# Jefferson Proving Ground
# South of the Firing Line

## Draft Phase II Remedial Investigation
## Summary Report and Comments

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## Executive Summary

This report summarizes the Draft Phase II Remedial Investigation report, methods and recommendations and adds specific comments or concerns we have about these recommendations and the report in general. We have also made some suggestions about potential future uses or restrictions on future uses for some of the sites. This is the fourth draft of our report summary. We may change or add to this summary as new information becomes available.

This report summary presents general and background information first, followed by individual site summaries. The final sections are overall concerns and the bibliography. A full bibliography will be added in the next draft.

For the most part, we agree with the generic recommendations made by RUST Environment and Infrastructure, the authors of the report, with regard to which sites move forward to the feasibility study. However, we have expressed some concerns and caveats with regard to future monitoring and uses of some of the sites. The list below summarizes our recommendations and how they compare to RUST's recommendations.

| ***Site Name and Number*** | ***RUST Recommendations*** | ***Henshel EnviroComm Recommendations*** |
|---|---|---|
| 1 - Incinerator (Bldg. 185) | Move to FS | Move to FS, limit residential/agricultural development |
| 2/27 - Sewage Treatment Plant & Sludge Application Areas | Move to FS | Move to FS, limit residential/agricultural development |
| 3/4 - Explosive Burn Area & Abandoned Landfill | Move to FS | Move to FS, institute monitoring of groundwater and crops |
| 5/6 - Wood Storage Pile & Wood Burning Pile | No Further Action | No Further Action |
| 7/21B - Red Lead Disposal Area & Bldg. 211 | Move to FS | Move to FS |
| 8 - Small Arms Firing Range (Bldg. 295) | No Further Action | Confirmatory sampling needed before No Further Action recommended |
| 9 - Burning Ground South of Gate 19 Landfill | Move to FS | Move to FS, further sampling for several chemicals (see summary) |
| 10 - Gate 19 Landfill | No Further Action | Move to FS because of its proximity to Site 9 |
| 12A - Solvent Pit (Bldg. 602) | Move to FS | Move to FS, improve understanding of groundwater flow dynamics |
| 12B - Solvent Pit (Bldg. 617) | Move to FS | Move to FS, improve understanding of groundwater flow dynamics |
| 12C - Solvent Pit (Bldg. 279) | Move to FS | Move to FS, improve understanding of groundwater flow dynamics |
| 13 - Old Fire Training Pit | Move to FS | Move to FS, further sampling for several chemicals (see summary) |

| ***Site Name and Number*** | ***RUST Recommendations*** | ***Henshel EnviroComm Recommendations*** |
|---|---|---|
| 14 - Yellow Sulfur Disposal Area | Move to FS | Move to FS |
| 15 - Burn Area South of the New Incinerator | No Further Action | Confirmatory sampling needed before No Further Action recommended |
| 21A/30 - Temporary Storage Area (Bldg. 204) & Adjacent Shed | Move to FS | Move to FS, further sampling of subsurface soil and groundwater |
| 25 - Papermill Road Disposal Area | No Further Action | No Further Action as long as institutional controls limit land use to industrial/commercial only |
| 26 – DRMO | No Further Action | No Further Action |
| 28 - Open Burn Area | No Further Action | Disagree with No Further Action because of poor reference comparison |
| 29 - Gator Z Mine Scrap Disposal Area | No Further Action | No Further Action |
| 31 - Former Storage Pad (Bldg. 227) | No Further Action | No Further Action |
| 33 - New Incinerator (Bldg. 333) | No Further Action | No Further Action as long as institutional controls limit land use to industrial/commercial only |
| 34 - Sand Blasting Area (Bldg. 136) | No Further Action | No Further Action |
| 38 - Northwest-Southeast runway Flare Test Area | No Further Action | No Further Action |
| 39 - Gator Z Mine Test Area | No Further Action | Disagree with No Further Action because of poor reference comparison |
| 42 - Indoor Range (Bldg. 281) | No Further Action | Confirmatory sampling needed before No Further Action recommended |

## Commonly Used Abbreviations

*CERCLA* –Comprehensive Environmental Response, Compensation and Liability Act - This act is often called "Superfund"

*EPA* – Environmental Protection Agency (federal)

*ERA* – Ecological Risk Assessment

*FS* – Feasibility Study

*HI* – Hazard Index

*JPG* – Jefferson Proving Ground

*PID* – photoionization detector; a PID is a field instrument that detects gaseous (volatilized)organic materials in the air.

*ppb* – parts per billion = nanograms/gram (ng/g) = micrograms/kilogram (µg/kg)

*ppm* – parts per million = micrograms/gram (µg/kg) = milligrams/kilogram (mg/kg)

*ppt* – parts per trillion = picograms/gram (pg/g) = nanograms/kilogram (ng/kg)

*QA/QC* – Quality Assurance/Quality Control

*RAGS* – Risk Assessment Guidance for Superfund (EPA)

*RCRA* – Resource Conservation and Recovery Act

*RfD* – Reference Dose

*RI/FS* – Remedial Investigation and Feasibility Study

*RUST* - Rust Environment and Infrastructure

*SVOC* – Semi-Volatile Organic Carbons - organic chemicals that move from a liquid to a gaseous state fairly rapidly and easily, but less so than VOCs

*TEQ* – Toxic Equivalency

*TPH* – Total Petroleum Hydrocarbons

*TSCA* – Toxic Substances Control Act

*VOC* – Volatile Organic Carbons - organic chemicals that move from a liquid to a gaseous state rapidly and easily

## A Few Important Definitions

*Reference Dose*: The reference dose is a daily exposure level for the human population, including sensitive subpopulations, that is likely to be without substantial risks or harmful effects for non-cancer health outcomes. It is specific for route of exposure (i.e., ingestion, inhalation), is based on human or animal data and may be based on chronic (lifetime), sub-chronic (less than lifetime) or developmental exposure times.

*Hazard Quotient*: The hazard quotient is an exposure level to a particular chemical divided by the reference dose for that particular chemical over the same time period (i.e, chronic, sub-chronic or developmental).

*Hazard Index*: The hazard index (HI) is the sum of more than one hazard quotient for multiple chemicals and/or multiple exposures. The hazard index is calculated separately for chronic, sub-chronic and shorter duration exposures. In general, a HI above 1 could be a concern, a HI above 5 warrants consideration of the situation and a HI greater than 10 is a cause of concern.

*Cancer Risk*: The cancer risk is the cancer risk from a lifetime exposure to a chemical. It is usually expressed as the number of cases of cancer in an exposed population that are associated with exposure to the chemical in question.

## The Risk Assessment Process

RUST followed the EPA Risk Assessment Guidance for Superfund (RAGS), a set of guidelines created by the EPA for evaluating the risks to hazardous materials at specific sites. The steps listed below summarize the EPA risk assessment guidelines and include a few specific concerns for hazards at JPG.

**<u>Four Main Steps in a Risk Assessment</u>**

1. Hazard Identification (I.D.)
   Is there a potential for harm to humans, animals, other living things (like plants)?

2. Response versus Dose
   How much of an effect can be expected for any given amount "taken in" by the human/animal/plant?

3. Exposure Assessment
   How much is the responding human/animal/plant "taking in"?

4. Risk Characterization
   Put information together to estimate likelihood of harm.

**<u>1. Hazard I.D.</u>**

First phase is the problem formulation and asks 'What do we know', and 'what do we need to know in order to assess risk?'

The endpoint of the hazard ID/problem formulation is a conceptual model with hypotheses for
- what is the stressor/contaminant?
- who/what is being affected?
- how are they being exposed?

The second phase is to identify the media (environmental areas) of concern.
Air; water (surface water, groundwater), soil and biota.

- identify what is currently contaminated
- identify what is currently *uncontaminated*, BUT potentially could be contaminated in the future due to movement of the chemicals

Finally, identify the potential movement of the chemicals

soil → (wash through) groundwater → surface water

soil → (wash-out, erosion) surface water

soil, water → (volatilization, dust) air

air → (precipitation) soil, water

soil, water → biota → food chain transfer

An important component of the hazard identification is to evaluate the 'normally' occurring levels of contamination in background or reference sites. These are sites that share similar characteristics to the contaminated site (i.e., similar soils, water flow, biota, etc.) but have, ideally, no history of contamination or a known history of contamination. They serve as the baseline by which chemical levels from the contaminated site can be compared. We must ask:

- What is off-site?
- Is the off-site contamination due to another point source?  (If so, don't use for "reference")
- Is the off-site contamination due to this source/site? (Again, this would make this site inappropriate as a reference site.)
- Is the sample size sufficient to provide a good reference comparison?

Two types of background/reference contamination exist:

- naturally occurring
- anthropogenic

Both types of contamination seem to be occurring in the reference areas used in the JPG risk assessments.

**2. Response versus Dose (TOXICITY)**

The response is the adverse effect produced by a chemical or physical agent (i.e. by a stressor) and the dose is the level of that stressor that produces the given response. This relationship is toxicity. TOXICITY varies with DOSE & EXPOSURE.

Responses relevant here (JPG) include: effects on the nervous system (learning disabilities, dyslexia, behavioral problems (ADD [attention deficit disorder], ADHD [attention deficit and hyperactivity disorder]) due to DEVELOPMENTAL (in utero – ie in the womb) and early childhood  exposure.

The contaminants of greatest concern for these effects include:
Heavy metals (lead, manganese especially), PCBs (polychlorinated biphenyls), and mercury compounds, and maybe dioxins.

**Overall Effects of Greatest Concern**

1. *Cancer*
(VOCs [the solvents], some metals, dieldrin – at relevant sites).

2. *Non-cancer: Developmental nervous system effects*
Learning disabilities, IQ deficits, ADD/ADHD (Heavy metals, dieldrin).

3. *Non-cancer*: Non-specific and specific nervous system, blood, liver and kidney problems (VOCs, Arsenic, some heavy metals).

**Note**: Effects of background contamination of heavy metals throughout the site* could cause non-cancer effects, especially in infants and children.  Such effects should be assessed before allowing infants and children to live on site.

(*based on reference soil sampling)

**Other chemicals and responses of concern:**
**Arsenic**
Arsenic is commonly found naturally in many forms. High doses are fatal. Low dose frequent exposure can lead to a sickness that includes problems with many organs, including the heart (arrhythmia or abnormal heart beat), nervous system (neuropathy – breakdown of parts of nerve cells in specific parts of the body), liver (jaundice), blood (vascular disease, anemia and low white blood cell count). Overall, arsenic affects the ability of cells to make energy to live.

**Silver**
Problems may exist in the kidneys (lesions) and lungs (bronchitis), and arteriosclerosis may be induced by long term silver ingestion.

**VOCs (Volatile Organic Compounds): The Solvents**
The most common non-cancer effect of most of these solvents is on the nervous system. Non-specific nervous system effects are the most likely to occur from the moderate to low doses expected here (headaches, nausea, irritability as examples). The VOCs are otherwise a cancer concern. Benzene (a common VOC) is also linked with increased risk of arteriosclerosis.

**Dieldrin (a pesticide)**
Dieldrin is a chlorinated "cyclodiene" (related to the banned pesticide chlordane.). This is a nervous system toxicant that affects young animals more severely than older animals. Severe high dose effects can include epileptic convulsions. Lower doses over longer periods of time can include generally feeling bad, headaches, dizziness, nausea and vomiting, and excess responsiveness of the muscles (jerking when stimulated or poked). There are indications that dieldrin also affects animal reproduction and it is listed as an environmental endocrine disruptor. Both male and female animals may reproduction affected.

## 3. Exposure Assessment

This step asks the questions 'By which route does it come into body?' and 'How long and how frequently is there a chance of absorbing the chemical?'

**There are three main routes of exposure for all animals and humans:**
- ingestion (eating or drinking contaminated food, water or soil)
- inhalation (breathing in vapors, fumes, gases or dust)
- dermal absorption (absorption directly through the skin)

In order to have an effect, to interact with body, the chemical must be in contact with the body. Therefore any internal organ effects require ABSORPTION of the chemical into the body by one of the three routes listed above.

The exposure frequency (how often someone is exposed) influences:
- the concentration of the chemical available to the target organ (the organ or tissue which is affected by the contaminant);
- the time available between exposures for repair of the damage caused by the contaminant.

Therefore, the exposure frequency affects the toxicity of the chemical.

**Several factors affect toxicity in addition to exposure.**
These are the factors related to the person or animal exposed:

- age *
- sex *
- genetics *
- body size
- stage of life (e.g. pregnancy)
- hormonal status
- health
- nutritional status

*These factors are critical for Risk Assessments

This is the main factor related to the chemical in combination with the person or animal exposed:

- chemical interactions (i.e., co-exposures to other chemicals or to certain nutrients can alter the way chemicals act within the body)

**4. Risk Characterization**

Toxicity (dose-response) data tells us to expect a certain RESPONSE (what the effect is, as well as the magnitude of the effect) for a given animal or human for a given DOSE (amount "taken in"). The exposure data (estimations of how much the human or animal or plant "takes in") is combined with the toxicity data to characterize expected population responses.

Cancer Risk: Provides a estimate of the PROBABILITY of getting cancer within a lifetime. A lifetime is standardized to 70 years. Cancer risks between $10^{-4}$ – $10^{-6}$ are considered "acceptable." Translation: 1 in 10,000 to 1 in 1,000,000 people exposed can expect to get cancer in their lifetime, and this cancer was "caused" by this exposure.

Non-Cancer Risk: This is much more difficult to quantify, and the effects are not always as clear or easy to pin down to a single "cause".

Non-cancer risk is assessed using a HAZARD INDEX:

$$\text{Hazard Index} = \frac{\text{Real exposure value (i.e. how much the exposed group really "takes in")}}{\text{Exposure at which no effect is expected for any individual (reference dose [}R_fD\text{])*}}$$

*corrected by uncertainty factors & modifying factors

There is an assumption here that some exposure is safe, and that the concern is for effects above the safe dose.

## Ecological Toxicity Testing

***Aquatic Ecosystem Evaluation includes* (as an example of the Ecological Risk Assessment performed by RUST)*:***

1. Physical characteristics noted include: land use, width, depth, flow, substrate, and presence of dams.

2. Water quality measures include: temperature, pH, dissolved oxygen, cloudiness (total suspended solids), water odors, and surface sheen made by floating oil.

3. Evaluation of habitat quality.

4. Evaluation of macroinvertebrate communities, diversity, and relative numbers.

5. Evaluation of fish communities, diversity, and relative numbers.

Details for the last three are given below.

*Tests for Habitat Health:*
A reference site is chosen to provide as similar a habitat as possible without the same pollution sources.

1. The bottom substrate is evaluated. Better habitat includes rocks, gravel, submerged vegetation, undercut banks, logs and tree roots (that do not totally block the flow of water).

2. The amount of fine sediment surrounding boulders and gravel is evaluated. (More provides better habitat.)

3. The quantity and speed of water flow is quantified and a value is assigned. (RUST says the higher, the better.)

4. The presence of sediment bars is noted and used as an indication of watershed disturbance. Sediment bars indicate too much siltation (sediment build up), which decreases water quality.

5. The amount of siltation on the bottom of pools and riffles is noted. (Some is good, too much is bad.)

6. The percent of stream length examined containing pool, riffles or bends is calculated. (The more the better.)

7. The amount of evidence for bank erosion (washout of banks into the stream) is noted. Bank erosion indicates poor vegetation and can lead to excess siltation in the stream. (The more the worse.)

8. The density of the vegetation on the bank is semi-quantified. (The more the better, in general.)

9. The amount of and kind of stream shading and escape cover provided by the bank vegetation is compared. (The more the better.)

10. Results are summed and compared between the contaminated and reference sites.

*Tests for Ecological Risk:*
Macroinvertebrate Evaluation: Macroinvertebrates are invertebrates (e.g. bugs) that are visible to the naked eye. The larger invertebrate community was assessed by: comparing the total number of macroinvertebrate family classifications (the more species the better) and giving a ranking of the known pollution tolerance of the macroinverterbrates present (in a diverse population, some of each classification will be present, but not all species present should be known to tolerate pollution). The following measures are used:

1. Comparison of the type of feeding methods used by the macroinvertebrates present on-site. Examples of feeding methods include scraping food off of leaves or filtering the water for food. The ratio of animals using the two feeding methods should be about equal in a non-polluted area.

2. Assessment of the relative abundance of predefined species expected in a stream that provides "good quality habitat" in the specific type of ecosystem. (The more the better.)

3. The presence or absence of any single dominant species is noted. (No single species should dominate.)

4. Note the relative number of species present and known not to tolerate high levels of pollution. (The fewer, the more polluted.)

5. The relative similarity of the species present at the reference versus the contaminated site is determined. (The higher the number at the reference site but not at the contaminated site, and the fewer the number of species in common, the more likely the area is harmed.)

6. Macroinvertebrates that eat by shredding vegetation are particularly pollution sensitive, and essential to a healthy ecosystem. The relative percent of shredders to total macroinvertebrates is compared at the reference site and the contaminated site. This ratio (shredder ratio) should be similar.

7. All of the above tests are scored and the scores are summed. The reference site score should match the contaminated site score if the contaminated site is not severely affected.

*Tests for Ecological Risk to Fish (Aquatic Vertebrates):*
Again, the reference site is scored compared to the test contaminated site. The followed is assessed:

1. Total number of species present. (The more the better.)

2. The number of darter species, since the presence of darter species is a good indication of a healthy bottom habitat. (The more the better.)

3. The number of sunfish species, since sunfish, in general, are indicators of healthy pools and the presence of in-stream cover. (The more the better.)

4. The number of sucker species, since sucker species are sensitive to physical and chemical habitat degradation. (The more the better.)

5. The number of pollution intolerant species (note, some or all of these may overlap with the previous categories). (The more the better.)

6. The proportion of pollution-tolerant green sunfish to total fish. (The more the worse.)

7. The proportion of omnivores to total fish. (The more the worse as they tend to be more tolerant of pollution and of physically degraded habitat.)

8. The proportion of insectivores to total fish. (The more the better.)

9. The proportion of carnivores to total fish. (The more the better).

10. The total number of individual fish. (The more the better.)

11. The proportion of individuals that show physical indications of hybridization (mixing) between species. (As the suitability of habitat for reproduction decreases, the more likely it will be that some species will lay eggs in the same place. The males will then cross-fertilize, producing hybrids. Thus, the more hybrids, the worse the habitat.)

12. The proportion of individuals with visibly obvious diseases and anomalies. (The more the worse.)

13. These numbers are summarized and summed and compared to the numbers for the reference site.

## RUST's Sampling List

**Table 1.** Compounds tested for by RUST in soils, sediments, wipes and groundwater.

| **Dioxins and Furans** | **Explosives** | **Metals** |
|---|---|---|
| 2,3,4,6,7,8-Hexachlorodibenzofuran | 1,3,5-trinitrobenzene | Aluminum (Al) |
| 2,3,4,7,8-Pentachlorodibenzofuran | 1,3-dinitrobenzene | Antimony (Sb) |
| 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | 2,4,6-trinitrotoluene | Arsenic (As) |
| 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 2,4-dinitrotoluene | Barium (Ba) |
| 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin | 2,6-dinitrotoluene | Beryllium (Be) |
| 1,2,3,6,8,9-Hexachlorodibenzofuran | 2-amino-4,6-dinitrotoluene | Boron (Bo) |
| 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 2-nitrotoluene | Cadmium (Cd) |
| 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin | 3-nitrotoluene | Calcium (Ca) |
| 1,2,3,7,8,9-Hexachlorodibenzofuran | 4-amino-2,6-dinitrotoluene | Chromium (Cr) |
| 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin | 4-nitrotoluene | Cobalt (Co) |
| 1,2,3,4,7,8-Hexachlorodibenzofuran | Cyclotetramethylenetetranitramine | Copper (Cu) |
| 1,2,3,7,8-Pentachlorodibenzo-p-dioxin | Nitrobenzene | Iron (Fe) |
| 1,2,3,7,8-Pentachlorodibenzofuran | RCX/cyclonite | Lead (Pb) |
| Octachlorodibenzodioxin | Tetryl | Magnesium (Mg) |
| Octachlorodibenzofuran | | Manganese (Mn) |
| 2,3,7,8-Tetrachlorodibenzodioxin | | Mercury (Hg) |
| 2,3,7,8-Tetrachlorodibenzofuran | | Molybdenum (Mo) |
| | | Nickel (Ni) |
| | | Potassium (K) |
| | | Selenium (Se) |
| | | Silver (Ag) |
| | | Sodium (Na) |
| | | Thallium (Tl) |
| | | Tin (Sn) |
| | | Vanadium (V) |
| | | Zinc (Zn) |

| **Pesticides and Polychlorinated Biphenyls (PCBs)** | **Semi Volatile Organic Compounds (SVOCs)** | **Volatile Organic Compounds (VOCs)** |
|---|---|---|
| Alpha-hexachlorocyclohexane | 1,2,4-trichlorobenzene | 1,1,1-trichloroethane |
| Endosulfan I | 1,2-dichlorobenzene | 1,1,2-trichloroethane |
| Aldrin | 1,3-dichlorobenzene | 1,1-dichloroethylene |
| Beta-hexachlorocyclohexane | 1,4-dichlorobenzene | 1,1-dichloroethane |
| Endosulfan II | 2,4,5-trichlorophenol | 1,2-dichloroethylenes |
| Chlordane | 2,4,6-trichlorophenol | 1,2-dichloroethane |
| Delta-hexachlorocyclohexane | 2,4-dichlorophenol | 1,2-dichloropropane |
| Dieldrin | 2,4-dimethylphenol | O-xylene |
| Endrin | 2,4-dinitrophenol | Acetone |
| Endrin aldehyde | 2,4-dinitrotoluene | Acrylonitrile |
| Endosulfan sulfate | 2,6-dinitrotoluene | Bromodichloromethane |
| Heptachlor | 2-chlorophenol | Cis-1,3-dichloropropylene |
| Heptachlor epoxide | 2-chloronaphthalene | Vinyl acetate |
| Lindane | 2-methylnaphthalene | Vinyl chlorinde |
| Methoxychlor | O-cresol | Chloroethane |
| PCB 1016 | 2-nitroaniline | Benzene |
| PCB 1221 | 2-nitrophenol | Trichlorofluoromethane |
| PCB 1232 | 3-3'-dichlorobenzidine | Carbon tetrachloride |
| PCB1242 | 3-nitroaniline | Methylene chloride |
| PCB1248 | 4,6-dinitro-2-cresol | Bromomethane |
| PCB1254 | 4-bromophenyl phenyl ether | Chloromethane |
| PCB 1260 | 4-chloroaniline | Bromoform |
| PPDDD | 3-methyl-4-chlorophenol | Chloroform |
| 2,2-bis(p-chlorophenyl)-1,1-dichloroethene | 4-chlorophenyl phenyl ether | Chlorobenzene |
| 2,2-bis(p-chlorophenyl)1,1-trichlroroethane | P-cresol | Carbon disulfide |
| Toxaphene | 4-nitroaniline | Dibromochloromethane |
| | 4-nitrophenol | Ethylbenzene |
| | Acenaphthene | Toluene |
| | Acenaphthylene | Methyl ethyl ketone |
| | Anthracene | Methyl isobutyl ketone |

**Table 1.** Continued.

| Pesticides/Polychlorinated Biphenyls (PCBs) | Semi Volatile Organic Compounds (SVOCs) | Volatile Organic Compounds (VOCs) |
|---|---|---|
| | Bis(2-chloroethoxy) methane | Methyl N-butyl ketone |
| | Bis(2-chloroisopropyl) ether | Styrene |
| | Bis(2-chloroethyl) ether | Trans-1,3-dichloropropene |
| | Bis(2-ethylhexyl) phthalate | Tetrachloroethane |
| | Benzo(a)anthracene | Tetrachloroethylene |
| | Benzo(a)pyrene | Trichloroethylene |
| | Benzo(b)fluoranthene | Xylene |
| | Butylbenzyl phthalate | |
| | Benzoic acid | |
| | Benzo(ghi)perylene | |
| | Benzo(k)fluoranthene | |
| | Benzyl alcohol | |
| | Chrysene | |
| | Hexachlorobenzene | |
| | Hexachlorocyclopentadiene | |
| | Hexachloroethane | |
| | Dibenz(ah)anthracene | |
| | Dibenzofuran | |
| | Diethyl phthalate | |
| | Dimethyl phthalate | |
| | di-N-butyl phthalate | |
| | Di-N-octyl phthalate | |
| | Fluoranthene | |
| | Fluorene | |
| | Hexachlorobutadiene | |
| | Indeno(1,2,3-C,D)pyrene | |
| | Isodrin | |
| | Isophorone | |
| | Kepone | |
| | Naphthalene | |
| | N-nitrosodimethylamine | |
| | N-nitrosodi-N-propylamine | |
| | N-nitrosodiphenylamine | |
| | 1,4-oxathiane | |
| | Pentachlorophenol | |
| | Phenanthrene | |
| | Phenol | |
| | Parathion | |
| | Pyrene | |

## Site 1 (Chapter 6)
## Incinerator (Building 185)

**Site Use**
This site was used for the burning of debris, small ammunition and paper products from the installation at Jefferson Proving Ground (JPG) from 1941-1978. The incinerator is single chamber, single stack, single burner with no after burner. It is currently inactive. The land around the incinerator is leased to a farmer for tobacco and soybean production. These crops surround the building. The incinerator has been used infrequently since the Jefferson Proving Ground closed in 1995.

**Geology**
Flat to gently rolling land with slope to the southeast towards Harberts Creek several hundred feet away. The soil is Rossmoyne soil series with 15 feet of glacial till. Groundwater flows south to southwest.

**Contaminants of Concern**
RUST Stated: Metals, chlorinated solvents, chlorinated benzenes and/or PCBs, dioxins.

Phase 1 Sampling: Near surface soils (2 samples) at 0-6 inches below ground surface for metals.

Phase 2 Sampling: Additional surface soils (2 samples) for dioxins.

Analyses:
Dioxins and furans were present at concentrations similar to JPG background screening levels. Toxic equivalencies (TEQs) are greater than TEQ levels in EPA Region 9 action level criteria by four orders of magnitude. TEQs can vary by effect (a toxic endpoint such as immune system problems and reproductive alterations) and organism. TEQs indicate how individual dioxin and furan compounds compare to 2,3,7,8-Tetrachlorodibenzo-para-dioxin (TCDD; the most acutely toxic dioxin compound) and are estimates of the relative toxicity of all dioxins and furans measured in a sample and compared to TCDD.

All target metals exceed background JPG background screening levels. Of particular concern were: *Ag, Al, Ba, Be, Bo, Cr, Co, Mn, Hg, N, V* and*, Zn. Al, As, Be,* and *Mn* are all greater than EPA Region 9 action level criteria, the criteria that RUST uses to determine whether action needs to be taken.

**Health Concerns and Recommendations**
Chronic Non-cancer Health Risks: The hazard index (HI) for a future toddler (a toddler living on site in the future) is 9.9, the HI for a future adult is 2.6 and both are above an HI of one, which is considered a 'safe' HI. The critical exposure pathway is inhalation of *Mn* in fugitive dusts.

Cancer Risks: $1.2 \times 10^{-4}$ is the cancer risk for future adult residents. The cancer risk for future toddlers is slightly lower. The adult cancer risk is greater than even the extreme of the EPA "acceptable range," which is between $1x10^{-4}$ and $1x10^{-6}$. The critical exposure pathway is ingestion of 2,3,7,8-TCDD in beef.

Cancer risk for the off-site beef and milk consumers are within the EPA "acceptable range" (less than $10^{-4}$, but just barely).
Ecological risks are primarily based on *Ag*. Since the area is very small in size, no further ecological action is suggested by RUST.

<u>Recommendations</u>: Cancer risks for off-site consumers of products from cows eating on-site silage are calculated assuming that these consumers face no other cancer risk. The risks posed by eating this beef are based on risks due to persistent, bioaccumulative toxicants (dioxins), which remain in the body long after ingestion. These cancer risks, while within the extreme of the "acceptable" EPA range ($10^{-4}$-$10^{-6}$), are close to the extreme high end of this range, and it is higher than is typically used in Indiana ($10^{-5}$). These calculations do not allow for people who drink larger quantities of milk. It is recommended, for example, that non-lactating women drink at least a quart of milk a day, while lactating women may easily drink twice that. Thus lactating women may consume enough milk so that their exposure would result in a cancer risk greater than the extreme of the "acceptable" EPA range. Therefore, the raising of crops for silage is not recommended for the area downwind of this site. Agricultural uses should be limited to crops with lower human or animal ingestion volumes. We agree with the RUST recommendation to move this site forward into the feasibility study (FS).

**Sites 2 and 27 (Chapter 7)**
**Sewage Treatment Plant (2)**
**Sewage Sludge Application Areas (27)**

**Site Uses**

The sewage treatment plant treated most sewage for JPG as well as boiler blowdown water, rinses from the photographic lab (building 208), and water from the oil/water separator (building 186). There were four main sludge application areas (Site 27). Sewage sludge was applied on a clay bank south of the incinerator and on fields, two of which have been plowed under and cultivated (prior to any active remediation).

Sewage water is treated by passing it through a settling tank and a trickling filter prior to release at the outfall. The sludge is removed and placed in sludge drying beds prior to disposal of the sludge (sludge was previously laid in the sludge application areas).

Presently, this plant treats domestic sewage from buildings at JPG that are privately leased, including residential, light industrial, and storage. A water quality laboratory located in the sewage treatment plant tests water quality from the sewage treatment plant outfall. The area immediately surrounding the sewage treatment plant is under cultivation with tobacco and soybeans.

**Geology**

Flat to gently rolling land that slopes to the southeast toward Harberts Creek. The soil is Rossmoyne soil series with 15 feet of glacial till. Bedrock breaks through surface ground as observed in the water at nearby Harberts Creek.

**Contaminants of Concern (both sites)**

RUST Stated: Bleaches, *Ag*, cyanide (from photographic activities).

EnviroComm Potential: Other heavy metals, PCBs, and softener from boiler effluent (sodium hydroxide, tannins, cyclohexylamine).

Phase 1 Sampling:

Surface soils (2 samples) for metals, SVOCs and TPH (SVOC runs were suspect in the Phase 1 analysis).

Sediments from Harberts Creek (3 samples downstream and 2 upstream from the outfall) for metals, cyanides and TPH.

Surface water from Harberts Creek (1 sample upstream and 1 downstream from outfall) for anions and filtered and total metals.

Phase 2 Sampling:

Surface soil (1 sample) for SVOCs.

Surface soils (20 samples) in a 100 foot grid covering a 600x600 foot area were taken from the from sludge areas for metals.

Analyses:

Surface Soils: *Ag* is elevated above JPG background screening levels soils but is less than EPA Region 9 action level criteria. *As* exceeds EPA Region 9 action level criteria at the site and in JPG background screening levels soils. On-site *As* levels are higher than the JPG background screening levels soils. *Pb*, *Be*, and *Mn* are above both background and EPA Region 9 action level criteria. PCBs and pesticides are below EPA Region 9 action level criteria.

Subsurface Soils: *Al, As, Be, Cr, Mn, Tl*, and *Ag* exceed EPA Region 9 action level criteria. (*Be* and *As* in reference soils also exceed EPA Regional 9 action level criteria.)

Sediments: *As, Al, Be, Cr, Fe, Mn*, and *V* are greater than EPA Region 9 action level criteria.

Surface Waters (Harberts Creek): *Ag* is detectable in surface waters and downstream levels are 2-3 times the levels found in upstream waters. *Note—the sewage treatment plant outfall has a National Pollutant Discharge Elimination System (NPDES) permit. We could not find a reference for the contaminants allowed in the NPDES permit.*

**Health Concerns and Recommendations**

Chronic Non-Cancer Health Risks:

A) Future residents at Site 2: Both future adult and toddler residents have hazard indices (HI) greater than one (6.1 adult, 23 toddler). The critical exposure pathway is inhalation of *Mn* in fugitive dusts. (Inhalation of *Al* in fugitive dusts is also a concern for toddlers.)
B) Future residents at southwest corner of Site 27: Both future adult and toddler residents have HIs greater than one (9 adult, 38 toddler). The critical exposure pathway is ingestion of *Ag* in milk and inhalation of *Mn* in fugitive dust. (Inhalation of *Al* in fugitive dusts is also a concern in toddlers only.)
C) Future residents on remainder of Site 27: Both future adult and toddler residents have HIs greater than one (9.1 adult, 38 children). The critical exposure pathway is ingestion of *Ag* in milk, and inhalation of *Mn* in fugitive dust. (Inhalation of *Al* in fugitive dusts is also a concern in toddlers.)
D) Future on-site workers: Future on-site workers have HIs greater than one (1.4). The critical exposure pathway is inhalation of *Mn* in fugitive dust.
E) Off-site consumers: Both future adult and toddler off-site consumers have HIs greater than one (2.0 adult, 10.6 toddler). The critical exposure pathway is ingestion of *Ag* in milk from cows fed silage grown on the site.

Cancer Risks:

A) Future residents at Site 2: The adult cancer risk is $7.5x10^{-5}$ and the toddler cancer risk is $6.8x10^{-5}$. Both of these values are within the EPA target range ($1.0x10^{-4}$ to $1.0x10^{-6}$).
B) Future residents at southwest corner of site 27: The adult cancer risk is $9.4x10^{-5}$ and the toddler cancer risk is $8.3x10^{-5}$. Both of these values are within the EPA target range ($1.0x10^{-4}$ to $1.0x10^{-6}$).

C) Future residents at the remainder of site 27: The adult cancer risk is $8.2x10^{-5}$ and the toddler cancer risk is $7.4x10^{-5}$. Both of these values are within the EPA target range ($1.0x10^{-4}$ to $1.0x10^{-6}$).
D) Future on-site workers: The cancer risk for future on-site workers is $1.1x10^{-5}$, which is within EPA target range ($1.0x10^{-4}$ to $1.0x10^{-6}$).
E) Off-site consumers: The adult cancer risk is $1.8x10^{-6}$ and the toddler cancer risk is $7.5x10^{-7}$. Both of these values are within the EPA target range ($1.0x10^{-4}$ to $1.0x10^{-6}$).

Ecological Concerns (sites 2 and 27): A full aquatic ecosystem assessment was carried out. Details of the methods used in the aquatic assessments are in the 'Sampling' section of this report. A limited terrestrial ecological risk assessment was also modeled as per all the other sites. The upstream reference site was above the outfall, but below sites 9, 28, 29, 11, 3, 4, 46, 47, and 38. The test site is downstream, below the outfall.

The aquatic assessment indicates that part of the stream below the outfall is of higher habitat and water quality than the part of the stream above the sewage water outfall (the upstream reference site). This indicates that the upstream sites may be affecting the upstream "reference area" and a more appropriate "reference" area needs to be identified and used as comparison. The terrestrial ecological modeling of the sludge application areas indicate that the sludge application areas may affect the health of plants and soil fauna as well as the health of the white-footed mouse and eastern cottontail. Some impacts may also be seen on the little brown bat, chimney swift, American kestrel and similar species. Only the plants and soil fauna are likely to be affected more severely than they would by the levels of contamination found on "reference" soils taken from elsewhere at JPG.

Recommendations: Risks posed by the residual metals at this site would indicate that this site is not appropriate for residential development without further remediation. Non-cancer health risks modeled for consumers of beef and milk produced from cows fed silage grown at this site indicate that animal or human food crops should not be grown at this site. Given the potential for the metals to be taken up by food crops, we recommend that non-food crops be grown at this site. We agree with the RUST recommendation to move this site forward into the feasibility study (FS).

**Sites 3 and 4 (Chapter 8)**
**Explosive Burn Area (3) and**
**Abandoned Landfill (4)**

**Site Use**

In the mid 1970s, explosives and other burnable materials were burned on the open ground that makes up Sites 3 and 4. Site 3 was used between 1941 and 1970 to dump material from the photographic lab as well as spent solvents. Between 1941 and 1960 combustible materials were also likely to have been disposed here. These combustible materials may have been burned. After 1970, the dumping trenches were filled in. Pesticide containers, incinerator ash and paint waste are presumed to have been placed in the Site 4 landfill prior to the 1960s, since it was the only landfill at JPG at this time. A third area west of site 3 & 4 was also apparently used for burning and has been designated as the "New Burn Area."

**Geology**

The land surface slopes northeast toward a branch of Harberts Creek. The bedrock on the north side of the site also slopes to the northeast toward Harberts Creek. Therefore, groundwater from the north side appears to flow toward Harberts Creek. However, groundwater flows from one flat southern part of the site appears to flow west southwest. The soil is Rossmoyne soil series with 9-14 feet of glacial till.

**Contaminants of Concern**

<u>RUST Stated</u>: Acetate-based waste, *Ag*, cyanides, some pesticides, metals, explosives, VOCs and SVOCs.

<u>EnviroComm Potential</u>: Combustion by-products (dioxins and furans).

<u>Phase 1 Sampling</u>:

Magnetometry and electromagnet terrestrial conductivity were used to outline the boundaries of the landfill (Site 4) trench and identify the new burn area across the road. (The new burn area was identified by the presence of unexploded ordnance (UXO) in this area.)

Surface soils (16 samples) 0-6 feet below ground surface in a 100x100 foot grid covering one acre and encompassing the burn area (Site 3) and part of the landfill (Site 4) for explosives and metals. VOCs were checked at the time of collection using a photoionization detector (PID) with a moderate sensitivity; a PID is a field instrument that detects organic materials in the air.

Subsurface soil (n = 4) borings around the perimeter of the landfill trench. Borings were drilled to bedrock (9 to 14 feet), and samples were collected every 5 feet (3 samples per boring) for explosives, metals, VOCs and SVOCs. PID indicated that solvent contamination was present in the north boreholes (2 samples).

Groundwater (4 wells) screened at glacial cover/bedrock boundary, but little to no water at Site 4. Deepened to first water producing zone and water analyzed for explosives, metals, VOCs and SVOCs.

Phase 2 Sampling:

Surface soils (20 samples) and three duplicates in 300x400 foot area covering entire surface area of Sites 3 and 4 for total metals. 4/20 and 1/3 duplicates also analyzed for expanded explosives. Surface soils (10 samples) from new burn area (across the road to west) for metals, explosives, dioxins, and furans.

Subsurface soils (12 samples) from hand-augured borings (3 borings) to 5 inches in new burn area. Samples collected at surface 1, 3 and 5 feet for metals, explosives, SVOCs, dioxins and furans.

Groundwater (5 wells, four sampling times each) monitored for explosives, metals, VOCs and SVOCs. One new monitoring well was installed down gradient of the landfill trench (Site 4) and original (Site 3) burn area.

Analyses:

Surface Soils: *Ag, Al, Sb, As, Ba, Be, Bo, Cd, Cr, Co, Cu, Pb, Mn, Hg, Mb, Na, Ni, Tl, Sn, V* and *Zn* are above JPG background screening levels. *Pb* exceeds EPA Region 9 action level criteria in 3/36 samples taken during both Phase 1 and Phase 2. One out of three samples in the old burn area (Phase 1 sample) and 1/3 samples outside the north boundary of landfill (Phase 2), had unclear, contradictory labeling. *Al, Ba, Cd, Cr,* and *Mn* also exceed EPA Region 9 action level criteria in at least one sample (details not given in text).

The new burning area surface soils are contaminated with dioxins and furans. *Pb* and *Sb* (1/3 samples) all exceed EPA Region 9 action level criteria. Most of the higher surface soil contamination is in the trench area, in an area in the northern portion of the landfill, a burn area in the west central portion of the landfill (Site 3), and to the west of the loop off of Engineer's Road.

Subsurface Soils: SVOCs and VOCs were detected in the boreholes located around the landfill trench (Phase 1) and in the new burn area. None of these concentrations exceed Region IX action level criteria.

*Ag, Al, As, Ba, Be, Bo, Cd, Cr, Co, Cu, Mn, Hg, Ni, Pb, Sn, V,* and *Zn* are all above JPG background screening levels in the borings around the landfill trench. Of these, *Al, As, Ba, Be, Cd, Cr, Cu,* and *Pb* also exceed EPA Region 9 action level criteria.

In the new burn area only *Pb* exceeds EPA Region 9 action level criteria, and this contamination extended to the deepest level tested (feet) in one of the three boreholes. Dioxins and furans were detected in 2/3 borings to a depth of five feet (the deepest sample taken).

Groundwater: Geophysical probe analysis indicated that the groundwater beneath these sites is contaminated with VOCs. The VOC plume appears to have migrated beyond the boundaries of the landfill and burn areas, but has not yet migrated to the point where it is immediately likely to contaminate Harberts Creek. Since the VOCs have migrated down to at least bedrock level, and since the bedrock is in fact limestone that may be infiltrated with cracks and fissures, the VOCs may have (or may soon) infiltrated the bedrock groundwater.

Metals have infiltrated the groundwater. *Al, Sb, Ba, Be, Bo, Cd, Cr, Co, Fe, Pb, Mb, K, Mn, Ni, Se, Tl,* and *V* are present in groundwater at concentrations above the JPG reference concentration for groundwater, but none are above the EPA Region 9 action level criteria (assuming that the action level criteria is for groundwater). During Phase 2 sampling, *Sb, Be, Ca, Co, Pb,* and *Tl* were detected at concentrations above the Safe Drinking Water Act maximum contaminant level (MCL).

VOCs and SVOCs and explosives were also detected in groundwater, although none exceeded EPA Region 9 action level criteria.

**Health Concerns and Recommendations**

Chronic Non-Cancer Health Risks:

A) Future residents at Site 3 and 4 trench: Both future adult and toddler residents have hazard indices (HIs) greater than one (9 adult, 28 toddler). The critical exposure pathways are ingestion of *Fe* in groundwater and inhalation of *Mn* in fugitive dusts.
B) Future residents at the remainder of site: Both future adult and toddler residents have HIs greater than one (8.3 adult, 25.7 toddler). The critical exposure pathways are ingestion of *Fe* in groundwater and *Mn* inhalation in fugitive dusts.
C) Future residents at burn area: Both future adult and toddler residents have HIs greater than one (9.9 adult, 27.4 toddler.) The critical exposure pathways are ingestion of *Fe* through groundwater and inhalation of *Mn* through fugitive dusts.
D) Future residents at the remainder of new burn site: Both future adult and toddler residents have HIs greater than one (8.2 adult, 25.7 toddler). The critical exposure pathways are ingestion of *Fe* through groundwater and inhalation of *Mn* through fugitive dusts.
E) Off-site consumers: Both adult and toddler off-site consumers have HIs less than or equal to one (0.4 adult, 1.0 toddler). However, the toddler HI of 1.0 is concerning. Children (people who have not yet gone through puberty) are especially sensitive to the effects of toxic chemicals as their bodies are constantly changing and growing. Ingesting beef and milk products obtained from cattle fed crops grown at any of these sites increases the likelihood of ingesting heavy metals as well. Though the ingestion of these heavy metals would result in a health risk **just** below the EPA's HI of 1.0, it is a risk that should be avoided considering that children face many other risks to their health.

Comments: Toddlers are also at risk from ingestion (groundwater and fruits/vegetables grown on site) and inhalation of several other metals (*Al, As, Ba, Cd,* and *Mn*).

Cancer Risks:

A) Future residents at Site 3 and 4 trench: The adult cancer risk is $8.6x10^{-5}$ and the toddler cancer risk is $4.1x10^{-5}$. Both of these values are within the EPA target range ($1.0x10^{-4}$ to $1.0x10^{-6}$).
B) Future residents at remainder of site: The adult cancer risk is $8.6x10^{-5}$ and the toddler cancer risk is $4.1x10^{-5}$. Both of these values are within the EPA target range ($1.0x10^{-4}$ to $1.0x10^{-6}$).

C) Future residents at new burn area: The adult cancer risk is $2.4x10^{-4}$ and the toddler cancer risk is $1.6x10^{-4}$. Both of these values exceed the EPA target range and are due to TCDD, *As* and polycyclic aromatic hydrocarbons (PAHs) in soil, home-grown fruits/vegetables and groundwater.

D) Future residents at the remainder of the new burn site: The adult cancer risk is $1.2x10^{-4}$ and the toddler cancer risk is $7.4x10^{-5}$. The adult risk exceeds the EPA target range and is due to *As* exposure through the ingestion of home-grown fruits/vegetables and groundwater.

E) Off-site consumers: The adult cancer risk is $6.9x10^{-6}$ and the toddler cancer risk is $3.7x10^{-6}$. Both of these values are within the EPA target range ($1.0x10^{-4}$ to $1.0x10^{-6}$).

Ecological: Plants, soil fauna, white-footed mouse, eastern cottontail, little brown bat, birds (kestrel, chimney swift) all face adverse ecological impacts from these sites based on hazard indices clearly greater than one (from about 30 to 620).

Earthworm test, seedling growth (germination and amount of plant or 'biomass'), and soil fauna community structure did not vary much from that observed using the JPG reference soils. (However, the JPG reference soils are known to be contaminated [note hazard indices as high as 325 for the white-footed mouse] with JPG-derived contaminants, so this comparison says that both soil sets are contaminated and have the potential for adverse ecological effects.)

Recommendations:

1. Continue monitoring the groundwater to determine how fast the VOC plume is moving towards the creek. Model the data to assess when the VOCs may contaminate the creek.

2. It is also suggested that the Department of Defense (DoD) commences monitoring and evaluation of volatile organic compounds contamination of the bedrock aquifer.

3. The crops growing south of the site should be checked/tested for metal contamination (especially *Al*, *Mn*, *As*) due to fugitive dust.

4. Overall, we agree with the RUST recommendation to move this site forward into the feasibility study (FS).

## Sites 5 and 6 (Chapter 9)
## Wood Storage Pile (5)
## Wood Burning Area (6)

**Site Use**

Site 5 was a used wood stockpile containing wood debris, plywood struts, boxes, pallets, used crates (limited). Site 6 was used for the burning of these materials on an abandoned airport runway. Some grassy areas around the sites were included in the JPG "open burning program."

**Geology**

Surface water runs into storm sewer drainage and into Middle Fork Creek. The soil is Cobbsfork soil series with 30 feet of glacial till. No borings on limestone, no monitoring wells and no subsurface soil samples taken.

**Contaminants of Concern**

<u>RUST Stated</u>: Pentachlorophenol (PCP) and dioxins.

<u>EnviroComm Potential</u>: Furans.

<u>Phase 1 Sampling</u>:

Surface soils (4 samples) for VOCs, SVOCs and dioxins (many calibration problems with these samples).

<u>Phase 2</u>:

Surface soils (4 samples) for dioxins and SVOCs.

<u>Analyses</u>:

<u>Surface Soils</u>: Dioxins and furans are in the surface soils but are similar to concentrations found in JPG background screening levels. These chemicals were retained as chemicals of potential concern for the site, however, as the kinds of dioxins/furans found at the site were different than the kinds of dioxins/furans found in JPG background screening levels, indicating that dioxins/furans at the site are due to facility-related activities.

**Health Concerns and Recommendations**

<u>Chronic Non-Cancer Health Risks</u>:

Neither future adult residents and toddlers nor future on-site workers have hazard indices (HIs) greater than one.

<u>Cancer Risks</u>:

Neither future adult residents and toddlers nor future on-site workers have cancer risks that exceed the EPA's target risk range, though they are close ($12.x10^{-5}$ for a future adult resident and $1.0x10^{-5}$ for a future toddler resident) to the target risk range.

These sites are equivalent to urban areas located near municipal solid waste (MSW) incinerators. The sites are not really clean, but they are not really dirty either.

Ecological Concerns: Some concerns exist for the downstream environment in Harberts Creek and for soil invertebrates. Sediment and water in Harberts Creek was tested in a RAPD bioassay while testing for contaminants from the sewage treatment plant (Site 2). Results from the Site 2 analyses, however, are not relevant to this site since the assay did not test for the effects of dioxins, furans, or PCPs. These ecological concerns still remain as potential open concerns.

Other Concerns: What about the grassy areas, are they a site by themselves? What was burned there, when and for how long?

Recommendations: Given that cancer risks are close to the EPA target risk range and close to the Indiana action level of $10^{-5}$, it is probably better to slate these sites for non-residential uses. No childcare centers should be developed at this site as commercial properties. We agree with RUST's recommendation to prepare a No Further Action technical memorandum as long as the property is not developed for residential use.

**Updated Recommendations**

These updated recommendations are based on a report entitled 'Final Decision Document for Site 5 - Wood Storage Pile and Site 6 - Wood Burning Area,' written by RUST in March 1999. This document details the steps that the DoD will take to protect human health and the environment from risks posed by this site. The recommended remedy for this site includes 'institutional controls,' or legal administrative controls that limit access to or use of a property and/or that provide warnings of potential hazards associated with a site (as stated by RUST). Such restrictions will include land use restrictions, groundwater usage restrictions and five-year recurring reviews. The land use restriction will require that the property is used for industrial or commercial purposes only. These controls are completely acceptable and we are in full agreement. We now agree with issuing a memorandum of No Further Action.

**Sites 7 and 21B (Chapter 10)**
**Red Lead Disposal Area (7) and**
**Temporary Storage Area at Building 211 (21B)**

**Site Use**
Building 211 was used for the loading of inert ordnance and Site 7 was a ground disposal site at the southwest corner of Site 21B, north of a set of railroad tracks running south of building 211. Red lead (lead tetroxide), methylene chloride and barium sulfate were all disposed of at Site 7. Red lead was used as a filler in production of inert ammunition at building 211. Red lead was used from 1952-1958 and from 1961-1978.

**Remediation**
Between the summer of 1996 and October 1996 (according to the closure report submitted in June 1997) 42 cubic yards of contaminated soil was excavated and removed, and the excavated area was backfilled with clean soil. (The soil excavated was the visually red-contaminated soil in the area between building 211 and the railroad tracks.) Crushed stone aggregate was added to the fill material and graded. Confirmatory samples were taken (see **Updated Recommendations**, below).

**Geology**
The land surface is flat and surface water collects in narrow ditch between the railroad tracks and building 211 where it infiltrates the soil. During high water the water may run west into storm water drains which discharge into Middle Fork Creek. No vegetation grows in the ditch between the railroad tracks and building 211. The soil is of the Cobbsfork soil series with 40 feet of glacial till. The moving surface of the groundwater is 14-16 feet below ground surface. Groundwater flows to the southwest.

**Contaminants of Concern**
RUST Stated: Lead (lead oxide dust) and barium.

Phase 1:

Surface soils (5 samples) for PCB and pesticides, total petroleum hydrocarbons (TPH) and SVOCs. VOCs were not tested because monitoring with a photoionization detector (PID) indicated that VOCs were not present (identified as a data gap for future tests to complete). Surface soils (2) from stained areas analyzed for total metals.

Subsurface soils (10) drilled with a hand auger in a parallel line between railroad tracks and building 211. Samples visually inspected for signs of disposals (coloration, layering, staining, etc.). Soil borings (4) drilled in the southwest corner of land by building 211. Samples collected at 0-1.4 feet for *Pb*. Subsurface samples (8) from the four soil borings were collected at surface, 4.4 and 9.5 (two bores) and surface, 4 feet and 5.5 to 6.6 feet (2 bores) and analyzed for *Pb*.

Groundwater (1 upgradient well and 2 downgradient wells) monitored for metals and anions.

Wipes (3 wipes) collected from the south wall inside building 211 and analyzed for metals, explosives and SVOCs.

Phase 2:

Groundwater (one new down gradient well installed between two old down gradient wells) monitored for metals and dissolved metals from all four wells in four rounds of sampling.

Confirmation samples (post-remedial sampling; a total of 9)) collected for VOCs and target metals.

Analyses:

Subsurface/Surface Soils: *Pb* is greater than levels found in JPG background screening levels in red stained areas (one had 13,000 ppm and 100 mg/L leachable). *Ba, Cr, Co, Cu, Ni, Ag,* and *Zn* are greater than levels in JPG background screening levels. *Al*, *B* and, *Be* are greater than the EPA Region 9 action level criteria. The report does not specify whether these metals are from the surface samples, subsurface samples or both. *Pb* is both surface and subsurface. Dieldrin (a pesticide) exceeds EPA Region 9 criteria.

Groundwater: *As* is present in all four groundwater wells at 6-13 times the JPG background screening levels and far above EPA Region 9 action level criteria of 0.045 ug/L for cancer risks. The source of *As* is unknown. *Al, Ba, Cd, Ca, Cr, Cu, Fe, Pb, Mo, Sn* and *V* are greater than the JPG background screening levels. *As* and *Ba* are greater than EPA Region 9 action level criteria.

Confirmation: *Pb* detected. *As* greater than EPA Region 9 action level criteria but less than JPG background screening levels.

Wipes: Unknown SVOCs are present. These samples were collected from oily surfaces on walls. Some metals also detected.

**Health Concerns and Recommendations**

Chronic Non-Cancer Health Risks:

A) Future residents: Both future adult and toddler residents have hazard indices (HIs) greater than one (3.5 adult, 8.5 toddler). The critical exposure pathway is ingestion of *As* in groundwater.
B) Future on-site workers: Future on-site workers have HIs greater than one (1.3). The critical exposure pathway is ingestion of *As* in groundwater.

Cancer Risks:

A) Future on-site resident: The adult cancer risk is $5.4x10^{-4}$ and the toddler cancer risk is $2.6x10^{-4}$. Both of these values exceed the EPA target range ($1.0x10^{-4}$ to $1.0x10^{-6}$) due to ingestion of *As* through groundwater.
B) Future on-site worker: The cancer risk for future on-site workers is $1.6x10^{-4}$. This value exceeds the EPA target range ($1.0x10^{-4}$ to $1.0x10^{-6}$) due to ingestion of *As* through groundwater.

Recommendations: It is especially concerning that both cancer and non-cancer health risks stem from a contaminant with an unknown source at this site. Further research is recommended into the history of the site as well as additional *As* sampling down gradient in soils and groundwater. Considering that *As* is insecticidal and accumulates in soft tissues, white-footed mouse and plants are also at risk (as per the ecological risk assessment). Although *As* may be present at high levels in soils naturally, the fact that it was found in both soils and groundwater warrants further exploration. We strongly agree with RUST's recommendation that this site move forward into the feasibility study (FS).

**Updated Recommendations**

These updated recommendations are based on reports entitled Closure Report Building 211 (Site 7 - Red Lead) Jefferson Proving Ground Madison, Indiana,' written by Sverdrup Environmental, Inc., in June 1997 and a 'Confirmatory Sampling Report,' written by SAIC in July 1997. These reports are specific to the removal of obviously and suspected contaminated soils. The Sverdrup document details the steps taken to reduce the levels of contaminants at this site and the SAIC document contains information on contaminant levels at the site after the remediation described by Sverdrup.

SVOCs were tentatively identified in the collected samples, but as they were not specifically analyzed for, the results were rejected 'based on associated blank levels' (SAIC report). We suggest additional sample collection and analysis for SVOCs as these results could impact future uses of this site.

Our revised recommendation is consistent with our original recommendation that this site move forward into the feasibility study (FS).

**Site 8 (Chapter 11)**
**Small Arms Firing Range (Building 295)**

**Site Use**
This site was used for storage, small arms testing, training (i.e. target practice) and testing of flares. This site was not used after 1997.

**Remediation Actions**
In June-September 1997 the inside concrete and steel surfaces were washed with detergent and water followed by a water rinse. Wash and rinse water were collected, as much as possible, for appropriate disposal. Contaminated soil floor and soil in bullet traps was removed. Epoxy was sprayed on walls to encapsulate the lead dust.

**Geology**
The soil is Cobbsfork soil series, probably with 20-40 feet of glacial till to bedrock. Surface drainage is to the southwest but surface waters eventually move northwest to Middle Fork Creek.

**Contaminants of Concern**
All contaminants of concern derive from inside use, and migration of contaminated dust and dirt.

<u>RUST Stated</u>: *Pb* (lead dust and lead bullets), asbestos (wall tile, "unknown white powder" may also be asbestos).

<u>Phase 1 Sampling</u>:

> Wipe samples (20 samples) from the walls of each of the four firing lanes were analyzed for metals.
>
> Surface soils (4 samples) for metals.
>
> Confirmation soil samples were taken from the floor and bullet trap areas for metals. (The report did not specify what metals).

<u>Analyses</u>:

> <u>Surface Soils</u>: *Al, As, Ba, Co, Cr, Cu, Mn, Ni, Pb, Se* and *Zn* exceeded JPG background screening levels. No levels exceeded EPA Region 9 action level criteria. Interior wipe samples detected *Pb* (7/20 wipes), *Ag* (5/20 wipes), *Cd* (1/20 wipes, *Cr* (8/20 wipes) or *Ni* (3/20 wipes). There are no risk criteria for wipe sample data. However, these results indicate that the interior surfaces are not completely "clean."

**Health Concerns and Recommendations**
No health risk assessment was done. The soil sample data did not exceed action level criteria. No interior data was obtained for which risk criteria have been developed. Therefore, no further action is recommended by RUST.

Recommendations: Positive interior surface wipe samples indicate an on-going contamination issue. Air monitoring is recommended prior to making a final decision about future uses for this building. In addition soil samples should be taken near the door(s) and windows.

However, the apparent presence of low level, but above background, metal contamination suggests that the building should not be used for purposes that involve continuous exposure, and is inappropriate for residential use. Children should not have access to the site and pregnant women should also be allowed no more than limited exposure, if any exposure at all.

An appropriate use might be as a civilian firing range. While this site does not warrant moving forward to the feasibility study, a memorandum of No Further Action (RUST's recommendation) should only be drafted **after** confirmatory sampling has taken place for air contamination within the building and for contamination of the soil around the door(s) and windows.

**Updated Recommendations**

As we have no data on confirmatory samples for this site, we stand by our previous recommendations that this site is not worthy of a memorandum of No Further Action. Until air samples are taken from within the building and soil samples are taken from the soil around the windows and doors of the building, it is not appropriate to transfer this building to non-military personnel.

## Site 9 (Chapter 12)
## Burning Ground South of Gate 19 Landfill

**Site Use**
This site was used between the 1950s and the 1970s for open burning of construction debris, waste propellants, trichloroethene and paint waste.

**Remediation**
A fraction (about ¼) of the northeast section of site 9 was covered by a synthetic membrane and clean soil cover at the time of closure of the Gate 19 Landfill. (This comment is based on the maps of the site. This was not explicitly stated in the remedial investigation reports.)

**Geology**
The burning area is gently sloping down to the west/northwest. Water "often" ponds on the burning area after a rainfall. The western part of the burning area and the ground water under the burning area (site 9) may be affected by run-off from the pond to the south of the western part of site 9. Groundwater also appears to flow northwest. The soils are Cobbsfork and Avonburg soil series with 3.5-14 feet of glacial till. A void in well northwest 93-17 may indicate that at least part of the bedrock is karst (holey limestone).

**Contaminants of Concern**
<u>RUST Stated</u>: Solvents and metals.

<u>EnviroComm Potential</u>: Combustion by-products (dioxins, furans).

<u>Phase 1 Sampling</u>:

Surface soils (16 samples) were tested for VOCs, SVOCs*, explosives and metals**.
*There were many problems with the analysis of the SVOCs.
**Not all samples were analyzed for metals. Additional (10 samples) surface soil samples were taken from soil borings around the perimeter of trenches and tested for VOCs, SVOCs, explosives and metals.

Subsurface soils (32 samples) from 16 borings were collected at five and ten feet (or at the bottom of the bore hole when bedrock was encountered before ten feet). These samples were tested for VOCs, SVOCs, explosives and metals.

Groundwater (8 wells total) was monitored in three existing wells and five new wells installed during Phase 1. Samples were tested for VOCs, SVOCs and metals.

<u>Phase 2 Sampling</u>:

Surface soils (5 samples) were taken and tested for SVOCs and explosives.

Subsurface soils (4 samples) were collected from two borings at one foot and five feet and were tested for SVOCs.

Groundwater (1 well) was sampled four times and tested for metals [total and dissolved], VOCs, SVOCs and explosives.

Analyses:
All Phase 1 SVOC results were suspect, and the PCB and toxaphene samples were rejected due to lack of calibration.

Surface Soils: A variety of SVOCs were detected, apparently above JPG background screening levels but below EPA Region 9 action level criteria. Benzo(α)pyrene was detected above the EPA action level criteria. Of the explosives, only 2,4 DNT (dinitrotoluene) was found, at a concentration below the EPA Region 9 action level criteria. Of the metals, *Al, Be* and *Mn* all exceeded the EPA Region 9 action level criteria.

Subsurface Soils: *Al, Ba, Be, Bo, Cr, Co, Cu, Pb, Mn, Ni, Ag, V,* and *Zn* exceed JPG background screening levels in surface soils. All metals tested exceed JPG background screening levels in subsurface soil samples. *Al, As, Ba, Be, Mn* and *V* exceed EPA Region 9 action level criteria.

Groundwater: VOCs (trichloroethane, benzene, toluene, methylene, chloride, trichlorofluoro methane) were detected in 1988. *Hg* exceeded safe drinking water criteria in well 2, 4, and 7 (west and southeast of the landfill) in 1992. *Al, Ba, Be, Cr, Co, Cu, Hg, Mb, Ni, Sb, Se, V,* and *Zn* exceed the JPG background screening groundwater levels in the Phase 1 (1993) samples.

**Health Concerns and Recommendations**
Chronic Non-Cancer Health Risks:
The non-cancer hazard index exceeds the "safe" value of 1 for all residents: 5.6 for adults, 15.94 for children. When the hazard indices for sites 9 and 10 are combined, the net values are even higher: 21.6 for adults and 58 for children.

Cancer Risks: The human health calculations based on combined soil/subsurface soil exposure indicates a cancer risk of $9.65x10^{-5}$ for adults and $7.46x10^{-5}$ for children residing on-site. This is at the extreme high end of the EPA "acceptable risk for cancer" range, and is above the usual limit for Indiana of $10^{-5}$. Further, when the cancer risks for sites 9 and 10 together are summed ($1.81x10^{-4}$ for resident adults, $1.37x10^{-4}$ for children residents) the cancer risks exceed the extreme limit of the EPA's acceptable range.

On-site workers face a much lower cancer risk ($1.13x10^{-5}$) and hazard level (hazard index is 1.7).

Ecological: A large number of ecological target organisms are likely to be adversely affected by the contaminants in and leaching from Site 9, with hazard indices ranging from above one to up to about 300, depending on the testing tier and animal. The hazard indices for plants, soil fauna, and great blue herons even exceed those for the JPG on-site reference soils. Note: this is without PCBs, toxaphene or dioxins (bioaccumulative toxicants) due to lack of data.

Earthworm toxicity tests indicate that mortality was as high as 20% in Site 9 samples. This is significantly higher than earthworm mortality in Avonburg and Cobbsfork JPG “reference” soils, but not significantly higher than the Rossmoyne JPG “reference” samples. (In general, the Rossmoyne soil samples seem more toxic and appear to be more highly contaminated than the Avonburg or Cobbsfork reference samples. The Rossmoyne soil site marked is north of sites 29, 28, and 39, near Kreuger Lake, just off Ordnance Drive.) The phytotoxicity test indicated no significant effect on germination and a faster growth (based on plant weight) in Site 9 soils compared to the Cobbsfork and Avonburg soils.

Diversity was too variable at the “reference” sites to be used as an ecological test here.

Recommendations:
RUST says no further data are needed. However, due to problems with the chemical analyses and lack of certain testing, no bioaccumulative compounds were quantified. This testing needs to be carried out properly for PCBs, dioxins, and furans and toxaphene, and “unidentified organics” need to be identified. It is also strongly recommended that this site not be turned over for residential use until the contamination above and below ground is isolated or remediated. We agree with RUST’s recommendation to carry this site forward to the feasibility study (FS).

Comments: The samples that are being referred to in the text need to be clearly identified in the next draft of this document.

## Site 10 (Chapter 12)
## Gate 19 Landfill

**Site Use**

This site is a 12-acre landfill that was in use from 1960-1994. Asbestos (double-bagged) was placed in the northwest corner and along the western edge just prior to landfill closure. (Note, this is after the passage of the TSCA which specifically covers asbestos.) Construction debris (concrete block, metal, wire, wood) was deposited over much of the 12 acres (10 of the 12 acres). Other materials were mostly (apparently) placed in trenches in the landfill: incinerator ash, red lead paint, methylene chloride and polyurethane residues, paint and trichloroethane (TCE)* (*if the manifests only say TCE this could as well be trichloroethylene).

**Remediation**

At landfill closure in 1995 the landfill was covered with a synthetic membrane and a clean soil cover that is now covered with grass.

**Geology**

The land is flat to gently sloping to the west/northwest. RUST says that most surface-water run-off appears to flow toward a small pond at the southwest corner of the site, south of the western part of the burn area (Site 9). This may be true of the uncovered portion of the landfill south of the burning area (Site 9). The pond discharges to the west via a small drainage. The water runs through open farmland until it enters Middle Fork Creek north ¼ mile west of the JPG boundary. The pond apparently receives discharge from surface water flowing into a drainage ditch running along Firing Line Road. This drainage ditch drains from area as far away as build 602 (solvent pits). The groundwater under the landfill appears to flow northwest. Springs, apparently from the groundwater under the landfill, can be detected in Middle Fork Creek to the north and west of the landfill. The soils are Cobbsfork and Avonburg soil series with 3.5-14 feet of glacial till until bedrock. Some of this geology may be karst.

**Contaminants of Concern**

<u>RUST Stated</u>: Asbestos, solvents, metals.

<u>EnviroComm Potential</u>: Dioxins and furans in the incinerator ash and methyl mercury (*MeHg*) in the pond.

<u>Phase 1 Sampling</u>:

> Geophysical surveys were done and they identified trenches in several (five) places in the landfill, plus one trench that crosses from the burning area (Site 9) to the landfill—demarcated area (Site 10 proper). Buried metallic debris (drums, paint containers) was also identified.
>
> Surface/subsurface soils (10 samples) from soil borings were collected at the surface, five feet deep and 10 feet deep and tested for VOCs, SVOCs, explosives and metals.

Surface water and sediment samples from the pond (three each of surface water and sediment) were collected at the edges (north, west, southwest) of the pond and were analyzed for VOCs, SVOCs, TCLP metals and explosives.

Groundwater: Prior to Phase 1 RUST indicated that 20 groundwater monitoring wells had been installed around the perimeter of what is now the capped (northern) part of the landfill. However, only 13 groundwater monitoring wells (1981-1989) are marked on the maps. These were analyzed for VOCs, SVOCs and metals. In 1993, five additional groundwater monitoring wells (#15-19) were installed to the west (four) and the middle (one) of the southern uncapped part of the landfill. Well 19 is in the middle of site 9 (the burning area). Well 15 is directly west from the new 1993 wells. These were monitored and analyzed for metals, VOCs and SVOCs. Three wells (which are not clearly indicated) of the original "20" were sampled and tested only for *Hg*.

Phase 2 Sampling:

Subsurface oils (2 samples) were collected from additional borings drilled on either side of the trench in the uncapped southern portion of the landfill and analyzed for SVOCs and explosives.

Surface water and sediments (one set) from the pond were collected from the northeast edge of the pond, just west of the southern spur of the landfill and analyzed for explosives, metals and SVOCs.

Groundwater (10 wells) was monitored four times each and tested for metals (total and dissolved), VOCs, SVOCs and explosives.

Analyses:

All Phase 1 semi- volatile organic compounds were suspect, and the PCB and toxaphene samples were rejected due to lack of calibration.

Surface and Subsurface Soils: *Al, Ba, Be, Cr, Co, Cu, Pb, Mn, Ni, Ag, V* and, *Zn* exceed JPG background screening levels in surface samples. All metals tested exceed JPG background screening levels in subsurface soils. *Al, As, Ba, Be, Mn* and *V* all exceed the EPA Region 9 action level criteria (measured in the borings around the trench in the south part of the landfill). PAHs were detected at multiple levels in the borings taken from the trenches in the northern (capped) part of the landfill.

Pond Sediment: Both *Hg* and *As* were detected in pond sediment. *Hg* was above the JPG background screening level. All other metals tested for were also present in the pond sediment.

Pond Surface Water: *Hg* was detected in JPG background screening surface water and pond water. (Note—this is inorganic *Hg*, not the organic *Hg* potentially expected in this pond due to biotransformation of *Hg* to *MeHg* by sedimentary bacteria. *Al, Ba, Be, Bo, Cr, Co, Cu, Pb, Mn, Ni, Ag, V* and *Zn* were above the JPG background screening levels. *Mn* was above the EPA Region 9 action level criteria, as was 1,3,5 trinitrobenzene.

Groundwater: *Al, Ba, Be, Cr, Co, Cu, Hg, Mb, Ni, Sb, Se, V* and *Zn* exceed the JPG background screening levels. *As*, *Be*, *Co*, *Pb* and *Mn* were above the EPA Region 9 action level criteria. One explosive was detected above JPG background screening levels: 1, 3, 5-trinitrobenzene. SVOCs and VOCs were identified in groundwater wells above the JPG background screening levels. Based on the distribution of the "sections" listed, these chemicals appear to be below and moving west and northwest from the existing landfill, both the larger capped section and the uncapped southern section. VOCs and SVOCs detected above JPG background screening levels include: PAHs (benzo a penthracene, fluoranthrene, pyrene, acenapthene), phthalates (di-n-octyl phthalate, diethylphthalate, dimethylphthlate, di-n-butyl phthalate, butylbenzyl phthalate), and chlorinated straight-chain solvents and aromatic hydrocarbons (1,1,1 –trichloroethane, 1,1 –dichloroethenem chlorophenol, 4 –chloro–3–cresol, 2 –chlorophenol).

**Health Concerns and Recommendations**

Chronic Non-Cancer Health Risks:

The non-cancer hazard indices exceed the "safe" value of one for all projected residents: 15.0 for adults and 42.05 for children. When the hazard indices for sites 9 and 10 are combined, the net values are even higher: 21.6 for adults and 58 for children. On-site workers face a much lower cancer risk ($1.13 \times 10^{-5}$) and non-cancer and hazard level (hazard index is 1.7).

Cancer Risks:

The human health risk calculations are based on combined soil/subsurface soil exposure. These indicate a cancer risk of $8.42 \times 10^{-5}$ for resident adults and $6.26 \times 10^{-5}$ for residential children. These values are at the upper limit of the range for the EPA "acceptable risk" and are above the usual limit for Indiana of $10^{-5}$. Further, when the cancer risks for sites 9 and 10 are combined, since they are superimposed sites, the cancer risk for all residents exceed the acceptable EPA range ($1 \times 10^{-4}$ maximum risk): $1.81 \times 10^{-4}$ for adults, $1.37 \times 10^{-4}$ for children.

Ecological: Site 10 ecological risks were not evaluated because it was assumed that the capping of the north part of the landfill removed the possibility of exposure to any ecological target organism. Given that the southern part of the landfill is not capped, that there is clearly groundwater contamination, and that the groundwater appears to be connected (springs emerge) to Middle Fork Creek, this is probably an overly optimistic assumption.

Recommendations: Site 10 is not specifically recommended for moving forward, but as Sites 9 and 10 are overlapping and Site 9 is being moved forward to the feasibility study, Site 10 will likely, to some extent, be considered in the feasibility study. RUST says no further data is needed. However, due to problems with the chemical analyses and lack of certain testing, no bioaccumulative compounds were quantified. This testing needs to be carried out properly for PCBs, dioxins, furans and toxaphene, and "unidentified organics" need to be identified. Further, given the possible presence of karst (holey) limestone under these sites, and the observation of springs emerging in Middle Fork Creek, dye tests need to be run to evaluate groundwater flow and its emergence in Middle Fork Creek. The springs will need to be monitored for metals, PAHs, other semi-volatile organic compounds and possibly PCBs and/or dioxins. In addition, the pond should continue to be monitored as well and should be evaluated for the presence of organic *Hg*. It is also strongly recommended that this site not be turned over for residential use until the contamination above and below ground is isolated or remediated. Therefore, we recommend that both Sites 9 and 10 be carried forward to the feasibility study (FS).

## Site 12A (Chapter 13)
## Solvent Pit (Building 602)

### Site Use

Building 602 is a former ammunition-assembly plant. By the early 1990s, it was used an employee break area and a boiler plant. The building has not been used since 1995. To the southeast of building 602 was a leaking underground storage tank, previously used to store No. 2 diesel fuel (listed as site 35). This tank was removed in 1988, and the contaminated soils were stored above ground in the parking area east of building 602 (site 24). The stockpile has since been disposed of off-site. However, in the meantime, it is believed that surface run-off from the stockpiled soil (at site 24) flowed west and contaminated a small drainage swale just north of building 602. This small swale/pit was used from 1970-1978 to dump waste solvents and other degreasers, including as much as 500 gallons of trichloroethane.

### Geology

The 3x3 foot pit is now gravel-filled. The area around the pit and building 602 is relatively flat and covered by either pavement or grass. Woods lie to the south and east of the site. Surface water from the parking area and the area east, west, and south of the building drains to a ditch running south of the site along the railroad tracks. The water in the ditch flows west and drains into the site 10 (Gate 19 Landfill) pond, which drains over land to the west to Middle Fork Creek. The soil is Cobbsfork soil series with about 30 feet of glacial till. Groundwater is bilevel, with one level about 4 to 8 feet below the ground surface and the second about 9 to 11 feet below the ground surface. The two ground water levels appear to be connected somewhat. Building 602 and the soil pit appear to lie at a peak ground water contour, with groundwater flowing both northeast and southeast from this point. During the spring, peak flow season (June was tested, although April-May is probably wetter with a higher water table) ground water all seems to flow north, northeast from this site. During the lowest flow seasons (November 1996 was tested), all water may flow southwest from this site. The main thrust of groundwater, though, seems to consistently be from the southeast. The upper perched level of groundwater consistently flow southeast, however, the porosity studies indicate that the glacial till (deeper soil) is fractured, which may allow for rapid and complex movement of contaminants vertically, as well as horizontally.

### Contaminants of Concern

RUST Stated: Volatile organic compounds (solvents), especially trichloroethane.

Phase 1 Sampling:

> Surface/subsurface soils (4 samples) were collected as soil borings near the solvent pit. The core and cuttings were scanned for VOCs using a photoionization detector (PID). All samples were then analyzed for VOCs. Eighteen push probe holes were made and sampled for soil that was analyzed for VOCs.
>
> Groundwater (4 wells, one near the solvent pit, one southeast, one southwest, one north) were installed and monitored for VOCs. (These data were not usable for the risk assessment and were just used qualitatively.)

Phase 2 Sampling:

Groundwater (8 temporary well points, four top of bedrock wells and one deep well) was sampled in four rounds (two top of bedrock wells) and two rounds (two top of bedrock wells). The eight well points were installed to determine solvent contamination distribution and groundwater flow direction. Anions, metals and VOCs were analyzed.

Analyses:

Surface/subsurface soils: One VOC was detected in one borehole at a concentration less than the EPA Region 9 action level criteria.

Groundwater: VOCs that exceed EPA Region 9 maximum contaminant levels (MCLs) are 1,1-dichloroethylene, 1,1,1-trichloroethane, 1,1,2-trichloroethane, 1,2-dichloroethylene, chloroform, trichloroethylene and vinyl chloride. From the groundwater sampling, RUST determined that the primary solvent plume is confined to the immediate area surrounding the solvent pit.

**Health Concerns and Recommendations**

An assumption used by RUST is that VOCs will not volatize out of vegetated ground. This needs to be verified with air monitoring before any residential uses are suggested for this site. Further, all future residents would need to be warned not to disturb the soil by gardening or other plantings, as such digging could enhance volatilization of VOCs from the soil.

Chronic Non-Cancer Health Risks:

The hazard indices are 109 for adult residents, 243 for resident children and 36 for on-site workers.

Cancer Risks:

The VOCs create an unacceptably high cancer risk as well as a non-carcinogenic hazard to any residents or workers at or near this site. Cancer risks are $1.7x10^{-2}$ for resident adults, $7.4x10^{-3}$ for resident children, and $4.3x10^{-3}$ for on-site workers.

All hazard indices and cancer risks are considered unacceptable by any criteria.

Recommendations: The major concerns will be related to VOCs in the groundwater. This site is being carried on to the feasibility study (FS) stage. This is appropriate. It is also interesting to note that in the data quality analysis section contains a statement that 'the groundwater flow direction and distribution of solvent contamination is not well understood.' That the dynamics of the site are poorly understood is certainly an appropriate reason for moving this site forward to the FS.

## Site 12B (Chapter 14)
## Solvent Pit (Building 617)

**Site Use**
Building 617 was used as heating plant. The 3x3 foot solvent-disposal pit is now gravel-filled. The pit is located directly south of the west side of the building. Between 1970 and 1978 waste solvents/degreasers were dumped in the pit. The solvents used included about 500 gallons of trichloroethylene. Three steel underground storage tanks that were used to store fuel oil were located south of building 617 and of the site 12B solvent pit. The tanks have been removed and some residual subsurface soil contamination may remain.

**Geology**
The site is relatively flat. Surface water runs off to the east and enters a tributary to Middle Fork Creek about 1500 feet away. The soil is Cobbsfork soil series with about 20 feet of glacial till. Groundwater lies in 2 zones, a bedrock aquifer and a zone perched on top of the Illionian till which lies about 0.5-1.5 higher than the moving surface of the groundwater. The perched water is in communication with the bedrock aquifer. Bedrock groundwater flow is southwest and southeast from the site. Perched groundwater flow changes directions (northeast in April 1996, southeast and northwest in June 1996, southwest in September, October, November and December 1996).

**Contaminants of Concern**
RUST Stated: Solvents. 1989 remedial investigation and feasibility study detected acetonem, benzene, chloroform, 1,1, dichloroethane, 1,2 dichlorethane, 1,1, dichloroethylene, 1,2 dichloroethylene, toluene, 1,1,1 trichloroethane, trichloroethane, in soil samples immediately adjacent to the pit.

Phase 1 Sampling:

Surface/subsurface soils (4 surface, 8 subsurface) boreholes were drilled north, south, east, west of the solvent pit surface and deep (4 and 9.8 feet) samples were analyzed for VOCs.

Groundwater (4 wells) was monitored for VOCs. Well locations were selected from the soil boring and field screening results.

Phase 2 Sampling:

Groundwater (6 additional wells) was monitored down gradient to define groundwater flow and the extent of VOC contamination. Four rounds of samples were taken from the four old wells while two rounds were taken from the new.

Analyses:

Soils: The soil was contaminated with 1,1 dichloroethane, 1,1, dichloroethylene, toluene, 1,1,1 trichloroethane at detectable concentrations, but below EPA Region 9 action level criteria (Phase 1). Fuel oil is limited to some soil in the pits where the additional probeholes were placed to better identify the extent of the contamination. VOCs were present to at least 16 feet with concentrations in both soil and groundwater.

Groundwater: The solvent plume (ppb range) seems to extend west (north and south) from the site. (RUST says only southwest. The diagram indicates northwest as well.) Concentrations of 1,1, dichloroethylene are above EPA Region 9 action level criteria in the monitoring wells southwest of the solvent pit.

**Health Concerns and Recommendations**

The solvents present in the groundwater pose unacceptable carcinogenic and non-carcinogenic health risks to both on-site workers or to residents.

Chronic Non-Cancer Health Risks:

Non-cancer hazard indices are high for humans. The hazard index for adult residents is 86, for child residents is 195 and for on-site workers is 29. Most of these risks are due to 1,1 dichloroethylene and 1,1,1 trichloroethane, with some contributions from the other related and also present halogenated solvents.

Cancer Risks:

Cancer risks are $6.7x10^{-2}$ for resident adults, $3x10^{-2}$ for resident children and $1.8x10^{-2}$ for on-site workers. All risks are well above the “acceptable risk” range suggested by the EPA.

Recommendations: This site is to be carried forward to the feasibility study stage. This is appropriate. The data quality analysis section for this site and for site 12C also contained an interesting statement (similar to a statement contained in the data quality analysis section for site 12A) that 'the distribution of solvent contamination is not well understood.' Again, this is an appropriate reason for moving sites 12B and 12C to the FS.

## Site 12C (Chapter 15)
## Solvent Pit (Building 279)

**Site Use**
Building 279 is a former ammunition-assembly plant. It is now used for equipment storage. Between 1970 and 1978 waste solvents/degreasers were disposed of in a 3x3 foot gravel-filled pit located just north of Building 279. As much as 500 gallons of trichloroethylene were dumped into this pit.

**Geology**
This area is flat and covered with grass or pavement. Surface water run-off flows via a network of shallow roadside ditches to the northwest and discharges into Middle Fork Creek. The soil is Cobbsfork soil series with about 40 feet of glacial till. Groundwater lies in two semi-distinct zones. The bedrock aquifer seems to change direction. It flows west or southwest most of the time (November 1995 through June 1996), then moved north (September 1996), back to the southwest (October 1996, November 1996), and back to the north (December 1996). The perched groundwater (about 1 to 6 feet below ground surface) lies on top and within the Illinoran till and flows southeast.

**Contaminants of Concern**
RUST Stated: Solvents.

Phase 1 Sampling:

Surface/subsurface soils (4 surface, 8 subsurface) were collected for VOCs. Soils were collected from four borings, with one surface and two subsurface (5 and 10 feet) taken from each boring.

Groundwater (5 wells) was monitored for VOCs.

Phase 2 Sampling:

Groundwater (3 new wells) was monitored in all eight wells (5 old, 3 new) four times for VOCs.

Analyses:

Surface/subsurface soils: No volatile organic compounds were detected in any of the four borings that surrounded the solvent pit and were tested during Phase 1 sampling.

Groundwater: Solvents were detected in the monitoring well (88-15) at concentrations greater than the EPA Region 9 action level criteria: 1,1,1 trichloroethane (27,500 to 71,500 ug1L=ppb), 1,1 dichloroethylene (750 to 3,850 ppb), 1,1 dichloroethane (3,750 to 7,000 ppb), trachloroethylene (930 to 2,400 ppb). Solvents were also detected at three other, not clearly specified, wells on-site. WP96-1, WP96-4 are the only two identified in Figure 15.11 with more than trace concentrations of solvents and four others: (WP96-3, WP96-5, WP96-6 and WP96-1) are listed in Figure 15-11 with trace detections. No solvents were detected in bedrock-level groundwater. Thus solvents at this site appear to have stayed in the glacial till in the immediate vicinity of the solvent pit.

**Health Concerns and Recommendations**
The major health concerns at this site are due to the solvents in the perched groundwater, primarily 1,1 dichloroethylene and 1,1,1 trichloroethane. The solvents pose both carcinogenic and non-carcinogenic risks that are above the “acceptable range” as determined by the EPA.

Chronic Non-Cancer Health Risks:
Non-cancer hazard indices are 86 for resident adults, 193 for resident toddlers and 28 for on-site worker and are all due to solvents in groundwater.

Cancer Risks:
Cancer risks are estimated to be $1.6x10^{-2}$ for future adult residents, $7.3x10^{-3}$ for future resident children, and $4.3x10^{-3}$ for future on-site workers and are all due to solvents in groundwater.

Recommendations: RUST suggests that the site be moved forward to the feasibility study stage. This is appropriate. The data quality analysis section for this site and for site 12B also contained an interesting statement (similar to a statement contained in the data quality analysis section for site 12A) that 'the distribution of solvent contamination is not well understood.' Again, this is an appropriate reason for moving sites 12B and 12C to the FS.

## Site 13 (Chapter 16)
## Old Fire Training Pit

**Site Use**
This is an unlined 20x10x2 foot deep pit adjacent to the intersection of two abandoned runways. Wood was soaked with diesel fuel and other petroleum products and set on fire. The fire was extinguished as part of training procedures. Details on the type of extinguishment used are not given. The site was used in the 1970s and 1980s.

**Geology**
Flat, with surface water runoff directed through underground storm sewers into Harberts Creek, south of site 13. The soil is Cobbsfork soil series with 30 feet deep glacial till. Bedrock groundwater confirmed at about 7 to 9 feet below ground surface and flows to the northeast, away from Harberts Creek.

**Contaminants of Concern**
<u>RUST Stated</u>: Petroleum hydrocarbons, lead and other heavy metals from fuel, SVOCs.

<u>Phase 1 Sampling</u>: Four soil borings.

Surface soil (4) samples from boring holes were analyzed for TPH, VOCs, SVOCs, and total metals.

Subsurface soil (13) samples were taken from the four borings used for surface samples (3/4 to 15 feet, ¼ to 21 feet at “auger refusal”) on the perimeter of the site, northwest, south, southwest, in the center of the site, northeast. Samples were collected at 5, 10, and 15 feet (for 3/4), and at 5, 10, 15, and 19 feet deep (for 1/4). All samples were analyzed for SVOCs, VOCS, metals and TPH.

A field screening survey was done to determine where the location of groundwater monitoring wells should be placed. Groundwater monitoring wells were placed at the southwest (1), northeast (1), and southeast (1).

<u>Phase 2 Sampling</u>:

Surface/subsurface soil (8) samples were taken from two additional borings in the pit. Samples taken at the surface (1 foot deep) were analyzed for SVOCs, while deeper samples (taken at 5, 10 and 15 feet) were analyzed for SVOCs and VOCs. (Note: VOCs were only analyzed for in samples with the highest PID reading).

Groundwater (3 well, four rounds of sampling) was taken from each of the groundwater monitoring wells and analyzed for total and dissolved metals, SVOCs and VOCs.

<u>Analyses</u>:

<u>Soils</u>: The Indiana state action level for TPH is 100 ppm. TPH was as high as 59,000 ppm in the southwest boring. TPH as high as 420 ppm was found in the northwest boring. Other SVOCs and VOCs were detected during Phase 2 sampling. No comment is made about these levels relative to any action levels. *As*, *Ba*, *Be*, *Co*, *Cu*, *Mn*, *Pb*, *Hg*, *N* and, *Ag* exceed the

contamination levels of the JPG reference soils. *Cr, Cd, V* and *Zn* exceed the EPA Region 9 action level criteria, as well as the JPG background screening levels.

Groundwater: Toluene and *Pb* were detected in the groundwater, although at levels below the maximum allowable contaminant level (MCL) and EPA Region 9 action level criteria. *Pb* was only found in the filtered water, possibly indicating that the filters were contaminated. Toluene was detected in the associated trip blank as well, possibly indicating that the air at this monitoring well was also contaminated with toluene. *Bo* was also present in the northeast and southwest monitoring wells, but again not above MCL or EPA Region 9 action level criteria. During Phase 2 sampling, VOCs were detected in all three wells, and SVOCs were detected in the southeast and southwest wells. *Al, As, Bo, Ca, Cr, Co, Fe, Pb, K, Mn, Mo, Ni, Se, Sn* and *V* were all above the JPG background screening levels and *Al* was also above EPA Region 9 action level criteria.

**Health Concerns and Recommendations**

Chronic Non-Cancer Health Risks:

The primary human concern appears to be non-cancer health risks, with a hazard index of 4.8 for adult residents and 6.6 for child residents.

Cancer Risks:

No excessive cancer risk was determined. On-site workers areor will be exposed to no excessive health risks based on the risk assessment modeling.

For ecological risk, *As, Ba, Cd* and *Zn* may have some impacts on site flora and fauna. However, since this site presents insufficient habitat and is small, risks appear to be minimal. The site is judged (by Rust) to present no excessive ecological risk to the overall JPG flora and fauna populations.

Recommendations:

Potential human health risks posed to future residents are sufficient to warrant moving this site into the feasibility study (FS). This site also has major data quality concerns; 14 SVOCs in soil, 11 SVOCs in water, and all polychlorinated biphenyls (PCBs) were rejected. We agree with RUST’s recommendation to move this site forward to the FS.

**Site 14 (Chapter 17)**
**Yellow Sulfur Disposal Area**

**Site Use**
No explicit description of past use was indicated for this site other than that the site was used for storage and disposal of yellow sulfur.

**Remediation**
A 45x80x5 foot deep area was excavated following the Phase I RI. At time of the ERA in September 1997, the entire floor of the pit was covered with black plastic pending receipt of confirmatory sampling results.

**Geology**
The land slopes gently to the south. Grasses and perennials surround site and woods and intermittent drainage are at south of site. Groundwater apparently flows in different directions depending on time of year, (flat moving surface), though RUST implies that equipment was faulty, and that groundwater moves generally southwest. The soil is Avonburg soil series with about 35 feet of glacial till.

**Contaminats of Concern**
RUST Stated: Metals, because when rain mixes with sulfur, sulfuric acid is produced. Sulfuric acid can remove (leach) metals from soil.

Phase 1 Sampling:

Surface soil (6) samples from borings were tested for total metals and pH and one was tested for VOCs based on a photoionization detector (PID) field screening.

Subsurface soil (13) samples were collected from four borings. Samples were collected from various depths between 3.3 and 10.1 feet and were tested for total metals and pH and two were tested for VOCs based on a PID field screening.

Surface water and sediment (4) samples were collected from the intermittent stream next to and downstream from Site 14. The samples wee 50 feet apart and were analyzed for sulfur and metals.

Groundwater (two down gradient and one up gradient) wells were monitored for total metals, sulfur, VOCs and SVOCs. Two wells were also sampled for filtered metals.

Phase 2 Sampling:

Note - Five surface soil samples were taken during the ERA, but not explicitly during Phase 2 investigations.

Groundwater (one new down gradient well installed for Phase 2) was monitored in four rounds of sampling at each of the three old wells and the new well. Groundwater was analyzed for total and dissolved metals.

Confirmatory samples were taken from various points on the excavation site, including surface soils (43 samples), grab surface samples (24), samples from the side and bottom of the excavation pit (8) and from sulfur-contaminated locations (12). All of these samples were analyzed for metals, sulfur and pH.

Analyses:

Soils: Low pH was noted in most of the samples, with pH values ranging between 1.4 (very acidic) and 7.9 (relatively neutral). *As, Ba, Be, Bo, Cd, Ch, Co, Cu, Pb, Mn, Mo, Ni, Ag, Sn, V* and *Zn* were greater than JPG background screening levels. *As, Be, Cr* and *Pb* were greater than EPA Region 9 action level criteria. (JPG background screening levels of *As* were also greater than EPA Region 9 action level criteria.)

Sediments: *Pb* was greater than the JPG background screening levels. *As* and *Be* were greater than the EPA Region 9 action level criteria.

Groundwater: *Al, Ba, Cr, Fe, Mn, Ni* and *V* were greater than the JPG background screening levels. *As, Pb* and *Co* were greater than the EPA Region 9 action level criteria.

Confirmation: Only *Cr* was greater than the EPA Region 9 action level criteria.

**Health Concerns and Recommendations**

Chronic Non-Cancer Health Risks:

The primary health concern at this site for future on-site resident adults and toddlers and future on-site workers is the ingestion of *As* in groundwater. All hazard indices for these populations exceed one.

Cancer Risks:

The primary cancer risk for future on-site residents and workers is the ingestion of *As* in groundwater. All risk estimates for these populations exceed the EPA Region 9 target risk range.

Recommendations: Similar concerns exist for this site as in Sites 7 and 21B. However, the difference in soils (Avonsburg here, Cobbsfork 7/21B) and the distance between the sites suggests a human-based source of the *As*, perhaps as an insecticide or rodenticide. Chromium is also a concern at this site. We agree with the RUST recommendation to move this site forward into the feasibility study (FS).

**Updated Recommendations**

These updated recommendations are based on reports entitled 'Closure Report Yellow Sulfur Area and Small Burn Area (Sites 14 and 15) Jefferson Proving Ground Madison, Indiana,' written by Sverdrup Environmental, Inc., in July 1997, 'Confirmatory Sampling Report,' written by SAIC, in July 1997, and 'Draft Project Report Removal of Contaminated Soils and UXO Clearance and Removal Support Jefferson Proving Ground yellow Sulfur Area,' written by TolTest Inc., in December 1999. The Sverdrup document details the steps taken to reduce the levels of contaminants at this site, the SAIC document contains information on contaminant levels at the site after the remediation described by Sverdrup, and the TolTest document contains additional sampling and analyses performed after the Sverdrup and SAIC activities.

The Sverdrup and the SAIC documents detail soil contamination, including sulfur, pH (a measure of acidity or alkalinity of the soil), and metal contamination in the soil. These reports indicate that contaminant levels are 'acceptable.' The TolTest document details actions taken to remove UXO from the site.

UXO is no longer a concern at this site, but concerns about metal contamination remain. In areas with high levels of sulfur, such as this site, the potential for metal leaching is high, especially where water run-off occurs. This suggests that run-off water from the site could contaminate the area of surface water drainage, which is Middle Fork Creek.

Data quality concerns also exist for this site. Half of the soil samples had SVOC calibration problems and *As*, a contaminant of concern, may be biased low by up to 30%.

We stand by our original recommendation to move this site forward to the FS because of metal contamination, sulfur, and low pH at the site.

## Site 15 (Chapter 18)
## Burn Area South of New Incinerator

**Site Use**

A burned (scorched) area was identified around a concrete pad south of building 333 and the new incinerator (Site 33) and near Site 14 (yellow sulfur disposal area). No vegetation is present. Burned debris (electrical wiring, other metal scrap) is present for about two to three feet out from the burned area.

**Interim Measures**

In 1997 the concrete pad and the top 12 inches of the "contaminated soil" (this was visual removal of discolored soil only) was removed. (Figure 18-1 makes this appear to be 6 to 8 feet out from pad.)

**Geology**

The land slopes to the west to an intermittent creek. Surface water drainage is in this direction as well. The soil is Avonburg soil series with about 35 feet of glacial till.

**Contaminants of Concern**

RUST Stated: Heavy metals.

EnviroComm Potential: Dioxins and furans and other combustion by-products were likely to have been present. However, since they attach readily to soil, excavation was probably an appropriate remediation for the combustion by-products as well as for the heavy metals.

Phase 1 Sampling:

Surface soil (4) samples were collected and analyzed for explosives, metals and TPH.

Phase 2 Sampling:

No additional sampling was performed, although confirmatory samples were taken and tested for metals (1997).

Analyses:

Surface soils: *Ag, Ba, Cd, Co, Cr, Mn, Ni, Sb, Sn, V* and *Zn* exceed JPG background screening levels. *Al, As, Ba, Cd, Co, Cr, Mn, Pb, Sb,* and *Zn* exceed EPA Region 9 action level criteria.

Confirmation samples: Only *Pb* exceeds the EPA Region 9 action level criteria.

**Health Concerns and Recommendations**

Since the contaminated confirmation sample is at a point farther away from the concrete pad than the other samples, it is likely that the excavation was not thorough at points farther away from the concrete pad. Due to the continued presence of higher levels of *Pb* around the concrete pad, we recommend that additional samples be taken at transects away from the pad starting within the clean up boundaries marked in Figure 18-2 and moving outward from there (to at least the creek to the west). This will better delineate the extent of contamination remaining.

Confirmatory sampling seems to indicate that excavation will be an appropriate remediation method for the contamination remaining.

Any potential ecological and human health concerns will be removed once the residual contaminated soil is removed. Confirmation testing should include dioxins and furans. After remediation is complete this site could potentially be used for any typical industrial use. Given its proximity to other on-going concerns (i.e. the incinerator), we suspect this site is unlikely to be considered for residential use in the future. However, because of the lack of confirmation sampling for dioxins and furans, we do not agree with RUST's recommendation for a memorandum of No Further Action.

**Updated Recommendations**

These updated recommendations are based a report entitled 'Confirmatory Sampling Report' written by SAIC in July of 1997. Confirmatory samples taken to ensure successful removal of contaminated soil during the interim measures only revealed metal contamination (*Pb* was above EPA Region 9 action level criteria). No confirmatory samples exist for dioxins and furans. Therefore, we still do not agree with RUST's recommendation for a memorandum of No Further Action until confirmation of acceptable dixoin and furan levels are received.

## Sites 21A and 30 (Chapter 19)
## Temporary Storage Area (21A) (Building 204)
## and Adjacent Shed (30)

**Site Use**
Building 204 was used to store pesticides, and a small metal shed southeast of building 204 was used for mixing and rinsing of pesticides. Spills from loading, unloading, storage and mixing may have occurred. In 1991 practices were in compliance with current regulations, but past practices may have been less acceptable. Building 204 has not been used for pesticide storage since before 1995.

**Geology**
The land surface is flat and paved or bare of vegetation. A drainage swale is to the north and a ditch between the building and railroad tracks to the south directs surface water. Surface water all ends up in Middle Fork Creek, either through the storm sewer (north) or ditch (south then north). The soil is Cobbsfork soil series with about 40 feet of glacial till.

**Contaminants of Concern**
RUST Stated: None.

Phase 1 Sampling:

Surface soil (3) samples were taken from obvious surface water drainage pathways and were analyzed for pesticides.

Wipes (3) were taken from inside building 204 and were analyzed for pesticides.

Phase 2 Sampling:

Surface soil (13) samples were taken along the drainage ditch and were analyzed for pesticides.

Subsurface soils (3) samples were collected from one soil boring where Phase 1 revealed high surface soil contamination. Samples were collected at two, five and ten feet and were analyzed for pesticides.

Analyses:

Surface soil: Dieldrin was greater than EPA Region 9 action level criteria. Thirteen other pesticides, including DDT and DDE (bioaccumulative pesticides) were detected.

Wipes: Nothing above background was detected.

**Health Concerns and Recommendations**
Chronic Non-Cancer Health Risks:

A) Future, on-site residents: Both adult and toddler future residents have hazard indices (HI) that exceed one (1.9 adult, 5.5 toddler). The critical exposure pathway is ingestion of dieldrin in homegrown fruits and vegetables.
B) Future on-site workers have a hazard index less than one.

Cancer Risks:

A) Future, on-site residents: Both adult and toddler future residents have cancer risks that exceed the EPA acceptable risk range ($6.5x10^{-4}$ adult, $3.8x10^{-4}$ toddler). The critical exposure pathway is incidental ingestion of dieldrin in soil and in homegrown fruits and vegetables.
B) Future on-site workers have cancer risks that are within the EPA risk range.

For the ecological risk assessment (ERA), RUST says that because contaminants detected are low, there is no cause for concern. Our interpretation is that because the site is small and mostly paved or enclosed, the chances of wildlife exposure are minimal.

Recommendations:

Additional subsurface soil and groundwater sampling is recommended to further characterize the horizontal and vertical extent of pesticide contamination. Because of the persistence of the particular pesticides detected and the potential for bioaccumulation of pesticides in the area, we agree with RUST's recommendation to move this site into the feasibility study (FS).

## Site 25 (Chapter 20)
## Papermill Road Disposal Area

**Site Use**

This site was used for the storage of surplus materials awaiting salvage or sale. A blackened ground surface, debris, ground mounding and containers with tarry material were noticed at the site. In 1997 corn was planted at this site. Plowing mixed the tarry material into the soil to a depth of about 2 feet. Some of the more heavily blackened spots were left untouched during plowing. Note that the corn grew poorly. (The corn stalks were only 1 to 2 feet tall in September). The area is now fenced and is not used for farming.

**Geology**

Surface water run-off appears to flow to a southwest drainage ditch alongside the railroad tracks, and then out to Paper Mill Road. The soil is Cobbsfork soil series with about 35 feet of glacial till.

**Contaminants of Concern**

<u>RUST Stated</u>: None.

<u>EnviroComm Potential</u>: PAHs, dioxins, furans (i.e. combustion by-products).

<u>Phase 1 Sampling</u>:

Surface soil (3) samples were collected from areas with surface staining and/or stressed vegetation and were analyzed for metals, PCBs/pesticides and TPH. Other samples (2) were collected from the surface of soil borings and were analyzed for total metals, VOCs, SVOCs, TPH and explosives.

Subsurface soil (3) borings were drilled into the water table and were analyzed for total metals, VOCs (one sample only), SVOCs (one sample only), explosives (one sample only), TPH and PCBs/pesticides. Samples were collected at depths of 4 to 5 feet and 9 to 10 feet.

<u>Phase 2 Sampling</u>:

Surface soil (8) samples were taken from eight random locations in a 200 foot square (40,000 square feet) grid encompassing all Phase 1 sample sites and two new subsurface sites.

Subsurface soil (2) borings were taken to address suspect metal and SVOC sample results from Phase 1.

<u>Analyses</u>:

<u>Surfacesubsurface soils</u>: DDD and DDE were found in one sample above their respective reporting limits. Benzo[α]pyrene, and benzo[β]fluoranthene were detected above EPA Region 9 criteria in three samples. *Sb, As, Ba, Be, Bo, Cd, Cr, Co, Cu, Pb, Mn, Hg, Mo, Ni, Se, Ag, Tl, Sn, V* and *Zn* were all detected above the JPG background screening levels. *Al, As, Ba, Be, Cr, Mn* and *Tl* all exceeded EPA Region 9 action level criteria.

**Health Concerns and Recommendations**
As with several other sites, the overall cancer risk for future on-site residents is close to the Indiana action level. While these levels are within the target risk range for EPA, the risks are high enough that residential use should be discouraged. Similarly, future off-site consumers of beef and milk will ingest enough contaminants that will be at amounts close to or above the Indiana action level for carcinogens. It is recommended that agriculture be restricted on this site. Therefore, industrial use is preferred for this site.

Ecological Concerns: Although the laboratory tests run with unspecified soil indicate that there were no significant ecological problems; the on-site 'test' of trying to grow corn at this site (in 1997) shows more effectively that the contamination at this site is and will be a problem for plant growth. This is corroborated by the observation that vegetation growth and diversity is poor, which is indicative of unfavorable environmental conditions for plant ecosystem health.

Recommendation: This site appears to be a problem and should not be used for agriculture as is, without remediation. We do not agree that issuing a memorandum of No Further Action is acceptable following the scheduled remediation without appropriate and thorough confirmatory testing.

**Updated Recommendations**
These updated recommendations are based on a report entitled 'Draft Decision Document for Site25 - Papermill Road Disposal Area,' written by RUST in March of 1999. This document details the steps that the DoD has taken and will take to protect human health and the environment from risks posed by this site. The area bare of vegetation was excavated to a depth of 12 inches and the excavation pit was filled with "clean" material. Confirmatory samples were taken from the soil remaining after the top layer (one foot) was excavated, and before the fill was placed in the excavated area. Confirmatory sampling indicated that all materials remaining were below Region 9 action criteria.

The recommended remedy for this site includes 'institutional controls,' or legal administrative controls that limit access to or use of a property and/or that provide warnings of potential hazards associated with a site (as stated by RUST). Such restrictions will include land use restrictions, groundwater usage restrictions and five-year recurring reviews. The groundwater restrictions are due to the potential for solvent from the solvent pits (Sites 12A,B,C) to reach the groundwater below this site. The land use restriction will require that the property allows for industrial/agricultural use only.

This land use restriction does not sufficiently reduce potential risks to human health and the environment.

Many of the concerns were met by the remedial action, though a few remain:

1) It is not clear if the contamination is confined to the defined excavation area alone and whether samples were taken outside the perimeter of the defined excavation area. No data were given for extra-perimeter sampling, therefore we assume this was not done. Since positive (moderately high) contaminant levels were detected originally in the perimeter samples, whether the site was properly outlined remains an issue. Given the moderately low

risk of the unremediated site for the industrial scenario, using the site for industrial purposes remains a viable alternative regardless of the true extent of the original or spread contamination.

2) Data quality concerns should be addressed (this is the case for many, if not all sites).
3) Prior to use of this site for non-industrial purposes, the original soil that remains below the two foot excavation and around the perimeter of the excavation should be analyzed for dioxins and furans as plant roots may extend deeper than two feet and deep tillage may bring soil deeper than two feet toward the surface.
4) In future ecological risk assessments, evaluated ecological risks that are high (HIs above 5-10) should NOT be disregarded because of similar or higher ecological risks in reference soils. If the risk to the biota is present, it exists regardless of risks at another non-solid waste management unit (SWMU) site on base (i.e. at the areas where the reference soils were collected). All the ecotoxicity reference results indicate that there is moderate to high ecological risk as many non-SWMU areas around the base. That this risk may have been introduced by widespread dispersion of metal dust due to base activities (i.e., burnings and detonations) can not be ignored or disproved and may indicate that the entire area south of the firing line should have institutional controls placed on its use.

We therefore slightly revise our original recommendation that a memorandum of No Further Action for this site must include an institutional control that restricts land use to industrial/commercial with a restriction on agriculture as well as residential unless further testing shows that the excavation removed all of the contamination from the area.

## Site 26 (Chapter 21)
## Storage Area and Possible Disposal Site South of Defense Revitalization Marketing Office (DRMO)

**Site Use**

This site was used for storage of scrap metal and scrap equipment and a fenced area was used for storage of lead-acid batteries and transformers. A small area was used to store spent lead-acid vehicle batteries. Storage of used oil and transformers with "less than 50 ppm" PCBs was also reported as a site use.

**Geology**

Surface water flows southwest to drainage ditches by railroad tracks (and west to Paper Mill Road) and to ditches by Infantry Road, then into a tributary to Middle Fork Creek. The soil is Cobbsfork soil series with 35 feet of glacial till. The area around site is presently agricultural.

**Remediation Action**

January/February 1997: 40x40x1 foot deep hole excavated in bare ground area south of DRMO. Post excavation sampling found total lead to be less than 10 ppm based on nine soil samples.

**Contaminants of Concern**

Phase 1 Sampling:

Surface soil (9) samples were collected in three locations and were tested for: 1) *Pb* in the lead acid battery area, 2) TPH and PCBs in the transformer storage area, and 3) metals, PCBs, pesticides, SVOCs and TPH in the bare ground south of the DRMO.

Analyses:

Soils: *Al, As, An, Cu* and *Pb* exceed EPA Region 9 action level criteria in the contaminated area defined by a surface devoid of vegetation. No PCBs were found, but no statement of detection limits or of the analytical results were presented. Confirmatory sampling indicates *Pb* is now at "acceptable levels," (i.e. below 13 ppm).

**Health Concerns and Recommendations**

Health concerns appear to be nominal for this site.

Recommendation: We agree with the No Further Action memorandum recommendation by RUST.

**Updated Recommendations**

These updated recommendations are based on a report entitled 'Confirmatory Sampling Report' written by SAIC in July of 1997. Confirmatory sampling revealed that the site is now acceptable. We still agree with RUST's recommendation to issue a No Further Action memorandum for this site.

## Site 28 (Chapter 22)
## Open Burn Area

**Site Use**
Between 1985 and the 1990s scrap Styrofoam and plywood was burned at this site. Live detonators and blasting caps could be embedded in the scrap. Scrap metal is also present.

**Interim Measures**
In 1997, 17 $yards^3$ of ash and gravel and 64 $yards^3$ of contaminated soil beneath the ash and gravel were removed. The net excavation area was 70x140x1 foot deep.

**Geology**
The land surface is relatively flat with a slight slope to the southwest. Water drainage leads to a tributary of Harberts Creek via roadside drainage ditches. The soil is of the Cobbsfork soil series. Bedrock is about 30 to 50 feet below glacial till.

**Contaminants of Concern**
<u>RUST Stated</u>: Scrap metal, steel from mines.

<u>Phase 1 Sampling</u>:

> Surface soils (3 samples) were analyzed for explosives and total metals and an ash sample (1) was analyzed for TCLP metals, total metals and explosives in the open burn area.
>
> Remediation included the removal of debris, ash and 12 inches of soil beneath debris and ash. Confirmatory samples (10) taken from the open burn area were tested for total metals.

<u>Analyses</u>:
In general, many metals exceed the JPG reference screening levels. Metals that exceed the EPA Region 9 action level criteria include *As, Cr, Cu, Ni, Pb, Sb* and *Tl*.

**Health Concerns and Recommendations**
Neither the chronic non-cancer health risks nor the cancer risks exceed EPA criteria.

<u>Recommendation</u>: These levels need to be compared to an uncontaminated reference site before such generalizations about a lack of ecological risk can be made. In addition, graph 22-7.14 indicates that the hazard index for soil fauna (170) remains two to three times higher than the hazard index for any of the JPG "background" (i.e. background screening levels) soils (~40 to 80). Thus, there still remains an apparent ecological risk at this site. We do not agree with issuing a No Further Action memorandum without an appropriate reference comparison for the ecological risk assessment.

**<u>Updated Recommendations</u>**
These updated recommendations are based on reports entitled 'Closure Report Jefferson Proving Ground Site 28 Gator Z Open Burn Area Madison, Indiana,' written by TolTest Inc. in July of 1997, and a 'Confirmatory Sampling Report' written by SAIC in July of 1997. The TolTest document details the steps that TolTest Inc. took to excavate, remove, and test contaminated ash

and soils from the Gator Z Open Burn Area in accordance with a closure assessment for this site. The SAIC document lists contaminant levels remaining at the site following the excavation and removal of contaminated materials.

Our disagreement with RUST's recommendation to write a No Further Action memorandum for this site do not stem from the clean-up procedures or from the results of the confirmatory sampling, which indicate low levels of contaminants at this site. They stem from the collection methods for the background, or reference samples. At this point we understand that additional background sampling is infeasible, but still do not agree with issuing a No Further Action memorandum for this site.  Periodic monitoring to assess future ecological risk is warranted.

**Site 29 (Chapter 22)**
**Gator Z Mine Scrap Disposal Area**

**Site Use**
This site is a man-made pond used to dispose of steel mine components.

**Interim Measures**
In the winter of 1997, soil and metal debris were removed from floor of the pond. The pond was left open to allow it to redevelop into a wetland habitat.

**Geology**
The land surface is relatively flat with a slight slope to the southwest. Water drainage leads to a tributary of Harberts Creek via roadside drainage ditches. The soil is Cobbsfork soil series and bedrock is about 30 to 50 feet below glacial till.

**Contaminants of Concern**
RUST Stated: Scrap metal, steel from mines.

Phase 1 Sampling:

Geophysical survey to ensure other (filled-in) pits don't exist. Some metals appeared to be in a soil mound 70 feet to northwest of the open pits.

Surface water and sediment (three samples – together) were analyzed for explosives and total metals.

Analyses:

Sediment: *Ag* and *Cd* are above JPG background screening screening levels, although *Cd* is not above EPA Region 9 action criteria.

Surface Water: Trinitrobenzene, *Cd* and *Zn* greater than background, *Cd* is greater than maximum contaminant levels (MCLs) listed under the Safe Water Drinking Act, but none exceed EPA Region 9 action criteria.

**Interim Remediation**

In January of 1997, debris and sediment were removed. Confirmatory samples (two sediment, one water) were tested for metals. All metals were below EPA Region 9 action levels, but no data is given.

**Health Concerns and Recommendations**
Assumption: No clear health hazard or ecological risk is present after the removal of debris and sediment occurred.

Recommendation: Periodically monitor the water and sediment in the pond to ensure that the assumptions of "no ecological risk" are correct. Otherwise we agree with the recommendation of drafting a memorandum of No Further Action.

## Site 31 (Chapter 23)
## Former Storage Pad (Building 227)

**Site Use**
This site was used for heavy gun maintenance and repair. A shed (shed 11) just east of this building, next to 30 foot x 50 foot concrete pad, was also used for storage of Stoddard solvent, waste oil, paint waste and lubricants and is owned by the Army. The area is currently owned by the Indiana Department of Transportation.

**Geology**
The surface water runs off to a ditch on the south side of Woodfill Road where it enters a storm water sewer or it runs into a ditch between the building and the railroad tracks to the south where it discharges to Middle Fork Creek. The soil is Cobbsfork soil series with 35 to 40 feet of glacial till. The shallow bedrock groundwater flows west to southwest.

**Contaminants of Concern**
RUST Stated: None.

Phase 1 Sampling:

Surface soil (3) samples were collected at the surface of borings near stained areas around the concrete pad. Samples were analyzed for TPH and total metals.

Subsurface soil (10) samples from three borings were analyzed for TPH and total metals.

Phase 2 Sampling: None.

Analyses:

Surface/subsurface soils: TPH was detected but was below EPA Region 9 action levels. Metals above JPG background screening levels included *As, Ba, Be, Bo, Cr, Co, Cu, Pb, Mn, Ni, Ag, V* and *Zn*. Metals that exceeded EPA Region 9 action level criteria included *Al, As, Ba, Be* and *Mn*.

**Health Concerns and Recommendations**
Only one hazard index (HI) exceeded one; the future on-site toddler resident had a HI of 2.0. The critical exposure pathway is ingestion of *Mn* in home-grown fruits and vegetables. None of the cancer risks calculated by RUST exceeded the EPA acceptable risk range.

Recommendations: Barium in the site could be harmful to site fauna, but, in agreement with RUST, the small size of this site (less than 15 square feet) makes this risk negligible. Other heavy metals found in the site, however, do pose a risk to toddlers and should not be dismissed as risks from background levels. If the site is to be used as residential, we recommend that families of child-bearing age or with children under the age of 18 be restricted from residing at this site. Industrial use is acceptable. With the implementation of limited Institutional Controls, we agree with issuing a memorandum of No Further Action.

## Site 33 (Chapter 24)
## New Incinerator (Building 333)

**Site Use**

The incinerator at this site was primarily used to burn paper and paper products between 1978 and 1995. The incinerator is fuel-oil fired with an after burner. During 1988-1989, polyurethane foam and wastes containing iron oxide were also burned. Ash was “properly disposed of” in fiber drums and taken to the Gate 19 landfill on another off-site landfill. Adjacent land (to the east) is under cultivation.

**Geology**

Surface water at the site runs off to the tributary of the Middle Fork Creek located south of the site and south of the railroad tracks. The soil is Cobbsfork soil series with 35 to 40 feet of glacial till. There is a flat horizontal ground water gradient.

**Contaminants of Concern**

RUST Stated: Heavy metals.

EnviroComm Potential: Combustion by-products (dioxins and furans).

Miscellaneous Testing: Ash was routinely sampled for total cyanide, total sulfides, pH, ignitability, and EP toxicity metals (which is the toxicity of extracted metals).

Phase 1 Sampling:

Wind direction data was gathered (no details are given regarding frequency duration, or timing of those measurements) to help with modeling.

Ash (1) sample was taken and tested for TCLP metals.

Near surface soil (2) samples, one downwind from each of the two prevailing wind directions (northwest and southeast) were collected and tested for metals.

Phase 2 Sampling:

Surface soil (2) samples from Phase 1 sampling locations were tested for dioxins.

Analyses:

Ash: The ash collected during Phase 1 contained levels of *Pb* that exceeded RCRA limits for leachable *Pb* (TCLP lead). All other leachable metals were acceptable.

Surface soil: *Ba, Cr, Co, Cu, Pb, Mn, Ni, Ag, V* and *Zn* exceeded the JPG background screening levels. *Al* and *Mn* exceeded EPA Region 9 action level criteria. The maximum detected level for dioxins and furans was 89 parts per trillion (ppt). The congener pattern for this sample did not match the background soil congener pattern so the assumption is that the dioxin in this sample was from a local source, i.e. the incinerator. (On-site background soil dioxin levels was around 20 ppt, a fairly typical level for a non-urban area.)

**Health Concerns and Recommendations**

Chronic Non-Cancer Health Risks: Non-cancer hazard indices are less than one for both future adults and toddlers living on-site, and for industrial workers who may work on-site.

Cancer Risks:

Cancer risk is just above $10^{-5}$ (2-4x$10^{-5}$) for residential use, which is at the extreme of the still acceptable range for EPA, and above the recommended Indiana limit of $10^{-5}$. Cancer risk is less than $10^{-5}$ for the industrial worker.

Ecological risk assessment was not completed as contaminant levels did not exceed JPG background screening levels.

Recommendations: This site should probably be used as an industrial facility. Since cultivated land (to the east) and the major drainage (to the south) are downwind of the incinerator, the soil and the air should be monitored should the incinerator be activated again. We agree with RUST's recommendation of issuing a memorandum of No Further Action as long as the site remains industrial and not residential or agricultural.

## Site 34 (Chapter 25)
## Sand Blasting Area (Building 136)

**Site Use**
From the 1940s to1995, this site was used as an area for sandblasting of paint and rust off vehicles prior to repainting. The sandblasting area is an open 20 x 20 x ½ foot asphalt pad. The vehicles were painted inside building 136. The primer used was lead-based until more recently (date not specified). No remediation has occurred so far (based on documentation provided), beyond removal of loose and used sand.

**Geology**
The land surface is flat. Surface water run-off flows to the north along a drainage swale by the railroad tracks. The drainage swale flows to Middle Fork Creek. The soil is Cobbsfork soil series with around 18 to 25 feet of glacial till. Regional groundwater flow is toward the west to southwest, although locally the groundwater flows toward the northeast.

**Contaminants of Concern**
<u>RUST Stated</u>: *Pb*.

<u>Phase 1 Sampling</u>:

Surface soil (3) soil samples were collected around the perimeter of the sandblast area and tested for total metals.

Sand samples were taken from a pile of unused sand (1 sample) and a composite of used sand (1 sample) stored in drums outside the building and were tested for metals.

<u>Phase 2 Sampling</u>: None.

<u>Analyses</u>:

<u>Surface soil</u>: All metals were below EPA Region 9 action level criteria. *Ba, Bo, Cr, Co, Cu, Pb, Mn, Ni, Ag* and *Zn* were, however, above JPG background screening levels.

<u>Unused Sand</u>: *Al* and *Fe* were detectable.

<u>Used Sand</u>: *Pb* exceeded JPG background screening levels.

**Health Concerns and Recommendations**
Chronic non-cancer hazard indices indicate no significant risks to future workers or residents. No significant cancer concerns for future residents or workers were calculated either. Ecological risks are present for the on-site soil fauna. However, the site is very small and should pose minimal overall harm to the ecosystem and fauna in the area. We agree with RUST’s recommendation of issuing a memorandum of No Further Action.

## Site 38 (Chapter 26)
## Northwest-Southeast Runway Flare Test Area

**Site Use**
This site was used for flare testing. Flares contain *Mg*, *Na*, *K*, *S*, nitrate and white phosphorus. The ground surface is also covered with coal ash deposits (called "clinkers").

**Geology**
The land surface is flat. Surface water drains to an underground storm sewer that releases in Harberts Creek. The soil is Cobbsfork soil series with about 30 feet of glacial till. Groundwater flows to west/southwest.

**Contaminants of Concern**
<u>RUST Stated</u>: UXO and residual metals from flares.

<u>Phase 1 Sampling</u>:

Checked for buried metal with magnetometry and a geophysical survey.

Surface soil (1) sample was collected as a composite (small samples from along the flare test area) and analyzed for metals and explosives.

<u>Phase 2 Sampling</u>: None.

<u>Analyses</u>:

<u>Surface soils</u>: *Be* exceeded EPA Region 9 action level criteria, as does the *Be* found in the JPG background screening levels. *Bo, Co, Cu, Ni, Fe* and *Ag,* were above the JPG background screening levels.

**Health Concerns and Recommendations**
Chronic non-cancer health risks are insignificant for both future residential and industrial users. Cancer risks are within the acceptable range (i.e. $10^{-4}$ to $10^{-6}$) for future residential users and below this range for industrial workers. No ecological risk was evaluated since the site is small. The risk from the residual flare material is low and the habitat has been made unsuitable for plants or animals by the presence of the cinders.

<u>Recommendation</u>: The cinders are themselves a ***potential*** hazard if they are disturbed. The dust from the cinders can cause respiratory health effects for animals or humans breathing the dust. If this site is to be reused, the cinders need to be removed and properly incinerated, disposed of or not disturbed.. While the cinders are present, we recommend that they be disturbed (i.e. crushed) as little as possible to minimize production of cinder (coal) dust. We agree with RUST's recommendation of issuing a memorandum of No Further Action.

## Site 39 (Chapter 22)
## Gator Z Mine Test Area

**Site Use**
Twenty-six mine test pits (pits are steel boxes with steel walls, no floor and a removable top) were embedded in concrete walls. Drain pipes in the bottom drained (now contaminated) precipitation to Harberts Creek. Pits were used for testing of mines. The two pits on the east end were used most frequently. There is a fence around the area now.

**Interim Measures**
In 1993 the steel boxes were removed from the pits for resale of the metal. However, many steel boxes were not sold and remain within the fenced area.

**Geology**
The land surface is relatively flat with a slight slope to the southwest. Water drainage leads to a tributary of Harberts Creek via roadside drainage ditches. The soil is Cobbsfork soil series with bedrock about 30 to 50 feet below glacial till.

**Contaminants of Concern**
RUST Stated: *Li, V, As, Hg* and residual explosives.

Phase 1 Sampling:

> Surface soil (6) samples were taken from recently used pits (2 of 6 samples were taken from the east end and 1 of 6 in the middle) and from the drainage swales (3/6) and tested for explosives and total metals.

Phase 2 Sampling:

> Biased surface soil samples were taken from a middle pit and an eastern pit and were tested for explosives only.
>
> Subsurface soils (5) were sampled at two feet from auger cores drilled in the middle of the mine area (a little west of the central drainage ditch).

Analyses:

> Surface/subsurface soils: No detectable explosives. *Al, Cr, As* and *Mn* were above EPA Region 9 action level criteria. *As, Ba, Cr, Co, Cu, Pb, Mn, Hg, Ni, Ag, V* and *Zn* were above JPG background screening levels. 1/3 samples from the drainage swale in the middle tested positive (above JPG background screening levels) most frequently for metals (*Al, As, Ba, Cr, Co, Cu, Fe, Pb, Mn, Ni, K, Ag, V* and *Zn*).

**Health Concerns and Recommendations**
The major concerns in surface soils were *Al, As, Cr* and *Mn*. Based on fugitive dust (air emission dispersion) modeling, the primary COCs were *Al, Ag, Tl, V* and *Zn* for residents, and the greatest health concern (non-cancer hazard index is greater than 1 [1.68]) is for on-site child resident. Only the hazard index for soil fauna exceeds the hazard index posed by contaminants in

reference soil samples taken from other areas at JPG. Therefore, RUST suggests no excessive ecological risk exists post-interim-remediation.

Recommendations: Ecological non-cancer hazard indices are significantly above 1 (ranging from 6.4 for red fox to 173.8 for the white-footed mouse) for the remediated areas. The discounting of this risk is based on the assumption that it is valid (and protective) to take "reference" soils for "background" comparisons from other non-action sites at JPG. However, it is quite clear that these "reference" soils are also contaminated, probably from contaminated dusts and leaching contaminants in water. For example, the remedial investigation/feasibility study points out that Ag from site 39 leaches above ground approximately ½ the width of JPG, and reaches Harberts Creek (upstream from the sewage treatment plant) on the west side of the JPG. Therefore, it would be more protective, and make more sense, if the ecological risks at site 39, and elsewhere, were compared to soils taken from outside the JPG boundaries, away from JPG drift areas, away from incinerators and other obvious sources of such chemicals. Alternatively, as reference sites are truly recommended really for those ecotoxicity tests requiring habitat-based evaluations, the ecological risks should be based on the potential health effects to the fauna, and should not deduct risks that are present at any reference site.  We do not agree with issuing a No Further Action Memorandum without an appropriate reference comparison or a pure ecological risk assessment.

## Site 42 (Chapter 27)
## Indoor Range (Building 281)

**Site Use**
This site was used to test small arms for training purposes. This site is not presently in use. There are no roof vents, but there is a door (at least one).

**Geology**
The land surface around the building is flat. A small drainage ditch leads from the north of the building, west to Middle Fork Creek. The area around the building is grass or concrete covered. Metal debris (from firing activities) is scattered around the building.

The soil is Cobbsfork soil series with a depth to bedrock of about 40 feet. The groundwater gradient is west to southwest.

**Contaminants of Concern**
<u>RUST Stated</u>: Lead dust and lead oxide.

<u>Remedial Action</u>: In June of 1997, walls were washed with detergent and water followed by the removal of contaminated soil on the floor. The walls were sealed (presumably with epoxy) to encapsulate the lead dust.

<u>Confirmatory Testing</u>: Not yet available.

<u>Phase 1 Sampling</u>:

> Surface soils (3 samples) were collected from each firing lane and a composite of each lane and tested for TCLP.
>
> Wipes (10) were taken from walls and tested for metals.

<u>Analyses</u>:

> <u>Surface soils</u>: No soil samples exceeded TCLP RCRA (Resource Conservation and Recovery Act) limits.
>
> <u>Wipes</u>: *Ag* (2/10 samples), *Cr* (8/10 samples), *Ni* (6/10 samples), *Pb* (5/10 samples), *Mo* (1/10 samples) and *Zn* (10/10 samples) were detected.

**Health Concerns and Recommendations**
The interim measures are believed to have resolved the problem. No ecological concerns are present since (RUST says) this is an internal problem.

<u>Recommendation</u>: Confirmatory sampling need to be reported. Soil samples should be taken from around any building openings or vents to assess movement of contaminated dust to the outside. No recommendations for future uses can be made without confirmatory and external test data. However, it may be appropriate to keep this building as a civilian firing range. We do not agree with issuing a No Further Action memorandum without confirmation results.

**Updated Recommendations**

At the time of this draft (May 15, 2000), we have not seen additional documents for site 42. Our assumption is that confirmatory samples have not been collected. We stand by our original recommendation disagreeing with a No Further Action memorandum. This site is inappropriate for transfer until soil confirmatory samples are collected around building openings.

## Overall Concerns

1. The QA/QC field sampling and analytical methods were insufficiently detailed. Sampling protocols were insufficiently detailed. Sample bottle preparation (acid washed, solvent washed?, to ASTM standards?) or source was not always specified.

2. Page C-28, Appendix Q: "Duplicate field samples will be collected for approximately ten percent of the samples." Duplicates were taken for less than 10% of the samples, based on the report details. In addition, it appears that duplicate samples, when taken, were not always analyzed using the same chemical analytical techniques. This would have been a way to check the accuracy and consistency of the analytical techniques, and is one of the main reasons that one takes duplicate samples.

3. Many sites have had samples rejected due to problems with calibrations and calibration standards. Standard laboratory procedure in academic research or pharmaceutical and biotech laboratories requires that standard curves be run and checked prior to running the relevant samples. This appears not to have been the practice in the analytical laboratory that ran the chemical sample analyses.

4. Mercury (Hg) transforms via the action of soil organisms to the partially water-soluble methyl Hg, a bioaccumulative, highly toxic compound. Organic Hg needs to be evaluated in all surface water samples where inorganic Hg might have been present, such as at site 2 or in the pond near the Gate 19 landfill. Ludlum has stated (email date: 7/30/99) that pond water was analyzed for organic Hg at Site 10, but this is not evident from the report.

5. Antimony (*Sb*) was present at several of the sites (3/4, 9, 10, 15, 25, and 28) during either Phase I or Phase II field activities. During the Phase I analyses, *Sb* was rejected due to low recovery rates at the following sites: 7, 8, 9, 10, 11, 13, 25, 26, 27, 28, 29, 31, 33, 34, and 39. We do not have an equivalent data quality analysis summary for Phase II field activities. The data quality analysis report from the Phase 1 studies (performed by EcoChem Inc. in 1995) suggests that recovery techniques for *Sb* are poor and that results are questionable for all Phase I analyses. Similarly SVOCs, VOCs, and PCBs at several sites were rejected for various reasons.

6. Reference sites, when used, are supposed to be clean, or if contaminated, not contaminated by any compound similar to those under concern. EPA guidelines, texts, and ASTM standards (and draft standards) recommend that sites may be chosen away from the sites under evaluation if this is needed to avoid contamination leached or drifted from the sites of concern. EPA's *Risk Assessment Guidance for Superfund* (RAGS) requires that "Background samples collected during the site investigation should not be used if they were obtained from areas influenced or potentially influenced by the site." RAGS further states that "naturally occurring levels are levels of chemicals that are present under ambient conditions and that have <u>not</u> been increased by anthropogenic [man-made] sources." For inorganic chemicals such as metals, RAGS states that background concentrations may present a significant risk and an important site characteristic. RAGS suggests considering the risk posed by naturally occurring

background chemicals separately. The presence of organic chemicals in background samples, however (PCBs, pesticides, VOCs, SVOCs), indicates that the sample was collected in an area influenced by the site contamination and does not quality as a true background sample. RAGS suggests that such samples be included with other site samples in the risk assessment. Finally, RAGS states that "Omitting anthropogenic background chemicals from the risk assessment could result in the loss of important information for those potentially exposed."

Given the long history of solvent dumping and open burning and on-site explosions it is highly likely that all of JPG, as well as part of the countryside around JPG, has been contaminated by the JPG site activities. It is likely that no place on JPG is appropriate as a reference site for any JPG site.

7. From section 5.1.4 its appears that samples from areas near the JPG sites and groundwater possibly under these JPG sites were pooled and used as the generic background samples. Thus, it appears that contaminant levels in samples possibly contaminated by aerial drift, were used as the screening levels against which any single site was rated "of concern." This highly biases the risk analysis away from assessing the risks due to moderate, but still toxic, contamination.

8. In addition, JPG specific background threshold values (mean + 2 S.D.) are generally set at or above the detection range. This practice also biases the results towards false negatives, which is unprotective of human or ecological health.

9. Risk assessment should be compared to set risk criteria levels, not to a background risk. Risk is risk and the presence or absence of significant risk is not affected by risk posed by another site or from another soil sample. Thus, it is inappropriate to diminish the apparent ecological risk artificially by saying that it is or is not greater than risk posed by the contaminants in a "reference" sample. The comparison should be to health-based exposure or pre-determined contaminant concentration criteria. This was done properly for the human health risk assessments but not for the ecological risk assessments.

10. Assumptions made for the residential risk scenarios need to be tested. The assumption is that grass and other vegetation will completely eliminate air (from volatiles, semi-volatiles and dusts) as an exposure pathway. Yet, at other sites (for example Love Canal, NY), volatile compounds (such as solvents) have been observed to leach directly through foundations into basements. In addition, during dry spells at the end of the summer, dead grass and vegetation does a much poorer job of minimizing dust than during wetter parts of the year.

11. Non-cancer risks are poorly defined and do not appear to include most endocrine disruption effects, although many of the contaminants of concern are endocrine disruptors. (TCDD is known to act as an indirect anti-estrogen. PCBs, depending on the congener, disrupt both the reproductive and thyroid hormone systems. Lead, mercury and other heavy metals are neurotoxic, cause learning and behavioral problems, the

development of abnormal sperm and abnormal ovarian stuctures.) More appropriate RfDs (reference doses) could be found for sensitive endpoints (such as endocrine disruption).

12. No dioxin (2,3,7,8-tetrachlorodibenzo-p-dioxin or TCDD) reference dose is identified, although a reference dose could have been derived from the literature. This would have been useful in evaluating the endocrine disruption potential of lower level TCDD-related contaminant concentrations present at several of the sites.

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