DRAFT

Request for Trial Burn at RVAAP

Submitted by:
Ravenna Army Ammunition Plant
8451 State Route 5
Ravenna, OH 44266-9297

Contact:
Mark Patterson
Facility Manager

TABLE OF CONTENTS

Attachment 1. RVAAP Map
Attachment 2. Sampling Plan
Attachment 3. Summary of Sampling Data and Calculated Worst-Case Emissions
Attachment 4. Air Dispersion Modeling Protocol

DOCUMENT DISTRIBUTION

Name/Organization   **No. of Hard Copies**

Name/Organization   **No. of Electronic Copies**

1.0   EXECUTIVE SUMMARY

The Ravenna Army Ammunitions Plant (RVAAP) is located on 21,419 acres of land in Portage and Trumbull Counties in northeastern Ohio. Potentially contaminated sites are undergoing investigation and restoration activities in preparation for reuse of the facility by the Ohio National Guard as a training facility. Attachment 1 contains an area map of RVAAP.

Due to the historical use of the site and the time period of its operations, there are a number of residual explosive hazards associated with the site restoration activities. One significant hazard to site operations is the potential presence of munitions as well as bulk explosives and propellants in unknown quantities and unexpected locations. To complete the restoration, the structures and associated equipment must be rendered explosively safe prior to demolition.

The U.S. Army Joint Munitions Command Safety Office, U.S. Army Technical Center for Explosive Safety (USATCES), and the Department of Defense Explosive Safety Board (DDESB) have determined from historical experience that the best available technology (BAT) to safely decontaminate and demolish these structures is to thermally decontaminate (i.e., burn) them prior to demolition. Controlled, engineered thermal decomposition eliminates the threat of injury or death from residual explosives that are present, yet not visible (i.e., present within cavities and voids where they have accumulated over the years), and could detonate during demolition activities.

During the hazard evaluation of the structures at the RVAAP, it was determined that polychlorinated bi-phenyls (PCBs) were present in some applied dried paints. These paints were thoroughly evaluated with respect to U.S. EPA's Toxic Substances Control Act (TSCA) regulatory requirements and it was determined that paints on several structures fall within TSCA jurisdiction (i.e., concentrations of PCBs are greater than 50 parts per million (ppm)). Therefore, RVAAP is seeking U.S. EPA approval for this thermal decomposition activity.

This report presents a summary of the assessment of the risk that PCBs and their decomposition products would have on human health and the environment as a result of the thermal decomposition (burn) of explosive residues in the buildings at RVAAP. This report is submitted to obtain approval for a monitored trial burn of a limited number of structures at the RVAAP, from U.S EPA Region V's TSCA office in Chicago, IL. The trial burn will provide data about the actual emissions and concentrations that can then be extrapolated to evaluate the impact of thermal decomposition of other contaminated structures at RVAAP. It is proposed that the structures situated within Load Line 11 be utilized for this trial burn. Load Line 11 is situated well within the RVAAP property and is one of the safest options available for this proposed trial burn based upon the following criteria:

- Load Line 11 is a small load Fuze and Booster Load Line
- Historical use suggests a lower risk of secondary explosions

- Load Line 11 is centrally located within the RVAAP; approximately 1.5 miles from the RVAAP fence line
- The results of the risk assessment presented in this report predict off-site impacts that are significantly lower than acceptable risk levels.

Following the thermal decomposition of the explosives, traditional demolition techniques can be safely employed without the risk of explosion to the work force. No injuries or deaths have occurred during demolition activities when preceded by thermal decomposition.

Under TSCA regulations, it is necessary to obtain EPA Region V approval for this thermal decomposition activity, thus necessitating the preparation of this summary document. This submittal contains the following information:

- Hazard analysis and evaluation of load lines
- Analysis of options available to decontaminate the load lines
- Estimation of potential PCB emissions
- Analyses of impacts due to Load Line 11 emissions

2.0 HAZARD ANALYSIS AND EVALUATION OF LOAD LINES

2.1 Background of the Ravenna Army Ammunition Plant

The Ravenna Army Ammunition Plant (RVAAP) was erected in the early 1940's and is located on 21,419 acres in Portage and Trumbull Counties in northeastern Ohio. Since the 1940s, the RVAAP has been used by the U.S. Army to produce munitions charged with propellants and explosives. The RVAAP has been declared as excess property by the Department of Defense. Contaminated areas are being restored for future use by the Ohio National Guard. As part of the restoration effort, a number of structures must be investigated, decontaminated from explosives, and demolished.

2.2 Hazard Analysis of the Load Lines

The processes used to evaluate and decontaminate munitions production and assembly facilities across the country have evolved over time through what was thought to be the "best available technology" at the time and lessons learned experiences. Initially building excess or demolition projects were handled much like conventional building demolition projects. Visual inspections were conducted of the facilities and any explosive materials that were found were removed and treated offsite. Equipment was usually manually disassembled, using penetrating oils to minimize the explosive risk and removed from the buildings for scrap. However, it soon became clear that this "standard" approach did not always reveal the locations where residual explosives were residing. The presence of residual explosives on the threads of bolts or on hinge points combined with the ineffectiveness of the oil to penetrate to the point of friction, resulted in unplanned detonations, injuries and death to the workers.

In addition, explosive residues were being found in unexpected locations such as inside fire suppression pipes, positive pressure air ductwork, behind and between walls, under floors and on building beams. In essence, every corner and cavity of these structures has proven to be a potential location for the accumulation of explosive and propellant residues as well as specific ordnance and munition items. In the past, the result of introducing heat, shock or friction associated with these methodologies to residual explosives or propellants during conventional demolition were disastrous, resulting in personnel injury and death. Subsequently, remote demolition processes (i.e., engineered shaped charges, perforators and detonation cord) were developed for desensitizing equipment and piping, which lessened but did not eliminate the threat of detonation of residual explosives or propellants during the follow-on standard demolition activities.

Prior to initiating decontamination and demolition activities, a thorough hazard analysis of the structures and adjacent areas within the load lines was conducted. The analysis involved the evaluation of the structural integrity of the buildings, followed by a more detailed analysis of potential explosive and environmental hazards that would subject the work force to injury during removal. These potential hazards include:

- Asbestos containing materials
- PCBs contained in light ballasts and paint
- Mercury contained in fluorescent light bulbs, switches and gauges
- Explosives in process equipment, piping, wall cavities and on floors

Once the hazard analysis is complete, plans are developed on a building-by-building basis to safely remove any explosive hazards in order to assess the environmental hazards and complete the demolition of the structures. These plans are formalized in a document called an Explosive Safety Submission or ESS, which is prepared in a specified format and submitted to the Department of Defense Explosive Safety Board (DDESB) for review and approval. It is essential to eliminate the introduction of any type of heat, shock or friction to a surface, a cavity, a void or piece of process equipment prior to the removal or desensitization of the residual explosives. Residual explosives are often found within the wall cavities, inside equipment that has been certified safe, and beneath the floor slabs. Turning of a bolt on a flange with residual explosives on the threads can be sufficient to cause the explosive residue to detonate.

The U.S. Army Joint Munitions Command Safety Office, the USATCES and the DDESB has determined that the only safe and responsible way to explosively decontaminate and demolish these structures is to add the step of thermal decomposition prior to demolition. Controlled, engineered thermal decomposition eliminates the threat of injury or death from residual explosives, which are present, yet not visible, and can detonate during demolition activities. The thermal decomposition is initiated from a remote location so as to remove the work force from harms way should a secondary explosion occur. Unlike other methods of desensitizing and demolition of such structures, engineered open burning of the structures has resulted in no deaths or injuries and has been determined to be the safest means to decompose residual explosives.

It is appropriate to examine the potential environmental consequences of this approach as well as the other options available to decompose or remove the residual explosives from the structures prior to demolition.

2.3   Actions Taken to Decommission Load Lines

Based upon the type and use of a given load line, the nature and extent of these hazards vary. For example, Load Lines 6 and 9 at Ravenna were fuze and booster lines that handled smaller quantities (ounces to pounds) of primary or extremely shock-sensitive explosives. The accumulation of explosive residue on floors, sills and beams is one of the areas identified during the hazard analysis that presents an explosive hazard. The second most prevalent explosive hazard identified in the fuze and booster lines is the accumulation of explosives in wall cavities and beneath the floors due to the use of steam to clean and wash down work areas.

By contrast, the melt pour lines in Load lines 2, 3 and 4 differ in that these lines were used to melt and pour thousands of pounds of secondary explosives into the munitions (projectiles). Once melted, the explosives were piped filling stations where the projectiles were filled. After cooling, the top of the projectile was cleaned, and the explosives drilled out, to permit the fuze to be installed at a later time. All

of these processes resulted in the accumulation of residual explosives within piping, equipment, air handling systems and sumps. Steam was heavily used to clean the load line work areas, resulting in the accumulation of explosives in areas not visible to inspection. Crystallized explosives have been observed lining the interior walls of equipment, piping and even on the threads of bolts and flanges. The physical removal and demolition associated with these types of load lines through standard means has resulted in injuries and death to workers handling these materials without the use of thermal decomposition of the explosives.

The hazard analysis determines the structural integrity of the buildings, the presence of asbestos containing materials, mercury containing switches and lights, PCBs in ballasts and paint, and presence of explosive residue within equipment, piping, wall cavities and on the floors. Once it has been determined that these materials can be safely removed from the structures, the floors are swept and the hazardous materials are removed. These materials are profiled, packaged and shipped offsite for proper disposal or recycling, as appropriate. The next step is to remove as much of the explosive hazard (i.e., accumulation of explosives) as possible from the process piping and equipment within the structures. This is completed by using remote cutting and shape charge technologies. This action cuts open the pipe or item, desensitizes the explosives and permits the inspection by qualified UXO personnel to ensure that no exposure hazard remains prior to initiating any subsequent handling or sampling operations. Upon final inspection, the piping and equipment are removed. The recyclable materials (such as structural steel) are field screened by UXO technicians to ensure that they are explosively safe for public reuse (5X) prior to being shipped offsite.

2.4   Analysis of Options Available to Desensitize Residual Explosives within the Load Lines

The U.S. Army and RVAAP have considered alternate methods to remove the explosive hazard from the buildings prior to demolition. The following paragraphs describe each of those alternate methods, their known effectiveness and feasibility.

2.4.1   *Mechanical Removal*

Mechanical removal requires the physical removal of the explosive contamination using methods such as pressure washing, hydro blasting, sandblasting or scraping the contaminated equipment and buildings. This method can be effective for surface contamination, but it cannot ensure removal of explosive contamination from porous surfaces or within cracks and crevices. In addition, this method generates large quantities of decontamination waste fluids requiring containment during removal, treatment and disposal. In terms of safety, this method may incur substantial risk to workers due to exposure to dust and liquids, potential migration of contaminants to the environment if the containment fails and explosive hazards due to shock/friction during the blasting or scraping processes.

2.4.2   *Chemical Removal*

Chemical removal uses fluids to dissolve or extract and then remove explosive contaminants. As with mechanical removal methods, chemical removal may be effective for surface contamination, but cannot

assure removal of explosives from porous surfaces or within cracks or crevices. This method also generates large quantities of liquid waste, the chemicals used are often hazardous and toxic, and it suffers from the same limitations of uncertainty as mechanical removal. In addition, most chemical stripping agents generate heat and may react with the contaminants.

2.4.3   *Chemical Deactivation*

Chemical deactivation uses reactive chemicals to convert explosives into other chemicals. This method may be effective for surface contamination, but it cannot ensure deactivation of explosives in porous surfaces or within cracks and crevices. The drawbacks to this method include generating large amounts of waste requiring treatment or disposal, creating substantial risk to workers because the chemicals used are often hazardous or toxic adding to the environmental risks at the site. Some oxidizing agents may react with the contaminants strongly enough to start a fire.

2.4.4   *Biological Deactivation*

Biological deactivation relies on microorganisms to decompose explosives. However, it is not effective on building surfaces or equipment. Biological treatment can be very effective when dealing with soil contamination because the soil is contained within a well-defined area and the organisms are maintained with appropriate temperatures, moisture and oxygen levels. Healthy organisms cannot be maintained on the surfaces of the buildings, and must be consistently redistributed throughout the buildings in cracks, crevices and pores in such a manner to ensure that all explosive contamination was deactivated. This method is not practical for application to these structures.

2.4.5   *Fluid Penetration*

This method relies on the penetration of fluids designed to minimize the sensitivity of the explosives. This method can be effective for surface contamination, but it cannot ensure that the fluids will penetrate porous surfaces or cracks and crevices. Application of "amended water" (with surfactants) may be effective in enhancing wetting prior to selective demolition operations, but cannot be relied upon as a generic method for eliminating explosive risk. Residual explosives can crust over preventing the fluid from penetrating through the full extent of the explosive residue.

2.4.6   *Ozone Treatment*

Ozone treatment would require building a fireproof, sealed structure over the contaminated building and pumping in ozone. Although theoretically possible, there are several drawbacks to this method.   It is difficult to ensure that the tent was completely sealed and that the seal could be maintained, and as such exposing the work force to the high concentration of ozone. The reactive gases required for the process may cause a fire, which in turn could lead to the detonation of the explosives within the building. In addition, this process will create additional health and safety concerns for the workers handling the gases as well as increasing the risk of explosive conditions by the addition of an enriched oxygen atmosphere. Finally, there is a risk that this method would increase the adverse environmental impacts because of the

potential airborne emissions of ozone. The increased risk combined with the number, location, size and distribution of the buildings renders this method impracticable for the magnitude of explosive decomposition.

2.4.7 *Robotic Removal*

Robotic (remotely-controlled heavy equipment) removal is effective when applied to situations involving the removal and disposal of identifiable buried ordnance. The ordnance is detected and the robotic device goes to the ordnance, picks it up and places it in a disposal structure. Robotic removal is not practical when applied to explosive contamination within structures. A modified version of robotic demolition could be employed for single story structures. However, a number of the buildings at RVAAP are large two and three story structures, which make robotic removal impractical. Hydraulic hammers and wrecking balls are typically required to demolish the hardened, re-enforced poured concrete walls and floors, which present a high explosive risk. In addition, there remains a continued risk of explosion to workers handling these materials on and off site.

2.4.8 *Thermal Decomposition*

Thermal decomposition has been proven to be a safe and effective technology to remove the explosive hazard from these former loading, packing and manufacturing lines for more than 10 years. No injuries or deaths have been reported during the use of this technology, which is not the case with the other options. It is this best available technology that permits the decontamination of the structures while keeping the workforce safe. Prior to thermal decomposition, hazardous materials are removed from the structures and equipment, as safety allows, thereby minimizing the risks of unnecessary emissions. Although the hazardous materials are removed prior to thermal decomposition, the accumulation of explosives in inaccessible areas such as wall cavities and floor joints has resulted in secondary explosions. Desensitizing these structures with thermal decomposition methods circumvents this dangerous situation to the workforce.

Thermal decomposition of residual explosives through open burning desensitizes the explosive compounds and is the safest and most effective process to remove the explosive hazard for the types of structures and equipment found at RVAAP. The process is easily monitored to ensure destruction of the explosives hidden from inspection through the use of thermocouples and other temperature sensing devices. As part of the preparation phase, the proposed thermal process requires opening pipes and vessels for inspection (remotely, with the use of engineered shape charges) to minimize the potential for secondary explosions during thermal decomposition activities. The risks associated with the secondary explosions can then be assessed and minimized on site by experienced explosives safety personnel.

2.5 **Paint Issues**

Once the hazardous materials have been removed, the one remaining element is the presence of the paint on the walls, doors, frames and steel support beams inside the structures. Paints cover most of the interior of the structures found at Ravenna. The paint was sampled and analyzed for the presence of the eight

RCRA metals to evaluate compliance with NESHAPS and for PCBs. The presence of PCBs in applied dried paints has been found to be quite common. The PCBs provided a much more flexible and resilient paint, which could withstand temperature extremes, yet still maintain its properties. The Toxic Substances Control Act (TSCA) currently regulates PCBs at concentrations at 50 ppm and above. As such PCB's at these regulated concentrations cannot be burned. This paper serves to evaluate the distributions and concentrations of PCBs in paint and evaluate the potential risks associated with thermal decomposition when PCBs are present in paints. This risk assessment evaluates the potential release of PCBs into the air via the smoke plume and is discussed in Section 4.

Given the current status of the regulations, the prospect of stripping the PCB containing paints was evaluated. Residual explosive remain the primary danger factor and the potential introduction of heat, shock or friction during stripping operations incurs undue risk. Physical stripping can initiate an explosion due to shock or friction, whereas, chemical stripping often produces an exothermic reaction generating heat. The other consideration to chemical or liquid stripping is the containment of the liquids generated and preventing migration of contaminants from the structures and into the environment. A potential solution under consideration is the introduction of an alkali catalyst, which if introduced during the burn could promote the destruction of the PCBs as they are liberated from the paint. This option is being researched for its applicability to the types of materials and surfaces involved with these structures.

2.6   Paint Sampling Summary

The various paint colors associated with structures at the RVAAP were evaluated and sampled in accordance with the USEPA and OEPA approved Sampling Plan for Applied Dry Paints at RVAAP (October 2002, included as Attachment 2). The purpose of the sampling effort was to determine the concentration of PCBs and RCRA regulated heavy metals. If the paints contained PCB concentrations equal to or greater than 50 parts per million (ppm), they would be subject to regulation under 40 CFR 761, as a PCB solid bulk waste. In addition, the paint samples were analyzed for heavy metals to determine the potential combined loading with respect to NESHAP emissions for subsequent thermal decomposition operations. The structures were then evaluated based upon a number of criteria to select the most suitable load line to conduct the initial thermal decomposition effort on structures. The following criteria identified Load Line 11 as the most appropriate choice:

- Load Line 11 is a small load Fuze and Booster Load Line
- Historical use of Load Line 11 suggests a lower risk of secondary explosions
- Load Line 11 is centrally located (approximately 1.5 miles from the RVAAP fence)

Load Line 11 exhibited two colors (a light green and a dark green paint) within the 18 buildings of Load Line 11. Observations made during the site assessment revealed that paint was peeling. A representative sample was collected of each paint color to represent each building in the load line by randomly collecting fifteen separate aliquots. Each sample was then prepared for analysis by grinding and blending to achieve a uniform, representative sample, which was then sent to Water and Wastewater Laboratories, Inc. (Cleveland, OH) for analysis. The light green paint exhibited PCB concentrations ranging from 36 to 14,000 ppm whereas the dark green paint exhibited PCB concentrations from 290 to 8,200 ppm. The

paints within load line 11 exhibited a smaller loading of PCBs in applied dried paints, than the larger load lines in the RVAAP. The buildings were then identified as explosive and non-explosive structures. The explosive structures require explosive decomposition prior to demolition whereas the non-explosive structures could be demolished using standard techniques and equipment. The explosives contaminated buildings were evaluated for potential PCB emissions, dispersion modeling and risk evaluation, which are presented, in the following sections. A summary of the buildings, their dimensions and PCB concentrations are provided in Attachment 3.

2.7   PCB Emission Rate Calculations

To be conservative, for this initial effort, it is assumed that all PCBs in the paint are released during the thermal decomposition of the Load Line 11 buildings. The emission rate is calculated using the sample results specific to each building or group of buildings as well as specific building dimension information. The following expressions (1 & 2) determine the total PCBs and subsequent emission rate for each building.

$$\textbf{Total PCB (lb)} = \textbf{SA (ft}^2) * \textbf{\%Paint/100 (\%)} * \textbf{Wt/Area (lb/ft}^2) * \textbf{Conc (ppm) /10000} \qquad \textbf{(1)}$$

Where:

SA	= Building Surface Area, ft^2
%Paint	= percent coverage of paint within building, %
Wt/Area	= paint thickness, based on sample results, lb/ft^2
Conc	= concentration of PCBs, ppm

$$\textbf{PCB Rate (g/s)} = \textbf{Total PCB (lb) / Burn Duration (hr) * (gram/lb) *(hr/sec)} \qquad \textbf{(2)}$$

Where:

Total PCB	= specific PCB amounts calculated in expression (1), lb
Burn Duration	= time PCBs released during decommissioning, 3 hrs
gram/lb	= conversion from lbs to grams for modeling
hr/sec	= conversion from hours to seconds for modeling

The percent coverage of the walls with paint was estimated based on a survey of each building. The building surface area is calculated from the dimensions of the building. The paint thickness measurement is calculated from the sample weights and sample area dimensions. The concentration is the sum of all identified PCBs within the paint samples. Specific building data is used to calculate emission rates for each building. The emission rate calculations for each building are included in Attachment 3 along with the paint sampling data.

3.0   DISPERSION MODELING SUMMARY

This modeling analysis was completed to evaluate the impact of PCBs and dioxin toxicity equivalents (TEQ) from the thermal decomposition at RVAAP as compared to chronic inhalation affects and a one in a million (1×10^{-6}) cancer risk. The details of the modeling methodology used in estimating the maximum off-property ground-level concentrations of PCBs are included in the Modeling Protocol in Attachment 4.

3.1   Unit Risk Calculation

For evaluating risks from chemicals found in environmental sources, dose-response measures are expressed as risk per concentration unit. For inhalation, this measure is called the Unit Risk for air. Based on the EPA Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities a slope factor of 2.0 per (mg/kg)/day is used.[1] Slope factors are multiplied by lifetime average daily doses to estimate cancer risk.   However, since the thermal decomposition of Load Line 11 at RVAAP will be a discrete event and not a persistent exposure, the unit risk is adjusted for exposure duration and frequency.

The following is the calculation for maximum exposure concentration at a unit duration and frequency based on the Table C-2-1 in the EPA Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities.

$$\textbf{Risk}_{(inh)} = \textbf{ADI x CSF}_{(inh)} \qquad \textbf{(3)}$$

where:

$Risk_{(inh)}$ = cancer risk at time = t
ADI = average daily intake via inhalation, (mg/kg-day)
$CSF_{(inh)}$ = Inhalation Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$

$$\textbf{ADI} = \frac{\textbf{Ca * IR * ET * EF * ED * 0.001 (mg/µg)}}{\textbf{BW * AT * 365 (day/yr)}} \qquad \textbf{(4)}$$

where:

Ca = air concentration, µg/m^3
IR = inhalation rate, m^3/hr
ET = exposure time, hrs/day
EF = exposure frequency, days/year
ED = exposure duration, yr
BW = body weight, kg
AT = averaging time, yr

Using air concentration from the ADI calculation and multiplying by the Cancer Slope Factor provides an Adjusted Unit Risk Factor (URadj), where URadj = ADI *CSF/ Ca. Substituting into the Risk equation 3 results in the following:

---

[1]U.S. EPA, *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, pg. 2-49, 1998.

$$\text{Risk = URadj * Ca} \qquad (5)$$

The following table (Table 1) lists the values and references for the parameters used for the cancer risk calculations above.

Table 1. Values used in cancer risk calculation.

Variable	Reference	Value
$CSF_{(inh)}$, $(mg/kg/d)^{-1}$	Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities (HHRAP), Chapter 2, Page 49	2.0
Ca, $\mu g/m^3$	ISCST3 Modeling Results	See Section 3.3
IR, m^3/hr	HHRAP Table C-2-1	0.63 (adult) 0.30 (child)
ET, hrs/day	Site Specific based on duration for burn	3
EF, days/year	Site Specific based on number of events	1
ED, yr	Site Specific based on number of events	1
BW, kg	HHRAP Table C-2-1	70 (adult) 15 (child)
AT, yr	HHRAP Table C-2-1	70

Since ISCST3 results in concentrations in $\mu g/m^3$, rearranging the risk equation (5) for Ca, results in the following acceptable impact level based on a 1×10^{-6} risk and the assumptions in Table 1.

$$\text{Ca = Risk / URadj} \qquad (6)$$

Or

$$\text{Ca} = \frac{\text{Risk}_{(inh)} \text{ * BW * AT * 365 (day/yr)}}{\text{CSF * IR * ET * EF * ED * 0.001 (mg/}\mu g\text{)}} \qquad (7)$$

Ca = 1×10^{-6} * 70 * 70 * 365 / [2 * 0.63* 3 * 1*1*0.001]
Ca = 473 ($\mu g/m^3$)

3.2 Dispersion Model Summary

The latest version (02035) of the Industrial Source Complex Short Term 3 (ISCST3) model is used to estimate concentrations of PCBs emitted during the proposed trial burn of Load Line 11.

The regulatory default option is employed for the model for all parameters except initial vertical height. The Open Burn and Open Detonation Model (OBODM) was used to estimate vertical plume rise and used to calculate Z init and release height. For the plume rise calculation, worst-case met data is employed.

Urban coefficients are used, as the land within a 3-km circle surrounding the center of the sources is primarily light industrial. Five (5) consecutive years (1987 to 1991) of meteorological data are used with the SCRAM surface meteorological data from the Akron-Canton Airport (Surface Station Number 14895) and SCRAM upper air measurements made at Pittsburgh, PA (Upper Air Station Number 94823).[2]

Three receptor grids are utilized in the modeling analysis to identify the maximum off-property ground-level concentrations. The first is a Cartesian "fine" grid with 100-meter receptor spacing. The fine grid will extend 1-kilometer beyond the property boundary in all directions. A course Cartesian grid with 1000-meter receptor spacing will then extend from 1-kilometer to 5-kilometers. The third grid is a "discrete" grid with receptors placed at 100-meter intervals along the property boundary. Only those receptors considered off-property are analyzed.

3.3   Modeling Results

Table 2 shows the modeled maximum off-property impact concentrations and the calculated resulting risk using the expression Risk = Ca * UR discussed in section 4.1.

Table 2. Modeling results for Load Line 11 compared to acceptable risk-based levels for PCBs.

Highest Impact (mg/m^3) (Ca)	Type of Exposure	Unit Risk Factor (UR) $(Risk/mg/m^3)$	Calculated Risk (Ca*UR)	Acceptable Risk Level	Comments
6.73	Adult	2.11E -09	1.42E-08	1E-06	Approximately 70 times below the acceptable risk level.
	Child	4.70E-09	3.16E-08	1E-06	Approximately 32 times below the acceptable risk level.

3.4   Dioxin TEQ estimation

For the estimation of dioxin emissions and their impact, a conversion rate of 2,312 µg dioxin TEQ per kg PCB is assumed based on studies on the role of PAHs and related compounds in PCDD/F formation on model fly ashes by Wilhelm and Stieglitz.[3] The cancer risk slope factor for Dioxin TEQ is 1.5×10^5 $(mg/kg\text{-}day)^{-1}$.[4] Following the calculation of risk discussed in section 4.1, this slope factor results in an adult URadj of 1.59×10^{-4} (Risk /(µg/m³)) for a 3-hour burn duration. Table 3 provides a summary of the

---

[2] Ohio EPA - Division of Air Pollution Control, Air Quality Modeling and Planning Section, "Engineering Guide #69 - Air Dispersion Modeling Guidance," 2003.

[3] Wilhelm, J. and L. Stieglitz, E. Dinjust, R. Will, "Mechanistic studies on the role of PAHs and related compounds in PCDD/F formation on model fly ashes", Chemosphere 42 (2001).

[4] U.S. EPA, 1997. Health Effects Assessment Summary Tables, FY 1997, EPA-540-R-97-036; PB97-921199, U.S. Environmental Protection Agency, Washington D.C.

risk calculation for dioxin TEQ. Even if the PCB and dioxin TEQ results were combined to obtain a worst-case cumulative exposure, the resultant risk levels will still be insignificant.

Table 3. Modeling results for Load Line 11 compared to acceptable risk-based levels for dioxins & furans.

Highest Impact (Ca) ($\mu g/m^3$)	Type of Exposure	Unit Risk Factor (UR) (Risk/$\mu g/m^3$)	Calculated Risk (Ca*UR)	Acceptable Risk Level	Comments
1.56E-05	Adult	1.59E-04	2.47E-09	1E-06	Approximately 405 times below the acceptable risk level.
	Child	3.52E-04	5.48E-09	1E-06	Approximately 182 times below the acceptable risk level.

3.5 Indirect Exposure Pathways

Due to the low ambient concentrations obtained via air dispersion modeling, it is expected that the impacts from the trial burn on water quality and soil will also be insignificant. The Army will conduct ambient air sampling before and after the trial burn to ensure that no adverse impacts are caused due to the trial burn. RVAAP will work with the U.S. EPA to develop an acceptable monitoring plan for the trial burn.

4.0   SUMMARY

RVAAP requests that EPA Region V approve the proposed thermal decomposition of explosive materials in Load Line 11 based on the following criteria:

➢ RVAAP requests that EPA approve a trial burn for Load Line 11 so that RVAAP can conduct adequate emissions and ambient concentration sampling to substantiate the air dispersion modeling results that show that there will be no adverse impacts to human health or the environment. Load Line 11 is situated well within the RVAAP property and is one of the safest options available for this proposed trial burn.

➢ Although PCBs in the paint in Load Line 11 exist in concentrations greater than 50 ppm, initial thermal decomposition of the explosive materials is the ONLY safe method for demolishing the structures at these load lines. This technology is widely accepted as the Best Available Technology for the situation at RVAAP.

➢ RVAAP's detailed air dispersion modeling analyses for Load Line 11 confirms that potential PCB emissions will not cause any adverse impacts on human health or the environment (i.e., off-site impacts are below relevant and applicable EPA risk levels).

➢ RVAAP will work with EPA Region V, Ohio EPA and ARAQMD to ensure that all appropriate measures are taken to ensure that all procedures and guidelines are met prior to, during, and after the thermal decontamination event.

➢ The RVAAP Load Line 11 monitoring data will be incorporated into the dispersion model in order to adjust the model with real time response data. The results will be resubmitted to the USEPA, applying the revised model to the paint sampling results from the remaining load lines in order to determine the combined impact of all of the thermal decomposition projects. RVAAP will seek the approval of the USEPA to thermally treat the explosives in all remaining load lines structures based upon these results.

Attachment 1

RVAAP Area Map

N 576,250

E 2,388,250

EAGLE CREEK

SAND CREEK

SAND CREEK

HINKLEY CREEK

E 2,327,500

N 546,500
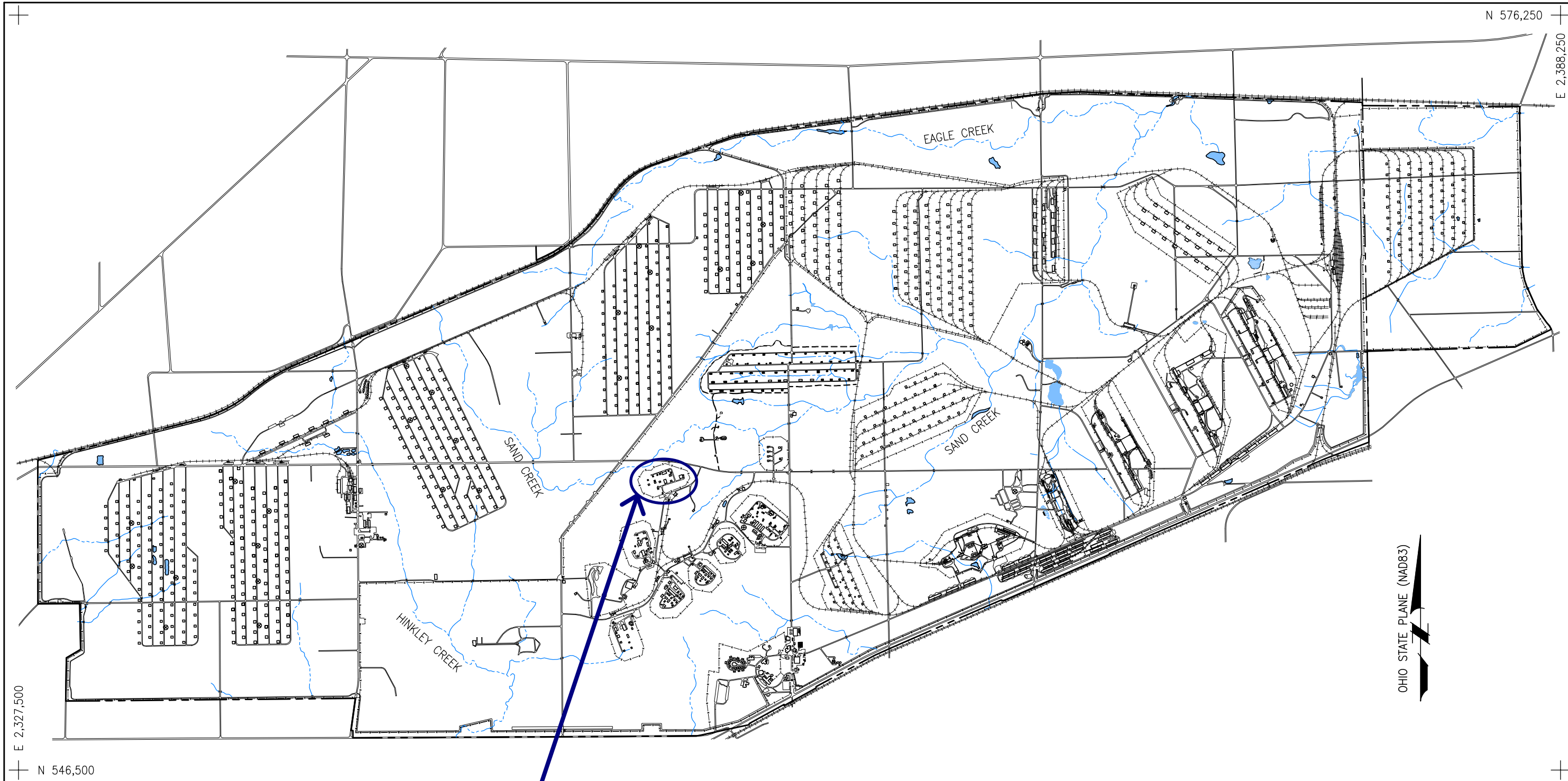
Load Line 11

OHIO STATE PLANE (NAD83)

MKM Engineers, Inc.

RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO
INSTALLATION MAP

DRAWN BY:	REVISED BY:	CHECKED BY:	DATE:	FIGURE:
P. HOLM	MD		21 AUG 02	1-2

++++++++ ....RAILROAD TRACKS
—×——×— ....FENCELINE
— - — - — ....PROPERTY BOUNDARY
............................STREAM OR CREEK

0   2000   4000   8000

SCALE: 1"=4000'

Attachment 2

Sampling Plan

PCB SAMPLING PLAN

FOR APPLIED DRIED PAINTS
AT
THE RAVENNA ARMY AMMUNITION PLANT

ON BEHALF OF
MKM ENGINEERS, INC.

COMPLETED BY NEAL ENVIRONMENTAL SERVICES, LLC

OCTOBER 2002

Sampling Plan for Applied Dry Paints at the
Ravenna Army Ammunition Plant

1. Site Description.

The Ravenna Army Ammunition Plant (RVAAP) is located on 21,419 acres in Portage and Trumbull Counties in northeastern Ohio. Since the 1940s, the RVAAP has been used by the US Army to produce munitions charged with propellants and explosives. The RVAAP has been declared as excess property by the Department of Defense. Contaminated areas are currently undergoing restoration for future use by the Ohio National Guard. As part of the restoration effort a number of structures must be investigated, decontaminated and demolished. To properly manage the wastes produced by the restoration efforts the RVAAP must accurately characterize the potential waste streams. The waste stream that is the subject of this plan is applied dry paints used in some of the facility structures.

The RVAAP and it facilities were built in 17 months time in the early 1940s. Army ammunition plants were built in accordance with a set of uniform plans. From one plant and one structure to the next the design and materials used to construct the buildings varied little. For example, fuse and booster load lines at the RVAAP, which were used to manufacture munitions, vary little from one fuse and booster load line to the next. Further, the materials used vary little from one fuse and booster load line to the next or from one part of a fuse and booster load line to another part of the same load line. Site facilities consist of individual buildings or groups of buildings or structures. For example a load line consists of a number of similarly constructed attached structures that served as the production line for assembling munitions.

In the construction of the facilities a number of paints were applied. The same paints were applied in and through out each structure or grouping of structures. The type of paint applied was based upon the type, location and function of the structure or item being painted. Thus, the walls and piping in a load line will contain several distinct but uniform types of paints, which can be differentiated by the paint color. Unlike a residential structure it can be said with certainty that when a paint type was selected for use it was used consistently through out the structure or grouping of structures for that particular purpose.

2. Goal.

The goal of this sampling plan is to achieve characterization of dry applied paints used in various structures and groupings of structures at the RVAAP to determine if, as wastes, the applied dry paints are subject to regulation under 40 CFR 761- Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use

Prohibitions. It is suspected that prior to application a number of the paints used at the RVAAP were mixed with various concentrations of PCBs. It should be stressed that any concentration of PCBs present in the RVAAP paints resulted from the mixing of PCBs with the paints prior to their application. It is not known or suspected that any liquid PCBs were spilled or released onto the painted surfaces. Pursuant to 40 CFR 761 the RVAAP will determine the PCB concentration in applied dry paints used on facility structures (walls) and appurtenances (piping). 40 CFR 761.3 defines PCB Bulk Product Waste as waste derived from manufactured products containing PCBs in a non-liquid state, at any concentration where the concentration at the time of designation for disposal was $\geq$ 50 ppm. This definition further specifically lists "applied dry paints" as potential PCB Bulk Product Waste. 40 CFR 761.62 Disposal of PCB Bulk Product Waste states that when it is necessary to analyze wastes to make determinations on the PCB concentration Subpart R of 40 CFR 761 should be utilized. Subpart R envisions that the material be to sampled has been demolished and can be configured in one of several types of piles. However, the US EPA Question and Answer September 2001 Guidance Manual indicates that EPA has not specified a procedure for collecting samples of applied dried paints prior to demolition of the painted surface. Further, this document suggests that the regional US EPA office be contacted for advice on sampling. Thus the goal of this sampling effort will be to identify the various paint types in use at the RVAAP, collect representative samples of each type of paint and determine the PCB concentration in each paint type. Finally, these concentrations will be compared to the PCB Bulk Product Waste concentration characterization limit of $\geq$ 50 ppm and the paints will be characterized for regulation or non-regulation under 40 CFR 761.

3. Condition of Material to be Sampled.

As previously noted contaminated portions of the RVAAP are undergoing restoration for future use by the Ohio National Guard. Many of the existing structures must be investigated, decontaminated and demolished. Thus, the walls and piping can be designated as wastes and characterized for proper disposal. In general, the existing structures are in good condition considering the overall age of the facility and the facility structures. However, the facility structures have not been used or maintained for a number of years. As such, the paint on the walls and piping can be found to be both in good condition, still adhered to the walls or piping, and pealing or flaking from the walls and piping.

4. Waste Classification.

The first step in the waste identification process will be to identify the number and type of different waste streams. This will be accomplished via a visual survey during which a listing will be made of separate paint types by color and use in a structure or grouping of structures. As previously noted, while there are several types of paint in-place in the RVAAP facilities, it is believed that the same few paints were used universally and extensively through out the facility. Thus, a visual survey will be conducted and paint types will be classified via use and color. For example, there may be a waste paint type noted as green in color and primarily used for application on the walls. Each use type

regardless of color will be noted as a separate waste stream. For example, there may be a green paint used on walls and green paint also used on pipes. In this case, two categories would be established; green paint on walls and green paint applied to piping.

Once this initial survey has been completed the various paint colors by use shall be considered to be the list of distinct waste streams for characterization. Following waste stream identification another survey will be conducted to identify the locations of each waste stream in the structure or grouping of structures. As part of this survey, an attempt will be made to identify the relative percentage/amount of each paint waste stream present in a structure or grouping of structures. This will be accomplished via hand measurement or if hand measurement is impractical estimation supported via measurement to the extent practical will be utilized. Where estimation is utilized this shall be noted.

5. Sample Site Selection.

Following identification and location listing of the distinct waste streams, 15 potential sample sites shall be identified for each distinct waste stream. These potential sample sites shall to the extent possible, be evenly distributed through out the structure or grouping of structures being surveyed. Due to the fact that the goal of this sampling effort is to characterize the applied dry paints, the potential sample sites will be identified based upon the presence of paint rather than on a random grid selection process. Potential sample sites shall be at least 1 meter apart unless the amount of painted surface per color and use does not allow such spacing. The potential sampling sites, to the extent possible, will also be evenly distributed through out the structure or grouping of structures being sampled. If the available sample site surface does not allow for the 1-meter spacing, the potential sample sites shall be evenly spaced. Each sample site shall be marked with a number and waste stream designation such as green, wall, #1 and so on beginning at one end of the structure or pipe and continuing down the length of the structure or pipe assigning numbers sequentially. From the 15 potential sample sites, 5 sample sites shall be randomly selected and sampled for each waste stream. The 15 potential sites shall be divided into 3 groups of 5 potential samples sites (1-5), (6-10) and (11-15). One sample site shall be randomly selected from potential sample site group (1-5). Two sample sites shall be randomly selected from potential sample site group (6-10) and 2 sample sites shall be randomly selected from potential site group (11-15).

The following tables/examples illustrate the above described sample site selection process.

1. Visual Survey Fuse and Booster Load Line #6. (May result in identifying the following waste streams.)

Green/Pipe	Green/Wall	Grey/Wall	Red/Pipe	Blue/Wall	Yellow/Pipe

2. Identification of Potential Sample Sites using Green/Pipe as an example. (each waste stream will go through the same process.)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

3. Division of Potential Sample Sites for Green/Pipe into 3 Groups of 5 Each.

1,2,3,4,5	6,7,8,9,10	11,12,13,14,15,

4. Random Selection of Green/Pipe Sample Sites. 1 from Group 1-5, 2 from Group 6-10 and 2 from Group 11-15.

1,**2**,3,4,5	6,**7**,8,9,**10**	**11**,12,13,14,**15**

5. Sample Randomly Selected Green/Pipe Sites

2	7	10	11	15

6. Composite Collected Green/Pipe Samples

2,7,10,11,15

7. Thoroughly Mix the Composited Green/Pipe Sample and Remove Sample to be Submitted to Lab

6. Sample Collection.

Following identification of the sample sites, a sample shall be collected from each site and composited with the other samples collected for that distinct waste stream. Each sample shall be collected by manually removing the paint, to the extent practical, down to the bare subsurface. Each sample collected from a sample site shall consist of approximately the same amount of removed applied dry paint. Following collection of all five samples the resulting composite shall be completely and thoroughly mixed. From the resulting composite a sample shall be removed, placed in a sample container approved for shipment of the sample and sent to the laboratory for chemical extraction and analysis of PCB concentration.

Following collection of the composite samples another sample site will be chosen randomly from the remaining sample sites for each waste stream. A sample shall be collected from each of these sites consisting of the applied dry paint, removed to the

extent practical down to the bare subsurface, from an area equivalent to 30 square centimeters. This sample shall be weighed and the result used to calculate the approximate amount/percentage of each waste stream present in the facility being sampled.

7. Laboratory Analysis.

The Laboratory shall use either Method 3500B/3540C or Method 3500B/3550B from EPA's SW-846 Test Methods for Evaluating Solid Waste for chemical extraction of PCBs from the composite samples. Method 8082 from SW-846 shall be used to analyze these extracts for PCBs.

8. Results Reporting.

Each composite sample shall be analyzed for PCB concentration and all sample concentrations shall be reported as ppm by weight on a dry weight basis.

9. Results Analysis.

Any sample concentration of $\geq$ 50 ppm shall result in the corresponding waste stream being designated as PCB Bulk Product Waste and subject regulation under 40 CFR 761.

Attachment 3

Summary of Sampling Data and Calculated Worst-Case Emissions

PCB Paint Sample Data and Worst-Case Emissions Calculations for LL 11

LL #	BLDG. #	Dimensions		Building (sq. ft.)	Color	Lt. Green	Dk. Green	PCB Conc Light Green	PCB Conc Light Green	Total PCBs Light Green	PCB Conc Dark Green	PCB Conc Dark Green	Total PCBs Dark Green	Total PCBs Per Building
								PPM	WT%	Lbs	PPM	WT%	Lbs	Lbs
LL11	AP-1	10'	12'	120	Lt. Green/Dk. Green	720	480	3000	0.30	0.03	5800	0.58	0.04	0.08
LL11	AP-10	10'	12'	120	Lt. Green/Dk. Green	720	480	3000	0.30	0.03	5800	0.58	0.04	0.08
LL11	AP-11	50'	182'1"	9104	Lt. Green/Dk. Green	99507	63671	13000	1.30	20.21	8200	0.82	8.16	28.37
LL11	AP-18	30'9"	38'1"	1171	Lt. Green/Dk. Green	9895	6597	6000	0.60	0.93	5300	0.53	0.55	1.47
LL11	AP-20	14'4"	16'4"	234	Lt. Green/Dk. Green	1613	1075	3000	0.30	0.08	5800	0.58	0.10	0.17
LL11	AP-3	16'10"	25'10"	435	Lt. Green/Dk. Green	1786	1190	3000	0.30	0.08	5800	0.58	0.11	0.19
LL11	AP-4	10'	12'	120	Lt. Green/Dk. Green	720	480	6800	0.68	0.08	6000	0.60	0.04	0.12
LL11	AP-5	20'	22'	440	Lt. Green/Dk. Green	2640	1760	6800	0.68	0.28	6000	0.60	0.16	0.45
LL11	AP-6	20'	22'	440	Lt. Green/Dk. Green	2640	1760	6800	0.68	0.28	6000	0.60	0.16	0.45
LL11	AP-7	10'	12'	120	Lt. Green/Dk. Green	720	480	6800	0.68	0.08	6000	0.60	0.04	0.12
LL11	AP-8	50'	101'6"	5075	Lt. Green/Dk. Green	63090	42060	14000	1.40	13.80	7600	0.76	4.99	18.80
LL11	AP-9	20'	32'	640	Lt. Green/Dk. Green	4608	3072	6000	0.60	0.43	5300	0.53	0.25	0.69
													TOTAL:	50.98

Attachment 4

Air Dispersion Modeling Protocol

Air Dispersion Modeling Protocol

Thermal Decontamination of
Ravenna Army Ammunition Plant Load Line 11

Submitted by:

Ravenna Army Ammunition Plant

8451 State Route 5

Ravenna, OH 44266-9297

Contact:

Mark Patterson

Facility Manager

Submitted:

December 29, 2004

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

DOCUMENT DISTRIBUTION

NAME/ORGANIZATION   **NO. OF HARD COPIES**

NAME/ORGANIZATION   **NO. OF ELECTRONIC COPIES**

1.0   EXECUTIVE SUMMARY

The Ravenna Army Ammunitions Plant (RVAAP) is located on 21,419 acres of land in Portage and Trumbull Counties in northeastern Ohio. Potentially contaminated sites are currently undergoing investigation and restoration activities in preparation of fulfilling the intended reuse of the facility by the Ohio National Guard as a training facility.

This protocol is submitted to receive approval for polychlorinated biphenyls (PCB) dispersion modeling procedures to be performed in support of a trial burn to perform thermal decontamination at the Ravenna Army Arsenal Plant (RVAAP) in Ravenna, Ohio in Portage and Trumbull Counties. This protocol describes the proposed modeling methodology to be used in estimating the off-property ground-level concentrations of PCBs and the proposed risk assessment approach.

2.0   CALCULATION OF MAXIMUM ALLOWABLE IMPACT

This modeling analysis will be used to evaluate the impact of PCBs and dioxin toxicity equivalents (TEQ) from the decontamination at RVAAP through thermal decomposition.

For evaluating risks from chemicals found in environmental sources, dose-response measures are expressed as risk per concentration unit. For inhalation, this measure is called the Unit Risk for air. Based on the EPA Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities a slope factor of 2.0 per (mg/kg)/day.[1] Although a slope factor (SF) of 0.4 is available for inhalation of PCBs, the U.S. EPA Office of Solid Waste (OSW) does not expect that the 0.4 SF will be widely used in combustion risk assessments because the PCB mixture will usually contain 0.5 percent or more PCB congeners with greater than 4 chlorines. Since we do not have specific data on the congeners of PCBs released during the decontamination of the buildings, the more conservative slope factor will be used.

Slope factors are multiplied by lifetime average daily doses to estimate cancer risk.   However, since the thermal decomposition at RVAAP will be a set of discrete events and not a persistent exposure, the unit risk is adjusted for exposure duration and frequency. The following is the calculation for maximum exposure concentration at a unit duration and frequency.

$Risk_{(inh)} = ADI \times CSF_{(inh)}$

where:

$$Risk_{(inh)} \qquad = cancer\ risk$$
$$ADI \qquad = average\ daily\ intake\ via\ inhalation,\ (mg/kg\text{-}day)$$
$$CSF_{(inh)} \qquad = Inhalation\ Cancer\ Slope\ Factor\ (mg/kg\text{-}day)^{-1}$$

$ADI = \dfrac{Ca * IR * ET * EF * ED * 0.001\ (mg/\mu g)}{BW * AT * 365\ (day/yr)}$

where:

$$Ca = air\ concentration,\ \mu g/m^3$$
$$IR = inhalation\ rate,\ m^3/hr$$
$$ET = exposure\ time,\ hrs/day$$
$$EF = exposure\ frequency,\ days/year$$
$$ED = exposure\ duration,\ yr$$
$$BW = body\ weight,\ kg$$
$$AT = averaging\ time,\ yr$$

Obtaining air concentration from the ADI calculation and multiplying by the Cancer Slope Factor provides an Adjusted Unit Risk Factor (URadj), where URadj = ADI *CSF/ Ca. Substituting into the Risk equation 3 results in the following:

$Risk = URadj * Ca$

---

[1]U.S. EPA, *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, 1998.

The following table (Table 1) lists the values and references for the parameters used for the cancer risk calculations above.

Table 1. Values used in cancer risk calculation.

Variable	Reference	Value Used
$CSF_{(inh)}$, $(mg/kg/d)^{-1}$	Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities (HHRAP), Chapter 2, Page 49	2.0
Ca, $\mu g/m^3$	ISCST3 Modeling Results	Varies with Averaging Time
IR, m^3/hr	HHRAP Table C-2-1	0.63 (adult) 0.30 (child)
ET, hrs/day	Site Specific based on duration for burn	3
EF, days/year	Site Specific based on number of events	1
ED, yr	Site Specific based on number of events	1
BW, kg	HHRAP Table C-2-1	70 (adult) 15 (child)
AT, yr	HHRAP Table C-2-1	70

Since ISCST3 results in concentrations in $\mu g/m^3$, rearranging the risk equation (5) for Ca, results in the following impact standard based on a 1×10^{-6} (one in a million) risk and the assumptions in Table 1.

Ca = Risk / URadj

Or

$$\textbf{Ca} = \frac{\textbf{Risk}_{(inh)} \textbf{ * BW * AT * 365 (day/yr)}}{\textbf{CSF * IR * ET * EF * ED * 0.001 (mg/}\mu\textbf{g)}}$$

where

              Ca   = 1×10^{-6} * 70 * 70 * 365 / [2 * 0.63* 3 * 1*1*0.001]
              Ca   = 473 ($\mu g/m^3$)

The thermal decontamination of Load Line 11 can be considered one event with a duration of approximately 3 hours. The maximum off-property concentration is modeled to simulate the impact of the trial burn of Load Line 11.

3.0 MODELING METHODOLOGY

The techniques used in the dispersion modeling analysis will be consistent with current United States Environmental Protection Agency (U.S. EPA) procedures.[2]

3.1 Dispersion Model

The latest version (02035) of the Industrial Source Complex Short Term 3 (ISCST3) model will be used to calculate concentrations for pollutants modeled over a 3-hour and annual averaging periods. The regulatory default option is employed for the model for all parameters except initial vertical height as discussed under section 3.6 Source Parameters.

3.2 Land Use Analysis

Since atmospheric dispersion takes place differently over rural and urban areas, an analysis is performed to determine the land-use classification for use in the modeling analysis. Per Ohio EPA[3] and U.S. EPA guidance, the Auer Classification Typing Scheme for land use is applied within a 3-km radius of the facility to determine the application of either urban or rural dispersion coefficients.[4,5]

The Auer procedure involves classifying areas within the 3-km radius by the land types listed in Table 2. For modeling purposes, areas having land use which sums to more than 50 percent of the total area for types I1, I2, C1, R2, and R3 are considered urban in nature. Otherwise, the area is considered rural.

---

[2] U.S. EPA, Office of Air Quality Planning and Standards, *Supplement C to the Guideline on Air Quality Models (Revised)*, Research Triangle Park, North Carolina, EPA-450/2-78-027R-C, July 1999.

[3] Ohio EPA - Division of Air Pollution Control, Air Quality Modeling and Planning Section, "Engineering Guide #69 - Air Dispersion Modeling Guidance," 2003.

[4] Auer, Jr., A.H., "Correlation of Land Use and Cover with Meteorological Anomalies," *Journal of Applied Meteorology*, 17:636-643, 1978.

[5] *Supplement C To The Guideline on Air Quality Models (Revised)*.

Table 2. Land-Use categories.

Type	Use and Structures	Vegetation
I1	**Heavy Industrial** Major chemical, steel and fabrication industries; generally 3-5 story buildings, flat roofs	Grass and tree growth extremely rare; <5% vegetation
I2	**Light-moderate industrial** Rail yards, truck depots, warehouses, industrial parks, minor fabrications; generally 1-3 story buildings, flat roofs	Very limited grass, trees almost totally absent; <5% vegetation
C1	**Commercial** Office and apartment buildings, hotels; >10 story heights, flat roofs	Limited grass and trees; <15% vegetation
R1	**Common Residential** Single family dwelling with normal easements; generally one story, pitched roof structures; frequently driveways	Abundant grass lawns and light-moderately wooded; >70% vegetation
R2	**Compact Residential** Single, some multiple, family dwelling with close spacing; generally <2 story, pitched roof structures; garages (via alley), no driveways	Limit lawn sizes and shade trees; <30% vegetation
R3	**Compact Residential** Old multi-family dwellings with close (<2 m) lateral flat roof structures; garages (via alley) and ash pits, no driveways	Limited lawn sizes, old established shade trees; <35% vegetation
R4	**Estate residential** Expansive family dwelling on multi-acre tracts	Abundant grass lawns and lightly wooded; >80% vegetation
A1	**Metropolitan natural** Major municipal, state, or federal parks, golf courses, cemeteries, campuses; occasional single story structures	Nearly total grass and lightly wooded; >95% vegetation
A2	**Agricultural rural**	Local crops (e.g., corn, soybean); 95% vegetation
A3	**Undeveloped** Uncultivated; wasteland	Mostly wild grasses and weeds, lightly wooded; 90% vegetation
A4	**Undeveloped rural**	Heavily wooded; >95% vegetation
A5	**Water surface**	Rivers, lakes

In order to define the land use in the area surrounding the RVAAP facility as urban or rural, a 3-km radius circle is drawn about the center of the sources (shown in Figure 1.). Based on a review of Land Use maps, aerial photographs as well as a tour of the RVAAP facility and surrounding areas, it was determined that the area within the 3-km radius circle is greater than 50 percent is classified as I2 (Light-Moderate Industrial.) While the land outside the facility boundary is mostly rural, RVAAP would be urban. A 3-km circle around the center of the sources includes a majority of the land on the RVAAP facility. Therefore, the area is considered urban for modeling purposes.

Figure 1. Land-Use analysis.
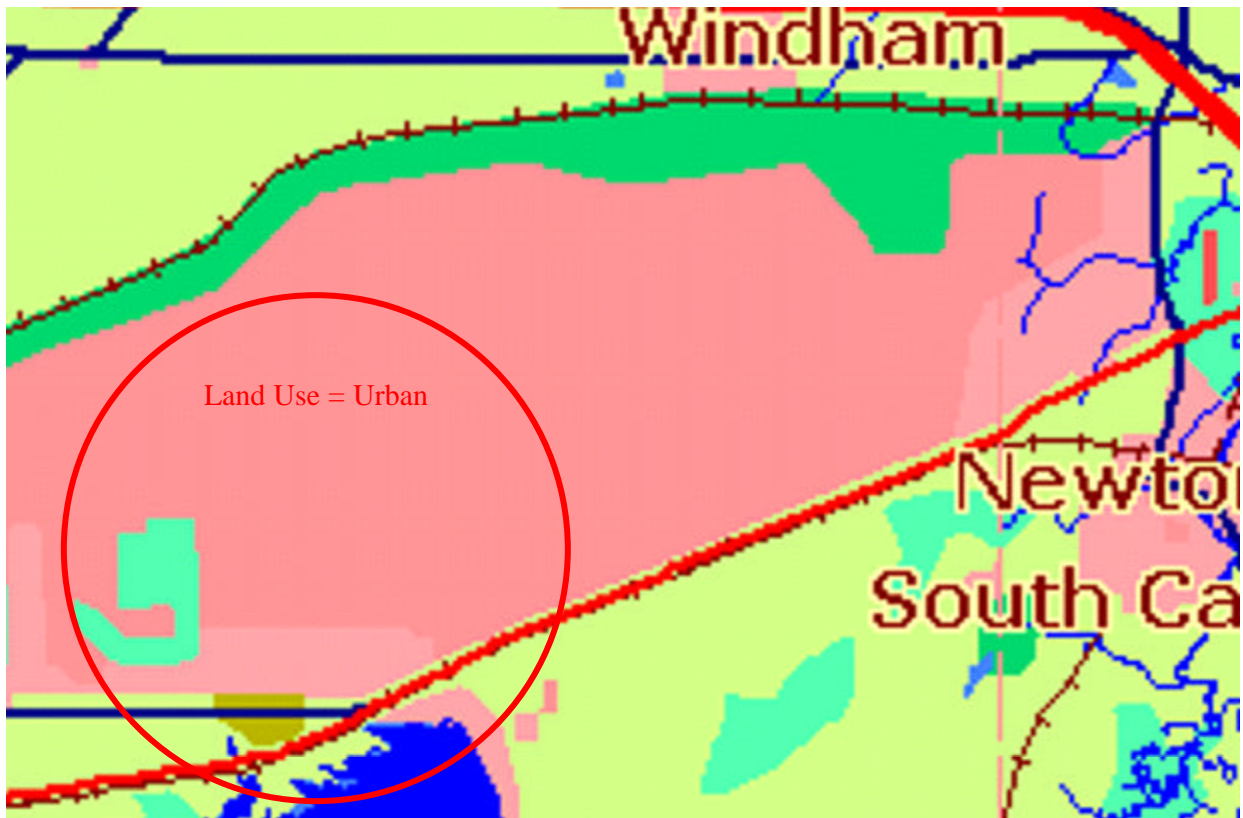
Pink = Light-Moderate Industrial, Commercial

Green = various Agricultural and Common Residential

3.3   Meteorological Data

The ISCST3 modeling will be performed using pre-processed meteorological data based on SCRAM surface meteorological data from Akron-Canton Airport (Surface Station Number 14895) and SCRAM upper air measurements made at Pittsburgh, PA (Upper Air Station Number 94823).[6] This data is representative of the meteorological conditions at RVAAP (Portage County). Five years of meteorological data will be used for the modeling analysis. The basic weather conditions during the five-year period for Akron are

---

[6] Ohio EPA - Division of Air Pollution Control, Air Quality Modeling and Planning Section, "Engineering Guide #69 - Air Dispersion Modeling Guidance," 2003.

representative of the typical conditions around RVAAP during any particular five-year period. The anemometer height at the surface station in Akron is 20 feet.

Because the burning is required to be completed during the day, only daylight hours (approximated as 8 am to 5 pm) will be considered in the model. This ensures the modeling accurately represents the conditions expected during the themal decontamination event. A wind rose for 1991 is shown in Figure 2.

**Figure 2. 1991 Windrose for Akron Canton airport.**
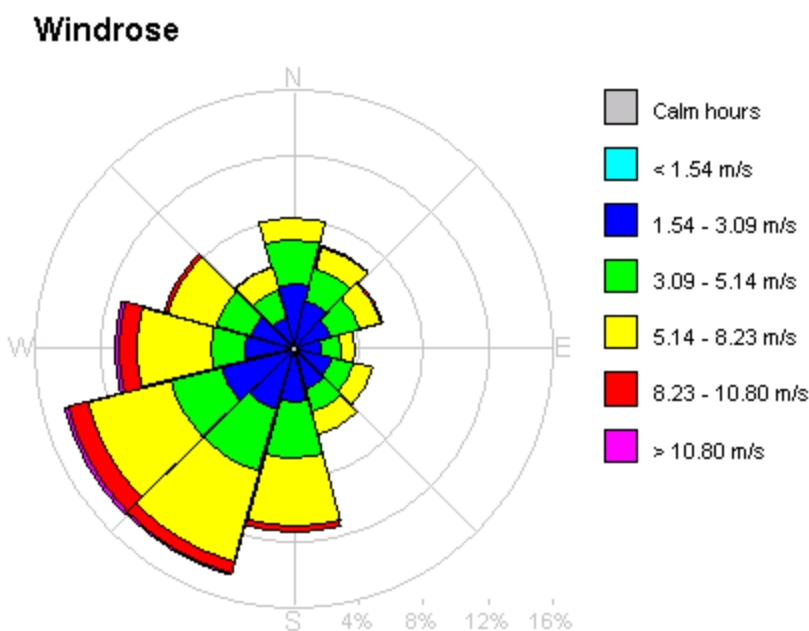
3.4   Receptor Locations

Three receptor grids will be utilized in the modeling analysis to identify the maximum off-property ground-level concentrations. The first is a Cartesian "fine" grid with 100-meter receptor spacing. The fine grid will extend 1-kilometer beyond the property boundary in all directions. A course Cartesian grid with 1000-meter receptor spacing will then extend from 1-kilometer to 5-kilometers. The third grid is a "discrete" grid with receptors placed at 100-meter intervals along the property boundary. Only those receptors considered off-property will be analyzed. The "fine", "course" and "discrete" grid parameters will be located in a single data file. If necessary, additional grids will be utilized to identify maximum ground-level concentrations or to identify the impact area.

Discrete receptors are also modeled which correspond to residences in the area immediately around RVAAP. Figure 3 shows the fine and course receptor grids as well as the receptors located around the property fence line.

Figure 3. Facility boundary and receptor locations.
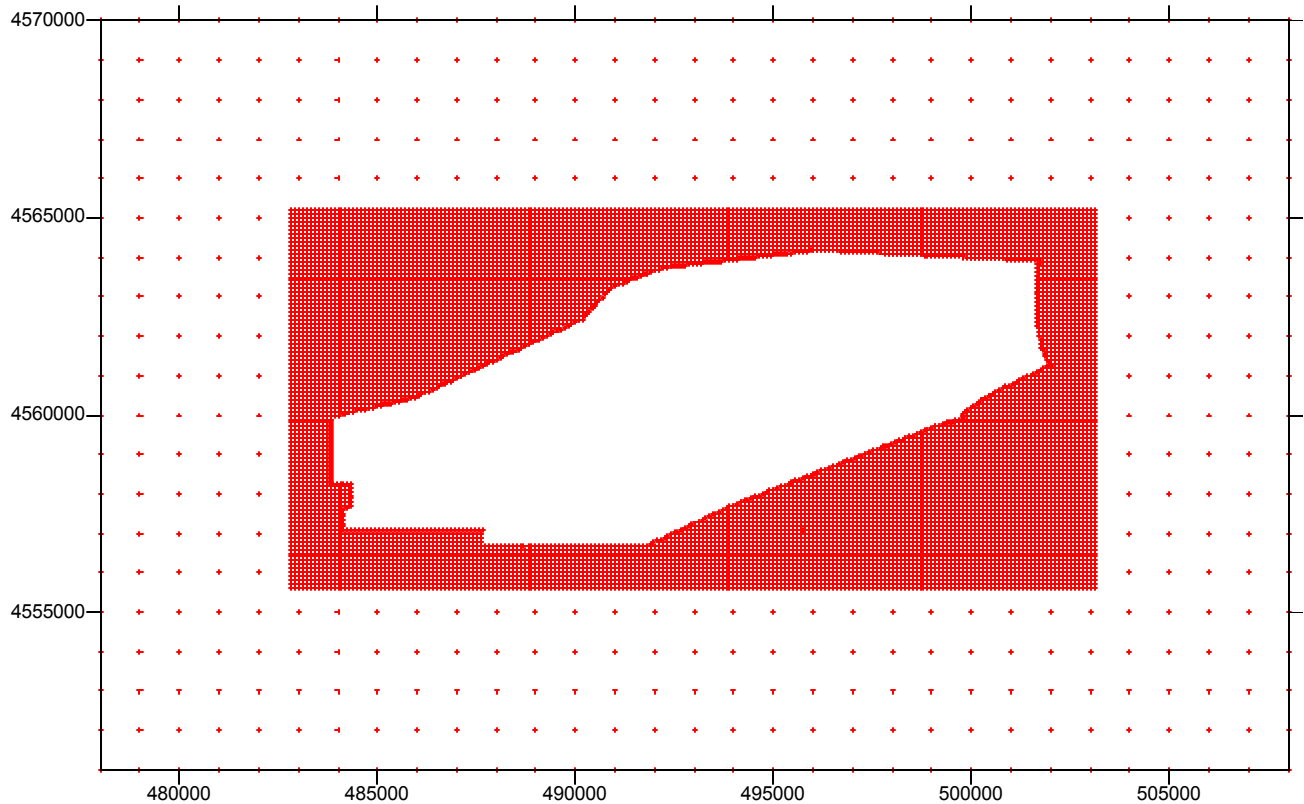
3.5   Terrain

Although, the area surrounding RVAAP is relatively flat, Digital Elevation Models (DEM) will be used to calculate the elevation for the sources and receptors surrounding RVAAP. This information is obtained from the United State Geological Survey (USGS) in a standard format. The DEM data is then used to assigned specific elevations to each receptor. The ISCST3 will be run considering simple terrain.

3.6   Source Parameters

Modeling will include the open burning of the buildings within Load Lines 2, 3, and 4. The buildings will be modeled as volume sources. Volume sources will be used to represent individual or groups of buildings at RVAAP based on their size and proximity to each other. The vertical dimension for each volume source is determined based on the plume rise formulas presented in the Open Burn and Open Detonation Model (OBODM). The OBODM plume rise predicts the buoyant rise of the plume from an open burn. The equations consider ambient meteorological conditions such as wind speed and atmospheric stability. The equations also account for the large horizontal dimensions (>5M) of a burn such as occurring from the thermal decommissioning of the building at RVAAP.[7] All buildings proposed to be thermally decontaminated will be included in the modeling analysis.

---

[7] Bjorklunda, Jay R., James F. Bowers, Gregory C. Dodd and John M. White, *Open Burn/Open Detonation Dispersion Model (OBODM) User's Guide, Volume II. Technical Description*, Arlington, VA, 1998.

3.7   Additional Modeling Data Available

The following additional modeling information is available and can be provided as needed:

- Plot plan
- Receptor plots
- Impact contour plots
- Raw and pre-processed meteorological data
- Model input and output files