Final
OB/OD Risk Management Plan
(Attachment 17)

For

Tooele Army Depot-North Area
Tooele, Utah

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Prepared for

Tooele Army Depot-North Area (TEAD-N)
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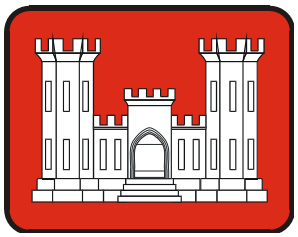

prepared by

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1.0 INTRODUCTION

The Utah Department of Environmental Quality (UDEQ) issued (September 2005) a modified Resource, Conservation and Recovery (RCRA) Permit that included Module VI for the Open Burning (OB) and Open Detonation (OD) Unit at Tooele Army Depot-North Area (TEAD-N). The Permit also includes static firing (SF) that is conducted at the OB/OD Unit. Permit conditions include the need for the development and implementation of a Risk Management Plan (RMP) as a follow up to the site characterization study and risk assessments conducted for the Permit Application. The RMP (i.e., Attachment 17 to Module VI), as presented in the sections that follow, will ensure protection of human health and the environment from continuing OB/OD/SF operations at TEAD-N.

Permit conditions included in Module VI of the Permit Modification (2009) that are relevant to this objective are as follows:

- Section VI.B.4. Maximum treatment limits.
- Section VI.C.1. Includes risk mitigation measures regarding operating conditions.
- Section VI.C.2 – VI.C.4. Compliance with environmental performance specified in Attachments 17a - Air Dispersion Modeling, 17b - Human Health Risk Assessment for OB/OD and 17c – Ecological Risk Assessment for OB/OD (and the need to update the information in these attachments).
- Section VI.G. Environmental monitoring requirements.

Soil sampling data for the OB/OD unit were collected in 2006, 2007, 2010, and 2014 subsequent to issuance of the Permit. Also, changes in operational needs for TEAD-N warrant the evaluation of modified OB/OD treatment limits (from those specified in the Permit). Therefore, the air dispersion and human health and ecological risk modeling included as Attachments 25, 26A and 26B, respectively, of the Permit Application were updated as a prerequisite for development of the RMP and renumbered as Attachments 17a, 17b, and 17c, respectively. Attachments 17a, 17b and 17c, based on remodeling, are presented in Appendices A, B, and C, of this RMP. Summaries of updated results for the air dispersion modeling, human health risk assessment and ecological risk assessment are included in Section 2.0. A discussion of the risk management strategy for the RMP is presented in Section 3.0 and recommendations for future RMP updates are provided in Section 4.0. A summary of the RMP is presented in Section 5.0.

2.0 REMODELING SUMMARIES

The air dispersion modeling, human health risk assessment and ecological risk assessment conducted for and presented in the Permit Application have been updated, commensurate with the OB/OD Risk Management Action Plan (U.S. Army, November, 2006), based on the following to support Permit Modification Module VI (2010):

- Revised OB/OD/SF treatment limits
- OB/OD/SF emission factor updates
- Model updates (as available)
- Toxicity updates (as available)
- Reevaluation of land use
- Refined ecological risk assessment

A summary of these remodeling results are presented in Sections 2.1-2.4. Additional supporting information is provided in the following appendices to this RMP:

- Appendix A: Attachment 17a – OB/OD Unit Air Modeling
- Appendix B: Attachment 17b – Human Health Risk Assessment
- Appendix C: Attachment 17c – Ecological Risk Assessment

Atmospheric dispersion and deposition remodeling results (presented in Appendix A) were used as input for human health risk assessment remodeling (Appendix B) and ecological risk assessment remodeling (Appendix C).

2.1 AIR QUALITY REMODELING

The air quality remodeling was based on applications of the OBODM model (version 01.3.0023, April 2006) for the following revised source scenarios (see Appendix A – Attachment 17a of this RMP for additional information on methodology and results):

- OB
  1 hr = 6,000 lb NEW
  24 hr = 6,000 lb NEW/day
  Quarterly = 360,000 lb NEW
  Annual = 360,000 lb NEW

- OD (including donor)
  1 hr = 7,500 lb NEW
  24 hr = 7,500 lb NEW/day
  Quarterly = 675,000 lb NEW
  Annual = 675,000 lb NEW

- SF
  1 hr = 6,040 lb NEW
  24 hr = 6,040 lb NEW/day
  Quarterly = 362,400 lb NEW
  Annual = 362,400 lb NEW

The remodeling in presented in Attachment 17a was based on the conduct of only one type of treatment (i.e., OB, OD or SF) during any 1-hr period. However, the RMP has also evaluated the potential for the conduct of OB plus OD plus SF (each at the 24 hr. maximum treatment limit) during the same calendar day but not during the same hour. In addition the conduct of OB (6,000 lb NEW) plus OD (750lb NEW) or SF (6,040lb NEW) plus OD (750lb NEW) were also evaluated.

The refined human health risk assessment process (that includes both chronic and acute inhalation pathway exposures) takes precedence over the Utah Toxic Screening levels. And the air quality assessment in Appendix A – Attachment 17a (of this RMP) demonstrates that criteria pollutant emissions are expected to result in offsite ambient concentrations far below National Ambient Air Quality Standards (NAAQS) adopted by Utah with the exception of particulate matter and lead. Therefore, the RMP air quality assessment was limited to evaluation of NAAQS compliance for PM10, PM2.5 and lead.

2.1.1 Lead Remodeling Results

Maximum remodeled quarterly lead concentrations presented in Table 2-1 are all significantly less than the NAAQS of 1.5 $\mu g/m^3$ quarterly average. However the NAAQS rolling quarterly average criterion has the potential to be exceeded at the TEAD south/west boundary. Table 2-1 also includes (in parenthesis) revised concentrations based on planned risk mitigation measures discussed in Section 3.2. These risk mitigation measures (i.e., wind direction exclusions for OB/OD/SF operations) are expected to facilitate compliance with the NAAQS for lead.

2.1.2 PM10 and PM2.5 Remodeling Results

The PM10 and PM2.5 remodeling results are presented in Table 2-2 thru 2-4. These results indicate the potential for exceeding PM10 and PM2.5 NAAQSs. These tables also include (in parentheses) reduced PM10 and PM2.5 concentrations based on planned risk mitigation measures discussed in Section 3.2. Open detonation (i.e., crater soil ejecta) is the primary source associated with these potential exceedances.

Modeling results indicate the potential to exceed annual PM2.5 standards in the vicinity of the south/west OB/OD Unit and south/west TEAD boundaries (see Figure 2-1 for an illustration of the proximity of modeled OB/OD/SF sources relative to these boundaries). Also, modeling results indicate the potential to exceed PM2.5 and PM10 24-hr standards at Grantsville, Tooele and Stockton in addition to the south/west unit and installation boundaries. However, available air monitoring data suggests that these emission factors may significantly overestimate PM10 and PM2.5 air concentrations in the vicinity of Tooele.

2.1.3 PM10 Air Monitoring Data

Available (1993-1997) PM10 24-hr air monitoring data for Grantsville (operated by UDEQ) are presented in Table 2-5. There were no exceedences of the PM 10 24-hr NAAQS (that is based on the second-highest concentrations). Only one time (i.e., in 1993) was the maximum 24-hr concentrations (not a NAAQS criterion) greater than 150 $\mu g/m^3$. However, the monitoring data for that exception is not considered representative due to the influence of nearby road repair operations. These air monitoring data support the conclusion that available PM10 emission factors (as used in Attachment 17a) are very conservative and significantly over-estimate emissions from the combination of OB/OD/SF sources (especially OD associated with the predominant particulate emission factor) at TEAD-N. The UDEQ has discontinued PM10 monitoring at Grantsville (as well as other locations in Tooele County).

2.1.4 PM2.5 Air Monitoring Data

Available (2000-2009) PM2.5 air monitoring data in the vicinity of TEAD has been reviewed to update the air quality reassessment. Table 2-6 presents a summary of PM2.5 monitoring data. Grantsville data are available for 2000-2003 and Tooele data for 2005-2009. PM2.5 air monitoring at Tooele is expected to continue.

During the period 2000-2009 there were no exceedances of the PM2.5 annual NAAQS (see Table 2-6). The annual averages of PM2.5 at Grantsville and Tooele have been among the lowest in Utah. Therefore, it can be concluded that emissions from OB/OD/SF sources at TEAD-N have not had any discernable impact on annual average PM2.5 conditions at Grantsville and Tooele. However, as indicated in Table 2-7, the actual OB/OD/SF treatment quantities during 2000-2009 were generally lower than proposed (modeled) maximum annual treatment quantities.

Air monitoring data, Table 2-6, indicate exceedances of the PM2.5 24-hr (98^{th} percentile) NAAQS in 2002 (Grantsville) and 2005 (Tooele). Therefore, monitoring data were further evaluated to determine 24-hour monitoring events associated with high PM2.5 concentrations. Table 2-8 lists the dates with 24-hr PM2.5 maximum concentrations (that are not a NAAQS criterion for PM2.5) greater than 35 $\mu g/m^3$. As apparent from this table, there is no correlation with these high PM2.5 24-hr concentration events and concurrent OB/OD/SF treatment operations at Tooele.

In summary, available local PM2.5 monitoring data do not demonstrate any significant contributions or impacts from OB/OD/SF sources at TEAD-N. However, periodic review of data from continuing PM2.5 monitoring at Tooele by UDEQ should be considered.

2.2 LAND USE REEVALUATION

The population centers of Tooele (to the east) and Grantsville (to the north) are adjacent to the TEAD-N boundary. The next closest population center is Stockton (located about 10 km southeast of the OB/OD Unit). Therefore, for conservatism, the TEAD-N installation boundary was the basis for evaluation the need for and effectiveness of risk mitigation measures identified in this RMP. The TEAD-N boundary represents the maximum offsite exposure to OB/OD/SF releases for each downwind sector for these sources. Based on dispersion/deposition/risk remodeling

results the maximum exposure potential (hypothetical) is at the south/west Unit and TEAD-N boundary. Evaluation (i.e., visual and aerial photographs) of current land use in the vicinity of the south/west has not identified potential receptors. Land south and west of TEAD-N is zoned multiple use (i.e., agriculture, grazing and mining) while land north and east of TEAD-N is zoned residential and commercial.

2.3 HUMAN HEALTH RISK ASSESSMENT REMODELING

The HHRA remodeling was based on the revised HHRA Protocol applicable to hazardous waste combustion facilities (USEPA, September 2005). The revised dispersion modeling results were used as input to the IRAP-*h* View model (February 2005) to obtain quantitative risk and hazard characterization estimates for the human health risk assessment (HHRA) update. These risk and hazard characterization results include the following:

- Cancer risks and hazard indices
- The results of the risk assessment of exposure to lead
- The results of the risk assessment of exposure to contaminants of potential concern (COPCs) from the consumption of breast milk
- An acute hazard characterization of direct inhalation of COPCs in air.

The following target levels or benchmarks for characterizing risks and hazards were based on the TEAD-N Protocol:

- Cancer risk less than or equal to 1×10^{-6} for off-site receptors and 1×10^{-4} for on-site workers
- Hazard Index (HI) less than or equal to 1.0 for noncarcinogens
- Media-specific concentrations for lead
    + Air concentration of less than or equal to 1.5 $\mu g/m^3$ (maximum quarterly concentration based on the National Ambient Air Quality Standards [NAAQS]/Utah Ambient Air Quality Standards [UAAQS])
    + Soil concentration of less than or equal to 400 mg/kg (screening level for residential exposures)
    + Drinking water concentration of 4 $\mu g/L$
- Average daily dose of 2,3,7,8-TCDD (based on application of toxicity equivalent factor for other dioxins and furans) to nursing infants exposed to contaminated breast milk of 60 pg/kg-day

- Acute Hazard Quotient (AHQ) for inhalation less than or equal to 1.0.

The following sections discuss the results of the revised HHRA. Additional details on the HHRA reevaluation process and results are provided in Appendix B – Attachment 17b of this RMP.

2.3.1 Cancer Risks and Hazard Indices

Cancer risks and hazard indices are summarized in Tables 2-9 and 2-10, respectively. Cancer risks and hazard indices were less than the target levels for all receptors at all locations with the exception of the South/West OB/OD TEAD-N boundary. Cancer risks for all receptors exceeded the target level of 1×10^{-6} at the South/West OB/OD TEAD-N boundary. Tables 2-8 and 2-9 also present reduced cancer risk and hazard index values (in parenthesis), respectively based on risk mitigation measures discussed in Section 3.0. Emissions from the OB, OD, and SF were all major contributors to the elevated cancer risks. Hazard indices were less than the target level of 1 for all receptors with the exception of the adult resident at the South/West OB/OD TEAD-N boundary. Emissions from the OD and SF units were the major contributors to the elevated hazard indices. As noted above there are currently no receptors located at the South/West OB/OD TEAD-N boundary.

Ingestion of produce was the major contributor to the elevated cancer risks for the hypothetical child and adult recreational fisher and the child and adult resident at the south/west TEAD-N boundary. Ingestion of produce and ingestion of milk were the major contributors to the elevated cancer risks for the child and adult farmer. Ingestion of produce was the major contributor to the elevated hazard index for the child recreational fisher and child resident. Ingestion of produce and ingestion of milk were the major contributors to the elevated hazard index for the child and adult farmers. HIs for individual target organs were all less than one, although target organs effects were not available for all chemicals (e.g., lead).

Emissions of lead from the OB and SF units and cadmium from the OD unit were the major contributors to the elevated cancer risks attributed to the ingestion of produce for all receptors (hypothetical) at the south/west TEAD-N boundary. Emissions of lead from the OD and SF units were the major contributors to the elevated hazard indices for the child recreational fisher, child resident, child farmer, and adult farmer.

For the hypothetical child farmer at the south/west TEAD-N boundary, dibenzo(a,h)anthracene for the OD unit and lead from the OB and SF units were the major contributors to the elevated cancer risks attributed to the ingestion of milk. For the hypothetical adult farmer, benzo(a)pyrene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, lead, and 2,3,7,8-TCDD from the OD unit and lead from the OB and SF units were the major contributors to the elevated cancer risks. Lead from the OB and SF units was the major contributor to the elevated hazard indices for the hypothetical child and adult farmer.

2.3.2 Lead Exposures

The estimated lead concentrations in surface soil, air, and surface water in each medium are all significantly less than the chemical-specific target levels.

2.3.3 Breast Milk Pathway

Estimated 2,3,7,8-TCDD TEQ concentrations in breast milk are all significantly less than the chemical-specific target level of 60 pg/kg-day.

2.3.4 Acute Hazard Characterization from Direct Inhalation

AHQs from direct inhalation for the OD and SF units were less than the target level of 1 (see Table 2-11). AHQs for the OB unit exceeded the target level of 1 at the Firing Control Point, North/East OB/OD Boundary, and South/West OB/OD TEAD-N/Boundary. Lead, hydrogen chloride, and chlorine were the major contributors to the AHQs for the OB unit based on a compilation of potential waste streams. However, based on review of the OB emission factor database it has been determined that lead emissions are not expected for waste energetic treated at TEAD that have significant emissions of chlorine and hydrogen chloride. Therefore, the AHQ contributions of lead and chlorine/hydrogen chloride are not additive and the AHQ target level of 1 is expected to be met at all locations. Additional information to support this conclusion is presented in Enclosure 1 of this RMP.

2.3.5 Risks Based on Soil Sampling Data

A summary of cancer risks and hazard indices for potential onsite workers exposed to OB/OD unit surface soil is presented in Table 2-12 (based on 2006, 2007, 2009, and 2014 soil sampling results). Target risk goals are attained with the exception of lead.

For the 2006 surface soil samples, results for all workers do not exceed the USEPA goal of no more than 5% of children (fetuses of exposed women) exceeding a 10 μg/dL blood-lead level. For the 2007 and 2014 surface soil samples, results for future outdoor workers exposed to soil at the OB unit exceeded the USEPA goal of no more than 5% of children exceeding a 10 μg/dL blood-lead level. For the 2009 surface soil samples, results for OB workers and future outdoor workers exposed to soil at the OB unit exceeded the USEPA goal of no more than 5% of children exceeding a 10 μg/dL blood-lead level. Note that the future outdoor worker is based on USEPA standard default exposure assumptions and does not represent current site workers. See Attachment 17b for additional information.

2.4 ECOLOGICAL RISK ASSESSMENT REMODELING

The following locations previously evaluated in the Screening Level Ecological Risk Assessment (SLERA) for the Permit Application have been remodeled (see Appendix C – Attachment 17c of this RMP for details):

- OB source area

- OD source area
- SF source area
- North/East OB/OD Unit boundary (maximum onsite impacts at or beyond the OB/OD Unit boundary)
- South/West OB/OD Unit and TEAD-N boundary (maximum offsite impacts)
- Grantsville Reservoir
- Rush Lake

The OB/OD/SF source areas are upland habitats situated directly where operational activities take place (i.e., very disturbed areas). The OB/OD Unit boundary locations are upland habitats that support the annual grassland and disturbed sagebrush habitats typical of TEAD-N and surrounding lands. The Grantsville Reservoir is a reservoir assumed to support an aquatic food chain typical of perennial man-made water bodies of substantial depth. Rush Lake displays some properties typical of a Great Basin Plata that accumulate surface runoff and inflow from streams but that lack surface outlet. Incoming water accumulates during infrequent rainfall events and then evaporates, exposing a salt-encrusted soil surface.

2.4.1 Screening Level Ecological Risk Assessment Conclusions, Risk Management, and Recommendations

Risk characterization in the ecological risk assessment consists of calculating ecological screening quotients (ESQ values, often referred to as hazard quotients, HQs) for each chemical evaluated, for each group of receptors corresponding to one of the assessment endpoints. An ESQ less than 1.0 indicates that there is little or no potential for adverse risk to the corresponding assessment endpoint. An ESQ greater than 1.0 indicates that there is a potential for adverse risk to the corresponding assessment endpoint. The ESQ values represent the values used to quantify exposure (exposure point concentrations or doses) divided by the corresponding TRV.

The ESQs presented in Table 2-13 were calculated using the EcoRiskView computer program that was used to estimate exposure levels. The EcoRiskView is a commercial model that is based on the Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities (USEPA, August 1999). The TRV values from EPA, 1999 (as well as supplemental TRVs), are programmed into EcoRiskView, which automatically divides the estimated exposure level by the corresponding TRV.

OB/OD/SF Source Areas: The greatest number of COPCs with ESQ values greater than or equal to 1.0 were found for the broadest diversity of ecological receptors, as well as the highest ESQ values, was identified for Locations 1 through 3, the OB, OD, and SF areas themselves. ESQ values higher than 1,000 were calculated for terrestrial plants exposed to contamination in the surface soils in which they grew. Despite the conservatism in the exposure assessment and

ecological effects assessment, the very high ESQ values calculated by the SLERA clearly suggest that terrestrial plants growing in soils in the OB, OD, and SF areas themselves are experiencing substantial stress from chemical contamination originating from site activities. The plants are also subject to injury and soil compaction from operations of vehicles and equipment at the sites; from heat, exhaust clouds, and falling debris from OB/OD and SF operations; and from staff walking around the sites. However, the area of the sites is small, and the vegetation at the sites has a long history of disturbance. The ecological impacts resulting from inhibited growth of vegetation at the sites themselves are trivial in the context of the overall regional landscape. Herbivores that feed on vegetation in the vicinity of the sites would be expected to find adequate vegetation in adjoining areas and not be dependent of vegetation on the sites as a food source.

ESQ values as high as 61 were also calculated for soil invertebrates such earthworms and insect larvae inhabiting surface soils at the OB/OD/SF source areas. Considering the conservatism in the exposure assessment and ecological effects assessment, it is unclear if the soil invertebrate community at the locations is actually experiencing substantial stress due to soil contamination. Further evaluation would be necessary to determine conclusively whether stress is substantial. However, for similar reasons outlined for terrestrial plants, the potential regional ecological impact from even severe localized stress to soil invertebrates within the OB, OD, and SF Sites themselves is expected to be trivial. Hence, no further evaluation is recommended.

However, ESQs greater than 1.0 were also found for most other categories of receptors evaluated. The results suggest that birds and mammals of various feeding guilds (i.e., herbivores, carnivores, and omnivores) that forage at the three locations could potentially be adversely affected by exposure to one or more site-related COPCs through their diet. Although the highest ESQ values were found for herbivorous and omnivorous mammals, which tend have small home ranges; the likelihood of occurrence directly on the OB, OD, and SF sites is low considering the sparse and degraded vegetation, irregular but frequent noise, and human activity. Further investigation is therefore not recommended.

OB/OD Unit Boundary: COPCs for which at least one ESQ was found to be greater than or equal to 1.0 are limited to hexachlorobenzene and the metals lead, cadmium, thallium, and zinc. Hexachlorobenzene is an industrial chemical and fungicide but is also used as an additive in explosives. Hence, its presence could be a result of site operations. Metals are also produced by OB, OD, and SF operations. The highest ESQ values were between 10 and 100 rather than greater than 100 as for the OB/OD/SF source areas. Clearly, the risk is lower in areas surrounding the OB, OD, and SF sites than within the sites. However, the surrounding areas support vegetation that is less degraded than that on the site itself. They therefore support terrestrial food chains that are generally typical of undeveloped areas in the region.

The maximum ESQ values beyond the source areas occur at south/west Unit boundary that is colocated with the south/west TEAD-N boundary. The OB/OD Unit boundary while not generally denuded of vegetation is heavily influenced by the noise and bustle of site activities. Adverse effects on individual ecological receptors at these locations are therefore unlikely to have substantial adverse effects on regional populations and communities of ecological receptors. Hence, no further evaluation is recommended.

Grantsville Reservoir: No ESQ values greater than or equal to 1.0 were found for any category of receptor considered at Grantville Reservoir. The SLERA therefore suggests that COPCs originating from site activities are not likely adversely affecting ecological receptors at Grantsville Reservoir. No further investigation is recommended.

Rush Lake: ESQ values greater than or equal to 1.0 were found only for lead and thallium (metals) and benzo(b)fluoranthene and benzo(k)fluoranthene (SVOCs). No ESQ was found that exceeded 2.6. Because of the high conservatism of the SLERA calculations, especially the exposure calculations, and low and few ESQ values, it is concluded that the probability of adverse risk to ecological receptors at Rush Lake is too low to warrant further investigation.

2.4.2 Ecological Risk Assessment Refinement Analysis

Because the OB, OD, and SF areas are considered impacted, as agreed to by the State of Utah Department of Environmental Quality, the refinement analysis only considered the potential risks associated with the terrestrial locations 4 through 6 (Southwest OB/OD Area Boundary, Northeast OB/OD Area Boundary) and the aquatic location 8 (Rush Lake). Location 7 (Grantsville Reservoir) was not included because no ESQs greater than one were estimated for this receptor location. The results of the risk assessment were subjected to a refinement analysis where conservative assumptions were examined in order to more realistically estimate potential risks to plants, invertebrates, and wildlife receptors. Overall, while potential risks may be present, adverse effects on individual ecological receptors at the modeled locations are unlikely to have substantial adverse effects on regional populations and communities of ecological receptors.

The following sections summarize the results of the refinement analyses (see Appendix C – Attachment 17c of this RMP for details).

2.4.2.1 Risks to Soil Invertebrates and Plants

Chemicals initially selected as COPCs in the screening process were further evaluated to determine the likelihood that concentrations in surface soil predicted by the EcoRisk View model pose potential risk to plants; no chemicals were initially selected as COPCs for soil invertebrates. Based on comparisons of modeled soil concentrations with alternate ecological soil screening levels, COPCs demonstrated little to no potential risk based on the soil concentrations predicted by the model at any unit.

2.4.2.2 Risks to Benthic Invertebrates and Aquatic Organisms

No chemicals in Rush Lake had ESQs greater than 1.0 for the benthic invertebrate or aquatic organism guilds; they were only for birds and mammals. Therefore, impacts to benthic invertebrates and aquatic organisms are not expected so a Step 3A refinement was not conducted for these receptors.

2.4.2.3 Risks to Mammals and Birds

There is uncertainty in the level of potential risk from exposure to hexachlorobenzene through the food chain although it appears that potential risks are overestimated. Little to no risk is expected

for avian and mammalian receptors through food chain exposure to the modeled concentration of polycyclic aromatic hydrocarbons (PAHs). There is uncertainty regarding potential risks from exposure to thallium through the food chain however USEPA does not consider thallium to be bioaccumulative so potential risks are most likely minimal. No risk from exposure to lead or zinc through the food chain is anticipated. There is a potential for risk to mammalian receptors exposed to cadmium through the food chain. The use of an alternate TRV or calculation at the lowest observed adverse effect level (LOAEL) level would result in ESQs less than or equal to 1.0.

2.4.3 SUMMARY

Initially, a SLERA was based on modeling conducted using EcoRiskView. Many COPCs were retained as COPCs for most site locations. The refinement evaluated the conservative exposure assumptions and compared modeled soil concentrations to screening criteria including USEPA Eco Soil Screening Levels (SSLs) and Canadian Soil Quality Guidelines (SQGs). After the refinement, some uncertainties remain regarding thallium and a potential risk to mammals from cadmium; however, these risks are expected to be minor. Therefore, modeled concentrations of chemicals are expected to present a negligible risk to ecological receptors.

Table 2-1 Modeled Lead Maximum Quarterly Average Air Concentrations, µg/m^3

Location	OB	OD[b]	SF	Total
Maximum Offsite[a]	**0.2** (<0.1)[c]	<0.1 (<0.1)[c]	**0.2** (<0.1)[c]	**0.4** (<0.1)[c]
Grantsville	<0.1 (<0.1)[c]	<0.1 (<0.1)[c]	<0.1 (<0.1)[c]	<0.1 (<0.1)[c]
Tooele	<0.1 (<0.1)[c]	<0.1 (<0.1)[c]	<1 (<0.1)[c]	<0.1 (<0.1)[c]
Stockton	<0.1 (<0.1)[c]	<0.1 (<0.1)[c]	<1 (<0.1)[c]	<0.1 (<0.1)[c]

[a] South/West OB/OD Unit and TEAD-N boundaries
[b] OD + donor
[c] Based on exclusion of winds from SE counter-clockwise through WNW.
Note: NAAQS is 1.5 µg/m^3 quarterly average and 0.15 µg/m^3 for the rolling quarterly average.

Table 2-2 Modeled Maximum PM10-24 hr Air Concentrations, µg/m^3

Location	OB	OD[b]	SF	Total
Maximum Offsite[a]	50 (20)[d]	**2,750[c]** **(1,375)[d]**	24 (14)[d]	**2,824[c]** **(1,409)[d]**
Grantsville	6 (6)[d]	**558[c]** **(558)[c, d]**	3 (3)[d]	**567[c]** **(567)[d]**
Tooele	2 (2)[d]	**256[c]** **(256)[c, d]**	1 (1)[d]	**259[c]** **(259)[d]**
Stockton	4 (<2)[d]	**356[c]** (<150)[d]	2 (<1)[d]	**362[c]** **(<153)[d]**

[a] South/west OB/OD Unit and TEAD-N boundaries
[b] OD + donor
[c] Greater then NAAQS of 150 µg/m^3
[d] Based on exclusion of winds from SE counter-clockwise through WNW.

Table 2-3 Modeled Maximum PM2.5-24 hr Air Concentrations, µg/m^3

Location	OB	OD[b]	SF	Total
Maximum Offsite[a]	3 (1)[d]	**1,376[c]** **(688)[c, d]**	12 (7)[d]	**1,391[c]** **(696)[c, d]**
Grantsville	<1 (<1)[d]	**279[c]** **(279)[c, d]**	1 (1)[d]	**280[c]** **(280)[c, d]**
Tooele	<1 (<1)[d]	**128[c]** **(128)[c, d]**	1 (1)[d]	**129[c]** **(129)[c, d]**
Stockton	<1 (<1)[d]	**178[c]** **(<89)[c, d]**	1 (<1)[d]	**179[c]** **(89)[c, d]**

[a]South/west OB/OD Unit and TEAD-N boundaries
[b]OD + donor
[c]Maximum greater then NAAQS of 35 µg/m^3 applicable to the 98th percentile 24 hrs concentration for a three-year period.
[d]Based on exclusion of winds from SE counter-clockwise through WNW.

Table 2-4 Modeled Maximum PM2.5-Annual Air Concentrations, µg/m^3

Location	OB	OD[b]	SF	Total
Maximum Offsite[a]	<1 (<1)[d]	**37[c]** (6)[d]	<1 (<1)[d]	**37[c]** (6)[d]
Grantsville	<1 (<2)[d]	2 (5)[d]	<1 (<2)[d]	2 (5)[d]
Tooele	<1 (<2)[d]	<1 (<2)[d]	<1 (<2)[d]	<1 (<2)[d]
Stockton	<1 (<1)[d]	1 (<1)[d]	<1 (<1)[d]	1 (<1)[d]

[a]South/west OB/OD Unit and TEAD-N boundaries
[b]OD + donor
[c]Maximum greater then NAAQS of 35 µg/m^3 applicable to the 98th percentile 24 hrs concentration for a three-year period.
[d]Based on exclusion of winds from SE counter-clockwise through WNW.

Table 2-5 PM10 Monitoring Data, Grantsville, UT, µg/m^3

	24-Hours		
Year	Standard	Measured highest	Measured second Highest
1997	150	45	32
1996	150	72	50
1995	150	55	49
1994	150	133	98
1993	150	186[a]	75

[a]Not considered representative due to the influence of nearby road repair operations.

Table 2-6 PM2.5 Air Monitoring Data, µg/m^3

	24 hr Max		24 hr 98th Percentile		Annual[b]	
Year	**Grantsville**	**Tooele**	**Grantsville**	**Tooele**	**Grantsville**	**Tooele**
2009	--	67.1	--	NA	--	7.0
2008	--	37.7	--	19.4	--	6.4
2007	--	39.4	--	23.3	--	7.2
2006	--	32.1	--	22.8	--	6.60
2005	--	67.0	--	**45.5**[a]	--	9.00
2004	--	--	--	--	--	--
2003	43.9	--	24.3	--	6.74	--
2002	62.3	--	**39.9**[a]	--	9.39	--
2001	52.2	--	32.5	--	7.94	--
2000	34.2	--	29.6	--	7.09	--

[a]Greater than NAAQS 24 hr 98th percentile of 35 µg/m3
[b]Annual NAAQS is 15 µg/m^3
-- No monitoring data collected
NA Not available

Table 2-7 TEAD-North NEW Treatment Quantities, Tons

	OB		OD[a]		SF		Total	
Year	Actual	Modeled[b]	Actual	Modeled[b]	Actual	Modeled[b]	Actual	Modeled[b]
2009[c]	103	180	175	338	20	181	298	699
2008	104	180	125	338	72	181	301	699
2007	99	180	117	338	8	181	224	699
2006	50	180	38	338	0	181	88	699
2005	50	180	66	338	62	181	178	699
2004	33	180	56	338	139	181	228	699
2003	3	180	187	338	43	181	233	699
2002	20	180	143	338	8	181	171	699
2001	47	180	20	338	15	181	82	699
2000	<1	180	102	338	412	181	514	699

[a]OD + donor
[b]Based on 1991 – 1995 meteorology
[c]Based on Jan – Nov 2009 data

Table 2-8 PM2.5 – 24 hr Monitoring Events (2000 – 2009) Greater than 35 µg/m^3

Date	Monitoring Location	TEAD-N OB/OD/SF Treatment Quantity, NEW
January 22, 2009	Tooele	0 lb
January 25, 2008	Tooele	0 lb
February 21, 2008	Tooele	0 lb
January 27, 2007	Tooele	0 lb
December 18, 2005	Tooele	0 lb
November 24, 2005	Tooele	0 lb
December 7, 2002	Grantsville	0 lb
February 7, 2002	Grantsville	1 lb
January 6, 2002	Grantsville	0 lb
December 31, 2001	Grantsville	0 lb
December 27, 2001	Grantsville	0 lb

Table 2-9 HHRA Maximum Cancer Risks[a]

Location	OB	OD	SF	Total
Firing Control Point	5E-09 (1E-08)[b]	3E-08 (7E-08)[b]	3E-09 (7E-09)[b]	4E-08 (9E-08)[b]
Guard Shack	6E-09 (1E-08)[b]	8E-08 (2E-07)[b]	5E-09 (1E-08)[b]	9E-08 (2E-07)[b]
North/East Unit Boundary	3E-08 (7E-08)[b]	5E-07 (1E-06)[b]	4E-08 (1E-07)	5E-07 (1E-06)[b]
South/West Unit Boundary	**3E-06** (1E-07)[b]	**7E-06** (7E-07)[b]	**4E-06** (2E-07)[b]	**1E-05** (1E-06)[b]
Grantsville	7E-08 (2E-07)[b]	4E-07 (1E-06)[b]	7E-08 (2E-07)[b]	5E-07 (1E-06)[b]
Tooele	1E-09 (2E-09)[b]	5E-08 (1E-07)[b]	1E-08 (2E-08)[b]	8E-08 (1E-07)[b]
Stockton	3E-08 (<6E-10)[b]	2E-07 (<8E-09)[b]	4E-08 (<8E-10)[b]	2E-07 (9E-09)[b]
Grantsville Reservoir	(2E-15) (<4E-17)[b]	(2E-08) (<8E-10)[b]	(1E-16) (<2E-18)[b]	(2E-08) (<8E-10)[b]
Rush Lake	(2E-14) (<4E-16)[b]	(2E-08) (<8E-10)[b]	(3E-16) (<6E-18)[b]	(2E-08) (<8E-10)[b]

[a]Bold print values are greater than the target cancer risk of 1E-06 for potential offsite receptors.
[b]Based on exclusion of winds from SE counter-clockwise through WNW.

Table 2-10 HHRA Maximum Hazard Indices[a]

Location	OB	OD[b]	SF	Total
Firing Control Point	2E-02 (4E-02)[b]	2E-03 (4E-03)[b]	1E-03 (2E-03)[b]	2E-02 (5E-02)[b]
Guard Shack	2E-02 (4E-02)[b]	6E-03 (1E-02)[b]	2E-03 (4E-03)[b]	3E-02 (5E-02)[b]
North/East Unit Boundary	9E-02 (2E-01)[b]	4E-02 (1E-01)[b]	1E-02 (2E-02)[b]	1E-01 (3.2E-01)[b]
South/West Unit Boundary	**3E-00** (1E-01)[b]	4E-01 (4E-02)[b]	**3E-00** (1E-01)[b]	**7E-00** (2E-01)[b]
Grantsville	8E-02 (2E-01)[b]	1E-02 (2E-02)[b]	6E-02 (1E-01)[b]	2E-01 (3E-01)[b]
Tooele	3E-02 (7E-02)[b]	1E-02 (2E-02)[b]	1E-02 (2E-02)[b]	5E-02 (1E-01)[b]
Stockton	3E-02 (<6E-04)[b]	1E-02 (<8E-04)[b]	1E-02 (<4E-04)[b]	6E-02 (<2E-03)[b]
Grantsville Reservoir	4E-05 (<8E-07)[b]	1E-04 (<4E-06)[b]	4E-11 (<8E-13)[b]	1E-04 (<5E-06)[b]
Rush Lake	6E-05 (<1E-06)[b]	1E-04 (<4E-06)[b]	1E-10 (<2E-12)[b]	2E-04 (<5E-06)[b]

[a]Bold print values are greater than the target hazard index of 1.0 for potential offsite receptors.
[b]Based on exclusion of winds from SE counter-clockwise through WNW.

Table 2-11 HHRA Maximum Acute Hazard Quotients (Inhalation)[a]

Location	OB	OD	SF
Firing Control Point	**2E+00** (1E+00)[b]	3E-01	5E-01
Guard Shack	9E-01 (5E-01)[b]	5E-01	3E-01
North/East Unit Boundary	**2E+00** (1E+00)[b]	1E+00	6E-01
South/West Unit Boundary	**2E+00** (7E-07)[b, c]	1E+00 (5E-1)[c]	6E-01 (<5E-01)[c]
Grantsville	5E-01 (3E-01)[b]	3E-01	2E-01
Tooele	3E-01 (2E-01)[b]	2E-01	1E-01
Stockton	4E-01 (<1E-01)[b, c]	3E-01 (<2E-01)[c]	1E-01 (<1E-01)[c]
Grantsville Reservoir	4E-01 (<1E-01)[b, c]	4E-01 (<2E-01)[c]	2E-01 (<2E-01)[c]
Rush Lake	(4E-01) (<1E-01)[b, c]	(3E-01) (<2E-01)[c]	(1E-01) (<1E-01)[c]

[a]Bold print values are greater than the target AIHQ of 1E+00.
[b]Accounts for AHQ contributions for lead separate from chlorine/ hydrogen chloride (i.e., do not occur in the same energetic waste stream).
[c]Based on exclusion of winds from SE counter-clockwise through WNW.

Table 2-12 Summary of Cancer Risks and Hazard Indices for On-Site Workers Exposed to Surface Soil

Source	Unprotect Workers[(1)]							
	Cancer Risk[a]				Hazard Index[b]			
	2006	2007	2009	2014	2006	2007	2009	2014
OB Unit	1E-06	4E-06	2E-06	1E-06	0.3	0.05	0.05	0.09
OD Unit	2E-06	4E-06	2E-06	8E-07	0.04	0.07	0.05	0.05
SF Unit	2E-06	(4)	4E-06	3E-06	0.2	(4)	0.1	0.1
All Soils	6E-06	1E-05	1E-05	7E-06	0.3	0.2	0.3	0.3
Source	**Protected Workers[(2)]**							
	Cancer Risk[a]				Hazard Index[b]			
	2006	2007	2009	2014	2006	2007	2009	2014
OB Unit	1E-06	4E-06	2E-06	1E-06	0.2	0.05	0.05	0.08
OD Unit	2E-06	4E-06	2E-06	7E-07	0.04	0.06	0.05	0.04
SF Unit	2E-06	(4)	4E-06	3E-06	0.2	(4)	0.09	0.1
All Soils	5E-06	1E-05	1E-05	7E-06	0.2	0.2	0.3	0.3
Source	**Future Outdoor Workers[(3)]**							
	Cancer Risk[a]				Hazard Index[b]			
	2006	2007	2009	2014	2006	2007	2009	2014
OB Unit	6E-06	2E-05	8E-06	6E-06	1	0.2	0.2	0.4
OD Unit	4E-06	9E-06	4E-06	2E-06	0.09	0.1	0.1	0.1
SF Unit	7E-06	(4)	2E-05	1E-05	0.8	(4)	0.4	0.5
All Soils	7E-06	1E-05	1E-05	9E-06	0.3	0.2	0.4	0.4

Notes:
1 - Unprotected workers head, hands, and forearms are assumed to be exposed.
2 - Protected workers are assumes to wear gloves and long sleeved shirts, only the head is assumed to be exposed.
3 - Default USEPA industrial worker.
4 - No surface soil samples were collected at the SF unit in 2007.
[a] – Target risk level of 1E-04.
[b] – Target hazard index of 1.

Table 2-13 SLERA – Summary of Ecological Screening Quotients[a]

Location	OB	OD	SF
OB Area	**1,878**[a]	-	-
OD Area	-	**579**[a]	-
SF Area	-	-	**1,050**[a]
North/East Unit Boundary	**9**[a] **(22)**[b]	**27**[a] **(73)**[b]	**12**[a] **(30)**[b]
South/West TEAD-N Boundary	**16**[a] (<1)[b]	**19**[a] **(2)**[b]	**16**[a] (<1)[b]
Grantsville Reservoir	<1 (<1)[b]	<1 (<1)[b]	<1 (<1)[b]
Rush Lake	**2.6**[a] (<1)[b]	**1.4**[a] (<1)[b]	**2.6**[a] (<1)[b]

[a]Bold print values are greater than the target ESQ of 1.
[b]Based on exclusion of winds from SE counter-clockwise through WNW.

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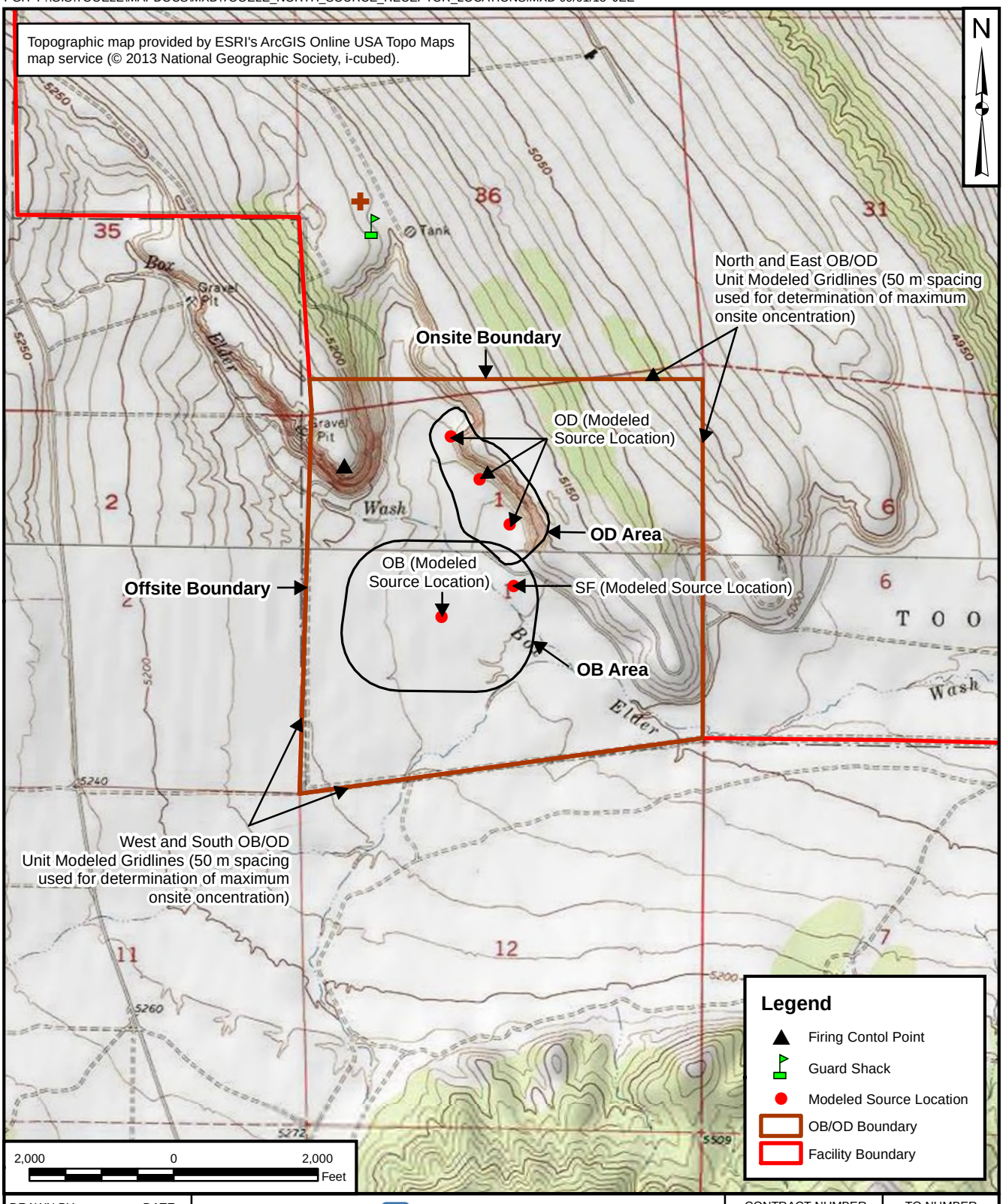

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CHECKED BY: B. JUPIN	DATE: 09/01/15	TEAD-NORTH OB/OD UNIT - SOURCE AND RECEPTOR LOCATIONS TOOELE, UTAH	APPROVED BY / DATE
REVISED BY	DATE		APPROVED BY / DATE
SCALE: AS NOTED			FIGURE NO.: FIGURE 2-1 / REV: 0

3.0 RISK MANAGEMENT STRATEGY

TEAD-N plans to implement the risk management strategy identified in this RMP to mitigate potential risks to human health and the environmental attributed to OB, OD, and SF operations. Section 2.0 identified potential risks, based on dispersion and risk modeling that were greater than target risk goals and warrant risk management measures. This section provides a discussion of the following methods to meet target risk goals:

- Waste treatment limits, and
- Wind direction exclusions

These methods are discussed in Sections 3.1 and 3.2, respectively.

3.1 WASTE TREATMENT LIMITS

Maximum OB/OD/SF treatment quantities will be implemented by TEAD-N to attain target risk goals. The following maximum treatment limits (commensurate with source scenarios used for air quality and risk remodeling) are proposed (based on implementation of wind direction exclusion risk management measures):

- OB
  1 hr = 6,000 lb NEW
  24 hr = 6,000 lb NEW/calendar day
  Quarterly = 360,000 lb NEW
  Annual = 360,000 lb NEW

- OD (including donor)
  1 hr = 7,500 lb NEW
  24 hr = 7,500 lb NEW/calendar day
  Quarterly = 765,000 lb NEW
  Annual = 765,000 lb NEW

- SF
  1 hr = 6,040 lb NEW
  24 hr = 6,040 lb NEW/calendar day
  Quarterly = 362,400 lb NEW
  Annual = 362,400 lb NEW

The maximum treatment quantities presented above (based on modeling/risk results) also provides the operational flexibility for the conduct of a combination of OB plus OD plus SF (each at the calendar day maximum treatment quantity) during the same calendar day but not during the same hour.

During each calendar day OB/OD/SF treatment would be limited to a 7-hour period starting at 1000 and any releases from treatment would end by 1659. Only one treatment source (i.e., OB,

OD, or SF) is allowed during a one hour period. Wind direction exclusions will also facilitate the treatment of OB (6,000lb NEW) plus OD (750lb NEW) or SF (6,040lb NEW) during the same hour.

Other waste stream limitations (e.g., munition-specific or chemical composition limits) are not necessary at this time to achieve target risk goals. However, wind direction exclusions for OB/OD/SF operations will be implemented as an additional risk management measure to facilitate the waste treatment limits specified and conformance to environmental performance standards.

3.2 WIND DIRECTION EXCLUSIONS

The air quality and risk remodeling results summarized in Section 2.0 indicates that the maximum offsite potential exposures/risks are expected to be associated with the south/west OB/OD Unit and TEAD-N boundaries. This situation can be attributed to the relative proximity of the OB, OD, and SF treatment area to the south/west boundaries. However, exclusion of OB/OD/SF treatment during certain wind directions (i.e., those for which the south/west boundaries are downwind of these sources) can be an effective risk management measure at TEAD-N.

The specified wind direction exclusions ensure compliance with the NAAQS for lead and PM2.5/PM10, with the exceptions of particulate emissions from OD operations. However, available air monitoring data suggests that these emission factors may significantly overestimate OD particulate emissions. In summary, available particulate monitoring data for Grantsville and Tooele do not demonstrate any significant contributions or impacts from OB/OD/SF sources at TEAD-N.

A summary of the relative contribution of exposure pathways to maximum risk at the south/west unit/TEAD-N boundary is provided in Table 3-1. It is evident that ingestion is the primary exposure pathway for chronic risks (i.e., HHRA-Hazard Index, HHRA-cancer risk and SLERA - ESQ). And inhalation is the pathway of concern for the acute (1-hr) exposure for the HHRA - AHQ.

The source-specific and location-specific maximum concentrations as well as maximum deposition tables for the south/west unit/TEAD-N boundary (presented in Appendix A – Attachment 17a of this RMP) were evaluated to determine the potential for risk reduction by excluding a select set of wind directions (i.e., OB/OD/SF operations would not be conducted for these excluded directions). Since air pathway remodeling results are presented for individual years in the 1991-1995 period, the year with the maximum annual air concentrations and maximum annual deposition rate for the south/west unit/TEAD-N boundary was selected (i.e., 1992). The maximum air concentrations tables and associated modeling output files were used to characterize potential inhalation exposures. Maximum deposition tables and associated modeling output files were used to characterize potential ingestion exposures. Based on this approach, a summary of risk reduction factors is presented in Table 3-2 that would reduce risk to target goals identified in Section 2.0.

The risk reduction factors presented in Table 3-2 are based on excluding OB/OD/SF treatment during winds coming from the southeast counter-clockwise through west-northwest. These

excluded wind directions are equivalent to winds flowing towards (i.e., wind vectors) the northwest counter-clockwise through east-southeast sectors. Figure 3-1 illustrates the effected sectors that would be characterized by reduced/ minimal risk based on implementation of wind direction exclusion measures.

This risk mitigation approach would also significantly reduce risks from OB/OD/SF operations for areas further downwind from the south/west unit /TEAD-N boundary including a major portion of the drainage basins for Rush Lake and Grantsville Reservoir, as well as the Stockton population center (see Figure 3-2). However, exposures for non-excluded sectors would increase by a factor of about 2.4. This increase has been accounted for in the tables presented in Section 2.0.

The locations of the two onsite meteorological towers at the OB/OD Unit are identified in Figure 3-3. Instructions for implementing and documentation of wind direction exclusion measures are provided in Enclosure 2. The instructions and the Demilitarization Approval Form are subject to change and the current version can be obtained from the TEAD-N Environmental Management Division.

A wind rose (illustrating the frequency from which winds are coming from) based only on hourly wind data for the time period of 1000-1600 hours (i.e., candidate treatment hours). Seasonal and monthly wind frequencies are included in Enclosure 3. Table 3-3 presents a summary of the frequencies for excluded winds (i.e., southeast counter-clockwise thru west-northwest). The annual frequency for wind directions excluded is 59 percent (i.e., 0.59 x 365 days/yr = 215 days) with only minor seasonal variations. Therefore, during a typical year the number of candidate OB/OD/SF treatment days is expected to be approximately 150 (i.e., 365 days - 215 days = 150 days) versus the 210 days needed (60 days for OB, 90 days for OD and 60 days for SF) for maximum allowable treatment quantities specified in Section 3.1. However, as indicated in Section 2.0, the maximum OB/OD/SF quarterly and annual treatment quantities can still be achieved because a combination of OB, OD, and SF (all at maximum calendar day treatment limits) can be conducted during the same calendar day.

The maximum cancer risks, HIs and AHQs based on the HHRA remodeling will meet target risk goals at all locations as indicated in Section 2.0 based on exclusion of winds coming from the east counter-clockwise through west-northwest. As indicated in Section 2.3.5 target risk goals, based on remodeling and 2006, 2007, 2009 and 2014 soil sampling results, are expected to be met for OB/OD Unit workers (that are involved in pre-treatment and post-treatment activities within the Unit). The target risk goal of 10^{-4} can be met for the unprotected worker. However, the OB/OD workers are required by TEAD-N to wear a long-sleeved shirt and pants as well as gloves. Therefore, the expected risk for the "protected" OB/OD Unit worker is the equivalent to the target risk for the general public (i.e., less than 1E-06).

The maximum ecological risks (as characterized by ESQ values) will meet target goals at offsite locations, as indicated in Section 2.0, based on exclusion of winds from the east counter-clockwise through west-southwest. However, the maximum ESQ is 2 at the south/west Unit/TEAD-N boundary with wind direction exclusions for OB/OD/SF treatment (compared to a maximum ESQ of 21 without wind exclusions) this represents a significant risk reduction that approaches the target goal of ESQ = 1 and may actually be lower based on the results of the refinement analysis. Environmental screening quotients greater than one at the OB/OD/SF treatment areas and the

north/east OB/OD Unit boundary can be characterized as disturbed habitats that are not associated with protected or endangered ecological receptors.

Table 3-1 Summary of Exposure Pathway Contributions to Maximum Risk, Fraction (South/West Unit/TEAD-North Boundary)

Maximum Exposure Type Receptor	Inhalation	Ingestion	Total
HHRA – Hazard Index (annual)	2.8E-02	9.7E-01	1.0E+00
HHRA – Cancer Risk (annual)	6.0E-02	9.4E-01	1.0E+00
HHRA – AHQ (1-hr)	1.0E+00	-	1.0E+00
SLERA – ESQ (annual)	-	1.0E+00	1.0E+00

Table 3-2 Summary of Risk/Hazard Reduction Factors[a], Fraction (South/West Unit/TEAD-North Boundary)

Exposure Pathway	OB	OD	SF
Inhalation (1-hr)[b]	7E-01	5E-01	8E-01
Inhalation (24-hr)[c]	4E-01	5E-01	6E-01
Inhalation (quarterly) [d]	2E-02	9E-02	5E-03
Inhalation (annual)[e]	4E-02	7E-02	3E-02
Ingestion (annual)[e]	2E-02	4E-02	2E-02

[a]Based on excluding winds from SE counter-clockwise thru WNW (equivalent to winds going towards the W counter clockwise through ESE sectors).
[b]Applicable to HHRA – AHQ.
[c]Applicable to PM2.5 – 24 hr and PM10-24 hr
[d]Applicable to lead-quarterly average.
[e]Applicable to PM2.5 – annual, HHRA – HI, HHRA - Cancer Risk and SLERA – ESQ.

Table 3-3 Summary of Excluded Wind Frequencies[a], Percent (applicable to OB, OD, and SF)

Wind Direction (direction wind is coming FROM)	Wind Vector (sector wind is going TOWARD)	Spring (March-May)	Summer June-August	Fall (September-November)	Winter (December-February)	Annual
SE	NW	1.52	1.77	2.48	1.84	1.90
ESE	WNW	1.09	0.93	1.10	0.76	0.97
E	W	0.68	0.93	0.72	0.70	0.76
ENE	WSW	1.40	1.58	1.16	1.05	1.30
NE	SW	4.94	3.88	3.17	3.90	3.97
NNE	SSW	9.94	12.67	10.93	11.05	11.15
N	S	15.59	18.39	16.08	10.36	15.12
NNW	SSE	12.48	12.64	13.85	9.00	12.00
NW	SE	9.38	5.28	7.91	9.82	8.09
WNW	ESE	4.01	2.55	3.17	3.77	3.37
Total		61.03	60.62	60.57	52.25	58.63

[a]Based on 1991-1995 data for NWS-Salt Lake City (wind direction adjusted clockwise one 22.5 degree sector to better approximate TEAD-N conditions).

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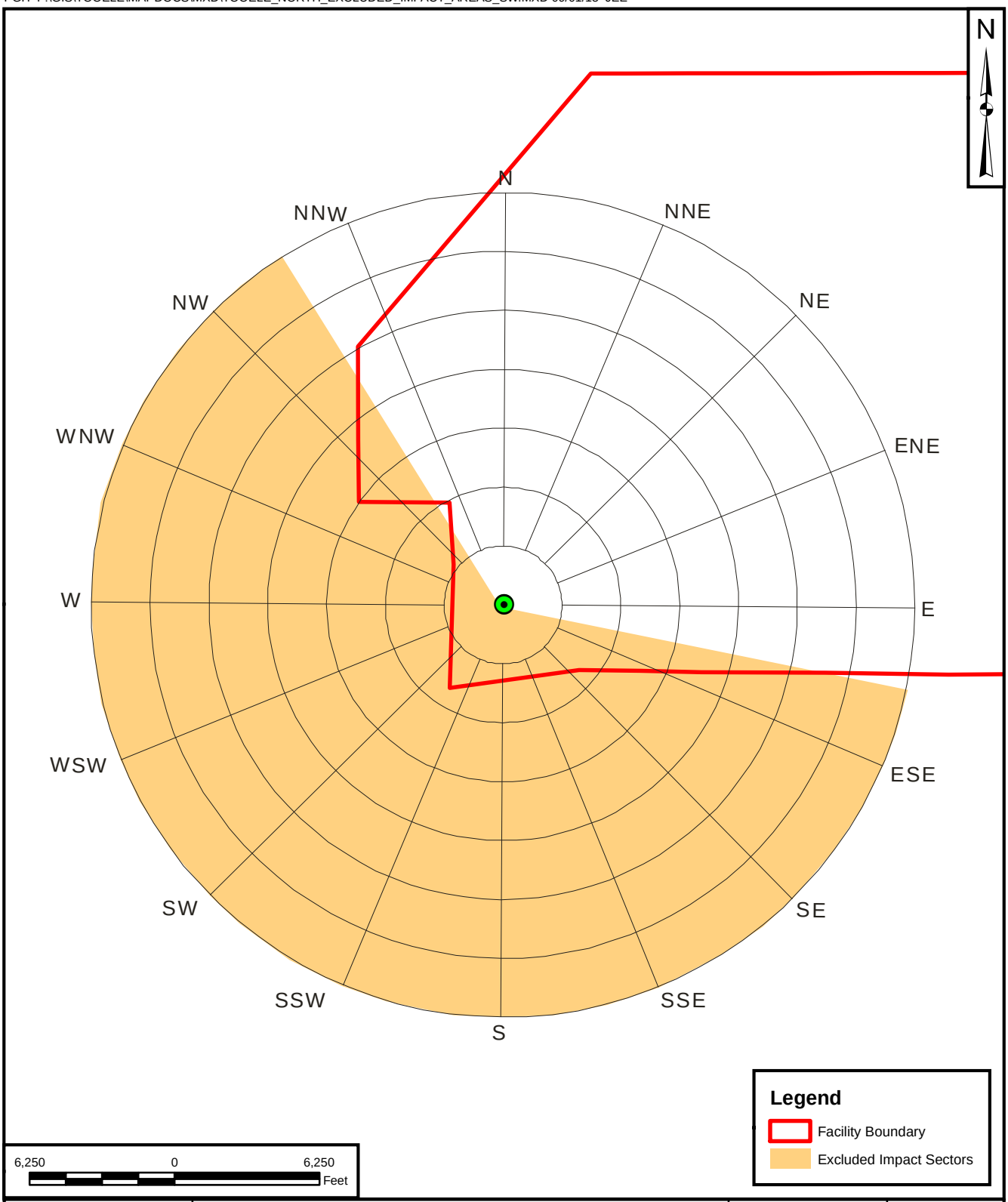

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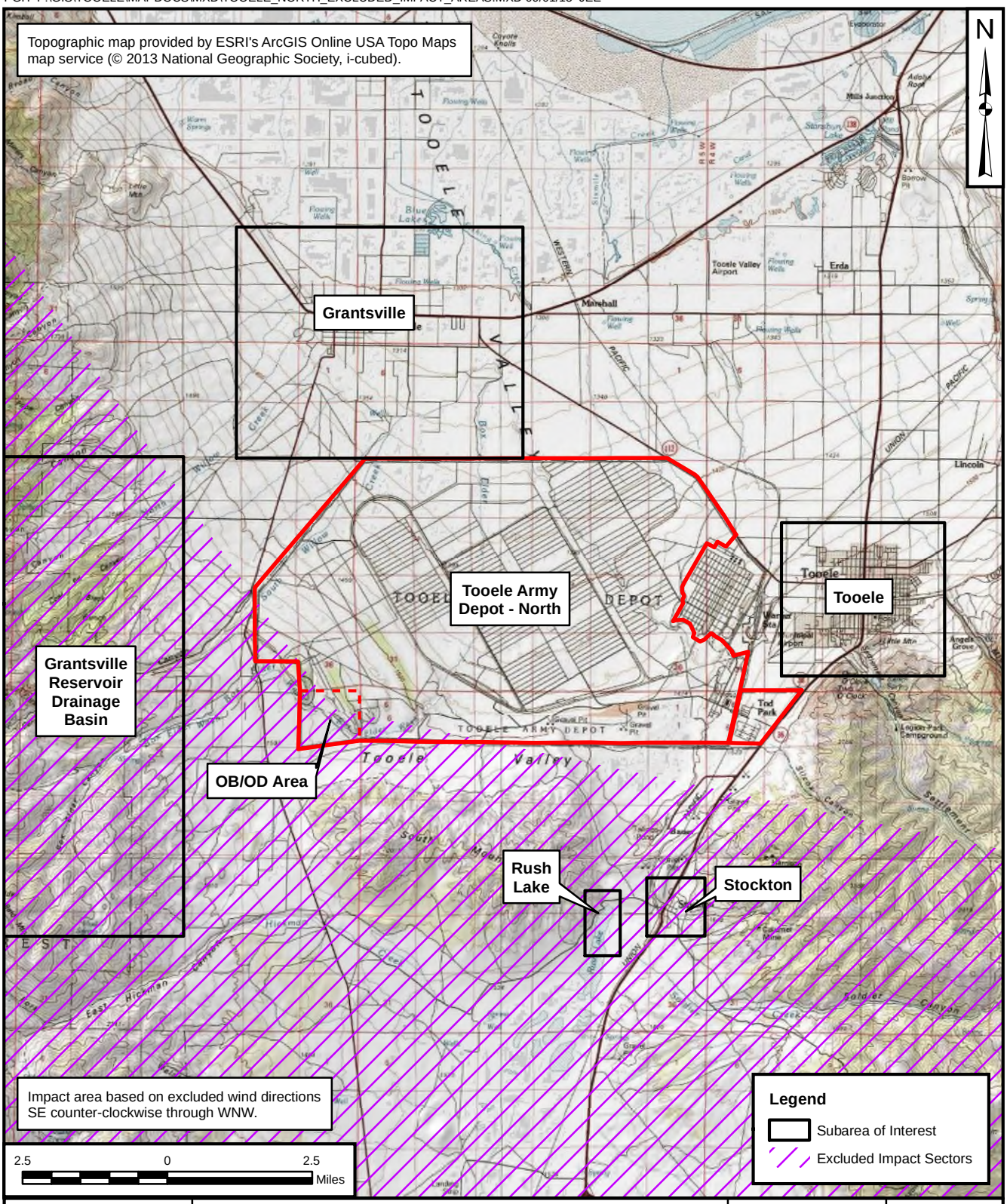

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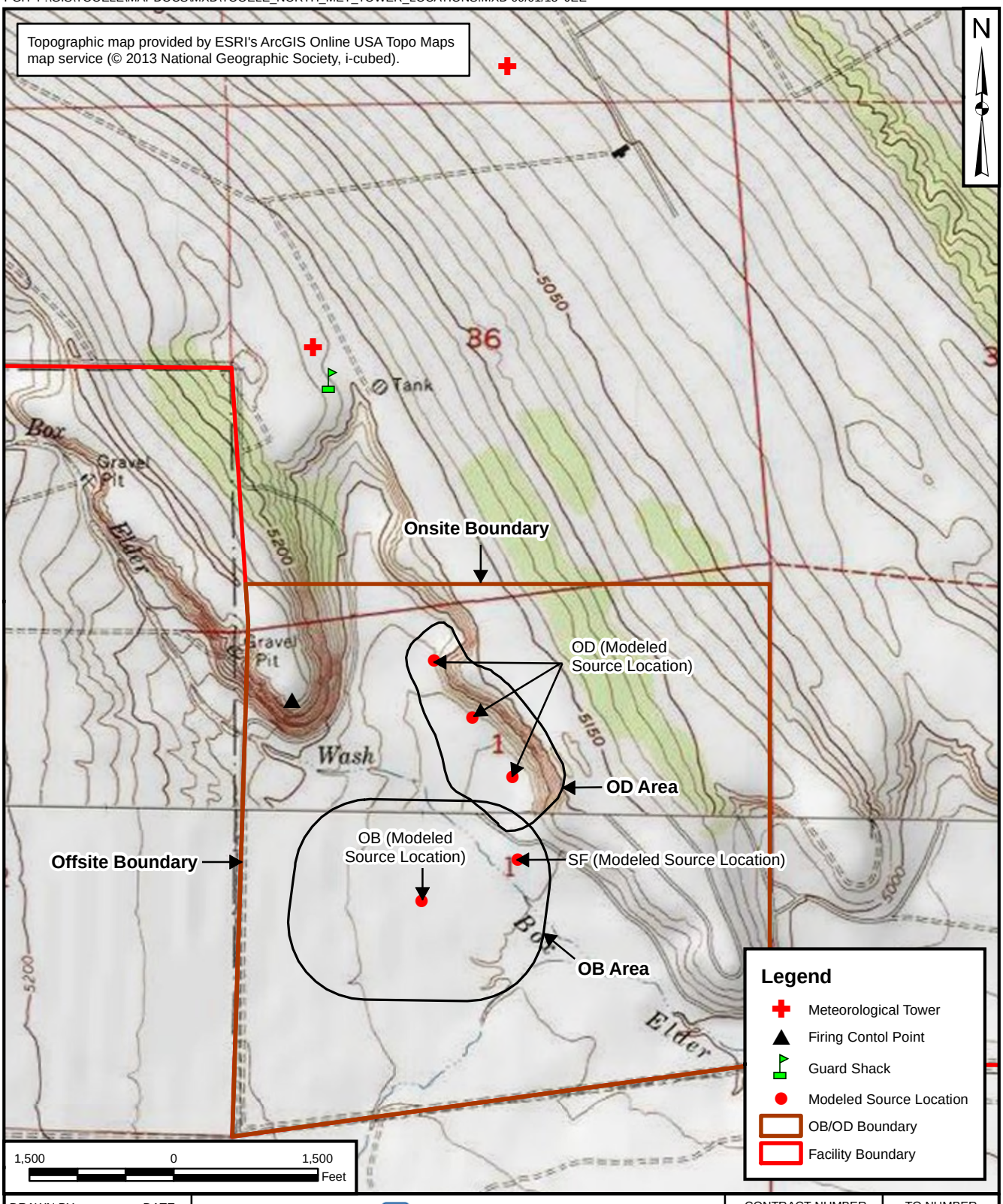

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REVISED BY: ___	DATE: ___			APPROVED BY: ___	DATE: ___
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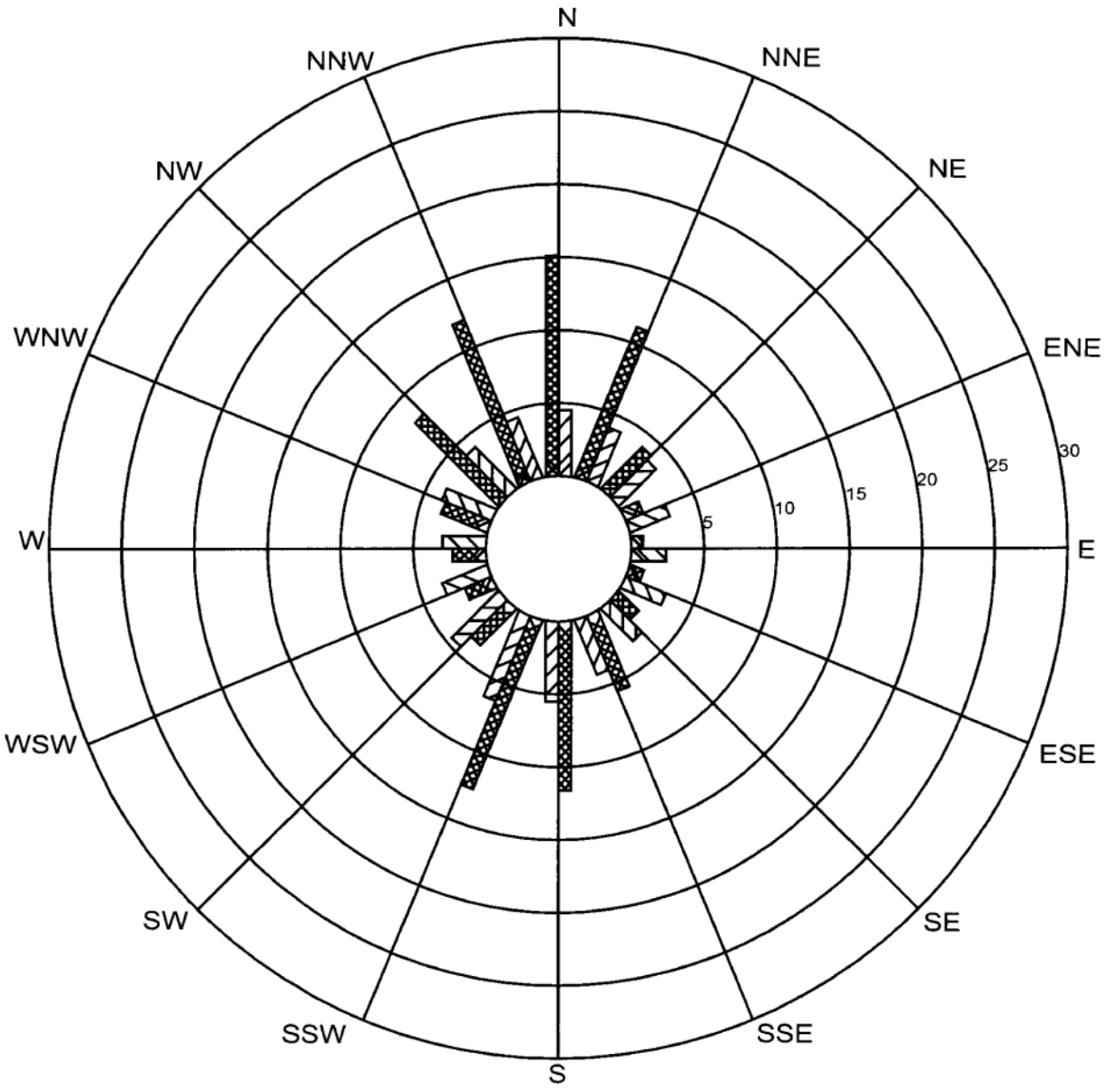

Wind Direction Frequency (Percent)

Mean Wind Speed (M/Sec)

January - December 1991 - 1995
1000 through 1600 hours

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REVISED BY: ___	DATE: ___			APPROVED BY: ___	DATE: ___
SCALE: AS NOTED				FIGURE NO.: FIGURE 3-4	REV: 0

4.0 RISK REEVALUATION UPDATES

Soil sampling and groundwater monitoring to support the OB/OD Permit Application were conducted in 1997-1998. The air pathway assessment/dispersion modeling, HHRA, and SLERA were conducted in 2002 to support the Permit Application. Soil sampling of the OB/OD Unit was conducted in 2006 to support Permit requirements and additional soil sampling and groundwater monitoring were conducted in 2007 and 2009. Remodeling/reevaluation of the air quality assessment, HHRA and SLERA were conducted in 2008 to support preparation of this RMP.

Section 4.1 provides recommendations for the scope of annual TEAD-N risk management reviews and Section 4.2 addresses the scope risk assessment/management reevaluations to support UDEQ reviews and renewal/modification of the Permit modification.

4.1 ANNUAL RISK MANAGEMENT REVIEWS

Available soil sampling and groundwater monitoring data for the OB/OD Unit (as presented in the Permit Application, as well as 2006, 2007, 2009, and 2014soil sampling data) characterize the cumulative impacts of over 50 years of operations (US Army, August 2006; TtNUS, 2007, 2010, and 2015). As can be expected the immediate OB/OD/SF treatment areas can be considered as disturbed, but not critical, ecological habitats. With minimal protective clothing, the OB/OD Unit workers are not exposed to unacceptable risk from soils in treatment areas. Furthermore, recent risk modeling indicates that implementation of waste treatment limits and wind direction exclusions for treatment operations would mitigate onsite and offsite risks to meet HHRA target goals.

Previous studies of the hydrogeology of the OB/OD Unit (including groundwater monitoring data) have concluded that there is a low potential for contaminant migration from surface and subsurface soils at the OB, OD, and SF treatment areas to groundwater (U.S. Army, November 1996). Factors that support this conclusion include the following:

- Over 600 ft to groundwater
- Excess evaporation over precipitation (minimal infiltration potential)
- Alkaline nature of soil (i.e., minimal potential for infiltration of metals)
- Soils with low to moderate infiltration properties for other types of potential contaminants
- No contaminants-of-potential-concern (COPCs) based on cumulative impacts of over 50 years of OB/OD Unit operations
- Nondetection of energetics based on groundwater monitoring data (i.e., cumulative impacts of over 50 years of OB/OD Unit operations

- Groundwater modeling results indicate that the most rapidly migrating contaminants (e.g., cyanide, thallium, 2,4-DNT, HMX, nitrobenzene, and 2,4,6-TNT) would not migrate to groundwater for over 125-200 years. Other potential contaminants would need thousands of years to reach groundwater.

- Information regarding the modeled time duration for RDX to reach groundwater is presented in Enclosure 4.

Therefore, annual soil sampling and groundwater monitoring at the OB/OD Unit are not warranted. However, limited soil and groundwater monitoring to support UDEQ review and renewal of the Permit will be conducted as noted in Section 4.2.

Based on the above considerations, limited annual OB/OD risk management reviews are recommended to include the following:

- Review of the most recent one-year period of PM2.5 monitoring data (as available from the UDEQ web site) relative to concurrent TEAD OB/OD/SF treatment operations to determine potential TEAD-N impacts. The same approach used in Attachment 17a – OB/OD Unit Air Modeling, will be used to determine the potential for TEAD-N impacts. The strategy is to review wind conditions and concurrent TEAD-N OB/OD/SF operations for 24-hr PM2.5 exceedance events at Tooele. The potential for other source contributions to these exceedance events will also be evaluated considering location/distance relative to the Tooele monitoring station.

- Review of OB/OD/SF treatment records and associated meteorological data to determine the effectiveness of utilizing onsite meteorological to ensure compliance with wind direction exclusions for treatment operations and to identify revised risk management procedures, as warranted. This would consist of reviewing the following Enclosure 2.

  + Wind direction/time used for a “go” treatment decision

  + Actual wind direction/time during a treatment event

  + Actual wind directions 15 min following a treatment event

Based on the action items listed above, appropriate revisions to the RMP would be identified and, with the concurrence of UDEQ, implemented.

4.2 PERMIT REVIEW AND RENEWAL RISK MANAGEMENT REEVALUATION

Risk management reevaluation to support UDEQ Permit reviews (5 years after permit issuance) and renewals (10 years after permit issuance) will include the same scope recommended for annual

reviews. In addition the following reevaluations will also be conducted to support UDEQ Permit reviews and renewals pursuant to Permit Modification Module VI:

- Limited surface soil sampling at the OB, OD, and SF treatment areas based on a sampling and analysis plan (SAP) developed by TEAD-N with UDEQ concurrence.

- One round of groundwater monitoring based on a SAP developed by TEAD-N with UDEQ concurrence.

- Preparation of a sampling and analysis report to include the following:

  + Statistical summary of soil and groundwater monitoring data

  + Comparison of sampling results to human health and ecological screening criteria to identity COPCs

  + Use of OB/OD Unit soil sampling and groundwater monitoring data for COPCs as input to applicable risk models (remodeling results have confirmed that the air pathway is not significant compared to ingestion) to characterize risk at the Unit. Updated models should be used if there have been significant changes to the modeling protocol relative to the previous modeling.

- The need for reevaluation (such as reinterpretation or scaling of previous modeling results) and /or remodeling of offsite receptors should be determined if significant changes have occurred for the following factors:

  + Toxicity data for COPCs
  + Modeling protocols/models
  + Maximum treatment quantities
  + Waste streams
  + Source scenarios
  + OB/OD Unit particulate emission impacts based on Tooele air monitoring exceedances for PM2.5
  + Need for revisions to risk management strategies

- If reevaluation of risk is warranted based on the above factors, a brief land use description update (for the local TEAD-N area) will be included with remodeling results (similar to the approach used for Attachment 17b – HHRA) as background information for the risk assessment. The RMP is based on meeting target risk goals at the TEAD-N boundary. Therefore, this conservative approach ensures that target risk goals are also met for potential receptors at greater distances from the OB/OD Unit regardless of land use and encroachment.

Based on all of the action items discussed in this subsection, the RMP will be revised and implemented with the concurrence of UDEQ.

5.0 SUMMARY

The air dispersion modeling, human health risk assessment and ecological risk assessments presented in the Permit Application have been updated commensurate with the TEAD-N OB/OD Unit Risk Management Action Plan. This reevaluation was based on revised maximum OB, OD, and SF maximum treatment quantities identified by TEAD-N. Target risk goals will be achieved, based on this reevaluation, with the following exceptions:

- PM10 – 24 hours
  - + South/west OB/OD Unit /TEAD-N boundary
  - + Grantsville
  - + Tooele
  - + Stockton

- PM2.5 – 24 hours
  - + South/west OB/OD Unit /TEAD-N boundary
  - + Grantsville
  - + Tooele
  - + Stockton

- SLERA – Ecological Screening Quotient
  - + OB, OD, and SF treatment areas
  - + North/east OB/OD Unit boundary
  - + South/west OB/OD Unit/TEAD-N boundary

The exceedances of target risk goal levels will be mitigated by compliance with source-specific maximum treatment quantities that have been identified by TEAD-N, as necessary to meet mission needs. Other waste stream limitations (e.g., munition-specific or chemical composition limits) are not necessary at this time to achieve target risk goals.

The exceedances of target risk goal levels of the south/west OB/OD Unit/TEAD-N boundary represent maximum potential offsite risks. Review of current land use for adjacent offsite areas indicate there are no nearby residents or farms (i.e., potential long-term exposure receptors are not present). However, TEAD-N will implement wind directional criteria to exclude OB/OD/SF treatment when winds are coming from the southeast counter-clockwise thru west-northwest (i.e., winds flowing toward the south/west Unit/TEAD-N boundary). This approach is expected to mitigate risks to achieve target risk goals, with the exception of PM2.5 and PM10. Available local air monitoring data (e.g., from Grantsville and Tooele), however, suggests that the particulate emission factors used for remodeling (based on OD field tests at Dugway Proving Grounds) significantly overestimated OD particulate emissions and demonstrate that TEAD-N impacts are insignificant.

Risk reduction updates to the RMP will consist of annual risk management reviews and a more comprehensive risk management reevaluation when needed to support Permit renewal. Annual reviews will be conducted of PM2.5 monitoring data for Tooele and wind direction data for OB/OD/SF operations to determine if revisions to the RMP are warranted. Annual soil sampling

and groundwater monitoring are not warranted based on low contaminant migration rates. However, risk reevaluation and/or remodeling for future treatment scenarios may be warranted to support UDEQ Permit review (5 years after permit issuance) and renewal (10 years after permit issuance) if maximum treatment quantities are increased and/or there are significant changes in modeling protocols. In addition, one round of soil sampling and groundwater monitoring will be conducted (every 5 years) to support Permit renewal in order to provide data for comparison to screening criteria and/or to characterize risk inputs for risk remodeling.

6.0 REFERENCES

U.S. Army, November 1996. Tooele Army Depot-North Area Position on Groundwater Monitoring at the OB/OD Unit. Tooele Army Depot, UT.

U.S. Army, August 2006. Sample Results Report for RCRA Subpart X Permit OB/OD Area. Tooele Army Depot, UT.

U.S. Army, November 2006. OB/OD Risk Management Action Plan. Tooele Army Depot, UT.

TtNUS, 2007. Sample Results Report for RCRA Subpart X Permit OB/OD Area at Tooele Army Depot Tooele, Utah. December.

TtNUS, 2010. Sample Results Report for RCRA Subpart X Permit OB/OD Area at Tooele Army Depot Tooele, Utah. April.

TtNUS, 2015. Sample Results Report for RCRA Subpart X Permit OB/OD Area at Tooele Army Depot Tooele, Utah. February.

USEPA (U.S. Environmental Protection Agency), August 1999. Screening level Ecological Risk Assessment protocol for Hazardous Waste Combustion Facilities. Office of Solid Waste, Washington, D.C.

USEPA (U.S. Environmental Protection Agency), September 2005. Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities. Office of Solid Waste, Washington, D.C.

ENCLOSURES

Enclosure 1

Information to Support TEAD-North OB Treatment of Ammonium Perchlorate and Double Base Propellants at the Same Time

Information to Support TEAD-North OB Treatment of Ammonium Perchlorate (AP) and Double Base (DB) Propellants at the Same Time

TEAD-N may use OB to treat AP and DB propellants during the same treatment event but the total combined treatment quantity would be limited to 6,000 lb per treatment event and treatment day (i.e., the maximum treatment quantity specified in the Draft Final Risk Management Plan (RMP) – October, 2007). Following are the emission factors (EFs) and associated Acute Inhalation Hazard Quotients (AIHQs) based on the RMP that provide support for this operational flexibility.

+ EFs for Contaminants of Concern (based on AP and DB propellants)

- OB (generic - means)
  Pb = 9.30E-03
  HCl = 2.15E-01
  Cl2 = 6.90E-03

- OB (generic - max.)
  PB = 1.30E-02
  HCl = 2.20E-01
  Cl2 = 9.20E-03

- AP (Al)
  PB = 0.00E+00
  HCL= 2.10E-01
  Cl2 = 4.60E-03

- AP (nonAL)
  PB = 0.00E+00
  HCl = 2.20E-01
  Cl2 = 9.2 E-03

- DB (DPG)
  PB = 5.60E-03
  HCL= 0.00E+00
  Cl2 = 0.00E+00

- DB (Sandia)
  PB = 1.30E-02
  HCl= 0.00E+00
  Cl2 = 0.00E+00

+ AIHQs (max. onsite & offsite without wind direction restrictions)

- OB (generic – means)
  PB = 6.0E-01
  HCL = 1.0E+00
  Cl2 = 3.0E-01
  Total = 1.9E+00

- OB (generic – max.)
  Pb = 8.4E-01
  HCl = 1.0E+00
  Cl2 = 4.5E-01
  Total = 2.3E+01

- AP (Al)
  Pb = 0.0E+00
  HCl = 1.0E=00
  Cl2 = 2.3E-01
  Total = 1.2E+00

- AP (nonAl)
  Pb = 0.0E+00
  HCl = 1.0E+00
  Cl2 = 4.5E-01
  Total = 1.5E+00

- DB (DPG)
  Pb = 3.6E-01
  HCL = 0.0E+00
  Cl2 = 0.0E+00
  Total = 3.6E-01

- DB (Sandia)
  Pb = 8.4E-01
  HCl = 0.0E+00
  Cl2 = 0.0E+00
  Total = 8.4E-01

The AIHQs presented above do not account for OB treatment wind direction exclusions proposed in the RMP. However, target AIHQ risk levels (1.0 or less) would be attained at all offsite locations, as well as at nearby onsite receptor locations (i.e., the Guard Shack and Firing Control Point), based on RMP wind direction exclusions. These AIHQ results (based on a treatment quantity of 6,000 lb per event) also indicate that OB treatment of AP propellant is associated with a higher AIHQ compared to DB propellant. Therefore, if both AP and DB are open burned at the same time (but the total combined treatment quantity remained at 6,000 lb) the AIHQ would be less than based on treatment of 6,000 lb of only AP propellant. Also, a 95

percentile upper confidence limit of the mean emission factors will be used to calculate AIHQs for inclusion in the RMP.

Enclosure 2
TEAD Demilitarization Approval Form

DEPARTMENT OF THE ARMY
TOOELE ARMY DEPOT
TOOELE, UT 84074-5000

JMTE-RMD-EM DRAFT

MEMORANDUM FOR SEE DISTRIBUTION

SUBJECT: Environmental Management Division Policy Statement No. 5 – Wind Condition Monitoring and Completion of the Demilitarization Approval Form

1. The Demilitarization Approval Form, enclosure 1, will be completed as follows;

   a. The block of information entitled "Forecast Meteorological Conditions Initial Go Decision" shall be completed with information obtained from: the Salt Lake City National Weather Services (http://nimbo.wrh.noaa.gov/slc) or from AccuWeather (http://accuweather.com). The time the forecast is obtained will be recorded.

   b. The wind direction 15 minutes before, during, and 15 minutes after the treatment event shall be observed for each treatment event that takes place in a given day. The block of information entitled "Wind Direction Information" shall be completed as follows;

      - The section titled "Wind Direction 15 Minutes Prior to Treatment" will be completed for each event by indicating which tower (tower 1 must be used if it is operable and, if not, tower 2 will be used) the weather data is obtained from. The event number shall be recorded. The time each event is initiated shall be recorded. For open detonation or static fire, the event begins when the first button is pushed initiating the munitions in the first pit or silo. Open burning the event begins when the time fuse is initiated. The range of wind direction (i.e. 180 – 225 or S - SW) is recorded for the 15 minutes prior to the time recorded for the start of treatment. A yes or no is recorded if any excluded wind direction is observed during the 15 minutes prior to treatment. However, to ensure the wind direction is appropriately stable as specified in Condition VI.C.1.e.iv of the Hazardous Waste Permit, no excluded winds should be observed during this time frame.
      - The section titled "Wind Direction During Treatment" will be completed similarly to the 15 minutes prior to treatment. No action need be taken if an excluded wind is observed. This information will be used to assist in the evaluation of any complaints that might be received due to treatment activities.
      - The section titled "Wind Direction 15 Minutes After Treatment" will be completed similarly to the 15 minutes prior to treatment. No action need be taken if an excluded wind is observed. This information will be used to assist in the evaluation of any complaints that might be received due to treatment activities.

   c. The block of information entitled "Meteorological Approval Criteria" is used to determine if the weather conditions above are within the Hazardous Waste Permit, Army policy and the SOP.

   d. The block of information entitled "Notifications" identifies those organizations that will be notified, unless they are nonresponsive, prior to treatment. The person contacted for each organization listed and the time contacted must be identified in the specified location.

e. The block of information entitled "Item Data" will identify the NSN, Common Name and Quantity for each munition item placed in each pit, pan or silo. The NEW of the munition will be specified in either the "NEW lbs*" column if it is the waste munition to be treated or in the "Donor NEW lbs" column if it is used to initiate the waste munition that is being disposed of. The NEW including donor shall not exceed 750 lbs/pit or 7,500 lbs/day for Open Detonation (OD); 1,000 lbs/pan or 6,000 lbs/day for Open Burning (OB); or 6,040 lbs/day for Static Fire (SF). Only one treatment source (i.e., OB, OD or SF) is allowed during any one hour period, except 750 lbs may be OD during the same hour of an OB or SF event.

2. After reviewing the weather forecast and the initial determination is made to proceed to the range for treatment, the wind speed will be monitored the fifteen minutes before treatment to ensure compliance with the permit conditions. The wind speed shall be a minimum of three miles per hour and a maximum of twenty miles per hour, with gusts up to thirty miles per hour during that fifteen minute period. Once treatment has commenced treatment operations will not cease for incidental fluctuations in the wind speed, in or out of the permitted conditions.

3. Contact the EMD at extension 3504 for assistance/clarification, if needed.

THOMAS A. TURNER
Director, Risk Management

DEMILITARIZATION APPROVAL FORM

DATE:_____

FORECAST METEOROLOGICAL CONDITIONS INITIAL GO DECISION

Source	Wind Speed	Wind Dir Surface	Wind Dir Aloft	Cloud Cover	Ceiling	Clearing Index	Visibility	% Chance Precip	% Chance Thunder
NWS									
Accu-Weather									

Time Completed:_____

WIND DIRECTION INFORMATION

WIND DIRECTION 15 MINUTES PRIOR TO TREATMENT

Location*		Event	Time at Start of Treatment	WD Range During 15 Minute Period Prior to Treatment	Any Excluded WD Occurrence (yes/no)**
Tower					
Tower					
Tower					

WIND DIRECTION DURING TREATMENT

Location*		Event	Time at Start of Treatment	WD Range During Treatment	Any Excluded WD Occurrence (yes/no)**
Tower					
Tower					
Tower					

WIND DIRECTION 15 MINUTES FOLLOWING TREATMENT

Location*		Event	Time at End of Treatment	WD Range During 15 Minute Period Following Treatment	Any Excluded WD Occurrence (yes/no)**
Tower					
Tower					
Tower					

*Indicate which tower 1 or 2 data is being taken from. Tower 1 should be used, unless it is out of service.
**No 1-minute average Excluded Wind Direction, see criteria below, may occur during the 15 minute period prior to treatment.

METEROLOGICAL APPROVAL CRITERIA

Criteria	Limitation	Criteria	Limitation
Allowable Wind Speed	3-20 MPH/Gusts to 30 MPH	% Chance Thunder	< 50%
Clearing Index	>500	Wind Directions	Change in wind direction from surface wind to winds aloft shall be 120 degrees or less
Cloud Cover*	< 80%		
Ceiling*	> 2,000 feet		
% Chance Precipitation	< 75%	Excluded Wind Directions	WNW clockwise thru SE or 292 degrees clockwise thru 135 degrees
Visibility	1 Mile		

* Cloud cover and ceiling limits are in conjunction with each other. Operations shall not be carried out when the cloud cover is greater than 80 % and the cloud ceiling is less than 2,000 feet.

NOTIFICATIONS

Office	Phone #	Person Contacted	Time Contacted
Commander's Office	2211		
Ammo Equip & Manufacturing	5053		
Security	2314/2501		
Environmental Management Div	3504		
Safety Division	3486/3888		
Fire Department	2015/2001		
Tooele County Health Dept	843-2340/882-5600*		

* Use this phone number during the hours of 1300 to 0800.

ITEM DATA

NSN/Nomenclature	Quantity	Pit/Pan/Silo	NEW lbs*	Donor NEW lbs	Treatment Time**

* NEW including donor shall not exceed 750 lbs/pit or 7,500 lbs/day for OD; 1,000 lbs/pan or 6,000 lbs/day for OB; or 6,040 lbs/day for SF. Only one treatment source (i.e., OB, OD or SF) is allowed during any one hour period, except 750 lbs may be OD during the same hour of an OB or SF.
** During each day OD/OB/SF treatment is limited to a 7-hour period starting at 1000 and any releases from treatment would end by 1659.

FORM PREPARED BY

Signature _____ Title _____ Date _____

APPROVAL

I certify that the munition items listed above cannot be safely treated by any other means and the weather conditions are within permit and Army requirements for Open Burning and Open Detonation.

Signature _____ Title _____ Date _____

JMTE-AOD 25 February 2010

SUBJECT: Letter of Instruction (LOI) for Determining Meteorological Conditions to Conduct Demilitarization Range Activities.

1. **WIND SPEED FOR BURNING:** 3-20 MPH/GUSTS TO 30 MPH
2. **WIND SPEED FOR DETONATION:** 3-15 MPH/GUSTS TO 20 MPH.
3. **CLOUD COVER:** (SEE NOTE) <80%
4. **CEILING:** >2000 Feet
5. **PRECIPITATION:** <75%
6. **THUNDERSTORM:**<50%
7. **CLEARING INDEX:** >500
8. **VISIBILITY:** MINIMUM 1MILE
9. **WIND SHEAR:** Difference in wind direction at surface and 10,000 feet, will be as listed below:
   Equal to or less than 80 degrees: GO
   Equal to 81 degrees to 120 degrees: Division Chief or Director of DALE will make decision of **GO/NO-GO**
   Greater than 120 degrees: NO-GO

NOTE: Cloud cover and ceiling limits are in conjunction with each other. Operations shall not be carried out when cloud cover is greater than

4. Weather towers located on TEAD will be used in conjunction with the forecast to help in determination *GO/NO-GO* weather conditions. They will be monitored throughout the day to assist in verifying that weather conditions have not deteriorated from a **GO** condition.

5. After a **GO** has been given for demilitarization activities to be conducted, the Demil Leader will monitor the weather on site, if conditions deteriorate or unforeseen weather conditions arise will the Demil Planner will be notified.

6. All weather information will be recorded on the "Daily Meteorological Form" for the days that Demilitarization Activities are conducted.

Keith Siniscalchi
Director of Ammunition Operations

CONCUR/NON-CONCUR

THOMAS A. TURNER
Chief, Environmental Management Office

JMTE-AOD 25 February 2010

MEMORANDUM FOR Ammunition Operation Employees

SUBJECT: Letter of Instruction (LOI) for Determining Meteorological Conditions to Conduct Demilitarization Range Activities.

1. Reference: AMC-R 755-8; Hazardous Waste Storage, Incineration and Open Burn/Open Detonation Permit (dated 30 Sept 2005)

2. Purpose is to set procedures and standards to assist in making determination for *GO/NO-GO* of weather conditions to allow Demilitarization Activities on Range.

3. The following procedures will be utilized to make weather determinations.

a. Using the following internet sites, National Weather Service www.wrh.noaa.gov/slc and Accuweather www.accuweather.com.

b. All information used in making determination of weather conditions will be printed and filed.

c. Upon entering each Internet site, enter **Zip Code "84074"**, click **"Go"**, bring up and print the Local forecast. This will give you information such as **"wind speed and direction"**, **"chance of precipitation"** and "visibility".

d. National Weather Service website- enter **Zip Code**, click **"Go"**, print the forecast. **Click back**; Clearing Index: in the left column under **"Forecasts"** click on **"Fire Weather"**, place pointer over tab **"Forecasts/Outlooks"** go to the bottom of the drop down to **"Local"**. Folow link to the right and click on **"Clr Indx Forecast Table"**. Enter the **Latitude 40.503188'** and **Longitude 112.481294'** click **"Go", or** zoom in on the map all the way until the outline of TEAD is shown; with the pointer click on the very most **South West Corner** of the depot. Click **"Back"** twice and return to **"Forecasts/Outlooks"** go to the bottom of the drop down to **"Local"**. Folow link to the right and click on **"SLC winds aloft from current sounding"**; this will assist in determining if there is a **"Wind Shear"** for Open Detonation Activity. In the event that the **"Clearing Index Forecast Table"** is NOT operational- **"Air Quality Basin I Average Index"** will be used.

e. Accuweather website - enter **Zip Code**, click **"Go"**, click **"Currently"** to bring up and print current conditions, this will give you information such as **"Ceiling"**, **"Cloud Cover"**, and **"Wind Gusts"**. Click **"Back"**, click **"Today"** for daily forecast, this provides you with **"Thunderstorm Probability"** and **"Hour by Hour Weather"** which will be used to supplement the information ITomthe National Weather Service to assist in determining the best time of the day for activities to commence.

f. If weather conditions fall within the following perimeters then a **GO** can be given for Demilitarization Activities to be conducted.

Enclosure 3
Wind Direction Frequencies (1000-1659 hours)

FILES USED THIS RUN ARE:
OPTIONS FILE NAME:NUSWR.CNT

INPUT FILE NAME :T0416.XXX

PRINT FILE NAME :NUSWR.PRN

TOOELE ARMY DEPOT-HOURS 1000 THROUGH 1600 9/4/2007 PAGE 1

TIME OF DAY: 10:27:31

PROGRAM: NUSWR VERSION: PC-1.0
TITLE WILL BE : JAN-DEC 1991-1995
NUSWR VERSION PC-1.0
FORMAT OF THE DATA (YR,MN,DY,HR,WS,WD): (4I2,F7.4,F5.1)

START DATE= 91010101
END DATE= 95123124
OUTPUT FILE WILL BE WRITTEN

OUTPUT FILE NAME :NUSWR.PLT

INPUT WIND SPEED IN METERS/SEC
CALM THRESHOLD VALUE = .50
SAMPLE OF INPUT AS READ:

91	1	1	10	.0	173.5
91	1	1	11	.0	176.5
91	1	1	12	.0	168.5
91	1	1	13	2.6	25.5
91	1	1	14	3.1	11.5
91	1	1	15	2.0	24.5

TOOELE ARMY DEPOT-HOURS 1000 THROUGH 1600 9/4/2007 PAGE 2

TIME OF DAY: 10:27:31

PROGRAM: NUSWR VERSION: PC-1.0
JAN-DEC 1991-1995
NUSWR VERSION - PC-1.0

WIND ROSE FOR THE MONTH OF JAN

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	CALM
	12.44	4.98	1.11	.46	.65	1.11	7.00	12.07	9.12	3.04	1.20	3.23	5.62	9.95	6.45	10.97	10.60
METERS/SEC	2.9	2.6	2.4	1.5	2.0	2.6	3.3	3.8	4.9	3.1	2.4	2.8	3.2	3.2	3.4	3.4	

TOTAL OBSERVATIONS 1085=

WIND ROSE FOR THE MONTH OF FEB

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	CALM
	10.23	2.63	.61	.81	.71	2.03	5.67	12.87	13.98	3.95	1.42	3.65	2.74	10.54	12.06	10.64	5.47
METERS/SEC	3.2	3.0	2.7	1.7	2.6	2.7	3.0	4.5	5.4	4.1	2.3	2.4	3.0	3.7	3.7	3.7	

NUSWR

TOTAL OBSERVATIONS 987=

WIND ROSE FOR THE MONTH OF MAR

	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	CALM
	8.85	3.78	.92	.18	.74	1.47	4.24	13.92	17.05	3.69	1.75	2.86	3.69	9.12	11.61	13.82	2.30
METERS/SEC	4.2	4.0	2.7	2.0	1.9	2.9	4.6	6.5	7.1	5.7	3.6	2.9	4.6	4.0	4.7	4.5	

TOTAL OBSERVATIONS 1085=

WIND ROSE FOR THE MONTH OF APR

	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	CALM
	10.19	5.43	1.24	.76	.76	1.14	3.14	8.10	12.48	4.29	1.52	2.00	4.76	10.76	15.71	16.48	1.24
METERS/SEC	4.7	4.1	3.1	2.6	2.4	3.4	4.4	6.3	7.0	5.4	3.7	3.8	4.8	5.3	5.0	5.3	

TOTAL OBSERVATIONS 1050=

WIND ROSE FOR THE MONTH OF MAY

	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	CALM
	10.78	5.62	2.03	1.11	1.75	1.94	4.52	10.14	12.81	4.24	2.30	2.40	3.59	8.29	10.23	16.50	1.75
METERS/SEC	4.4	4.2	3.5	2.7	5.4	4.0	4.4	5.8	6.6	4.7	4.2	3.3	3.9	4.3	4.8	4.7	

TOTAL OBSERVATIONS 1085=

TIME OF DAY: 10:27:31

PROGRAM: NUSWR VERSION: PC-1.0

JAN-DEC 1991-1995

NUSWR VERSION - PC-1.0

WIND ROSE FOR THE MONTH OF JUN

	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	CALM
	12.29	3.62	1.05	.67	1.05	1.24	4.29	9.81	12.95	4.00	2.48	1.71	2.76	5.24	14.10	20.95	1.81
METERS/SEC	4.6	3.7	2.7	2.7	3.9	4.0	4.1	6.1	6.9	5.7	4.3	4.3	4.1	4.2	4.7	4.8	

TOTAL OBSERVATIONS 1050=

WIND ROSE FOR THE MONTH OF JUL

	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	CALM
	13.82	4.61	1.94	1.11	.92	1.75	3.50	9.49	11.34	2.86	3.41	2.21	2.67	5.71	13.64	19.17	1.84
METERS/SEC	4.8	4.5	3.5	2.7	2.5	3.0	4.2	6.3	6.1	5.0	3.6	3.2	3.0	3.9	4.5	5.0	

TOTAL OBSERVATIONS 1085=

WIND ROSE FOR THE MONTH OF AUG

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
	11.89	3.41	1.75	1.01	.83	2.30	7.00	14.93	15.76	3.69	2.21	1.47	2.21	4.88	10.23	15.12
METERS/SEC	4.5	4.1	2.9	2.6	2.4	3.2	4.8	6.4	6.3	4.4	3.7	3.2	3.5	3.6	4.4	4.8

CALM 1.29

TOTAL OBSERVATIONS 1085=

WIND ROSE FOR THE MONTH OF SEP

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
	11.71	3.71	1.33	.86	1.24	2.38	4.48	11.62	10.48	3.24	2.38	1.81	2.48	6.95	15.14	17.81
METERS/SEC	4.1	3.2	2.9	2.5	3.0	3.0	4.0	6.0	6.5	4.9	3.4	3.2	3.3	3.7	4.2	4.5

CALM 2.38

TOTAL OBSERVATIONS 1050=

WIND ROSE FOR THE MONTH OF OCT

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
	10.32	2.58	.83	.65	1.20	2.58	7.37	11.34	10.05	2.67	1.47	1.75	3.41	8.02	14.29	17.79
METERS/SEC	4.1	3.3	3.4	2.4	2.2	3.0	3.8	5.0	5.9	4.2	2.8	2.9	3.1	4.0	4.3	4.4

CALM 3.69

TOTAL OBSERVATIONS 1085=

TIME OF DAY: 10:27:31

PROGRAM: NUSWR VERSION: PC-1.0

JAN-DEC 1991-1995

NUSWR VERSION - PC-1.0

WIND ROSE FOR THE MONTH OF NOV

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
	10.76	3.24	1.33	.67	.86	2.48	7.71	12.38	12.48	2.29	1.43	2.10	3.62	8.76	12.10	12.57
METERS/SEC	3.8	3.1	2.2	2.0	2.4	2.8	3.6	4.9	5.7	3.6	2.6	2.3	3.7	4.3	4.3	4.5

CALM 5.24

TOTAL OBSERVATIONS 1050=

WIND ROSE FOR THE MONTH OF DEC

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
	10.41	3.96	1.38	.83	.92	2.40	8.11	13.09	11.52	3.50	2.21	2.58	2.86	9.03	8.76	9.49
METERS/SEC	3.0	2.7	2.3	2.7	2.0	2.6	4.1	4.8	6.0	2.8	2.1	2.6	3.3	3.1	3.6	3.9

CALM 8.94

TOTAL OBSERVATIONS 1085=

TIME OF DAY:
10:27:31
PROGRAM: NUSWR VERSION: PC-1.0
JAN-DEC 1991-1995
NUSWR VERSION - PC-1.0

WIND ROSE FOR SEASON 1

	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW
	2.42	4.01	9.38	12.48	15.59	9.94	4.94	1.40	.68	1.09	1.52	3.98	10.75	14.13	4.07	1.86
	3.3	4.5	4.6	4.8	4.8	METERS/SEC	4.4	4.1	3.2	2.6	3.9	3.5	4.5	6.2	6.9	5.2	3.9

TOTAL OBSERVATIONS 3220=

WIND ROSE FOR SEASON 2

	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW
	1.80	2.55	5.28	12.64	18.39	12.67	3.88	1.58	.93	.93	1.77	4.94	11.43	13.35	3.51	2.70
	3.5	3.5	3.9	4.6	4.8	METERS/SEC	4.6	4.1	3.1	2.7	3.0	3.4	4.5	6.3	6.5	5.1	3.8

TOTAL OBSERVATIONS 3220=

WIND ROSE FOR SEASON 3

	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW
	1.88	3.17	7.91	13.85	16.08	10.93	3.17	1.16	.72	1.10	2.48	6.53	11.77	10.99	2.73	1.76
	2.8	3.4	4.0	4.3	4.5	METERS/SEC	4.0	3.2	2.7	2.3	2.5	3.0	3.7	5.3	6.0	4.3	3.0

TOTAL OBSERVATIONS 3185=

WIND ROSE FOR SEASON 4

	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW
	3.14	3.77	9.82	9.00	10.36	11.05	3.90	1.05	.70	.76	1.84	6.97	12.67	11.47	3.48	1.62
	2.6	3.2	3.3	3.6	3.6	METERS/SEC	3.0	2.7	2.4	2.1	2.2	2.6	3.6	4.4	5.5	3.3	2.3

TOTAL OBSERVATIONS 3157=
TOOELE ARMY DEPOT-HOURS 1000 THROUGH 1600

TIME OF DAY:
10:27:31
PROGRAM: NUSWR VERSION: PC-1.0
JAN-DEC 1991-1995
NUSWR VERSION - PC-1.0

ANNUAL WIND ROSE

W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW

NUSWR
11.15 3.97 1.30 .76 .97 1.90 5.59 11.65 12.49 3.45 1.99
2.31 3.37 8.09 12.00 15.12 3.88
METERS/SEC 4.0 3.6 2.9 2.4 3.0 3.1 4.0 5.5 6.3 4.5 3.3
3.0 3.7 4.0 4.4 4.5
TOTAL OBSERVATIONS 12782=

WIND ROSE PROGRAM

VERSION PC-1.0

- EXAMPLE -
OB/OD Unit Excluded Wind Directions[a, b]
TEAD Documentation Form

Completed by: _____ Date: _____
Supervisor Review: _____ Date: _____

1. Treatment Information:
   a. Type (OB, OD, SF): _____
   b. Quantity (lbs NEW): _____
   c. Date (mm/dd/yy): _____
   d. "GO" decision time: _____
   e. Treatment start time: _____

2. Wind Direction Monitoring Data (direction wind is coming from; N, NNE, NE, etc.)
   a. At "Go" decision:
      i. Tower A
         + Wind direction: _____
         + Excluded WD occurrence (yes or no): _____

      ii. Tower B
         + Wind direction: _____
         + Excluded WD occurrence (yes or no): _____

   b. At start of treatment:
      i. Tower A
         + Wind direction: _____
         + Excluded WD occurrence (yes or no): _____

      ii. Tower B
         + Wind direction: _____
         + Excluded WD occurrence (yes or no): _____

   c. During 15 minute period after treatment start:
      i. Tower A
         + Wind direction range: _____
         + Excluded WD occurrence (yes or no): _____

      ii. Tower B
         + Wind direction range: _____
         + Excluded WD occurrence (yes or no): _____

- EXAMPLE -
OB/OD Unit Excluded Wind Directions
Documentation Form
(continued)

3. Comments (e.g., unusual weather conditions, etc.

_____

_____

_____

_____

_____

Reference Information:

a. Excluded wind directions for OB/OD/SF treatment:

+ SE
+ ESE
+ E
+ ENE
+ NE
+ NNE
+ N
+ NNW
+ NW
+ WNW
+ Calm

b. Allowable wind directions for OB/OD/SF treatment:

+ W
+ WSW
+ SW
+ SSW
+ S
+ SSE

Enclosure 4
Modeled Time Duration for RDX to Reach Groundwater

The modeled time duration for RDX to reach groundwater at TEAD-N is 2,388 years as presented in the Toole Army Depot – North Area Position on Groundwater Monitoring at the OB/OD Unit (USACE, November 1996). The migration time period for perchlorate was not modeled.

The migration of RDX to groundwater is limited by a relatively low solubility (64 mg/L). Once dissolved, however, RDX is persistent and mobile. The principle unknown factors governing predictions of the RDX leaching rate are the lack of knowledge recording particle size, conditions after dispersal in the environment (e.g. whether coated with soot) and contact time with water, all of which are data gaps hindering estimates of the source terms. (US Army, November 2006).

A groundwater well sample was collected in May 1998. There were no energetic compounds detected for that sample. Neither RDX nor any other energetic compounds were detected in the 2007 or 2009 groundwater sample. The 1998, 2007, and 2009 sampling results discussed above represent the cumulative impacts of approximately 40 – 50 years of OB/OD operations at TEAD-N.

Previous studies of the hydrogeology of the OB/OD Unit (including groundwater monitoring data) have concluded that there is a low potential for contamination migration from surface and subsurface soils at the OB, OD, and SF treatment areas to groundwater (U.S. Army, November 1996). Factors that support this conclusion include the following:

- Over 600 ft to groundwater
- Excess evaporation over precipitation (minimal infiltration potential)
- Alkaline nature of soil (i.e., minimal potential for infiltration of metals)
- Soils with low to moderate infiltration properties for other types of potential contaminants
- No contaminants-of-potential-concern (COPCs) based on cumulative impacts of over 50 years of OB/OD Unit operations
- Nondetection of energetics based on groundwater monitoring data (i.e., cumulative impacts of over 50 years of OB/OD Unit operations