Preliminary Review Comments

Draft Preliminary Assessment/Site Investigation Demolition Site No. 5
Former Badlands Bombing Range
Shannon & Jackson Counties, South Dakota

BY
TOSNAC PROGRAM
Great Plains/Rocky Mountain Hazardous Substance Research Center
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The Technical Outreach Services for Native American Communities (TOSNAC) program provides technical assistance to communities impacted by hazardous waste issues by presenting fundamental scientific information. Its goal is to empower Native American communities with an independent understanding of the underlying technical issues so that they may participate substantively in decision-making processes related to hazardous substances. These TOSNAC preliminary review comments provide one form of technical support through the summary and review of technical reports related to an environmentally impacted site.

The PA/SI and Purpose of this Review

TOSNAC program representatives performed a cursory review of the above-referenced preliminary assessment and site investigation, dated May 21, 1999, based on a request from the director of the Badlands bombing Range Project Office, Mrs. Emma Featherman-Sam. The objectives of the portion of the PA/SI pertaining to Demolition Site No. 5 are to:

- Determine the presence or absence of soil, sediment and surface water contaminants related to ordnance and DoD activity at the site.
- Determine background levels of metals for soil types found at the demolition site.
- Conduct a qualitative risk screen to determine need for further action at the site.

A report summarizing results of this evaluation will include recommendations about existing risks, site monitoring, further site investigations, and possible response actions. At many cleanup sites, follow-up activities take place as part of a Remedial Investigation/Feasibility Study (RI/FS).

This PA/SI is one of a number of activities underway to assess and reduce environmental risks related to military use of the former BBR, which is located within the Pine Ridge Indian Reservation. The location of the Demolition Site No. 5 is contained within 341,179 acres of land controlled by Ellsworth Air Force Base and is shown on a vicinity map, which is included as an attachment.

The draft PA/SI includes descriptions of the project, field activities, analytical methods and quality control, an evaluation of data gathered, as well as conclusions and recommendations. These review comments describe each PA/SI section and, at the end, provide a summary of specific TOSNAC recommendations (by page and paragraph number).

Project Description

An Ellsworth Air Force Base (EAFB) reference, (1964), pertaining to the location of Site No. 5 and previous activities conducted at that site can be found in the Appendix of the PA/SI. The Range Procedure for Demolition at Scenic Bombing and Gunnery Range document describes the procedures for surface demolition of explosives by electric detonation, non-electric firing, and burning. It does not however,

document the types and amounts of ordnance detonated. It also lacks clear delineation of the boundaries, which contain Site No. 5. This is the only written historical document of the site activities.

Within the PA/SI is a list of ten types of ordnance believed or known to have been managed at the demolition site. These are generally known as practice and conventional ordnance items, which contain a variety of explosives and metals that can potentially cause contamination of soil and water. Conventional explosives and their breakdown products consist of many rings of carbon atoms attached to each other and to nitrogen and other compounds. Many of these compounds fall into several chemical groups, generically called nitroaromatics, which include nitrotoluenes, nitrobenzenes, and amines. Simpler breakdown products of explosives may include nitrate, toluene, carbon dioxide, water, and possibly benzene. Metals associated with ordnance include lead, mercury and others. Scientists and engineers test for some or all of these compounds when evaluating a site for contamination from conventional ordnance.

For purposes of this PA/SI, two categories of data were generated. Screening data with a definitive confirmation was conducted infield using immunoassay techniques for ordnance, TNT and RDX. Definitive data was gathered in laboratory for explosives, Target Analyte List (TAL) Metals, Polynuclear Aromatic Hydrocarbons (PAHs), Gasoline and Diesel, Fraction of Organic Carbon, Soil Particle Size, and moisture content, using Standard EPA methods. Field-based analyses were used to determine the presence of a chemical and were not used to designate specific quantities, whereas laboratory results indicated chemical concentrations.

Field Activities

Chapter 4 of the PA/SI is divided into two main sections. The first part documents field procedures and includes QA/QC information.

This section describes both intrusive and non-intrusive activities used to assess surface and subsurface areas at Site No. 5. These are of potential environmental concern due to the possible presence of UXO and/or metals. Non-intrusive activities include the following:

- Review of historical EAFB document.
- Visual Survey to determine lateral extent of the demolition area and to delineate the interior boundaries.
- Magnetometer surveys to detect near-surface buried metallic debris for boundary delineation.

Intrusive activities conducted at Site No.5 include the following:

- Ten demolition site soil boring samples, four in each of the high density debris and low density debris areas, and two in surface water runoff pathway.
- Ten soil boring samples in soil type-specific area (background soil samples).
- Two surface water samples collected from Wind Creek, one upstream and one at outflow of runoff pathway from Site No. 5.
- Two sediment samples collected at same points where surface water samples were collected.

According to the field sampling plan, two soil samples were to be collected from each of the soil borings. In most cases, one sample was collected at 0.0 to 0.5 interval depth and two samples were collected from the 3.5 to 5.0 feet depth interval. A total of 62 soil samples were collected for analysis, including replicate and duplicate QA/QC samples.

All soil samples collected on the demolition area were analyzed for the following parameters:

- Explosives.
- Polynuclear Aromatic Hydrocarbons (PAHs).
- Gasoline-range Total Petroleum Hydrocarbons (TPH-G).
- Diesel-range Total Petroleum Hydrocarbons (TPH-D).

- Target Analyte List metals (TAL metals).
- Grain Size.

For purposes of background metals concentration (natural levels), selected soil samples from the soil type-specific (ST-S) area were analyzed for TAL metals. Samples were selected based on grain size analyses. Those with similar grain size distributions as soils found in the demolition area were submitted for metals analyses.

Surface Water and Sediment samples were analyzed for the following parameters:

- Explosives.
- Polynuclear Aromatic Hydrocarbons (PAHs).
- Gasoline-range Total Petroleum Hydrocarbons (TPH-G).
- Diesel-range Total Petroleum Hydrocarbons (TPH-D).
- Target Analyte List metals (TAL metals).

An extensive description of the quality control used for soil boring, sampling and transportation procedures is given in Chapter 4 of the PA/SI.

The second part of Chapter 4 documents the details and findings of the visual and geophysical survey for both the demolition area and for the soil specific type area, which was used for background sampling. High density area sites were determined by the abundance of metallic debris present. Field screening for TNT and RDX was performed on samples taken from the high density area, using immunoassay tests with detection limit of 0.5 ppm. Based on the lack of detection of explosives, specifically TNT and RDX in demolition site boring samples at depths up to five feet, the decision to sample at depths below 5 feet was declined. Groundwater was not encountered in any of the soil borings. Selection of ST-S boring sites were based on visual comparison of soils in the demolition area with soils in the area surrounding the demolition area. Upon field evaluation of soils, the majority of ST-S borings were completed in the area northwest of the demolition site, which exhibited similar clayey and sandy silts contents.

Analytical Methods and Quality Control Procedures

Chapter 5 of the PA/SI gives an overview of the analytical methods that were utilized in the laboratory on soil, sediment and water samples. Table 5-2 lists the specific parameters for explosives, metals, and PAH analyses and their associated method detection limits (MDL) and practical quantitation limits (PQL) for soil and sediment samples. Table 5-3 lists the same information for water samples. All analyses were conducted, using EPA certified procedures.

Samples were analyzed for 14 different explosives, including:
- Octahydro-1,3,576-tetranitro-1,3,5,7-tetrazocine (HDX)
- Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)
- 1,3,5-Trinitrobenzene (TNB)
- 1,3-Dinitrobenzene (DNB)
- Methyl-2,4,6-trinitrophenyl nitramine (teryl)
- Nitrobenzene (NB)
- 2,4,6-Trinitrotoluene (TNT)
- 2,4-Dinitrotoluene (2,4-DNT)
- 2,6-Dinitrotoluene (2,6-DNT)
- o-Nitrotoluene (2-NT)
- m-Nitrotoluene (3NT)
- p-Nitrotoluene (4-NT)
- 4-Amino-2,6-dinitrotoluene (4-Am-DNT)
- 2- Amino-4,6-dinitrotoluene (2-Am-DNT)

Samples were analyzed for 23 different metals, including:
- Aluminum
- Antimony
- Arsenic
- Barium
- Beryllium
- Cadmium
- Calcium
- Chromium
- Cobalt
- Copper
- Iron
- Lead
- Magnesium
- Manganese
- Mercury
- Nickel
- Potassium
- Selenium
- Silver
- Sodium
- Thallium
- Vanadium
- Zinc

Samples were analyzed for 18 types of Polynuclear Aromatic Hydrocarbons, including:
- Acenaphthene
- Acenaphthylene
- Anthracene
- Benzo(a)pyrene
- Benzo(b)pyrene
- Benzo(b)fluoranthene
- Benzo(g,h,i)perylene
- Benzo(k)fluoranthene
- Chrysene
- Dibenz(a,h)anthracene
- Fluoranthene
- Fluorene
- Indeno(1,2,3-cd)pyrene
- 1-Methylnaphthalene
- 2- Methylnaphthalene
- Naphthalene
- Phenanthrene
- Pyrene

Data Evaluation

For purposes of data analysis, soil samples collected within the upper 0.5 feet of soil were classified as surface soil, due to the exposure pathways associated with this depth interval. Results of analysis ran on the ST-S area samples were used to determine the background level of each chemical constituent. When demolition site sample results were less than or equal to the determined background levels, the chemical was eliminated as a contaminant of potential concern (COPC). Concentrations of remaining COPCs were then compared with EPA's risk-based concentration (RBCs). For surface soils, residential land-use

scenario was used to determine RBCs, which encompassed exposure pathways of ingestion, inhalation, and cross-media transfer to groundwater followed by ingestion of groundwater. For subsurface soils, collected at depth greater than 0.5 feet, the cross-media transfer to groundwater pathway was considered. Residential land-use scenario is generally used as the most conservative risk-based screening tool when comparing values of COPC to those recommended by EPA as being safe levels to human health and environment in the most updated RBC standards.

Five of the ST-S samples were selected in laboratory for submission for metals analyses, based on their grain size comparisons with soils taken from the demolition site. Section 6.1 describes the reasoning behind the using five ST-S samples as the optimum number of samples to represent naturally occurring conditions in this study. A description of the methodology used to select the representative ST-S samples is given in Appendix F. This type of soil-screening procedure is desirable in order to reduce possible bias in metals content as a result of grain size variability.

Once metals analyses were completed on the five selected ST-S samples, concentrations of naturally occurring metal concentrations in soils at the BBR site was determined for this study through statistical analysis of laboratory generated data. Two types of data sets were gathered and tested for normality. Constituent concentrations limits were set at the most frequently reported limit for data sets with fewer than three detected values. For data sets with a minimum of three detected values, data was transformed and analyzed statistically. Appendix G gives a detailed discussion of how the data was manipulated to determine background concentrations, which follows scientifically accepted procedures for statistical analysis of data and setting confidence limits to transformed data values. Through this analysis it was determined that that 95 percent of all future measurements at this site, (95 percent coverage), should fall below the tolerance limit with 95 percent confidence.

For the fourteen explosives parameters analyzed, none were detected in any of the soil, sediment or water samples collected during this PA/SI.

Polynuclear Aromatic Hydrocarbons (PAHs) are relatively large anthropogenic molecules (not naturally occurring), composed of various benzene rings fused together. Some of these are powerful carcinogens (cancer-producing agents). PAHs are often found left as residual product, resulting from incomplete combustion of organic material, including petroleum products like explosives. Data was reported in measures of micrograms of contaminant per kilogram of soil and sediment (ug/kg), and micrograms of contaminant per liter of water (ug/L). Results for the three different media are given as follows:

Soil- Benzo(b)fluoranthene was detected in one sample at 0.5 ug/kg, which is 4 orders of magnitude less than RBCs set at residential setting.
Naphthalene, 2-methylnaphthalene, acenaphthylene, and pyrene were detected in various samples at levels greater than 6 orders of magnitude less than RBCs set at residential setting. Results ranged from 0.4 to 1.0 ug/kg.
Benzo(g,h,i)perylene and phenanthrene were detected at levels ranging from 0.4 to 1.0 ug/kg. There are no residential setting based RBCs for these contaminants.

Sediment - 2-Methylnaphthylene was detected at 0.6 ug/kg in demoliton site sample, which is greater than 7 orders of magnitude less than RBCs set at residential setting.
Naphthalene was detected at 1 ug/kg, which is greater than 6 orders of magnitude less than RBCs set at residential setting.

Surface Water- 1-Methylnaphthylene was detected at 0.02 ug/L at Wind Creek demolition site, and at 0.06 ug/L at the upstream site. No RBSs are listed for this contaminant.
2-Methylnaphthylene was detected at 0.05 ug/L at Wind Creek demolition site, and at 0.03 ug/L at the upstream site. This is greater than 4 orders of magnitude less than RBCs set for tap water.
Naphthalene was detected at 0.07 ug/L at Wind Creek demolition site, and at 0.04 ug/L at the upstream site. This is greater than 4 orders of magnitude less than RBCs set for tap water.

Because diesel and gasoline were potentially used during demolition activities at Site No. 5, diesel- and gasoline-range petroleum hydrocarbon analyses (TPH-D and TPH-G) were conducted as part of this PA/SI.

TPH-D was not detected in any of the soil, sediment, or water samples collected. TPH-G was detected at levels of 0.2 mg/kg in the shallow soil samples at two demolition boring sites and at concentrations ranging from 0.23 to 0.1 mg/kg at six other demolition boring sites. To quantify toxicological risk associated with the detection of TPH-G in soils, benzene level RBCs were used to represent potential concern of TPH-G concentrations present, since it has the most stringent standards for contaminants associated in this class. The RBCs for benzene in soil in a residential setting is 200 mg/L, which is 3 orders of magnitude greater than the TPH-G levels those found in the most contaminated areas.

Based on the concentration distribution of each metal detected in the ST-S area, concentration limits were calculated for metals in each of three data sets. Data sets with no non-detects were managed by calculating the concentration limit on basis of the Upper Tolerance Limit (UTL) of detected concentrations for specific metals. The concentration limit was set at the most frequently reported reporting limit for data sets with three or more non-detects. For data sets with less than three non-detects, the UTL was calculated using a value equal to one–half of the detection limit for the concentration values reported at less than detection limit. This approach is consistent with EPA's Risk Assessment Guidance for Superfund (RAGS).

A phased approach, which is detailed in Appendix H, was used to compare demolition area metals concentration limits with concentrations derived from ST-S samples and RBCs. First demolition sample results were compared with the background concentration limits that were derived from the ST-S soil data. If a data set exceeded the background concentration, then it was compared to RBCs. Based on this approach, no demolition soil metals concentrations exceeded the RBCs. Any metals concentrations detected in the sediment from the Wind Creek demolition site sample were less than those detected in the upstream sample. The concentrations of fifteen metals in surface water sample at demolition site exceeded values of those upstream. No RBCs are listed for three of the metals, including calcium, magnesium, and potassium. Concentration values exceeded the RBCs for tap water for aluminum, arsenic, barium, chromium, cobalt, copper, iron, lead, manganese, selenium, vanadium, and zinc. These metals values were also compared with the South Dakota surface water quality standards, contained in Appendix I. Arsenic exceeded the State's standards based on the combined exposure routes of ingestion of contaminated aquatic organisms and ingestion of water through drinking. Arsenic does not exceed the standard based on ingestion of aquatic organisms only.

Analytical data submitted by the contract laboratories were reviewed by Baker team personnel. A separate document contains details of findings. The Quality Control Summary Report is summarized in this PA/SI. All of the analytical results qualified for use in this investigation with exception of the mercury analyses. Holding time for mercury soil samples is 28 days. Seventeen of the soil samples were held for 103 to 104 days before analysis took place. Thus, mercury data from the ST-S sites were not usable for this investigation.

Conclusions and Recommendations

The PA/SI report summarizes results of the study and concludes with recommendations about potential risks from ordnance, explosives and associated contaminants and includes recommendations about further investigation. Such recommendations may be addressed by follow-up RI/FS activities.

Explosives and TPH-D were not detected in any of the soil, sediment, or surface water samples collected during this PA/SI. Certain metals, PAHs and TPH-G were detected in various media at the demolition site. Concentration values obtained in this investigation were compared with EPA Risk-Based Concentration values for residential land-use scenarios. RBC values and technical background information, concerning the development and use of these standards are contained in Appendix J. The RBC values were used as a screening tool in this PA/SI to evaluate potential risk to human health, using conservative measures. Recommendations made in the conclusion of this PA/SI were developed through the use of this screening process. Specific study conclusions and recommendations were presented by contaminant classification, as follows:

TGH-G Detected in two surface soil samples.
Concentrations below RBCs, several orders of magnitude.
Do not present a risk to human health and environment.

PAHs Detected in demolition soils, and both sediment samples.
Concentrations below RBCs, several orders of magnitude.
Do not present a risk to human health and environment.

Metals Detected in soils from demolition area.
Concentrations below RBCs, several orders of magnitude.
Do not present a risk to human health and environment.
Metals Detected in demolition and upstream sediment site samples.
Upstream sediment site values are greater than demolition site values.
Do not present a risk to human health and environment.
Metals Detected in both demolition and upstream site samples.
Concentrations at demolition site exceeded RBCs for tap water for twelve metals.
Concentrations at demolition site exceeded one SD surface water quality standard for arsenic.
Elevated turbidity due to sampling process may account for elevated metals content in water.

No further investigation of soil or sediment at the demolition area is recommended on basis of the information described above. According to the recommendations in this PA/SI, the soil at the demolition site is suitable for residential land use. However, explosive items, possibly unexploded ordnance (UXO), may still be present.

Based on the surface water data generated in the PA/SI, no investigation into the occurrence of explosives, TPH-G, TPH-D, or PAHs is recommended. However, additional investigation into the occurrence of metals in surface water at the demolition area is recommended. In order to more accurately characterize metals contents in water samples, it is suggested that additional samples be taken from both Wind Creek sampling sites. The question of whether elevated metals levels found in surface water samples collected during this PA/SI is a function of past DoD activities or whether it is a function of high turbidity in the sample itself, can be more carefully addressed through further investigation.

This concludes the TOSNAC summary of the Draft Preliminary/Site Investigation for Demolition Site No. 5 for the Former Badlands Bombing Range.

TOSNAC Comments

Work performed in the PA/SI was used to determine background metals concentrations in soils found in the demolition area, to determine the presence of contaminants in various media, which may have resulted from DoD activity and to conduct a qualitative risk screen to determine the need for further action at the site. The following specific comments and recommendations may help the community improve and better understand the process.

- Pages 27-2 and 77-2. Sections 4.1.3.3 and 6.1. Use of the soil type-specific (ST-S) grain size distribution selection process was desired in order to reduce possible bias in metals content as a result of grain size variability. It should be noted that section 6.1 of the PA/SI states that "Previous experience associated with the evaluation of four disposal pits at the BBR during this PA/SI has shown that metals concentrations in soils may be inversely related to grain size." Certain metals, like beryllium, are known to be preferentially concentrated in fine-grained sediment and soils. Since metals are naturally occurring in soils at levels specific to the sites which they are collected in and at levels that correspond to grain size, the process used to establish background metals values described in the PA/SI are consistent with accepted scientific methodology.

- Pages 45-46. Section 4.2.1.1. The visual and geophysical survey description lacks specific detail concerning the size of Site No. 5. Even though the Detailed Location Map on page 46 shows the specific locations where soil boring samples were taken, and indicates a scale, it is difficult to interpret or comprehend the extent of the site from the information given. This would be especially helpful in determining whether or not ten soil borings is a representative number of samples based on surface area coverage of Site No. 5. The use of a representative number of samples is important in any site investigation or scientific study.

- Page 47. Section 4.2.1.2. The selection of high and low density debris areas in Site No. 5 relied heavily upon visual inspection of ground surface. Visual inspection techniques may not represent the most subjective measure of detecting locations of greatest concern. Debris may have been moved or covered over time through natural processes or through other means, making it difficult to rely on surface location of debris as an accurate means of locating sites of greatest impact. More discussion of field-based site characterization through magnetometer surveys should have been given to better describe the boundary delineation process used in the PA/SI. Other geophysical survey techniques, such as, Synthetic Aperture Radar could have also been used to more accurately characterize Site No. 5.

- Page 128. Section 6.3.4.3. Two sediment samples, one collected on Site No. 5 and one upstream for background measures do not represent a fair statistical number of samples for a good scientific study. To more accurately characterize the site, multiple samples should be taken at different times of the year at acceptable frequencies, generally done of a quarterly basis (four times per year). The use of composite samples could also alleviate bias associated with small sample size. In any case, the conclusion that "no impact to sediment in Wind Creek by metals derived from the demolition area is indicated," is not consistent with scientific methodology based on sample size alone. TOSANC recommends that more samples be collected for further investigation of sediment on and off site.

- Page 133-2. Section 6.4. Because the use of mercury is associated with ordnance and the demolition of ordnance on sites, it is unfortunate that the mercury data in this investigation were found to be unusable, due to quality control measures discussed with sample holding time. It seems reasonable that more attention should have been given to the topic and that it should have been discussed in concluding remarks given in the PA/SI. High levels of mercury can impose deleterious impact on human health and environment. However, it is unlikely that mercury concentrations could have been elevated to levels of potential concern at Site No. 5 as a result of DoD activities. Therefore, we do not recommend that re-sampling of soils be performed based on the lack of information pertaining to mercury levels. We do believe that mercury analysis should be given priority attention, if and when further soil sampling and investigation occurs on Site No. 5.

- Page 135. Section 7.1. Based on the non-detection of explosives at Site No. 5, the area was deemed safe for residential land-use for those contaminants. However, explosives do not remain inert in the environment. Through natural degradation and bioremediation processes, transformation products are formed. One mineralization product of explosives is nitrate, which readily moves in the environment and is easily monitored. Other transitional breakdown products include benzene and toluene. Investigation of the presence of these products was not part of the PA/SI. TOSNAC recommends that at the minimum, nitrates, toluene and benzene be monitored as part of any future sampling activities in the various media at Site No. 5. Continuous monitoring of these analytes would give an indication of whether or not natural degradation of explosives is occurring on site and give insight into the rates of degradation.

- Page 136-137. Section 7.1.1. Detection of Gasoline Range Total Petroleum Hydrocarbons (TPH-G) on the demolition site indicates that degradation processes on the BBR site are slow. Natural biodegradation rates of any contaminant are dependent upon complicated factors involving not only microbiology, but also hydrogeology and geochemistry. If we presume that TPH-G present at the site was a result of DoD demolition activities described in the 1964 Air Force Document (35 years ago), the detection of TPH-G currently at the site would indicate that either large amounts of gasoline were used or spilled on site and/or that natural biodegradation processes of petroleum products are relatively slow at the BBR. Considering the regional geology and hydrogeology, it is likely that natural biodegradation occurs at relatively slow rates on the BBR. Even though TPH-G may not be present in levels to cause concern, the practice of monitoring TPH-G could give some indication of how natural bioremedial processes are progressing over time.

- Page 137. Section 7.1.2. Although the investigation of PAHs in this PA/SI followed conservative measures using EPA guidelines, the cumulative effects of all PAHs was not given consideration. Because of their complex size and structure and relatively high toxicological effect on microorganisms, PAHs degrade slowly in situ. The higher molecular weight PAHs, those with greater than three benzene rings, degrade at much slower rates. Mineralization occurs when the PAH is broken down into its simplest products, including carbon dioxide, oxygen and water. However, breakdown of PAHs result in a mixture of mineralization and transformation products. Often the transformation products are non-extractable compounds that can not easily be identified. Sometimes these transformation products can be more toxic than their derivatives. Given the PAH concentrations found during this PA/SI, it seems unlikely that any future cumulative-effect risk screening on PAHs and potential transformation products, would yield results that could cause concern for site soils. However, we believe that further investigation should be given to sediment and water at the site. Tracking PAH and transition product levels in runoff water and sediment over time would be an appropriate means of monitoring degradation of these contaminants. TOSNAC recommends that further analysis of soils contents be conducted before it is deemed safe for residential land-use, based on the PAH results given this PA/SI.

- Page 138. Section 7.1.3.1. Following a detailed study of the procedures and data used to investigate the levels of metals in soils and comparison with background levels in this PA/SI, TOSNAC agrees that no risk is presented by metals concentrations in soils at Site No. 5. Regardless of the results of this PA/SI, TOSNAC does not recommend that the land designated as Site No. 5 be zoned for use in a residential setting, however. It is clear that due to the presence of metal debris and potential presence of UXO, that this site is not fit for residential use, whether the concentrations of contaminants are below RBCs or not.

- Page 138-139. Section 7.1.3.3. The concentration of arsenic found in the surface water sample, which exceeds the SD surface water quality standard based on combined exposure through ingestion of water and contaminated aquatic organisms, should be given careful consideration when screening for risk. At no point in the PA/SI were cultural risk assessment issues addressed. There is a lack of information concerning community use of surface water and aquatic resources, including fish. TOSNAC recommends that further investigation of site-specific exposure routes exploring quantities of fish and other aquatic organisms consumed from Wind Creek be performed as part of a more thorough risk assessment, which includes Native American cultural considerations.

- Page 139-3. Section 7.2. The PA/SI recommendation includes additional investigation into the occurrence of metals in surface water samples collected from Wind Creek. Uncertainty of results was attributed to high turbidity in the water sample collected at Site No.5. Preservation of highly turbid water samples with nitric acid may have caused the release of some metals from the particulate phase (suspended in sediment) into the aqueous phase (into the water), causing higher results than expected. TOSNAC recommends that several representative samples be taken from the site for evaluation at different times of the year, preferably on a quarterly basis. Composite samplers can be also used to collect representative samples. Through a combination of controlling turbidity upon sample collection, and collecting multiple or composite samples, a more accurate characterization of water at the site can be achieved. Based on the reviewer's knowledge of field investigation at other locations with semi-arid climates, we recommend collection of surface water samples during spring and early summer time periods, when annual precipitation rates are highest.

General Comments

These review comments for the Draft PA/SI Site No. 5 are intended to provide constructive, independent information on technical issues involved with this project. This information may help the community and other stakeholders gain a better understanding of he PA/SI and promote informed participation and input during the process.

Persons contributing to these review comments were Brenda Brandon (TOSNAC Coordinator and Environmental Scientist), Haskell Indian Nations University, and Dr. Michael Lambert (Geologist and Agronomy Research Associate), Kansas State University.