SOIL MONITORING PLAN
NIROP Hazardous Waste Storage and Subpart X Treatment Permit

Prepared for:
Utah Department of Environmental Quality
Division of Waste Management and Radiation Control

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June 2010
Modified September 2018
Reissued September 2020

TABLE OF CONTENTS

TABLES

FIGURES

1.0 INTRODUCTION

This Soil Monitoring Plan (SMP) has been developed to comply with Module IV.K.1 of the Hazardous Waste Storage and Subpart X Permit ("the Permit") issued to ATK Launch Systems LLC (a subsidiary of Northrop Grumman Corporation hereafter referred to as ATK) and the United States Navy ("the Navy"). The Permit is issued for hazardous waste operations conducted on the Naval Industrial Reserve Ordnance Plant (NIROP). NIROP is owned by the Navy and operated by ATK. The NIROP facility has a Subpart X thermal treatment unit that is operated as an open burn facility (OB).

This SMP will address the potential impact operation of the NIROP Burning Grounds may have on soils within the treatment zone, as identified by the air dispersion and deposition model of the Human Health Risk Assessment. Risks to human health and the environment will be evaluated using the data collected during implementation of this SMP.

1.1 GENERAL DESCRIPTION

The Burning Grounds is located in the northwestern portion of the NIROP facility. It consists of 17 burning pans and two burn cages. The burning pans are spaced approximately 50 ft apart; each pan is surrounded on three sides by an earthen berm. All open burning occurs on these pans and cages. Each pan and cage is designed to collect leachate from precipitation.

ATK burns both Class 1.1 and Class 1.3 propellant waste. A maximum of 500 pounds of reactive hazardous waste may be burned on each pan, with a maximum daily burn of 4500 pounds. Reactive hazardous wastes exceeding 500 pounds (large blocks of cured propellant) can be treated on an individual pan under Condition IV.C.1.d of the permit. Diesel fuel is used on the waste material to ensure initiation and a complete burn. Following a burn the remaining ash is collected and stored in a dedicated gondola pending off-site disposal. Emissions from OB activities can include volatile organic compounds, semi-volatile organic compounds, metals, and acid gases.

Under the permit, OB operations are constrained to burn primarily when the wind direction is from the north with small burns of certain materials permitted with winds from the south. Permissible wind speeds for open burning must be 15 miles per hour or less. These restrictions help ensure that significant emissions from the burning grounds are not directed toward the community of Magna.

1.2 HUMAN RISK ASSESSMENT

A Human Health Risk Assessment (HHRA) is typically conducted using a three tiered approach: 1) Tier 1 – a conservative initial screening evaluation, 2) Tier 2 – a more refined screening analysis, and 3) Tier 3 – a more extensive site-specific risk assessment. The HHRA conducted in support of the NIROP Subpart X permit describes a Tier 1 analysis for residential receptors and a Tier 2 analysis for a subsistence farmer. All known chemicals that may be emitted by Class 1.1 and 1.3 propellant wastes during operations at the OB were considered in the HHRA. The risk evaluated was for chronic (long-term) exposure.

The exposure routes included in the HHRA were inhalation; ingestion of soil, produce, beef, and milk; and human milk ingestion by infants. The residential receptors were assumed to reside at the location of maximum off-site impact for the Tier 1 analysis, which is currently in a manufacturing zone. The subsistence farmer scenario was evaluated over areas zoned for agricultural use where the Tier 2 impact is located. Of the exposure scenarios for the subsistence farmer, only the ingestion of dioxins through milk is associated with a carcinogenic risk greater than $1x10^{-6}$. The agricultural zone evaluated to the north (where the greatest Tier 2 impact is located) does not currently include the grazing of dairy cows. Non-cancer risk for all receptors at both the Tier 1 and Tier 2 locations was well less than the target hazard index of 1.0.

The constituents exhibiting a combination of the highest bioaccumulative potential and the highest toxicity were those that resulted in the highest risk, namely dioxins and polynuclear aromatic hydrocarbons (PAHs). Based on the assigned risk of the constituents, dibenzodioxins/dibenzofurans and dibenzo(a,h)anthracene were established as the contaminants of potential concern (COPC) that would drive the HHRA. In addition to these constituents, perchlorate is also considered a contaminant of concern. Perchlorate is not completely consumed by the thermal treatment and may therefore be present in the deposition zone from activities at the NIROP Burning Grounds.

The original HHRA only considered off-site receptors. An HHRA focusing on the ATK Bacchus worker was recently completed with no unacceptable risks identified for either cancer or non-cancer effects. While the Bacchus worker HHRA did not identify any new COPCs, it did determine the location of maximum on-site deposition from open burning which is the open field

north of the ATK Bacchus Waste Water Treatment Plant (WWTP). This location has been identified for soil monitoring as further described in this plan.

2.0 SOIL MONITORING PLAN OBJECTIVES

The SMP will be used to support the results of the Tier 1, Tier 2 and Bacchus Worker findings in the HHRA's, provide data to be used in the upcoming screening level ecological risk assessment (SLERA) for the NIROP Burning Grounds, and institute a method of evaluating the surrounding receptor points identified by the HHRA. This will be accomplished by the collection of surface soil samples in the area of particle deposition predicted by the HHRA model and periodic inspection of the land use.[1] [*Superscripts correspond to the steps associated with the EPA Data Quality Objectives. These steps are summarized in Section 5.0*].

The collection of surface soil samples will be based on aerial deposition that would occur over a specified area at the Tier 1 and 2, and Bacchus worker locations, and not for a discrete release or hot spot which may, or may not, be present. It is assumed that fallout from the NIROP Burning Grounds will create a relatively uniform deposition pattern.

2.1 HHRA SUPPORT

The actions and methodologies in this SMP will be used to lend support and confirmation to the results of the HHRA's. The off-site HHRA identified two potential areas of risk to offsite receptors based on the model objectives. The Bacchus Worker HHRA identified a potential area of risk to on-site Bacchus workers. Soil samples from these three areas of risk will be analyzed for the COPCs that are attributed to the risk calculations. The results will lend additional information using hard data in an effort to establish an acceptable risk to human health.[2]

2.2 ECOLOGICAL SUPPORT

A SLERA will be conducted in accordance with the Permit to satisfy the requirements of Module IV.L. The SMP includes additional COPCs required to assist in the risk determination of possible ecological receptors that could be potentially impacted by OB activities. The additional COPCs include: benzo(a)pyrene, hexachlorobenzene, pentachlorophenol, and perchlorate. These analytes have been added because of their persistency in the environment, bioaccumulation potential, and

toxicity. Soil samples will be collected from a defined area where maximum potential deposition of particulates and ecological diversity would occur.

2.3 BACKGROUND DATA

The COPCs presented in Section 1.2 and Section 2.2, were not necessarily detected at concentrations greater than the method detection limit (MDL), e.g. dibenzo(a,h)anthracene. Non-detected constituents such as these were used in the risk model at half the MDL. Soil samples will be collected and analyzed to support the potentially conservative nature of the HHRA's and establish a baseline at the Tier 1, Tier 2, and Bacchus worker locations

ATK has completed a background study for metals and dibenzodioxins/furans at the Bacchus facility. This statistically significant dioxin/furan background value will be available to compare to soil monitoring results. Comparison of data collected for this SMP will be evaluated as discussed in Section 4.0.

2.4 RISK AREA EVALUATION

As stated in the HHRA, neither the Tier 1 nor Tier 2 areas are being used under the conservative conditions that establish risk. No residents are located in the Tier 1 area, nor are there any cows grazing north of the OB operations that would contribute to subsistence farmer milk consumption in the Tier 2 area. Since it is possible for conditions to change over time, the monitoring and management of the HHRA will include an evaluation of land use conditions in accordance with Permit Condition II.G.2.

3.0 TECHNICAL APPROACH

The purpose of this SMP is to present the sampling protocols, analytes, and the data quality objectives for the soil monitoring program.[3]

3.1 SAMPLING LOCATIONS[4]

Surface soil samples will be collected to provide a current characterization at the Tier 1, Tier 2 and Bacchus worker locations, as established in the off site and Bacchus worker HHRA's and in support of the SLERA. The area of maximum exposure for the Tier 1 and Tier 2 locations occurs at the property boundary, shown on Figure 1. The area of maximum exposure for the Bacchus worker occurs in the empty field north of the WWTP also shown in Figure 1. Samples will be collected according to the protocol presented in Sections 3.2 through 3.7.

The Tier 1 location is based on a residential scenario. For the purpose of this monitoring program it will be assumed that the residence would be built on a 1-acre lot, for the monitored sampling area. The area will be measured uniformly on all four sides, with the front-center located approximately at the HHRA designation. A total of four discreet soil samples will be collected in this area.

The Tier 2 location is based on a subsistence farmer scenario. The greatest risk presented in the HHRA is at the closest location zoned for agricultural use which is located north of the NIROP Burning Grounds, on land owned by the LDS church. Since the associated risk is milk ingestion from a grazing cow, an area of approximately 10 acres will be established as the monitored sampling area. The area will be measured located based on the HHRA location and the outline shown on Figure 1. A total of 4 discreet soil samples will be collected in this area.

The closest potential Bacchus Facility receptors are located at the WWTP, about 1500 feet south of the OB facility. The Bacchus worker HHRA determined that the empty field between the WWTP and OB facility is the area of maximum exposure and has been selected as a sampling location. This area does not receive any traffic, nor is it used for any plant operations. It will however give an indication of particle deposition at the closest possible location to Bacchus workers. A total of four discreet soil samples will be collected over an approximate 10 acre area.

Surface soil samples in support of the SLERA will be collected within the remaining area shown on Figure 1. At total of 20 discreet soil samples will be collected. The remaining area comprises about 55 acres; of that acreage, about 15 acres includes the burning grounds and the springs which will not be sampled; leaving an average of 2.5 acres per sample.

3.2 SOIL SAMPLING

The intent of the sampling program is to collect actual field data based on, and in support of, the completed HHRA and pending SLERA. The sample results are expected to assist in evaluating the accuracy of the HHRA modeling. Surface soil samples will be collected in the areas presented in Section 3.1. Samples will be collected using a pre-cleaned stainless steel spoon. Soil will be removed to a depth of about six inches and placed into a pre-cleaned stainless steel bowl. Plant material, roots, and rocks will be manually removed. The soil will be lightly mixed before being placed into 4-oz wide-mouth glass jars with Teflon© lined lids. The number of jars will depend on the analytes of concern and quality control/quality assurance requirements.

3.3 SAMPLE HANDLING

The jars will be labeled, logged into the field log book, placed in a sealed plastic bag, and placed into an iced cooler. A chain-of-custody form will be completed as soon as possible to trace sample possession from the time of collection through laboratory analysis. One chain-of-custody form will accompany each shipping container of samples. While the samples are in the custody of the collector, they will not be left unattended at locations where the samples may be tampered with. The analyses to be performed will be indicated on the chain-of-custody, including the quantity and types of containers that comprise each sample. The completed chain-of-custody will be sealed in a resealable plastic bag and placed inside the shipping container. The shipping container will then be securely closed and delivered to the analytical laboratory.

All field data will be recorded in a log book. Information to be recorded in the log book will include, at a minimum, the date, time, location and depth of each sample collected, descriptions of the soils encountered at each sampling location, recording of field decisions concerning sample locations, and the basis for departures from prior plans and general observations.

3.4 EQUIPMENT DECONTAMINATION

Prior to the collection of each sample, any non-dedicated sampling equipment coming in contact with the soil will be cleaned with a non-phosphate detergent (e.g., Liquinox®), rinsed with tap water, and a final rinse using distilled water. Wastewaters generated during field decontamination will be collected and properly disposed.

Only decontaminated stainless-steel or Teflon sampling equipment and clean, disposable gloves will contact the samples during placement in the container. Disposable gloves will be worn at all times during sample handling to prevent cross contamination between samples and skin contact with potential contaminants. Gloves will be changed between each sample.

3.5 ANALYTICAL METHODS AND PROCEDURES[3]

Samples will be analyzed for dibenzodioxins/furans and the analytes specified in Sections 1.2 and 2.2. The dioxin/furan samples will be analyzed using EPA Method 8290, by high-resolution GC/MS. Method 8290 is normally used in conjunction with RCRA regulatory action in support of remediation activities, and is able to report lower method detection limits than Method 8280. Analyses are expected to be conducted by ALS/Columbia Laboratories, in Houston Texas, a Utah-certified laboratory for dioxins and furans; or an equivalent Utah-certified laboratory.

The semi-volatile analytes will be analyzed using EPA 8270-SIM (Selective Ion Monitoring). SIM has been selected over the Standard Method 8270 because it provides an order of magnitude better quantitation results. This is important since none of the semi-volatile analytes were quantified in the HHRA model. Perchlorate will be analyzed using EPA Method 314.0. As an early "warning," the samples will also be tested for the indicator parameter pH. Semi-volatile and perchlorate samples will be analyzed by the ATK Promontory laboratory, a Utah-certified laboratory, or an equivalent Utah-certified laboratory.

3.6 QUALITY CONTROL/QUALITY ASSURANCE SAMPLES

Quality assurance/quality control (QA/QC) samples will be analyzed for the analytes discussed above. QA/QC samples will consist of equipment blanks, field blanks, blind duplicates, and temperature blanks.

3.6.1 Field Quality Control Samples

Blind duplicates are used to evaluate the laboratory accuracy where analytical results of two samples collected from the same location are compared. A minimum number of blind duplicates will be collected to represent at least 10% of the total samples sent for analysis. The duplicate samples will be given a unique designation that will differentiate the duplicate from the original sample-of-record. All blind duplicate samples will be delivered to the laboratory under chain-of-custody as outlined previously.

Equipment blanks are designed to verify the effectiveness of procedures for cleaning the sampling equipment between individual samples. Equipment blank will be collected at a frequency of 5% of the total samples sent for analysis. Equipment blanks will be prepared as discussed in Section C.3.7.1.1.3 of the RFI Amended Work Plan (ATK, 2010). These blanks will be analyzed for the same constituents as the soil samples-of-record. Equipment blanks will not be collected if dedicated sampling equipment is used during collection operations.

Field Blanks are used to evaluate potential contamination that may arise from normal field and/or off-site activities; such as volatilization or dust and air-borne contaminates. Field blanks consist of empty, clean sample containers to be opened in the field and filled with reagent grade water. The water may be poured into the container and sealed, or remain open in a designated area during the duration of the sampling event. Field blank will collected at a frequency of 5% of the total samples sent for analysis. The field blanks will be analyzed for the same constituents as the samples-of-record.

Temperature Blanks are used to evaluate whether the coolers holding and transporting the samples to the laboratory are in compliance with sample temperatures arriving between 4ºC and 6ºC. To accomplish this a temperature blank and/or at thermometer will be included with each cooler of samples.

3.6.2 Laboratory Quality Control

Internal laboratory quality control checks will be performed according to Section C.3.7.2 of the Amended RFI Work Plan (ATK, 2010).

3.7 DATA REVIEW, VERIFICATION, AND VALIDATION

Data review, verification, and validation will occur as outlined in Section C.5.1 of the Amended RFI Amended Work Plan (ATK, 2010).

4.0 DECISION STATEMENT[5]

In accordance with Module IV.K of the Permit, the decision rule for this program will involve evaluating actual soil data based on the modeling conducted during the HHRA's. The HHRA model is inherently conservative based on potential risks to human health, even in the absence of hard analytical data. The data collected during this SMP will be evaluated and compared to the predicted results of the HHRA's.

Either a 95% upper confidence limit (95UCL) or maximum concentration will be provided for each COPC and compared to the HHRA concentrations associated with the Tier 1, Tier 2 and Bacchus worker risks. With only four samples per sample location, there is insufficient data to calculate a 95UCL for dibenzo (a, h) anthracene and perchlorate. For these two COPCs, the maximum concentration from among each of the four samples per sample location will be used to compare to HHRA concentrations. No maximum concentration will be reported for sample sets without any detects. For dibenzodioxins/furans, the ProUCL model will be used to calculate the 95UCL as long as at least 5 dibenzodioxin or furan congeners are detected in each of the four samples per sampling location. Nondetects will be considered as described in ProUCL guidance.

The respective 95UCL or maximum concentrations will also be compared to Regional Soil Screening Levels (RSLs) as presented in the current version of the "Regional Screening Levels for Chemical Contaminants at Superfund Sites." Whereas the HHRA model assumes a complete pathway from particle deposition to ingestion/bioaccumulation in an adult, comparison to the RSLs will indicate whether the soil concentrations have accumulated to levels that would warrant additional investigation. The additive effects of multiple COPCs will be evaluated in accordance with USEPA risk assessment guidance documents in situations where 95UCLs or maximum concentrations of multiple compounds exceed the RSLs.

The resulting data will be used to support the HHRA model or show that it has presented an overly conservative conclusion. Future actions taken will depend on these results, which may require additional sampling to define the extent of contamination. Frequency of sampling will be controlled by the NIROP Part B permit.

5.0 DATA QUALITY OBJECTIVE DESCRIPTIONS

Throughout the SMP, superscripts are placed to associate certain portions with the EPA Data Quality Objective Process, EPA QA/G4, 2006. There are seven steps in the DQO process, of which five are generally applicable to the SMP at this time.

1. **Define the problem** that necessitates the study. Describe the problem, develop a conceptual model of the environmental hazard to be investigated, and identify the general type of data needed
2. **Identify the goals of the study;** identify the key questions that the study attempts to address, along with alternative actions or outcomes that may result to develop a decision statement.
3. **Identify the information inputs** to determine the types and sources of information needed to resolve the decision statement or produce the desired estimates; whether new data collection is necessary; and whether appropriate sampling and analysis methodology exists to properly measure environmental characteristics for addressing the problem.
4. **Define the boundaries of the study** by defining the sampling unit as some area, volume, or mass that may be selected from the target population. When defining sampling units, you should ensure that the sampling units are mutually exclusive (i.e., they do not overlap), and are collectively exhaustive (i.e., the sum of all sampling units covers the entire target population). Practical constraints that could interfere with sampling should also be identified in this step. A practical constraint is any hindrance or obstacle (such as fences, property access, water bodies) that may interfere with collecting a complete data set.

5. **Develop an approach** to guide how to analyze the study results, draw conclusions from the data, and develop a decision rule.

6.

TABLES

TABLE 1 REGIONAL SCREENING LEVELS (RESIDENTIAL SCENARIO)		
Analyte	**RSL[1]**	**Units**
Dioxins	4.8E-06	mg/kg
Furans	73	mg/kg
Dibenzo(a,h)anthracene	0.11	mg/kg
Pentachlorophenol	1.0	mg/kg
Hexachlorobenzene	0.21	mg/kg
Benzo(a)pyrene	0.11	mg/kg
Perchlorate	55	mg/kg

1) RSL = Regional Screening Levels, values shown are from November 2018 edition of EPA RSL tables. Most recent edition of RSLs applies.

TABLE 2 SMP ANALYTICAL LIST		
	Soil	**Water**
	MRL[1]	**MRL[1]**
Dioxins/Furans (EPA 8290)	**(ng/kg)**	**(ng/L)**
Tetra	1	0.010
Penta, Hepta, Hexa	5	0.050
Octa	10	0.100
SVOC/PAH (EPA 8270-SIM)	**(ug/kg)**	**(ug/L)**
Dibenzo(a,h)anthracene	7	0.2
Pentachlorophenol	7	0.2
Hexachlorobenzene	7	0.2
Benzo(a)pyrene	7	0.2
Energetics (EPA 314.0)	**(mg/kg)**	**(ug/L)**
Perchlorate	0.4	4
pH (SW – 846, 9040B)	1 – 14 s.u.	NA

1) MRL = Minimum Reporting Limit

FIGURES

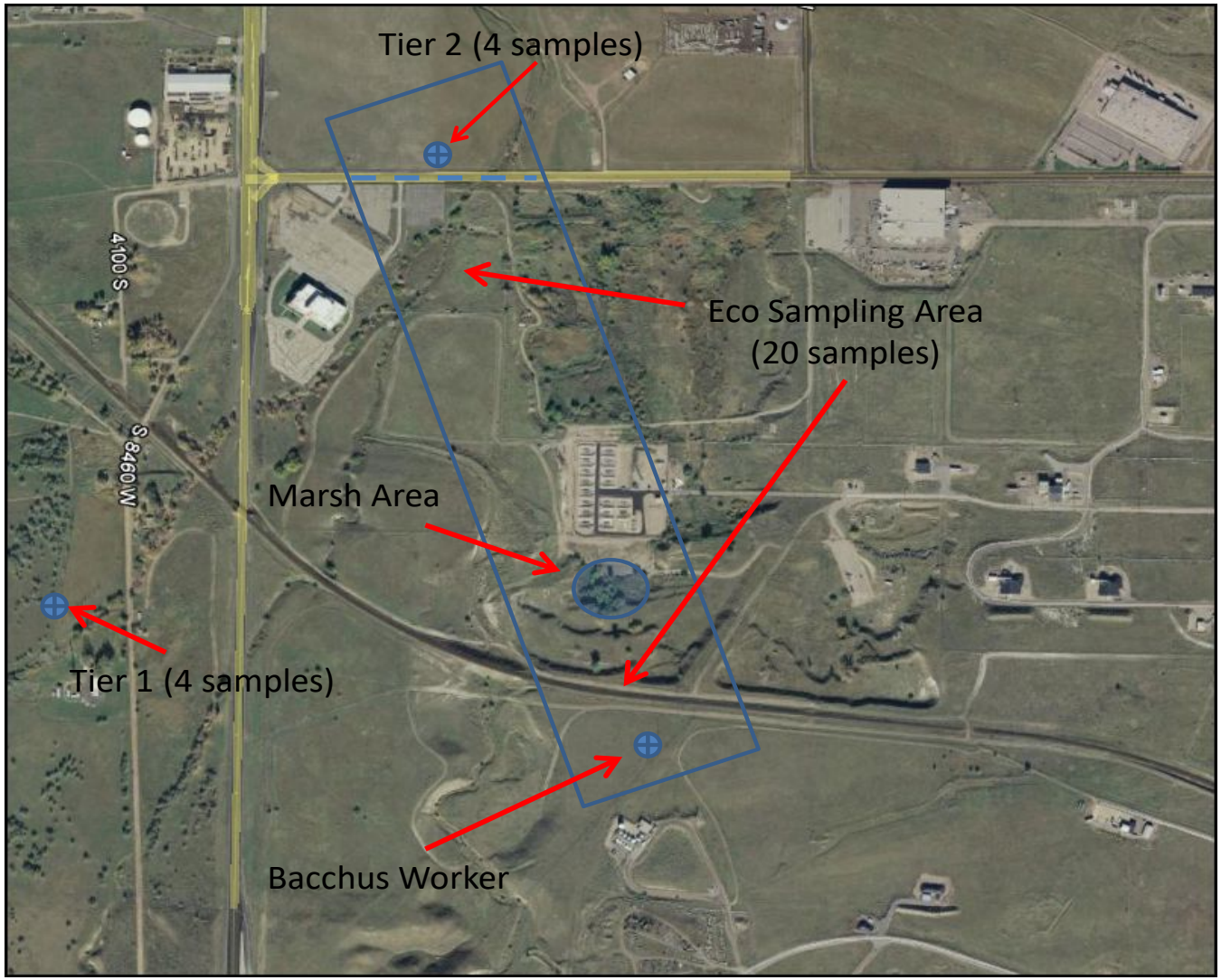

Figure 1
Sampling Locations