grid2	conc w/ depletion	burned	Barium
Pap2BARd	Prpl, AmPrc, Al-Grid2	depos only	burned	Barium
Pap2CL2c	Prpl, AmPrc, Al-Grid2	conc only (volatile)	burned	Cl2

Modeling Files and Descriptions				
PAPA OBODM files.zip — (continued)				
Run Name (inp, .out)	**Ordnance**	**Run Type**	**Exploded/Burned**	**Chemical**
Pap2CHRc	Prpl, AmPrc, Al-Grid2	conc w/ depletion	burned	Chromium
Pap2CHRd	Prpl, AmPrc, Al-Grid2	depos only	burned	Chromium
Pap2HCLc	Prpl, AmPrc, Al-Grid2	conc only (volatile)	burned	HCL
Pap2LEDc	Prpl, AmPrc, Al-Grid2	conc w/ depletion	burned	Lead
Pap2LEDd	Prpl, AmPrc, Al-Grid2	depos only	burned	Lead
Pap2ZNCc	Prpl, AmPrc, Al-Grid2	conc w/ depletion	burned	Zinc
Pap2ZNCd	Prpl, AmPrc, Al-Grid2	depos only	burned	Zinc
Papa.txt	Propell, Am Perc, Al	Hourly source file		
HBX OBODM files.zip				
Hbx1BUTc	HBX-Grid1	conc only (volatile)	exploded	1,3-Butadiene
Hbx11HXc	HBX-Grid1	conc only (volatile)	exploded	1-Hexene
Hbx1ALMc	HBX-Grid1	conc w/ depletion	exploded	Aluminum
Hbx1ALMd	HBX-Grid1	depos only	exploded	Aluminum
Hbx1BENc	HBX-Grid1	conc only (volatile)	exploded	Benzene
Hbx1CTCc	HBX-Grid1	conc only (volatile)	exploded	Carbon Tetrachloride
Hbx1CLFc	HBX-Grid1	conc only (volatile)	exploded	Chloroform
Hbx1COPc	HBX-Grid1	conc w/ depletion	exploded	Copper
Hbx1COPd	HBX-Grid1	depos only	exploded	Copper
Hbx1ETHc	HBX-Grid1	conc only (volatile)	exploded	Ethylbenzene
Hbx1MCHc	HBX-Grid1	conc only (volatile)	exploded	Methyl Chloride
Hbx1MCFc	HBX-Grid1	conc only (volatile)	exploded	Methyl Chloroform
Hbx1MCYc	HBX-Grid1	conc only (volatile)	exploded	Methylcyclohexane
Hbx1MCLc	HBX-Grid1	conc only (volatile)	exploded	Methylenechloride
Hbx1TOLc	HBX-Grid1	conc only (volatile)	exploded	Toluene
Hbx1ZNCc	HBX-Grid1	conc w/ depletion	exploded	Zinc
Hbx1ZNCd	HBX-Grid1	depos only	exploded	Zinc
Hbx1NHXc	HBX-Grid1	conc only (volatile)	exploded	n-Hexane
Hbx2BUTc	HBX-Grid2	conc only (volatile)	exploded	1,3-Butadiene
Hbx21HXc	HBX-Grid2	conc only (volatile)	exploded	1-Hexene
Hbx2ALMc	HBX-Grid2	conc w/ depletion	exploded	Aluminum
Hbx2ALMd	HBX-Grid2	depos only	exploded	Aluminum
Hbx2BENc	HBX-Grid2	conc only (volatile)	exploded	Benzene
Hbx2CTCc	HBX-Grid2	conc only (volatile)	exploded	Carbon Tetrachloride
Hbx2CLFc	HBX-Grid2	conc only (volatile)	exploded	Chloroform
Hbx2COPc	HBX-Grid2	conc w/ depletion	exploded	Copper
Hbx2COPd	HBX-Grid2	depos only	exploded	Copper
Hbx2ETHc	HBX-Grid2	conc only (volatile)	exploded	Ethylbenzene
Hbx2MCHc	HBX-Grid2	conc only (volatile)	exploded	Methyl Chloride
Hbx2MCFc	HBX-Grid2	conc only (volatile)	exploded	Methyl Chloroform
Hbx2MCYc	HBX-Grid2	conc only (volatile)	exploded	Methylcyclohexane
Hbx2MCLc	HBX-Grid2	conc only (volatile)	exploded	Methylenechloride
Hbx2TOLc	HBX-Grid2	conc only (volatile)	exploded	Toluene
Hbx2ZNCc	HBX-Grid2	conc w/ depletion	exploded	Zinc
Hbx2ZNCd	HBX-Grid2	depos only	exploded	Zinc
Hbx2NHXc	HBX-Grid2	conc only (volatile)	exploded	n-Hexane
Hbx.txt	HBX	Hourly source file		

Modeling Files and Descriptions				
PWDR OBODM files.zip				
Run Name (inp, .out)	**Ordnance**	**Run Type**	**Exploded/Burned**	**Chemical**
Pwd1BENc	Smokeless (Black) Powder-Grid1	conc only (volatile)	exploded	Benzene
Pwd1MCYc	Smokeless (Black) Powder-Grid1	conc only (volatile)	exploded	Methylcyclohexane
Pwd1MCLc	Smokeless (Black) Powder-Grid1	conc only (volatile)	exploded	Methylenechloride
Pwd1TOLc	Smokeless (Black) Powder-Grid1	conc only (volatile)	exploded	Toluene
Pwd1NHXc	Smokeless (Black) Powder-Grid1	conc only (volatile)	exploded	n-Hexane
Pwd2BENc	Smokeless (Black) Powder-Grid2	conc only (volatile)	exploded	Benzene
Pwd2MCYc	Smokeless (Black) Powder-Grid2	conc only (volatile)	exploded	Methylcyclohexane
Pwd2MCLc	Smokeless (Black) Powder-Grid2	conc only (volatile)	exploded	Methylenechloride
Pwd2TOLc	Smokeless (Black) Powder-Grid2	conc only (volatile)	exploded	Toluene
Pwd2NHXc	Smokeless (Black) Powder-Grid2	conc only (volatile)	exploded	n-Hexane
Pwdr.txt	Smokeless (Black) Powder	Hourly source file		

Met Processing Files	
AERSURFACE files.zip	
File	**Description**
BNA land use... .zip	Land use files for NWS location in Nashville, TN (BNA)
CKV land use... .zip	Land use files for NWS location in Clarksville, TN (CKV)
MEM land use... .zip	Land use files for NWS location in Memphis, TN (MEM)
Milan land use... .zip	Land use files for facility location in Milan, TN
MKL land use... .zip	Land use files for NWS location in Jackson, TN (MKL)
PAH land use... .zip	Land use files for NWS location in Paducah, KY (PAH)
BNA_1km.out, .log	AERSURFACE output files for BNA
CKV_1km.out, .log	AERSURFACE output files for CKV
MEM_1km.out, .log	AERSURFACE output files for MEM
Milan_1km.out, .log	AERSURFACE output files for Milan
MKL_1km.out, .log	AERSURFACE output files for MKL
PAH_1km.out, .log	AERSURFACE output files for PAH
MPRM files.zip	
13897_08.mix	Upper air data: Nashville, TN (BNA) mixing heights
PAH_2008.SAM	Surface data: Paducah, KY (PAH), Samson format
PAH08_S1.inp, rpt, .sum	MPRM Stage 1: input, output, summary
PAH08_S2.inp, .rpt, .sum	MPRM Stage 2: input, output, summary
PAH08_S3.inp, .rpt, .sum	MPRM Stage 3: input, output, summary
Met file.zip	
PAHBNA08.MET	ISCST3 Met Data File
Results Files	
40MM Results.xlsx	Results and conversion for 40 mm Cartridge
CMPB Results.xlsx	Results and conversion for Composition B
FLAR Results.xlsx	Results and conversion for Flare,... M206
FUZE Results.xlsx	Results and conversion for Fuzes
M1NI Results.xlsx	Results and conversion for M-1 Nitrocellulose
PM91 Results.xlsx	Results and conversion for Propellant M-9 (Exploded)
PM9B Results.xlsx	Results and conversion for Propellant M-9 (Burned)
PM31 Results.xlsx	Results and conversion for Propellant M31A1E1
RDX Results.xlsx	Results and conversion for RDX
SIG Results.xlsx	Results and conversion for Signal Illuminators
TNT Results.xlsx	Results and conversion for TNT
PAPA Results — Revised August 10, 2011.xlsx	Results and conversion for Propell, Am Perc, Al
HBX Results — Revised August 11, 2011.xlsx	Results and conversion for HBX
PWDR Results.xlsx	Results and conversion for Smokeless Powder

DISPERSION MODELING REPORT
MILAN ARMY AMMUNITION PLANT — MILAN, TENNESSEE

DISPERSION MODELING REPORT
MILAN ARMY AMMUNITION PLANT — MILAN, TENNESSEE

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MILAN ARMY AMMUNITION PLANT — MILAN, TENNESSEE

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DISPERSION MODELING REPORT
MILAN ARMY AMMUNITION PLANT — MILAN, TENNESSEE

Appendix L-1

Tennessee Natural Heritage Program

Rare Species Observations for Tennessee Counties

Quad Name	Quad ID	Type	Category	Scientific Name	Common Name	Global Rank	State Rank	Fed. Status	State Status	Habitat	Wet Habitat Flag
SPRING-CREEK	3508876	Vertebrate Animal	Fish	Etheostoma cervus	Chickasaw Darter	G2G3	S2S3	--	D	Small streams with slow to moderate current and predominantly sandy substrates; Forked Deer River watershed.	Aquatic
SPRING-CREEK	3508876	Vascular Plant	Flowering Plant	Symphyotrichum praealtum	Willow Aster	G5	S1	--	S	Moist Prairies And Marshes	Possible
SPRING-CREEK	3508876	Vascular Plant	Flowering Plant	Silphium laciniatum	Compass Plant	G5	S2	--	T	Barrens	Upland

Appendix L-1
Tennessee Natural Heritage Program and Rare Species Observations for Quadrangle (Spring Creek)

Appendix L-2

National Register of Historical Places

Tennessee

Tennessee - Carroll County

Carroll County Tennessee has 4 places on the National Register of Historic Places.

The famous person James Hillsman is associated with one of more of the Carroll County historic places.

Some of the country's most noteable architects helped create the Carroll County places including Hezekiah James Wilcox, Maj. John Hinde Hillsman, Audie Johnson, Railway, Chattanooga and St. Louis Nashville and McDonald Bros.. Prominent architectural styles found in Carroll Country are Gothic Revival, Greek Revival and Renaissance.

First Cumberland Presbyterian Church--McKenzie (added 1993 - - #93000476)
305 N. Stonewall St. , McKenzie

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Historic Significance:
Architecture/Engineering

Architect, builder, or engineer:
McDonald Bros.

Architectural Style:
Gothic Revival

Area of Significance:
Architecture

Period of Significance:
1900-1924, 1875-1899

Owner:
Private

Historic Function:
Religion

Historic Sub-function:
Church Related Residence, Religious Structure

Current Function:
Religion

Current Sub-function:
Church Related Residence, Religious Structure

Hillsman House (added 1982 - - #82003955)
Also known as Hillsman-Woodson House
Old Hinkledale-McKenzie Rd. , Trezevant

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Historic Significance:
Person, Architecture/Engineering

Architect, builder, or engineer:
Hillsman,Maj. John Hinde

Architectural Style:
Greek Revival

Historic Person:
Hillsman,James

Significant Year:
1898, 1866, 1869

Area of Significance:
Agriculture, Architecture

Period of Significance:
1875-1899, 1850-1874

Owner:
Private

Historic Function:
Domestic

Historic Sub-function:
Single Dwelling

Current Function:
Domestic

Current Sub-function:
Single Dwelling

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Long Rock Methodist Episcopal Church, South (added 2010 - - #10000466)
Also known as Long Rock United Methodist Church
340 Long Rock Church Rd , Huntingdon

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Historic Significance:
Architecture/Engineering, Event

Architect, builder, or engineer:
Wilcox, Hezekiah James, Johnson, Audie

Area of Significance:
Social History, Architecture

Period of Significance:
1950-1974, 1925-1949, 1900-1924, 1875-1899

Owner:
Private

Historic Function:
Funerary, Religion

Historic Sub-function:
Cemetery, Religious Structure

Current Function:
Funerary, Religion

Current Sub-function:
Cemetery, Religious Structure

McKenzie Depot (added 1996 - - #96000336)
85 E. Bruce St. , McKenzie

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Historic Significance:
Event, Architecture/Engineering

Architect, builder, or engineer:
Railway, Nashville, Chattanooga and St. Louis

Architectural Style:
Renaissance

Area of Significance:
Transportation, Architecture

Period of Significance:
1925-1949

Owner:

Private

Historic Function:
Transportation

Historic Sub-function:
Rail-Related

Current Function:
Commerce/Trade

Current Sub-function:
Professional

Return to Top

Select a Different Tennessee County (map) Anderson Bedford Benton Bledsoe Blount Bradley Campbell Cannon Carroll Carter Cheatham Chester Claiborne Clay Cocke Coffee Crockett Cumberland Davidson De Kalb Decatur Dickson Dyer Fayette Fentress Franklin Gibson Giles Grainger Greene Grundy Hamblen Hamilton Hancock Hardeman Hardin Hawkins Haywood Henderson Henry Hickman Houston Humphreys Jackson Jefferson Johnson Knox Lake Lauderdale Lawrence Lewis Lincoln Loudon Macon Madison Marion Marshall Maury McMinn McNairy Meigs Monroe Montgomery Moore Morgan Obion Overton Perry Pickett Polk Putnam Rhea Roane Robertson Rutherford Scott Sequatchie Sevier Shelby Smith Stewart Sullivan Sumner Tipton Trousdale Unicoi Union Van Buren Warren Washington Wayne Weakley White Williamson Wilson

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National Register
of Historic Places

State Listings | Historic Districts | Vacant / Not In Use

Tennessee - Gibson County

Gibson County Tennessee has 19 places on the National Register of Historic Places.

Several famous people are associated with these Gibson County historic places including Moses E. Senter, Col. Robert Z. Taylor, Gordon Browning and Julius Freed.

Some of the country's most noteable architects helped create the Gibson County places including Louis A. Simon, George O. Von Nerta, Chamberlain,Walter,& Co., William W. Dodson, E.D. Treatschel, Rueben A. Heavner and Algernon Blair. Prominent architectural styles found in Gibson Country are Classical Revival, Queen Anne and Greek Revival.

Bonds House (added 2010 - - #10000473)
Also known as Bonds--Williams House
204 S 19th Ave , Humboldt

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Historic Significance:
Architecture/Engineering, Event

Architectural Style:
Bungalow/Craftsman

Area of Significance:
Commerce, Architecture

Period of Significance:
1950-1974, 1925-1949, 1900-1924

Owner:
Private

Historic Function:
Domestic

Historic Sub-function:
Single Dwelling

Current Function:
Domestic

Current Sub-function:
Single Dwelling

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Booker T. Motel (added 2018 - - #100002750)
607 West Main Street, Humboldt

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Historic Significance:
Event

Area of Significance:
Black, Commerce

Period of Significance:
1954-1970 AD

Browning House (added 1974 - - #74001912)
E of Milan on Milan Army Ammunition Plant , Milan

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Historic Significance:
Person, Architecture/Engineering

Architect, builder, or engineer:
Unknown

Architectural Style:
No Style Listed

Historic Person:
Browning,Gordon

Significant Year:
1873

Area of Significance:
Politics/Government, Architecture, Military

Period of Significance:
1925-1949, 1900-1924, 1875-1899

Owner:
Federal

Historic Function:
Domestic

Historic Sub-function:
Single Dwelling

Current Function:
Government

Dodson House (added 1982 - - #82003969)
Also known as Dodson-Himelwright House
119 N. 17th Ave. , Humboldt

SH5544, CC BY-SA 4.0, via Wikimedia Commons

Historic Significance:
Architecture/Engineering

Architect, builder, or engineer:
Dodson,William W.

Architectural Style:
Queen Anne

Area of Significance:
Architecture

Period of Significance:
1875-1899

Owner:
Private

Historic Function:
Domestic

Historic Sub-function:
Single Dwelling

Current Function:
Domestic

Current Sub-function:
Single Dwelling

First Methodist Episcopal Church, South (added 2008 - - #08000702)
Also known as First United Methodist Church
200 N. 12th Ave. , Humboldt

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Historic Significance:
Architecture/Engineering

Architectural Style:
Gothic Revival

Area of Significance:
Architecture

Period of Significance:
1950-1974, 1925-1949, 1900-1924, 1875-1899

Owner:
Private

Historic Function:
Religion

Historic Sub-function:
Religious Structure

Current Function:
Religion

Current Sub-function:
Religious Structure

Freed, Julius, House (added 1994 - - #94000301)
Also known as Trenton Community Center;Villa Free
Eaton St. W of Gibson Co. Courthouse , Trenton

Johnblankenship71, CC BY-SA 3.0, via Wikimedia Commons

Historic Significance:
Architecture/Engineering, Person

Architect, builder, or engineer:
Unknown

Architectural Style:
Italianate

Historic Person:
Freed, Julius

Significant Year:
1871

Area of Significance:
European, Art, Commerce, Architecture

Period of Significance:
1925-1949, 1900-1924, 1875-1899, 1850-1874

Owner:
Local

Historic Function:
Domestic

Historic Sub-function:
Secondary Structure, Single Dwelling

Current Function:
Domestic, Government, Social

Current Sub-function:
Government Office, Meeting Hall, Secondary Structure

Gibson County Courthouse (added 1976 - - #76001777)
Court Sq. , Trenton

NO PHOTO

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Historic Significance:
Architecture/Engineering

Architect, builder, or engineer:
Chamberlain,Walter,& Co.

Architectural Style:
Classical Revival

Area of Significance:
Architecture

Period of Significance:
1900-1924, 1875-1899

Owner:
Local

Historic Function:
Government

Historic Sub-function:
Courthouse

Current Function:
Government

Current Sub-function:
Courthouse

Gibson County Training School (added 2012 - - #12000117)
1041 S. Harris St., Milan

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Historic Significance:
Event

Area of Significance:
Education, Black, Social History

Period of Significance:
1950-1974, 1925-1949

Medina City Hall (added 2004 - - #04000674)
115 2nd St. , Medina

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Historic Significance:
Event

Area of Significance:
Politics/Government, Social History

Period of Significance:
1950-1974, 1925-1949

Owner:
Local

Historic Function:
Education, Social

Historic Sub-function:
Civic, College, Library

Current Function:
Work In Progress

Mount Zion Negro School (added 2017 - - #100001823)
30 Mount Zion Road, Bradford

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Historic Significance:

Event

Area of Significance:
Education, Black, Social History

Period of Significance:
1915-1962 AD

Oakland Cemetery (added 2007 - - #07000186)
Also known as Silent City of the Dead
800 Brownsville St. , Trenton

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Historic Significance:
Event

Area of Significance:
Exploration/Settlement

Period of Significance:
1950-1974, 1925-1949, 1900-1924, 1875-1899, 1850-1874, 1825-1849

Owner:
Local

Historic Function:
Funerary

Historic Sub-function:
Cemetery

Current Function:
Funerary

Current Sub-function:
Cemetery

Peabody High School (added 1984 - - #84000326)
Also known as Old Peabody High School

S. College St. , Trenton

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Historic Significance:
Event, Architecture/Engineering

Architect, builder, or engineer:
Heavner,Rueben A.

Architectural Style:
Classical Revival

Area of Significance:
Education, Architecture

Period of Significance:
1900-1924

Owner:
Local

Historic Function:
Education

Historic Sub-function:
School

Current Function:
Vacant/Not In Use

Senter-Rooks House (added 1980 - - #80003797)
Also known as Twin Oaks
2227 Main St. , Humboldt

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Historic Significance:
Person, Architecture/Engineering

Architect, builder, or engineer:
Unknown

Architectural Style:
Other

Historic Person:
Senter,Moses E.

Significant Year:
1864, 1920

Area of Significance:
Politics/Government, Architecture

Period of Significance:
1900-1924, 1850-1874

Owner:
Private

Historic Function:
Domestic

Historic Sub-function:
Single Dwelling

Current Function:
Domestic

Current Sub-function:
Single Dwelling

Skullbone Store (added 1999 - - #99001369)
Also known as Cobb's Store, Dowland Store
1 Shade's Bridge Rd. , Skullbone

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Historic Significance:
Event

Area of Significance:
Commerce, Social History

Period of Significance:
1925-1949

Owner:
Private

Historic Function:
Commerce/Trade, Domestic

Historic Sub-function:
Department Store, Single Dwelling

Current Function:
Commerce/Trade, Domestic

Current Sub-function:
Department Store, Single Dwelling

Taylor, Col. Robert Z., House (added 1982 - - #82003970)
1008 S. College St. , Trenton

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Historic Significance:
Person, Architecture/Engineering

Architect, builder, or engineer:
Unknown

Architectural Style:
Queen Anne

Historic Person:
Taylor,Col. Robert Z.

Significant Year:
1895

Area of Significance:
Law, Architecture

Period of Significance:
1900-1924, 1875-1899

Owner:
Private

Historic Function:
Domestic

Historic Sub-function:
Single Dwelling

Current Function:
Domestic

Current Sub-function:
Single Dwelling

Trenton Historic District (added 1982 - - #82003971)
High, College, and Church Sts. , Trenton

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Historic Significance:
Architecture/Engineering

Architect, builder, or engineer:
Multiple

Architectural Style:
Queen Anne, Late 19th And 20th Century Revivals, Greek Revival

Area of Significance:
Architecture

Period of Significance:
1925-1949, 1900-1924, 1875-1899, 1850-1874, 1825-1849

Owner:
Private

Historic Function:
Domestic

Historic Sub-function:
Single Dwelling

Current Function:
Domestic

Current Sub-function:
Single Dwelling

US Post Office (added 1987 - - #87001169)
Also known as Post Office
382 S. Main St. , Milan

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Historic Significance:
Architecture/Engineering

Architect, builder, or engineer:
Blair,Algernon, Simon,Louis A.

Architectural Style:
Classical Revival

Area of Significance:
Architecture

Period of Significance:
1925-1949

Owner:
Federal

Historic Function:
Government

Historic Sub-function:
Post Office

Current Function:
Government

Current Sub-function:
Post Office

US Post Office (added 1988 - - #88001576)
200 S. College St. , Trenton

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Historic Significance:
Architecture/Engineering

Architect, builder, or engineer:
Von Nerta,George O., Simon,Louis A.

Architectural Style:
Greek Revival

Area of Significance:
Architecture

Period of Significance:
1925-1949

Owner:
Federal

Historic Function:
Government

Historic Sub-function:
Post Office

Current Function:
Government

Current Sub-function:
Post Office

Union Central School (added 1985 - - #85001490)
Union Central Rd. , Milan

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Historic Significance:
Event

Area of Significance:
Education

Period of Significance:
1925-1949, 1900-1924

Owner:
Private

Historic Function:
Education

Historic Sub-function:
School

Current Function:
Social

Current Sub-function:
Civic

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