

MEETING MINUTES

RESTORATION ADVISORY BOARD For PLUM BROOK ORDNANCE WORKS

Meeting Date: December 12, 2001

Meeting Time: 7:00 p.m.

Meeting Location: BGSU Firelands

Meeting Attendees:

Mark Bohne, RAB Co-Chairperson
Rick Meadows, USACE, RAB Co-Chairperson
Jan Bohne, RAB
Bob Hermes, RAB
Richard Pitsinger, RAB
David Speer, RAB
Gil Steinen, RAB
Starr Truscott, RAB
Lee Yeckley, RAB
Linda Ingram, USACE

Archie Lunsey, OEPA
Ron Nabors, OEPA
Frank Albert, USACE
Lannae Long, USACE
Mikael Spangberg, IT Corporation
Mike Gunderson, IT Corporation
Paul Goetchius, IT Corporation
Mark Weisberg, IT Corporation
Helen Owens, ICI

- The RAB Meeting was held on Wednesday December 12, 2001 at BGSU- Firelands, located in Huron, Ohio. The meeting was opened by Mr. Mark Bohne and Mr. Rick Meadows USACE, RAB Co-Chairpersons.
- The agenda for the evening included the following presentations:
 - *TNT Areas A/C Screening-Level Ecological Risk Assessments*, presented by Mr. Mark Weisberg of IT Corporation
 - *Baseline Human Health Risk Assessment – TNT Areas A and C Remedial Investigation*, presented by Dr. Paul F. Goetchius
 - *Red Water Ponds Baseline Ecological Risk Assessment* – presented by Mark Weisberg of IT Corporation
 - *Summary – Groundwater Remedial Investigation – TNT and Red Water Ponds Areas* – presented by Mike Gunderson of IT Corporation
- The NASA Point of Contact (POC) has changed, the new contact is Bob Lallier and he may be contacted at (419) 621-3234 or email Robert.F.Lallier@grc.nasa.gov.

SUMMARY

**TNT AREAS A/C
SCREENING-LEVEL ECOLOGICAL
RISK ASSESSMENTS**

**FORMER PLUM BROOK ORDNANCE WORKS
SANDUSKY, OHIO**

Presented by Mark Weisberg at:

PBOW Site Meeting - RAB

July 04, 2001
December 12, 2001




Presentation Outline

- 1. Problem Formulation
 - Assessment hypotheses
 - Ecological site descriptions, T & E species
 - COPEC Selection
 - Assessment receptors
 - Conceptual site models
 - Assessment/measurement endpoints
- 2. Exposure Characterization
 - Ecological Effects Characterization
- 3. Risk Characterization
- 4. Conclusions




Problem Formulation

- Assessment null hypotheses:
 - potential for adverse eco effects is minimal due to lack of viable habitat for ecological receptors
 - potential for adverse eco effects is minimal due to lack of potential ecological receptors
 - potential for adverse eco effects is minimal due to lack of potential exposure pathways
 - potential for adverse eco effects is minimal due to lack of potential stressor chemicals
- If null hypotheses rejected, predictive risk assess. triggered.




Problem Formulation

- Ecological site description based on site reconnaissance. Surface waters include Lindsley Ditch and unnamed drainage ditch to Pipe Creek. Wetlands include small palustrine shrub scrub and emergent habitats. Vegetative communities include open field, forest, and shrub thicket. Species inventories for plants, birds, mammals, reptiles, amphibians, and fish summarized.
- Identified threatened or endangered species at the sites include:
 - TNT Area A: fringed gentian - Ohio potentially threatened; bayberry - Ohio endangered; Carex - undocumented sedge
 - TNT Area C: closed gentian - Ohio potentially threatened sp.




Problem Formulation

- Plant species identified:
 - TNT Area A: 172 species (73 common or frequent)
 - TNT Area C: 144 species (60 common or frequent)
- Selected chemicals of potential ecological concern (COPECs), based on organic and inorganic chemicals detected in surface soil (0-2"), total soil (0-6"), surface water, and sediment samples collected from the sites
- COPECs ultimately selected were above both available background concentrations in site media and above risk-based screening ecological values




Problem Formulation

■ TNT Area A COPECs selected included:	■ TNT Area C COPECs selected included:
→ 14 COPECs in surface soil	→ 22 COPECs in surface soil
→ 18 COPECs in total soil	→ 26 COPECs in total soil
→ 19 COPECs in surf water	→ 21 COPECs in surf water
→ 21 COPECs in sediment	→ 21 COPECs in sediment




Problem Formulation

- Assessment Endpoints
 - Protection and long-term survival for herbivorous mammals
 - Protection and long-term survival for omnivorous mammals
 - Protection and long-term survival for carnivorous birds
 - etc.
- Measurement Endpoints
 - Comparison of total daily dose to species-specific toxicity endpoint values
 - Comparison of total daily dose to species-specific toxicity endpoint values
 - Comparison of total daily dose to species-specific toxicity endpoint values



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Exposure Characterization

- Using uptake models and intake equations, estimated total daily dose (in mg/kg bw-day) to selected assessment receptors, including:
 - Impacted soil, surface water, and sediment ingestion
 - Impacted plant ingestion
 - Impacted terrestrial invertebrate ingestion
 - Impacted small mammal and small bird ingestion
- Site-specific uptake factors used from RWP BERA: Pb in seed to aquatic inverts; nitroaromatics and PAHs in soil to terr inverts



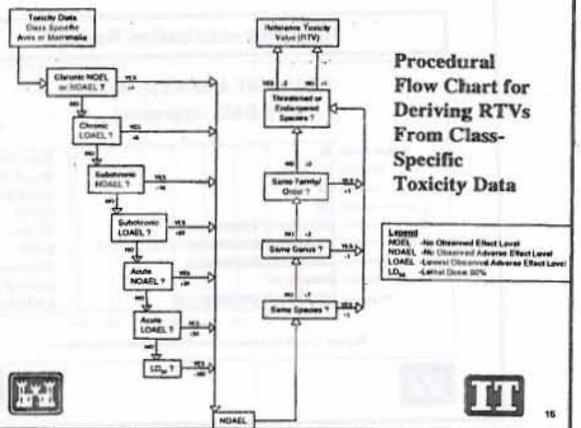
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Exposure Characterization - Ecological Effects

- Development of toxicity reference values (TRVs)
 - Obtained COPEC-specific chronic NOAEL or LOAEL for representative test species from the literature
 - If chronic NOAELs or LOAELs not available, used LD₅₀ values divided by uncertainty factor of 100, or other uncertainty factors, to account for endpoint
 - Used safety factors to extrapolate from test species to assessment receptors, depending on taxonomic genus, family, and order of each pair.



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Ecological Effects Characterization

- Development TRVs (continued)
 - Scaled TRVs from lab test species (rats and mice, etc) to selected wildlife assessment receptors using appropriate power function of body weight ratios.
 - See next slide for general TRV scaling equation.



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Ecological Effects Characterization

NOAEL_w = the No Observed Adverse Effect Level for the wildlife indicator species (mg/kg-day)

NOAEL_T = the No Observed Adverse Effect Level for the test species (mg/kg-day)

BW_T = body weight of the test species (kg)

BW_w = body weight of the wildlife indicator species (kg)

s = body weight scaling factor (s = 1/4 for mammals and s = 0 for birds)

SEE ATTACHED SLIDE



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Conclusions

- Based on uncertainties of toxicity, and the fact that no wildlife TE species have been confirmed onsite, remedial actions solely to address ecological concerns are not recommended at this time.
- As NOAEL-based hazards at TNT Area A are $> 1,000$ and LOAEL-based hazards are > 100 for some receptors, further evaluation is recommended. Risk drivers are PCBs, lead, and TNT.
- As NOAEL-based hazards at TNT Area C are $> 30,000$ and LOAEL-based hazards are $> 5,000$ for some receptors, further evaluation is recommended. Risk drivers are TNT, PCBs, and lead.
- Human health PRGs may be evaluated for eco protectiveness.



Ecological Effects Characterization

$$NOAEL_W = NOAEL_T \left(\frac{BW_T}{BW_W} \right)^s$$

$NOAEL_W$ = the No Observed Adverse Effect Level for the wildlife indicator species (mg/kg-day)

$NOAEL_T$ = the No Observed Adverse Effect Level for the test species (mg/kg-day)

BW_T = the body weight of the test species (kg)

BW_W = the body weight of the wildlife indicator species (kg)

s = a body weight scaling factor ($s = 1/4$ for mammals and $s = 0$ for birds)



Final

Volume II – Baseline Human Health Risk
Assessment

TNT Areas A and C Remedial Investigation
Former Plum Brook Ordnance Works
Sandusky, Ohio

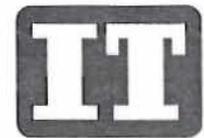
RAB Meeting
12 December 2001

Paul F. Goetchius, DVM, DABT
IT Corporation



Protocol for the Risk Assessment

- **Guidance documents from US EPA, OEPA, USACE**
- **Baseline Human Health Risk Assessment Work Plan**
- **Captures “lessons learned” from previous PBOW HHRAs**



Purpose of PBOW HHRA:

- To estimate the potential for cancer risk and noncancer adverse health effects from exposure to chemicals released to environmental media resulting from US DOD activities
- To provide this information in a format that facilitates decision-making and site management
- To identify the uncertainties associated with the assessment and articulate clearly their impact on the results/conclusions



Risk Assessment and Uncertainty

- Risk = (Toxicity Assessment) (Exposure Assessment)
- HHRA protocol incorporates safeguards to ensure protectiveness in the face of uncertainty
- Toxicity Assessment: 75 to 80% of the uncertainty (Tom McKone)
 - Cancer: SF/URF usually 95% upper confidence limit on slope of dose-response curve
 - Noncancer: RfD/RfC designed to protect most sensitive members of population
- Exposure Assessment:
 - Receptor selection: upper bound on exposure for each plausible/possible exposure scenario
 - Data Evaluation
 - ♦ COPC selection
 - RBRCs consistent with exposure scenarios
 - Intake rate estimation: RME for most chemicals:
$$I = \frac{(EPC)(CR)(EF)(ED)(CF)}{(BW)(AT)}$$
 - Enlarged font terms = upper bounds
 - Lead: Young child blood-lead model (IEUBK) and adult blood-lead model contain statistical modules



Exposure-Point Concentration

- **Exposure Unit: the area over which a receptor is expected to be randomly and uniformly exposed.**
 - **Receptor-specific: groundskeeper & hunter vs construction worker & resident**
- **Trouble with “hot spot” terminology**
- **STC reckoned as a conservative (upper bound) estimate of average**
- **“Total soil”**



HHRA Results COPCs

Chemical	Surface Soil	Total Soil	On-Site Sediment	Off-Site Sediment	On-Site Surface Water	Off-Site Surface Water
TNT Area A						
Metals:						
Arsenic	No	No	No	No	Yes	No
Lead	Yes	Yes	No	No	No	No
Manganese	No	No	No	No	Yes	No
Nitroaromatics	4	6	No	No	4	No
PCBs	Yes	Yes	Yes, low	No	No	No
PAHs	3	4	BaP, low	5, higher	No	No
TNT Area C						
Metals:				NA		NA
Arsenic	No	No	No		No	
Chromium	No	Yes	No		No	
Lead	Yes	Yes	No		No	
Manganese	No	No	No		Yes	
Nitroaromatics	6	6	5	NA	1	NA
PCBs	Yes	Yes	Yes, low	NA	No	NA
PAHs	7	7	BaP, low	NA	No	NA



Table 2-7

COPC Selection for Total Soil^a
TNT Area A, Plum Brook Ordnance Works
Sandusky, Ohio

Chemical Name (mg/kg)	STC Surface Soil ^b	STC Subsurface Soil ^c	Source Term Concentration
Metals			
Lead	5.88E+02	1.19E+04	1.19E+04
Nitroaromatics			
2-Amino-4,6-dinitrotoluene	9.23E+00	3.36E+01	3.36E+01
4-Amino-2,6-dinitrotoluene	5.98E+00	9.77E+00	9.77E+00
2-Nitrotoluene	--	5.82E+02	5.82E+02
3-Nitrotoluene	--	5.90E+01	5.90E+01
4-Nitrotoluene	--	4.84E+02	4.84E+02
2,4,6-Trinitrotoluene	1.52E+02	2.59E+02	2.59E+02
PCB			
Aroclor 1260	2.48E+00	6.98E+01	6.98E+01
Semivolatile Organic Compounds			
2,4-Dinitrotoluene	--	8.91E+03	8.91E+03
2,6-Dinitrotoluene	--	1.03E+04	1.03E+04
Benzo(a)anthracene	1.17E-01	2.95E-01	2.95E-01
Benzo(a)pyrene	1.07E-01	2.18E-01	2.18E-01
Benzo(b)fluoranthene	1.62E-01	3.05E-01	3.05E-01
Indeno(1,2,3-cd)pyrene	--	9.96E-02	9.96E-02

COPC = Chemical of potential concern

STC = Source term concentration

mg/kg = Milligram per kilogram

-- = Chemical was either not selected as a COPC, or not detected.

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

^b Please see Table 2-4.

^c Please see Table 2-5.

Table 2-16

COPC Selection for Total Soil^a
TNT Area C, Plum Brook Ordnance Works
Sandusky, Ohio

Chemical Name (mg/kg)	STC Surface Soil ^b	STC Subsurface Soil ^c	Source Term Concentration
Metals			
Chromium	--	2.02E+02	2.02E+02
Lead	9.34E+02	2.15E+02	9.34E+02
Nitroaromatics			
2-Amino-4,6-dinitrotoluene	3.80E+01	5.22E+00	3.80E+01
4-Amino-2,6-dinitrotoluene	1.13E+01	5.18E+00	1.13E+01
1,3-Dinitrobenzene	7.51E-01	--	7.51E-01
2-Nitrotoluene	--	5.08E+01	5.08E+01
4-Nitrotoluene	--	6.74E+01	6.74E+01
2,4,6-Trinitrotoluene	4.13E+04	2.59E+03	4.13E+04
PCBs			
Aroclor 1254	--	7.45E-01	7.45E-01
Aroclor 1260	4.88E+00	5.57E-01	4.88E+00
Semivolatile Organic Compounds			
2,4-Dinitrotoluene	9.85E+00	2.75E+02	2.75E+02
2,6-Dinitrotoluene	9.52E+00	1.94E+01	1.94E+01
Benzo(a)anthracene	6.94E+00	3.90E+00	6.94E+00
Benzo(a)pyrene	6.33E+00	2.76E+00	6.33E+00
Benzo(b)fluoranthene	8.43E+00	3.90E+00	8.43E+00
Benzo(k)fluoranthene	2.05E+00	1.95E+00	2.05E+00
Chrysene	5.85E+00	3.89E+00	5.85E+00
Dibenz(a,h)anthracene	1.03E+00	1.40E+00	1.40E+00
Indeno(1,2,3-cd)pyrene	2.05E+00	1.95E+00	2.05E+00

COPC = Chemical of potential concern

STC = Source term concentration

mg/kg = Milligram per kilogram

-- = Chemical was either not selected as a COPC, or not detected.

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

^b Please see Table 2-13.

^c Please see Table 2-14.

Risk-Based Remedial Concentrations

- **Cancer risk: suggest 1E-5 as within the risk management range and allowing sufficient protection for additivity of cancer risk.**
- **Noncancer hazard: suggest concentrations based on HI of 0.1 to be consistent with other sites and to allow sufficient protection for additivity for a class of morphologically and toxicologically similar chemicals.**
- **RBRCs applied as conservative estimate of average concentration for the appropriate exposure unit.**



Summary of Total Hazard and Total Cancer Risk by Source Medium: TNT-A

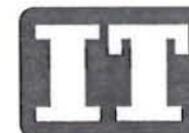
Source Medium	Groundskeeper	Indoor	Construction	On-Site	Adult	Child Venison
	Total HI	Worker Total HI	Worker Total HI	Resident Total HI	Hunter Total HI	Consumer Total HI
Surface Soil	6.45E-01	2.76E-01	NA	NA	3.30E-02	NA
Total Soil	NA	NA	6.04E+01	2.19E+02	NA	NA
Surface Water	NA	NA	5.93E-02	2.93E-02	NA	NA
Sediment	NA	NA	NA	NA	NA	NA
Total across all media	6.45E-01	2.76E-01	6.05E+01	2.19E+02	3.30E-02	NA

Source Medium	Groundskeeper	Indoor	Construction	On-Site Resident			Adult	Child
	Total ILCR	Worker Total ILCR	Worker Total ILCR	Adult ILCR	Child ILCR	Total ILCR	Hunter Total ILCR	Venison Consumer Total ILCR
Surface Soil	6.08E-06	2.71E-06	NA	NA	NA	NA	4.46E-07	2.34E-08
Total Soil	NA	NA	3.51E-04	1.06E-02	1.53E-02	2.59E-02	NA	NA
Surface Water	NA	NA	5.13E-09	6.76E-08	3.04E-08	9.79E-08	NA	NA
Sediment	NA	NA	6.46E-08	2.38E-07	4.63E-10	2.38E-07	NA	NA
Total across all media	6.08E-06	2.71E-06	3.51E-04	1.06E-02	1.53E-02	2.59E-02	4.46E-07	2.34E-08

HI - Hazard index.

ILCR - Incremental lifetime cancer risk.

NA - Not applicable.



Chemicals of Concern and Risk-Based Remediation Criteria On-Site Resident Exposure to Total Soil: TNT-A

Chemical	Source-Term Concentration (mg/kg)	Total HI All Pathways	Target Hazard Index		Total ILCR All Pathways	Target Risk Level	
			1.0	0.1		1.00E-06	1.00E-05
Nitroaromatics							
2-Amino-4,6-dinitrotoluene	3.36E+01	8.32E+00	4.04E+00	4.04E-01	NA	NA	NA
4-Amino-2,6-dinitrotoluene	9.77E+00	2.42E+00	4.04E+00	4.04E-01	NA	NA	NA
2-Nitrotoluene	5.82E+02	8.00E-01	7.28E+02	7.28E+01	NA	NA	NA
4-Nitrotoluene	4.84E+00	6.65E-01	7.28E+02	7.28E+01	NA	NA	NA
2,4,6-Trinitrotoluene	2.59E+02	7.70E+00	3.36E+01	3.36E+00	1.82E-05	1.43E+01	1.43E+02
PCB							
Aroclor 1260	6.98E+01	NA	NA	NA	2.43E-04	2.87E-01	2.87E+00
Semivolatile Organic Compounds							
2,4-Dinitrotoluene	8.91E+03	6.02E+01	1.48E+02	1.48E+01	1.19E-02	7.48E-01	7.48E+00
2,6-Dinitrotoluene	1.03E+04	1.39E+02	7.40E+01	7.40E+00	1.37E-02	7.48E-01	7.48E+00
Benzo(a)pyrene	2.18E-01	NA	NA	NA	4.02E-06	5.43E-02	5.43E-01

HI - Hazard index.

ILCR - Incremental lifetime cancer risk.

mg/kg - Milligrams per kilogram.

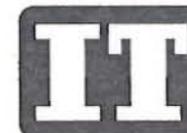
NA - Not applicable.



Summary by Building of total Cancer Risk and Noncancer Hazard by Receptor: TNT-A

Former Building Number	Total Soil Receptors					
	Construction Worker		HI	On-Site Resident		Total
	HI	ILCR		Adult	Child	
111	2.85E-02	2.04E-08	9.90E-02	5.94E-07	8.94E-07	1.49E-06
112	5.34E-01	9.32E-08	1.85E+00	2.62E-06	4.10E-06	6.72E-06
116	6.98E-04	1.36E-08	2.54E-03	4.72E-07	5.60E-07	1.03E-06
119	4.06E+00	1.96E-06	1.42E+01	5.84E-05	8.54E-05	1.44E-04
126	2.33E+00	2.65E-07	8.07E+00	8.98E-06	1.10E-05	2.00E-05
129	NA	2.39E-09	NA	6.35E-08	1.06E-07	1.69E-07
131	1.64E+00	4.34E-07	5.71E+00	1.32E-05	1.89E-05	3.21E-05
136	NA	3.26E-08	NA	1.17E-06	1.31E-06	2.49E-06
139	1.88E-01	3.89E-06	6.52E-01	1.04E-04	1.73E-04	2.77E-04
141	7.75E-01	1.69E-07	2.68E+00	5.22E-06	7.30E-06	1.25E-05
142	3.60E-01	1.57E-07	1.24E+00	4.30E-06	6.92E-06	1.12E-05
143	6.71E-02	8.39E-08	2.32E-01	2.93E-06	3.43E-06	6.36E-06
146	8.04E+00	5.03E-07	2.78E+01	1.73E-05	2.08E-05	3.81E-05
148	7.70E-02	2.40E-08	2.67E-01	6.85E-07	1.06E-06	1.74E-06
182	7.00E-02	5.02E-07	2.55E-01	1.52E-05	2.19E-05	3.71E-05
185	1.68E-03	1.02E-08	6.12E-03	3.10E-07	4.44E-07	7.54E-07
192	1.20E+01	5.93E-05	4.38E+01	1.80E-03	2.59E-03	4.39E-03
195	5.69E+01	3.47E-04	2.07E+02	1.05E-02	1.51E-02	2.57E-02

HI = Hazard Index.
 ILCR = Incremental Lifetime Cancer Risk.
 NA = Not applicable.



Summary of Total Hazard and Total Cancer Risk from Chemicals of Concern: TNT-C

Source Medium	Groundskeeper	Indoor Worker	Construction Worker	On-Site Resident	Adult Hunter	Child Venison Consumer
	Total HI	Total HI	Total HI	Total HI	Total HI	Total HI
Surface Soil	9.54E+01	4.08E+01	NA	NA	4.88E+00	NA
Total Soil	NA	NA	3.60E+02	1.24E+03	NA	NA
Surface Water	NA	NA	1.59E-01	7.84E-02	NA	NA
Sediment	NA	NA	1.37E+01	5.60E+00	NA	NA
Total across all media	9.54E+01	4.08E+01	3.74E+02	1.25E+03	4.88E+00	NA

Source Medium	Groundskeeper	Indoor Worker	Construction Worker	On-Site Resident			Adult Hunter	Child Venison Consumer
	Total ILCR	Total ILCR	Total ILCR	Adult ILCR	Child ILCR	Total ILCR	Total ILCR	Total ILCR
Surface Soil	5.43E-04	2.32E-04	NA	NA	NA	NA	3.39E-05	2.09E-07
Total Soil	NA	NA	5.01E-05	1.57E-03	1.91E-03	3.48E-03	NA	NA
Surface Water	NA	NA	1.77E-08	2.33E-07	1.05E-07	3.38E-07	NA	NA
Sediment	NA	NA	1.36E-06	5.51E-06	6.65E-06	1.22E-05	NA	NA
Total across all media	5.43E-04	2.32E-04	5.15E-05	1.57E-03	1.92E-03	3.49E-03	3.39E-05	2.09E-07

HI - Hazard index

ILCR - Incremental lifetime cancer risk

NA - Not applicable



Chemicals of Concern and Risk-Based Remediation Criteria On-Site Resident Exposure to Total Soil: TNT-C

Chemical	Source-Term Concentration (mg/kg)	Total HI All Pathways	Target Hazard Index		Total ILCR All Pathways	Target Risk Level	
			1.0	0.1		1.00E-06	1.00E-05
Nitroaromatics							
2-Amino-4,6-dinitrotoluene	3.80E+01	9.41E+00	4.04E+00	4.04E-01	NA	NA	NA
4-Amino-2,6-dinitrotoluene	1.13E+01	2.79E+00	4.04E+00	4.04E-01	NA	NA	NA
2,4,6-Trinitrotoluene	4.13E+04	1.23E+03	3.36E+01	3.36E+00	2.89E-03	1.43E+01	1.43E+02
PCBs							
Aroclor 1254	7.45E-01	4.79E-01	1.56E+00	1.56E-01	2.60E-06	2.87E-01	2.87E+00
Aroclor 1260	4.88E+00	NA	NA	NA	1.70E-05	2.87E-01	2.87E+00
Semivolatile Organic Compounds							
2,4-Dinitrotoluene	2.75E+02	1.86E+00	1.48E+02	1.48E+01	3.68E-04	7.48E-01	7.48E+00
2,6-Dinitrotoluene	1.94E+01	2.62E-01	7.40E+01	7.40E+00	2.59E-05	7.48E-01	7.48E+00
Benzo(a)anthracene	6.94E+00	NA	NA	NA	1.28E-05	5.43E-01	5.43E+00
Benzo(a)pyrene	6.33E+00	NA	NA	NA	1.17E-04	5.43E-02	5.43E-01
Benzo(b)fluoranthene	8.43E+00	NA	NA	NA	1.55E-05	5.43E-01	5.43E+00
Dibenz(a,h)anthracene	1.40E+00	NA	NA	NA	2.15E-05	6.51E-02	6.51E-01
Indeno(1,2,3-cd)pyrene	2.05E+00	NA	NA	NA	3.77E-06	5.43E-01	5.43E+00

HI - Hazard index

ILCR - Incremental lifetime cancer risk

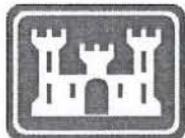
NA - Not applicable



Chemicals of Concern and Risk-Based Remediation Criteria On-Site Resident Exposure to Sediment: TNT-C

Chemical	Source-Term Concentration (mg/kg)	Total HI All Pathways	Target Hazard Index	
			1.0	0.1
Nitroaromatics				
2-Amino-4,6-dinitrotoluene	1.12E+01	3.08E-01	3.63E+01	3.63E+00
4-Amino-2,6-dinitrotoluene	1.28E+01	3.52E-01	3.63E+01	3.63E+00
2,4,6-Trinitrotoluene	1.50E+03	4.94E+00	3.03E+02	3.03E+01

HI - Hazard index
 ILCR - Incremental lifetime cancer risk
 mg/kg - Milligrams per kilogram.
 NA - Not applicable



SUMMARY

**RED WATER PONDS
BASELINE ECOLOGICAL RISK ASSESSMENT
FORMER PLUM BROOK ORDNANCE WORKS
SANDUSKY, OHIO**

Presented by Mark Welsberg at:
PBOW Site Meeting -RAB
July 31, 2001
December 12, 2001




Presentation Outline

- 1. Introduction
- 2. SLERA Results and Problem Formulation
- 3. BERA Study Design
- 4. Verification of Field Sampling Design
- 5. Site Investigation and Data Analysis
- 6. Risk Characterization
- 7. Conclusions




Introduction

- Objective of BERA is to produce a supplement to the Phase 1 Screening-Level Ecological Risk Assessment (SLERA) and to provide additional site-specific information to risk managers to allow them to decide if revised estimated ecological hazards to potentially exposed receptors are acceptable.
- Two sites within the Red Water Ponds (RWP) areas of PBOW were the focus of the BERA:
 - the West Area Red Water Pond (WARWP)
 - the Pentolite Road Red Water Pond (PRRWP)




SLERA Results and Problem Formulation

- In the SLERA (IT, 2000), ecological hazards were estimated using historical and 1999 analytical data collected from both RWP areas.
- WARWP: hazards for receptors were 28 for the deer mouse; 9 for the cottontail rabbit; 96 for the shrew; 452 for the marsh wren; 38 for the raccoon; 8 for the white-tailed deer; 0.006 for the red-tailed hawk; 724 for the great blue heron; and 665 for the raccoon.
- PRRWP: hazards for receptors were 4 for the deer mouse; 3 for the cottontail rabbit; 15 for the shrew; 412 for the marsh wren; 6 for the raccoon; 2 for the white-tailed deer; 0.002 for the red-tailed hawk; 126 for the great blue heron; and 38 for the raccoon.




SLERA Results and Problem Formulation

- Hazard drivers (i.e., those chemical constituents contributing the most to the elevated hazards) were as follows, by media:
 - Soil: nitroaromatics (DNT compounds), polynuclear aromatic hydrocarbons (PAH), and antimony;
 - Surface Water: aluminum, magnesium, lead, and iron; and
 - Sediment: nitroaromatics (DNT compounds), the PAH carbazole, and the inorganics aluminum, iron, magnesium, phosphorus, potassium, and calcium.




SLERA Results and Problem Formulation

- Based on the findings of the SLERA and discussions with USACE, the following was recommended:
 - Collect additional surface water, sediment, and surface soil background data;
 - Conduct terrestrial earthworm and aquatic worm bioaccumulation studies to estimate uptake and bioavailability of chemical constituents from soil and sediment;
 - Conduct fish uptake study to estimate bioaccumulation and bioavailability of metals from surface water; and
 - Conduct a literature search to obtain a more accurate avian toxicity benchmarks




BERA Study Design

- The Work Plan sampling and analysis plan included:
 - Data needs,
 - Analytical procedures,
 - Sampling techniques,
 - Quality assurance/quality control,
 - Land surveying,
 - Decontamination procedures,
 - Sample preservation, packing, and shipping, and
 - Investigation derived waste management plan.



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Verification of Field Sampling Design

- Field verification is Step 5 of the ERAGS eight-step process.
- IT ecologist verified that methods/sampling efforts (described in the Work Plan) were actually feasible at the RWP sites.
- The Field Verification Visit was conducted June 29-30, 2000, and a memorandum documenting the site visit was prepared. The site conditions and feasibility of the proposed approach were sent to CELRN, PBS and OEPA on July 18, 2000. OEPA review comments on the Work Plan and Memorandum were received August 1, 2000.
- The Work Plan was subsequently revised and resubmitted to OEPA on August 31, 2000



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Site Investigation and Data Analysis

- Following OEPA-approved Work Plan, sampling activities for soil, surface water, sediment, fish and aquatic biota occurred 9/2000.
- Samples were analyzed for key chemicals (ID'd in the SLERA).
- More background samples taken for soil, sediment, surface water.
- RWP samples also used to perform bioaccumulation studies (earthworm uptake from soil; aquatic worm uptake from sediment) and toxicity tests (minnow and cladoceran (water flea) toxicity from surface water; amphipod toxicity from sediment; earthworm toxicity from soil).



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Site Investigation and Data Analysis

Aquatic Organism Data - Red Water Ponds (Table 5-7)

SEE ATTACHED SLIDE



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Risk Characterization

- Results from the site investigation were used to revise and supplement the SLERA risk characterization.
- COPECs (ID'd in SLERA) were reevaluated using the additional background data and historic frequency of detection (FOD) data.
 - Constituents were eliminated as risk driver COPECs if concentrations were not found to be statistically greater than background concentrations or if the FOD (by media) was less than 5 percent and the constituent was not detected in the 9/2000 sampling event.



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Risk Characterization

- | | |
|--|--|
| ■ West Area RWP COPECs retained were: | ■ Pentolite Road RWP COPECs retained were: |
| → 8/10 COPECs in surf soil
• Exclusion Rationale: FOD | → 2/3 COPECs in surf soil
• Exclusion Rationale: FOD |
| → 10/10 COPECs in total soil | → 2/5 COPECs in total soil
• Exclusion Rationale: FOD and Bkgnd |
| → 3/5 COPECs in surf water
• Exclusion Rationale: Bkgnd | → 0/4 COPECs in surf water |
| → 2/7 COPECs in sediment
• Exclusion Rationale: Bkgnd | → 0/3 COPECs in sediment
• Exclusion Rationale: Bkgnd |



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Site Investigation and Data Analysis

Aquatic Organism Data - Red Water Ponds (Table 5-7)

Location	Species	Count	Total Weight (g)	Average Weight (g)	Lengths (cm)
West Area	fathead minnow	150	240	1.6	3.5 (average)
West Area	green sunfish	29	90	3.1	average = 4.8
West Area	green sunfish	9	115	13	average = 8.0
West Area	fathead minnow	170	250	1.5	3.5 (average)
Pentolite Rd	fathead minnow	165	140	0.85	2 – 4, some 7
Pentolite Rd	tadpoles	42	75	1.8	4 and 7 (2 size classes)
Pentolite Rd	crayfish	59	130	2.2	5.0 (average)

Risk Characterization Results

(Table 6-20)

Test Species = Earthworm, Toxicity Endpoint = Survival		
Constituent	Statistical Correlation Between Earthworm Survival and Soil Concentration	Correlation Result Suggests the Following:
Anthracene	- 1.0	Organic concentration may be related to toxicity
Benzo(a)anthracene	- 0.23	Organic concentration not related to toxicity
Benzo(a)pyrene	- 0.99	Organic concentration may be related to toxicity
Benzo(b)fluoranthene	- 0.99	Organic concentration may be related to toxicity
Benzo(ghi)perylene	- 1.0	Organic concentration may be related to toxicity
Benzo(k)fluoranthene	- 1.0	Organic concentration may be related to toxicity
Chrysene	- 0.99	Organic concentration may be related to toxicity
Dibenzo(ah)anthracene	- 0.99	Organic concentration may be related to toxicity
Fluoranthene	- 0.98	Organic concentration may be related to toxicity
Fluorene	+ 0.53	Organic concentration not related to toxicity
Indeno(123-cd)pyrene	- 0.99	Organic concentration may be related to toxicity
Phenanthrene	+ 0.44	Organic concentration not related to toxicity
Pyrene	- 0.16	Organic concentration not related to toxicity

Note: r^2 must be > 0.60 to be significant at P 0.05-level

SUMMARY

GROUNDWATER REMEDIAL INVESTIGATION TNT AND REDWATER PONDS AREAS

FORMER PLUM BROOK ORDNANCE WORKS SANDUSKY, OHIO

Presented To:

Restoration Advisory Board

December 12, 2001



K01PBCW/TNT-Area D/Red PCBW TNT B P3 999.pdf

Groundwater Remedial Investigation

- A groundwater investigation was conducted at TNT Areas A, B, and C beginning in 2001 to:
 - Determine the nature of the waste
 - Characterize contaminate plume boundaries
 - Refine Site Conceptual Model
 - Determine current and future routes of exposure as part of a site conceptual exposure model
 - Fill Data Gaps
 - Soil samples from TNT Areas A, B, C, West Area Red Water Pond, and Pentolite Road Red Water Pond.



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