MEETING MINUTES
RESTORATION ADVISORY BOARD
PLUM BROOK ORDNANCE WORKS
June 18, 2009

Attendees

Rick Meadows, USACE RAB Co-Chairperson
Lisa Humphreys, USACE Huntington
Lannae Long, USACE Nashville
Mark Bohne, RAB Community Co-Chairperson
Richard Pitsinger, RAB Member
Gil Steinen, RAB Member
Lee Yeckley, RAB Member
Paul Jayko, OEPA NWDO
Archie Lunsey, OEPA NWDO
Steve Downey, Shaw Environmental
Mike Gunderson, Shaw Environmental
Kim Chambers, McTech Corporation
Dan Cashbaugh, McTech Corporation
Julie Weatherington-Rice, Bennett & Williams
Eyn Kyoung Kim, OSU
Young Woon Kang, OSU
Sharon Barnes, Barnes Nursery
Mary Mischler, Barnes Nursery
Connie Livchak, EcoGeological, LLC
Greg Hoodlebrink, George Gradel Co.
Kurt Landefeld, Erie Metroparks
Helen Owens, Stillwater Environmental

Agenda

The agenda for the meeting included the following topics:

- Update on Active Projects – Shaw Environmental, Inc.
- Spring Eco-Site Walk – USACE
- Oil Fingerprinting – Shaw Environmental, Inc.
- Presentation of TNT Area C Responsiveness Summary – Shaw Environmental, Inc.
- Back to the Wild – Update on PBOW eaglets
- OSU Composting Presentation
- Open Topics

Update on Active Projects

Steve Downey, Shaw Environmental, Inc. presented an update of the current active projects at PBOW. The active projects include:

- WWTP 1 and 3
- Sewer Line Investigation
- Ash Pits 1 and 3
- Powerhouse 2 Ash Pits
- Locomotive Shop (Maintenance Area)

Mr. Downey's presentation is included as an attachment to these minutes.

Spring Eco-Site Walk

Lannae Long, USACE provided an overview of findings from the spring 2009 eco-site walk. Ms. Long's presentation is included as an attachment to these minutes.

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Oil Fingerprinting
Mike Gunderson, Shaw Environmental, Inc provided a review of the oil fingerprinting process conducted by NASA to determine the source of petroleum-like product that is present at PBOW in several monitoring wells, observed on limestone bedrock cores, and the detection of methane in a monitoring well. Mr. Gunderson's presentation is included as an attachment to these minutes.

TNT Area C Responsiveness Summary
Steve Downey, Shaw Environmental, Inc. presented the TNT Area C Responsiveness Summary. The RAB Co-Chairperson indicated the group was satisfied with the responses prepared by USACE. Mr. Downey's presentation is included as an attachment to these minutes.

Back to the Wild – Update on PBOW Eaglets
In the spring of 2009, high winds destroyed a bald eagle nest located on PBOW. Two eaglets were in the nest when it hit the ground near the Ash Pit 3 area. Back to the Wild, a local, non-profit, animal rescue organization was invited to the RAB to give an update on the eaglets and to talk about some of the work done at their facility. Back to the Wild was unable to attend the RAB, but provided an update to inform the RAB that one eaglet was recovering and the second one had to be euthanized because it had severe internal injuries. Additional information on the programs at Back to the Wild is available on their website http://www.backtothewild.org/.

Composting of TNT Contaminated Soils with Chicken Manure at PRRWP
Drs. Young Woon Kang and Eun Kyoung Kim of The Ohio State University (OSU) presented a third-party review of the composting project at Pentolite Road Red Water Ponds. The project field work and report was completed by McTech Corporation. The McTech report was presented to the RAB in March 2009. The OSU presentation is provided as an attachment to these minutes.

Meeting Schedule
The next RAB Meeting is scheduled for September 10, 2009.

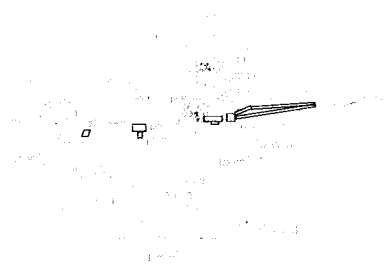
Field Work Completion Status

Plum Brook Ordnance Works RAB Meeting
Sandusky, Ohio
18 June 2009

Steven T. Downey, Shaw E & I, Knoxville, TN

Investigation Areas

- TNTA to WWTP 1 Wooden Sewer Lines
- WWTP 1 & 3
- Ash Pit 1 & 2 &3
- Rail Car Wash Area
- Locomotive Building Area



TNTA to WWTP 1 Wooden Sewer Lines

- Monitoring Wells
  - Three Residual Monitoring Wells Installed
    - Well Depths 18.7 to 28.8 ft bgs
  - Three Bedrock Monitoring Wells Installed
    - Well Depths 57.5 to 84.3 ft bgs
    - Weathered Bedrock 11 to 18 ft bgs
    - Competent Bedrock 20 to 34 ft bgs
  - One Residual and One Bedrock Well Not Sampled Due To Insufficient Water
  - Two Sampled Bedrock Wells >200 ppm H_2S
- Analytical Testing, Reporting, Validation in Progress

Vapors from Bedrock Well

Waste Water Treatment Plant 1

- Monitoring Wells
  - Three Residual Monitoring Wells Installed
    - All Well Depths 16.3 ft bgs
  - Two Bedrock Monitoring Wells Installed
    - One Dry Borehole – 95.6 ft bgs
    - Well Depths 53.4 to 55.4 ft bgs
    - Weathered Bedrock 21 to 24 ft bgs
    - Competent Bedrock 26 to 37 ft bgs
  - One Bedrock Well Not Sampled Due To Insufficient Water
  - Two Bedrock Wells >200 ppm H_2S
- Surface Water and Sediment
  - Collected One Collocated SW/SD and Three SD Samples
- Analytical Testing, Reporting, Validation in Progress

Waste Water Treatment Plant 3

- Monitoring Wells
  - Three Residual Monitoring Wells Installed
    - All Well Depths 18.4 ft bgs
  - Three Bedrock Monitoring Wells Installed
    - All Well Depths 52.3 ft bgs
    - Weathered Bedrock 24 to 26 ft bgs
    - Competent Bedrock 28 ft bgs
  - All Wells Sampled
    - Three Bedrock Wells >200 ppm H_2S
    - One Bedrock Well 0.10 ft Hydrocarbon
- Surface Water and Sediment
  - Collected One Collocated SW/SD and Three SD Samples
- Analytical Testing, Reporting, Validation in Progress

Ash Pit 1

- Monitoring Wells
  - Three Residual Monitoring Wells Installed
    - Well Depths 16.3 to 19.5 ft bgs
  - Two Bedrock Monitoring Wells Installed
    - Well Depths 59.4 and 79.4 ft bgs
    - Weathered Bedrock 24.1 to 25.3 ft bgs
    - Competent Bedrock ~28 ft bgs
  - All Wells Sampled
    - Two Bedrock Wells >200 ppm H_2S
    - One Bedrock Well 0.02 ft Hydrocarbon
- Surface Water and Sediment
  - Collected Four Collocated SW/SD Samples
- Analytical Testing, Reporting, Validation in Progress

Ash Pit 2

- Monitoring Wells
  - Three Residual Monitoring Wells Installed
    - Well Depths 11.3 to 20.0 ft bgs
  - Three Bedrock Monitoring Wells Installed
    - Well Depths 61.0 to 87.0 ft bgs
    - Weathered Bedrock 13 to 19.5 ft bgs
    - Competent Bedrock 15.5 to19.6 ft bgs
  - All Wells Sampled
- Surface Water and Sediment
  - Collected Five Collocated SW/SD Samples
- Analytical Testing, Reporting, Validation in Progress

Ash Pit 3

- Monitoring Wells
  - Not installed due to standing water and nesting eagles
  - Eagle's nest was blown down in May storm
- Surface Water and Sediment
  - Collected Three Collocated SW/SD Samples
- Analytical Testing, Reporting, Validation in Progress

Rail Car Wash Area

- Monitoring Wells
  - Three Residual Monitoring Wells Installed
    - Well Depths 9.4 to 28.7 ft bgs
  - Three Bedrock Monitoring Wells Installed
    - Well Depths 65.4 to 104.4 ft bgs
    - Weathered Bedrock 23.2 to 26 ft bgs
    - Competent Bedrock ~26 ft bgs
  - All Wells Sampled
- Analytical Testing, Reporting, Validation in Progress

Locomotive Building Area

- Monitoring Wells
  - Three Residual Monitoring Wells Installed
    - Well Depths 16.4 ft bgs
  - Two Bedrock Monitoring Wells Installed
    - Well Depths 70.4 and 100.4 ft bgs
    - Weathered Bedrock 25 and 27 ft bgs
    - Competent Bedrock 39.8 and ~27 ft bgs
  - All Wells Sampled
- Surface Water and Sediment
  - Collected Six Collocated SW/SD Samples
  - Collected One SW Sample from Clay Pipe where it drains into Plum Brook
- Analytical Testing, Reporting, Validation in Progress

Future Activities

- Additional investigation at Ash Pit 3
- Interim Data Summary Technical Memorandum Preparation
- Site Characterization Report Preparation

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Nashville District

Plum Brook Ordnance Works
Ecological Survey

Presented to the
PBOW Restoration Advisory Board
on 18 June 2009

Presented by Lance Long, USACE
Jonathan Lindberg, Shaw Environmental and Infrastructure
Todd Crandall, Davey Resource Group

Shaw Solutions

DAVEY RESOURCE GROUP

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Eco Recon Purpose

- Protection of Environment
- Ecological Risk Assessment
- Ecological Site Description
- Ecological Site Conceptual Model
- Species
- Habitat
- Ecosystems
- Vegetation

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Ecological Site Recon for 8 AOCs

- Waste Water Treatment Plants 1 and 3
- Ash Pits 1, 2, and 3
- Locomotive House Area
- WWTP 1-A Sewer Line
- WWTP 1-B Sewer Line

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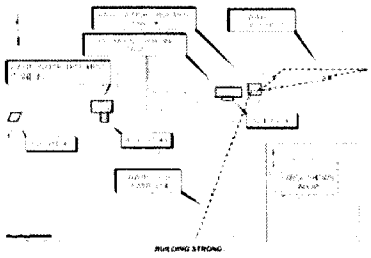
Ecological Recon Map



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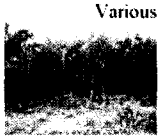
Various Types of Habitats



Successional Forest (AP 1)

Grassland (WWTP 3)

Inundated meadow (AP 3)

Mature forest (AP 2)

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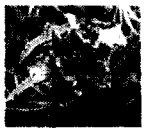
Examples of Flora

Yellow Iris

Wild Coffee

Sensitive Fern



Ohio Spiderwort

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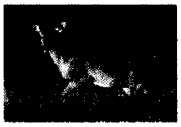
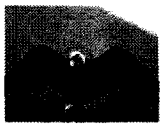
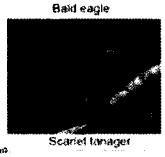
Examples of Fauna


White-tailed deer


Bald eagle

American goldfinch


Scarlet tanager

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Bald Eagle Protection Act

- June 2007, off the Federal List of Endangered and Threatened Wildlife and Plants
- Still covered by:
  - Migratory Bird Treaty Act 16 USC 702-712
  - Bald and Golden Eagle Protection Act 16 USC 668-668c
  - ODNR Threatened Species

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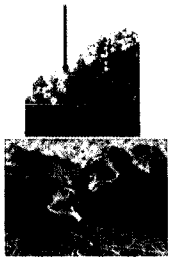
Ash Pit 3 and the Bald Eagles

- Postponed work at Ash Pit 3
- May 1st ok, May 13th, Friday May 15th
- Back to the Wild, Castalia
- Ottawa Nat'l Wildlife Refuge foster eagle parents June 4th
- Firelands Animal, Hosp Huron
- Dr Sue Orosz, Toledo
- www.backtothewild.com



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Results

- Habitat characteristics documented at each site
- Several mammalian tracks and visual observations
- Bird Survey results
- Field Flora Survey results
- Spring, Fall
- Use data for Ecological Risk Assessment

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Overview of Petroleum Fingerprinting

Plum Brook Ordnance Works Team Meeting
Sandusky, Ohio
18 June 2009

Michael Gunderson, Shaw E&I

Outline

- Petroleum in PBS Groundwater
- Fingerprinting (Forensic) Analysis
- Information Obtained from Fingerprinting
- Data Interpretation
- PBS Approach
- PBS Fingerpring Findings

Petroleum in PBS Groundwater

- Petroleum and related products reported in onsite monitoring wells with no identified sources
  - Petroleum staining present on limestone bedrock cores
  - Free product present (sheen to approx. 14 ft of free product)
  - Methane detected in one monitoring well during drilling
    - Reports of an abandoned natural gas well on PBOW
- NASA and the Army have stored petroleum onsite
- Typical CERLA investigations determine concentrations of contaminants in groundwater with known source areas
- Need to determine if the petroleum detected is from an anthropogenic or natural source

Fingerprinting (Forensic) Analysis

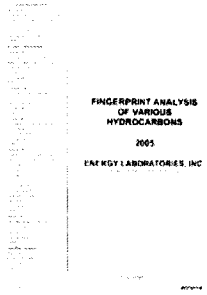
- Forensics implies some judicial or legal application
  - Applied at PBOW to determine source of petroleum
- Scientific methodology to determine sources/causes
  - Legally defensible
  - Uses scientific principles, analytical methods and site knowledge
- Site knowledge crucial to data interpretation
  - Known or potential sources
    - Limited fuel storage occurred both by NASA and the Army
  - Site Conditions
    - Hydrogeology
    - Potential for occurrence of natural petroleum in underlying limestone units

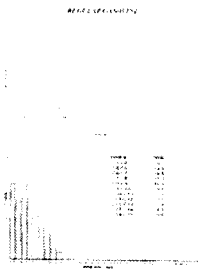
Information Obtained From Fingerprint Analysis

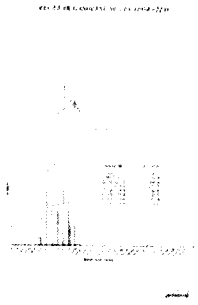
- Identification of product type
  - Refined products
    - Gasoline, diesel, heating oil, etc
  - Crude petroleum
    - Primarily used in the petroleum industry
- Age of product
  - Primarily used for releases of refined products
- Types of weathering
  - Evaporation, biodegradation, washing

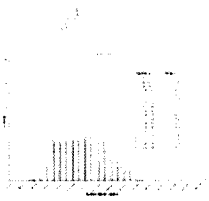
Fingerprint Data Interpretation

- Not always definitive
  - For example, spills of refined products from adjacent facilities
    - Gasoline stations with similar operational periods would likely provide similar signatures
  - Interpretation easier for two different types of product
    - Gasoline vs. heating oil
      - Fuel additives (TML, TEL, MTBE, EDB, EDC) indicative of gasoline
    - Crude petroleum vs. refined products (gasoline, heating oil, etc)
      - Crude petroleum is a complex mixture of compounds (C1 to C50)
        - » Wide range of n-paraffins, no olefins
      - Refined products generally have a more reduced mixture of compounds and may contain additives
        - » More limited range of n-paraffins,
        - » Olefins are an artifact of refining process GC Scans.pdf







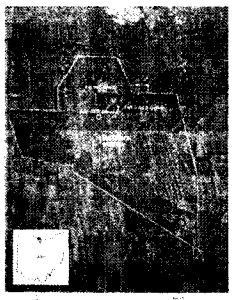


Fingerprint Data Interpretation

- Ultimately, data is used to determine responsibility
  - U.S. Army?
  - NASA?
  - Other upgradient source?
  - Mother Nature?
  - All of the above?

Plum Brook Approach

- Investigation/interpretation completed by NASA
  - Sampled free product from three bedrock wells Well Locations.pdf
    - AA1-BEDGW001 (max. of 0.89 ft of free product)
    - PB-BEDGW023 (max. of 0.21 ft of free product)
    - TNTA-BEDGW001 (max. of 13.86 ft of free product)
  - All samples were reported as dark brown in color with pungent odor
  - Samples analyzed for hydrocarbon fingerprinting, PAH concentrations, and biomarker concentration



Plum Brook Findings

- All three PBOW samples showed similarities in composition indicating a common source
- Total extractable hydrocarbons ranged from 42 to 68% of total mass
  - Wide range of hydrocarbons detected from C8 to C40 range
  - Total PAHs in the TEH ranged from 1 to 2%
    - Molecular ranges of PAHs matched the referenced crude oil
- Findings matched well with lightly weathered reference crude oil (Alaskan North Slope Crude Oil) SAIC Doc.pdf

TNT Area C Responsiveness Summary

Plum Brook Ordnance Works RAB Meeting
Sandusky, Ohio
18 June 2009

Steve Downey, Shaw Environmental and Infrastructure Group

Comments Received on TNTC Proposed Plan During Public Comment Period

1. Disposal of ADNT-contaminated soil at EC Landfill
   A. Specific health hazards associated with ADNTs?
   B. Potential for effectiveness of using alkaline hydrolysis after composting?
2. Concerns over migration of ADNT-contaminated compost from landfill
   A. Off-site hazards of airborne particles?
   B. Off-site hazards in public right-of-way (Hoover Rd.)?
   C. Off-site hazards to Mud Brook of compost tracked from traffic?

1. Disposal of ADNT-Contaminated Compost at Landfill

- A goal of remedial action for TNTC is to minimize residual post-treatment concentrations
- Expectation is to meet RGs for on-site placement
- Composting might not be used, or it may be used only after alkaline hydrolysis (if necessary)
  - Alkaline hydrolysis remediates TNT without generation of ADNTs

1A. Specific Health Hazards Associated with ADNTs?

- Human health hazards are extrapolated from animal studies
  - Effects on red blood cells
  - Safety factor was used for human toxicity value in TNTC risk assessment
  - RGs were derived from TNTC risk assessment

1B. Potential for Effectiveness of Using Alkaline Hydrolysis After Composting?

- Alkaline hydrolysis is suggested as a 1st step for use on heavily TNT-contaminated soils because it remediates TNT without generating ADNTs
- Limited data suggest that alkaline hydrolysis may not be highly effective at treating ADNTs already present
- During remediation multiple approaches using composting and/or alkaline hydrolysis may be evaluated
  - May use alkaline hydrolysis for high TNT contamination, then composting if necessary to meet RGs
  - May use composting alone if TNT is not elevated
  - Data will be evaluated during pilot studies as necessary and during actual remediation

2. Concerns Over Migration of ADNT-Contaminated Compost from Landfill

- Corps is responsible for proper disposal of materials from PBOW
- The Erie County Landfill is responsible for handling of materials once they are brought to the landfill

2A. Off-site Hazards of Airborne Particles?

- Dust control measures are in place at EC Landfill
- Based on EC Landfill description of operations, dust carried off site should be minimal
- Conservative "beyond worst-case" scenario developed and evaluated for inhalation using TNTC BHHRA
  - Assumes off-site residential dust concentration is same as for on-site groundskeeper active in dust-raising activities
  - Assumes average ADNT conc. of 11.3 mg/kg in dust (compost)
    - Essentially equals the TNTB stockpile max. of 11.8 mg/kg
  - Assumes young child resident receptor
  - Inhalation HI of ADNT is 0.004, far below HI criterion of 1

2A. Off-site Hazards of Airborne Particles? (cont'd)

- Conservative "beyond-worst-case" exposure also considered with respect to compost material deposited on nearby off-site property
  - ADNT concentrations from TNTB stockpiles:
    - Maximum: 11.8 mg/kg
    - Average: 2.4 mg/kg
  - EPA PRG Table residential soil value: 12 mg/kg
  - TNTC combined 2-ADNT/4-ADNT RG sum: 3.0 mg/kg
    - Includes summed effects of other COCs present at their RGs
- Even if off-site soil were 100% compost, average value meets RG

2B. Off-Site Hazards in Public Right-of-Way (Hoover Rd.)?

- Discussion with EC Landfill Operator
  - Trucks never drive directly on daily cover material
  - Daily cover material (including compost) does not get tracked on tires
  - Dozer remains in cell area; does not drive on landfill road
  - Landfill area and haul road are unpaved
- Material tracked onto Hoover Rd. is mud from landfill areas and unpaved haul road
- Virtually none of the material tracked onto Hoover Road is daily cover

2C. Off-Site Hazards to Mud Brook of Compost Tracked from Traffic?

- Discussion with EC Landfill Operator
  - Trucks never drive directly on daily cover material
  - Daily cover material (including compost) does not get tracked on tires
  - Dozer remains in cell area; does not drive on landfill road
  - Landfill area and haul road are unpaved
- Virtually none of the soil carried by vehicles is cover material
- All landfill run-off is contained by the leachate collection system
  - Collected in tank truck and disposed of off site

Conclusions

- EC Landfill has dust control measures in place
  - Likely results in minimal (or negligible) levels of off-site inhalation
  - Likely results in minimal (or negligible) levels of off-site deposition
- If dust controls were not in place and "beyond-worst-case" exposure is assumed:
  - Inhalation risks would be negligible
  - ADNT concentrations in soils would be acceptable for residential use
- Soils tracked from the landfill to Hoover Rd. are likely composed of virtually no cover material
- Cover materials are unlikely to reach Mud Creek
  - Vehicle traffic is isolated from the cover material
  - Run-off from stockpiles (and cells) is contained

Composting of TNT Contaminated Soils with Chicken Manure at PRRWP

Young Woon Kang, Eun Kyoung Kim, Julie Weatherington-Rice and Ann Christy

1

Composting Operation

- Composting method: Windrow
- Number of windrows: 10
- Composting period: 8 weeks
- Target waste for removal: TNT
- Initial TNT concentration: 3.4 – 280 mg/kg (average 120.5 mg/kg)
- PRG for TNT: 12 mg/kg

2

Composting Operation Factors

Parameters	Common Values*	Values for PRRWP
C/N ratio	30:1	27 – 53:1
Moisture content	60 %	4 – 15.2 %**
Temperature	< 65 °C	25 – 64 °C
Aeration	Proper aeration required	Daily turn over

* OSU Extension Bulletin 792-95, The composting process
** Measurements performed during last 4 weeks

3

Windrow Grouping for Result Analysis

- Group 1(Windrow #1, 2, 6 & 10)
  - **SLOW** TNT degradation
  - Hot spots **ABOVE** PRG level (12 mg/kg) presented during composting
  - Initial TNT concentration: 60 – 280 mg/kg
- Group 2(Windrow #3, 7 & 9)
  - **FAST** TNT degradation
  - Hot spots **BELOW** PRG level (12 mg/kg) presented during composting
  - Initial TNT concentration: 130 – 200 mg/kg

4

Continued

- Group 3(Windrow #4, 5 & 8)
  - Slow TNT degradation
  - Hot spots above PRG level (12 mg/kg) presented during composting
  - **LOW** initial TNT concentration (3.4 – 56 mg/kg)

5

TNT removals

Windrow #	Initial TNT conc., mg/kg	Final TNT conc., mg/kg	Removal efficiency, %
1	78	0.82	98.9
2	60	0.91	98.5
3	130	0.31	99.8
4	3.4	0.26	92.4
5	56	2.4	95.7
6	150	0.79	99.5
7	200	3.2	98.4
8	48	0.8	98.3
9	200	0.45	99.8
10	280	0.37	99.9
Comp.*	120.5	1.0	99.2

*Note: Numerical calculation for average

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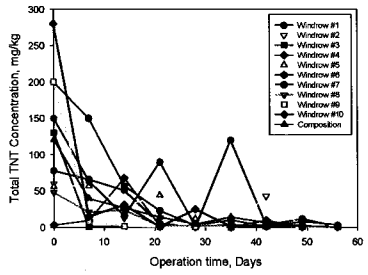
TNT Removal for 10 Windrows during 8-Weeks Composting



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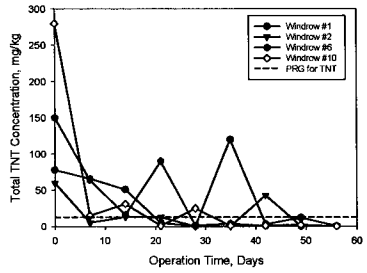
TNT Removal for Group 1 during 8-Weeks Composting



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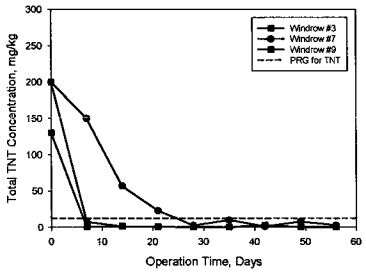
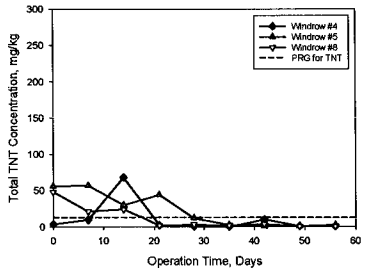
TNT Removal for Group 2 during 8-Weeks Composting



9

TNT Removal for Group 3 during 8-Weeks Composting



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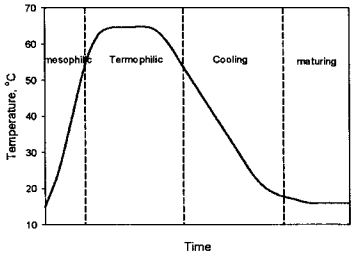
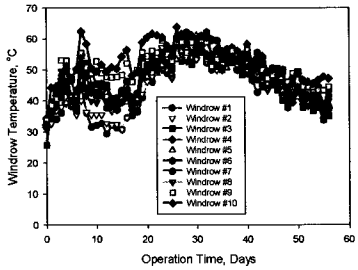
Temperature variation during the composting



Citation: Shilev et al., 2007, Chapter 15: Composting of food and agricultural wastes, In Utilization of by-products and treatment of waste in the food industry. Springer/US.

Windrow Temperature Variation for 10 Windrows during 8-Weeks Composting



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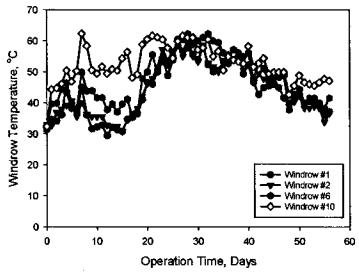
Windrow Temperature Variation for Group 1 during 8-Weeks Composting



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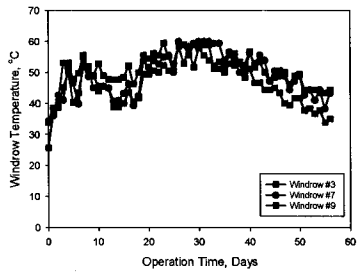
Windrow Temperature Variation for Group 2 during 8-Weeks Composting



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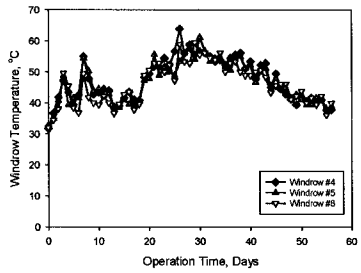
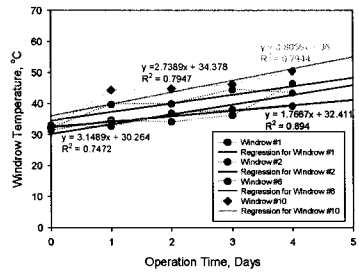
Windrow Temperature Variation for Group 3 during 8-Weeks Composting



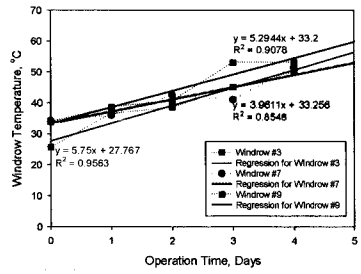
15

Regression of Temperature Variation for Group 1 during 1st 4-Days Composting



16

Regression of Temperature Variation for Group 2 during 1st 4-Days Composting



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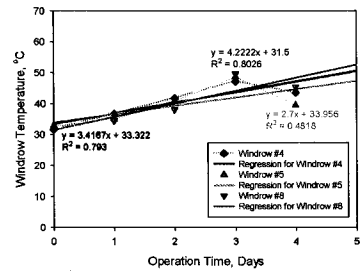
Regression of Temperature Variation for Group 3 during 1st 4-Days Composting



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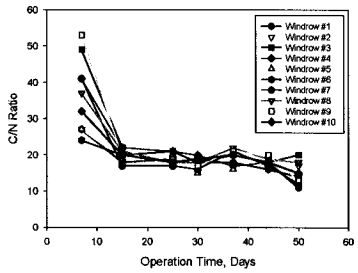
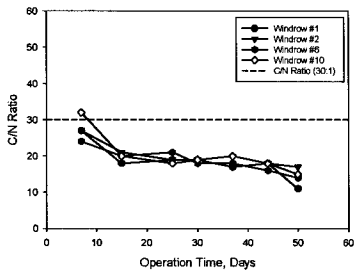
C/N Ratio Variation for 10 Windrows during 8-Weeks Composting



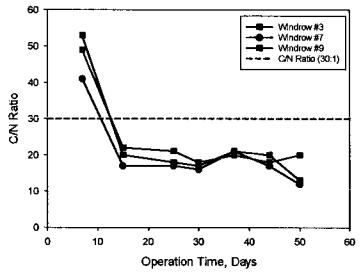
19

C/N Ratio Variation for Group 1 during 8-Weeks Composting



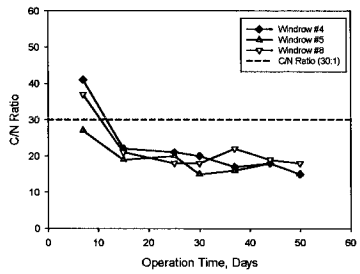
20

C/N Ratio Variation for Group 2 during 8-Weeks Composting



21

C/N Ratio Variation for Group 3 during 8-Weeks Composting



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Nitrogen Study for Composting of TNT Contaminated Soils

- Low C/N ratio case
  - Microorganisms use N from readily degradable N-sources, i.e. chicken manure first and then use N from reluctant N-sources, i.e. TNT
  - Balanced C/N ratio for supporting normal biological activities
- High C/N ratio case
  - Microorganisms use spontaneously or quickly N from both readily degradable N sources and reluctant N-sources
  - Accelerated N degradation with rich C condition

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Conclusions and Recommendations

- Composting is an effective treatment for TNT
- High pH affects natural microbial community.
- The choice of C and/or N is critical in composting because of also adding a new microbiological community
- Higher C/N Ratio, faster and shorter composting operation for TNT removal
- Need for a clean soil windrow with C/N addition for QA/QC
- Need for better data collection with controlled system, i.e. moisture content, pH of windrows during composting, etc

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Future Research Works

- Optimum C/N ratio study
- Composting study using other bulking agents as carbon sources, i.e. grasses vs woodchips, need for importing a new biological community, economic ratio
- Composting study using other nitrogen sources, i.e. raw vs heat treated, natural vs man-made
- Determine the role of phosphorus in this process, establish it's soluble reactive ratio byproduct at end of process
- Biotechnological & soil grain-size & parent material study
- Unexpected consequences of phosphorus, etc

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