Northeast Church Rock 95% Design Report

Appendix Q:
Dust Control and Air Monitoring Plan

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LIST OF ACRONYMS / ABBREVIATIONS

AMP	Air Monitoring Plan
AOC	Administrative Settlement Agreement and Order on Consent for Design and Cost Recovery
ARAR	Applicable or Relevant and Appropriate Requirements
CC	Construction Contractor
CFR	Code of Federal Regulations
DQO	Data Quality Objective
GPM	gallons per minute
HASP	Health and Safety Plan
LLD	Lower Limit of Detection
Mill Site	Church Rock Mill Site
Mine Site	Northeast Church Rock Mine Site
mrem	millirem
NMAC	New Mexico Administrative Code
NRC	US Nuclear Regulatory Commission
PTW	principal threat waste
QA	quality assurance
RA	Removal Action
RAO	Remedial Action Objective
RPP	Radiation Protection Program
ROD	Record of Decision
RSO	Radiation Safety Officer
SOP	standard operating procedure
TLD	thermoluminescent dosimeter
TWA	time weighted average
USEPA	US Environmental Protection Agency
µCi/ml	microcuries per milliliter
µR	microroentgen

Q.1 INTRODUCTION

This appendix to the Northeast Church Rock 95% Design Report presents requirements and protocols for dust control and air monitoring at the Northeast Church Rock Mine Site (Mine Site) and the Church Rock Mill Site (Mill Site).

This appendix:

- Demonstrates that the design will attain the applicable standards identified in the Record of Decision (ROD; USEPA, 2013)
- Explains performance requirements for dust control during construction
- Presents methods and protocols for air monitoring during construction, including radiation and dust monitoring

Q.2 PERFORMANCE STANDARDS

The Performance Standards presented here are defined in the Action Memorandum: Request for a Non-Time-Critical Removal Action at the Northeast Church Rock Site (2011 Action Memo; USEPA, 2011), the Record of Decision, United Nuclear Corporation Site, (USEPA, 2013), and the Administrative Settlement Agreement and Order on Consent for Design and Cost Recovery (AOC; USEPA, 2015) including the Statement of Work attached as Appendix D to the AOC, and were developed to define attainment of the Removal Action and Remedial Action Objectives (RAOs) for the Selected Remedy. The Performance Standards include both general and specific standards applicable to the Selected Remedy work elements and associated work components. Table Q.2-1 presents Performance Standards related to the Dust Control and Air Monitoring Plan and explains how the design accomplishes these standards.

Table Q.2-1: Performance Standards Applicable to the Dust Control Air Monitoring Plan

Identifying Number*	Location of Performance Standard Requirement	Topic	Performance Standard	Comments
44	2013 ROD, Section 2.9.5, Transportation	Transportation	Transportation of all mine waste will be transported in such a manner to mitigate the production of dust, including the use of covers and/or dust suppression actions. A transportation plan will be used to identify the routes of travel, times of operation, and traffic rules. Emergency spill containment and cleanup contingencies will also be included in the transportation plan to address mine waste spills.	Dust suppression controls are addressed in this appendix. The transportation plan is included as Appendix M.
30	2013 ROD, Section 2.9.5, Perimeter Air Monitoring	Air Monitoring	Perimeter air monitoring stations will be positioned and operated to monitor emissions during site preparation construction, stockpiling, loading of bulk-carriers, stockpile management, consolidation, cover construction and restoration. Dust suppression controls will be implemented to maintain a safe working environment and to protect human health and the environment.	Air monitoring and dust suppression controls are addressed in this appendix. The transportation plan is included as Appendix M.
9	2015 AOC SOW, Paragraph 24 – Air Monitoring	Air Monitoring	In the Design, Respondents shall include detailed plans and specifications for air monitoring stations to be installed around the perimeter of the SA Site during the response action. Respondents' detailed plans and specifications shall ensure that perimeter air monitoring stations will be positioned and operated to monitor emissions during dust-or emission-generating activities, including site preparation, construction activities, excavation and backfill, stockpiling (staging), loading of bulk-carriers, stockpile management, consolidation, cap construction and regrading. Respondents shall ensure that their detailed plans and specifications also include dust prevention and dust suppression controls that will be implemented to maintain a safe working environment and to protect human health and the environment.	Air monitoring and dust suppression controls are addressed in this appendix.

Identifying Number*	Location of Performance Standard Requirement	Topic	Performance Standard	Comments
49	2013 ROD Table 1	Environmental Monitoring	10 CFR 61.53(c), Environmental Monitoring. Refer to www.ecfr.gov.	Air monitoring to detect the release of radionuclides during construction is addressed in this appendix.

*Refers to identifying numbers listed in Summary of ARARs, Performance Standards and Applicable NRC Design Requirements Table (provided in Attachment 1 to main text of the 95% Design Report)

Q.3 DUST CONTROL PLAN

Dust will be controlled during the Removal Action (RA) using water, dust suppressants, gravel surfacing, and operational controls, as applicable. The Construction Contractor (CC) will be required to prepare and implement a dust control plan tailored to its specific operations prior to any earthwork activities at the Mine and Mill Sites (including borrow areas).

The CC's dust control measures must comply with the maximum nuisance dust levels discussed in Section Q.4. Perimeter air monitoring will be conducted to evaluate dust levels during construction and the CC will be notified if dust levels exceed acceptable limits. The CC will be required to stop work if dust levels are not kept below the levels outlined in Section Q.4. The CC shall use daily field reports to document dust control measures that were implemented and their effectiveness, as well as the details of water usage, storage, and withdrawal.

Q.3.1 Specific Dust Control Measures

The following sections describe dust suppression measures that will be employed for specific construction activities, including:

- Excavation, placement, and grading
- Hauling
- Speed limits
- Screening (separating soil and rock)
- Stockpiles

Q.3.1.1 Excavation, Placement and Grading

Methods and equipment to minimize/control dust generation during earthwork operations will include some or all of the following measures:

- Application of water or other approved dust suppressants to reduce visible dust during execution of work
- Avoidance of excavation or placement of overly dry or fine soils during high wind conditions to the extent practical
- Application of water or other approved dust suppressants to areas where wind can generate dust, including disturbed areas that are not being actively worked
- Use of windrows or other wind break methods
- Maintenance and protection of native vegetation where possible, through minimization of site disturbance
- Stabilization of inactive, disturbed work areas by longer term methods such as matting, tack and mulch, or crusting agents
- Implementation of permanent stabilization on a regular basis when sufficient area exists for application

Q.3.1.2 Hauling

The methods and equipment to minimize/control dust generation during earthwork operations will include some or all of the following measures:

- Application of water or other approved dust suppressants to haul roads to minimize visible dust during hauling
- Application of water during loading
- Wetting or covering loads during hauling

- Street sweeping and/or cleaning as necessary
- Implementing haul road speed limits (see below)
- Limiting access and haul road development to the minimum necessary to execute work

In addition, wet washing or dry brushing of equipment will be conducted as needed to control tracking of impacted material or mud onto roadways. Operators will secure and cover loads on haul vehicles carrying removal materials from the Mine Site.

Q.3.1.2.1 Speed Limits

A speed limit of 20 miles per hour will be implemented on haul and access roads. Speed limit and no-idle zone signs will be posted on on-site roads and haul roads. Lower speed limits may be necessary to control dust depending on actual day-to-day site conditions. Site supervisory personnel will enforce speed limits. Appropriate corrective actions will be implemented if equipment operators are observed to be operating equipment at excessive speeds.

Q.3.1.3 Screening

Material screening operations can be major sources of airborne dust due to the inherent nature of the size reduction and segregation processes. Dust from screening operations will be controlled using water trucks, water sprays, and/or manned water hoses.

Q.3.1.4 Stockpiles

Temporary stockpiles may be required for borrow and imported materials. During active stockpile construction, water will be applied directly to the stockpiles by spraying with hoses and water truck sprays.

Principal threat waste (PTW) stockpiles will require more robust dust control than water or chemical agents. Active stockpile areas can be effectively managed for dust control during placement using water and small tracked equipment for moderate compaction. Water is also effective for dust control during excavation and loading. Inactive PTW stockpiles will require a membrane cover. There are many effective alternatives for this application and the CC will be required to submit for approval the cover materials and system it will use to manage the PTW stockpiles. The CC will be required to demonstrate that its proposed cover system will be stable during reasonably anticipated high wind events.

Q.3.2 Water Management

The CC will have a minimum of two water trucks on-site to spray haul roads, excavation areas, placement areas, and borrow areas for dust control. Due to the potential for dry and windy conditions, work areas will likely need to be wetted regularly for dust control. Allowing a contractor to move water trucks between the Exclusion Areas and Support Areas for daily dust control operations would require decontamination and could result in insufficient dust control in either or both areas. Therefore, dedicated water trucks will be required for work conducted in contaminated and non-contaminated areas. The CC will employ the appropriate number of water trucks to suit its operations.

The Mill Site well will supply water for dust control as well as for decontamination and sanitary uses. Well details and location information are presented in Appendix B.

A typical haul road can be expected to require 25 to 50 gallons per 1,000 square feet per hour for dust control during summertime conditions, such as can be expected at the Mine and Mill Sites (Tannant and Regensburg, 2001). Additional dust control or construction suppression water will be required for excavation, placement, compaction, and stockpiling activities. Decontamination and domestic water demands are also considered. Table Q.3-1 provides estimates of daily dust control water demand during construction and the required storage capacity to meet this demand without the use of supplemental dust control measures. Table Q.3-2 provides estimates of daily dust control water demand during construction and the required storage capacity to meet this demand with the use of supplemental dust control measures to reduce water consumption. The calculation brief for dust control water demand is presented in Attachment Q.1.

Table Q.3-1: 95% Design Estimate of Dust Control Water Demand and Required Storage Without Supplemental Dust Control Measures

<table>
<tr><th rowspan="2">Dust Control Area
Construction Water Demand</th><th rowspan="2">Estimated Hourly Demand (gal/hr)</th><th colspan="2">Required Storage and Well Production</th></tr>
<tr><th>40-Hour Week*</th><th>50-Hour Week**</th></tr>
<tr><td>All Areas</td><td>22,773
(380 GPM)</td><td>231,000 gallon storage
(11) 21,000 gallon tanks
79 GPM well yield</td><td>295,000 gallon storage
(15) 21,000 gallon tanks
102 GPM well yield</td></tr>
<tr><td colspan="2">Dust Control Water</td><td colspan="2" rowspan="9">*40-hour week is (5) 8-hour shifts
**50-hour week is (5) 10-hour shifts

Well Pump Requirements:
Max TDH: 529 Feet
Required Pump HP: 16 - 21
4- to 6-inch discharge pipe diameter</td></tr>
<tr><td>Mine Waste Haul Roads</td><td>10,809</td></tr>
<tr><td>Borrow Haul Roads</td><td>2,498</td></tr>
<tr><td>Yards</td><td>275</td></tr>
<tr><td>Excavation/Placement/ Inactive Areas</td><td>1,200</td></tr>
<tr><td colspan="2">Operational Water</td></tr>
<tr><td>Compaction Control</td><td>6,825</td></tr>
<tr><td>Decontamination and Domestic Water</td><td>166</td></tr>
<tr><td>Evaporation Pond Wetting</td><td>1,000</td></tr>
</table>

GPM – gallons per minute

Table Q.3-2: 95% Design Estimate of Dust Control Water Demand and Required Storage with Supplemental Dust Control Measures

<table>
<tr><th rowspan="2">Dust Control Area</th><th rowspan="2">Estimated Hourly Demand (gal/hr)</th><th colspan="2">Required Storage and Well Production</th></tr>
<tr><th>40-Hour Week*</th><th>50-Hour Week**</th></tr>
<tr><td>All Areas</td><td>18,417
(307 GPM)</td><td>187,000 gallon storage
(9) 21,000 gallon tanks
64 GPM well yield</td><td>240,000 gallon storage
(12) 21,000 gallon tanks
82 GPM well yield</td></tr>
<tr><td colspan="2">Dust Control Areas</td><td colspan="2" rowspan="9">*40-hour week is (5) 8-hour shifts
**50-hour week is (5) 10-hour shifts

Well Pump Requirements:
TDH: 550 Feet
Required Pump HP:13-17
4- to 6-inch discharge pipe diameter</td></tr>
<tr><td>Mine Waste Haul Roads</td><td>7,154</td></tr>
<tr><td>Borrow Haul Roads</td><td>1,796</td></tr>
<tr><td>Yards</td><td>275</td></tr>
<tr><td>Excavation/Placement/ Inactive Areas</td><td>1,200</td></tr>
<tr><td colspan="2">Operational Water</td></tr>
<tr><td>Compaction Control</td><td>6,825</td></tr>
<tr><td>Decontamination and Domestic Water</td><td>166</td></tr>
<tr><td>Evaporation Pond Wetting</td><td>1000</td></tr>
</table>

GPM – gallons per minute

The on-site well currently yields between 45 and 67 GPM depending on operating conditions. As discussed in Appendix B, mechanical upgrades will be included in an early phase of the RA to increase yield to meet construction demand. Construction operations are likely to be constrained by water production and storage capacity as indicated in Tables Q.3-1 and Q.3-2. Alternative methods of dust suppression (e.g., use of road salts, resin modified emulsions, and/or biodegradable oils) on haul roads may be proposed by the CC to reduce water use or to increase working hours. The RA schedule in Appendix K is based on a 40-hour work week to account for the water production constraints indicated in Tables Q.3-1 and Table Q.3-2.

This 95% design assumes that 21,000-gallon closed-top portable water tanks, or similar, will be placed in the former Mill Site Yard and connected to the well with temporary piping. Sufficient space is indicated on the Drawings to accommodate each of the storage scenarios indicated above. Piping and layout configurations will be determined by the CC. Closed-top tanks are preferable to a water management pond because they offer scalability and eliminate water losses from evaporation. Well testing to confirm production capacity and determine necessary mechanical upgrades prior to commencement of the RA will be required. Water storage capacity and the RA schedule will be revised accordingly based on the outcome of this well testing and production evaluation.

Q.4 AIR MONITORING PLAN

The Air Monitoring Plan (AMP) establishes air monitoring, sampling and analysis protocol during construction activities to demonstrate protection of individual members of the public that meets the dose limits defined in 10 CFR 20, Appendix B, Table 2. To achieve this, air monitoring will be conducted at upwind and downwind locations for internal and external radiation. The proposed locations are shown on Figure Q.4-1. Based on the most recently available (2012) annual wind rose from the weather station at the Gallup, NM Municipal airport, as shown in Figure Q.4-1, the predominant wind direction in the region is from the southwest. The air monitoring stations will be placed as described below:

- Two Mine Site downwind air monitoring stations will be placed to account for occasional shifts in the wind direction throughout the day (one near each residence downwind of the Mine Site, which are located generally northeast of the excavation areas)
- One downwind air monitoring station will be placed northeast of the Repository at the Mill Site tailings impoundment
- One downwind air monitoring station for dust monitoring will be placed northeast of the borrow area
- One upwind (background) air monitoring station will be placed south of the Mine and Mill Sites

Occupational air monitoring for site workers is addressed in the RA Health and Safety Plan (HASP – Appendix L).

The methods that will be used to monitor internal and external radiation exposure are described in the Standard Operating Procedure for Perimeter Airborne Particulate Monitoring, which is included as Attachment Q.2 and is discussed below.

The AMP will also include monitoring for respirable dust according to U.S, Environmental Protection Agency's (USEPA's) Primary National Ambient Air Quality Standard. Respirable dust will be monitored during construction to determine the effectiveness of dust control measures. Records of air monitoring implemented during the RA at the Mine and Mill Sites will be provided with the RA Final Construction Report.

Q.4.1 Radiation Monitoring

Perimeter air monitoring for internal and external radiation exposure to individual members of the public will be conducted using the methods described here, and as summarized on Table Q.4-1. To evaluate the potential internal radiation exposure to the public, air particulates will be collected on a 47-mm Type A/E glass fiber air filters using air samplers (e.g., RAS-2 or equivalent), as specified in Attachment Q.2. The loaded filter will be counted on-site for gross alpha activity after allowing at least 72 hours for decaying of the alpha emitting radon progeny collected on filters from ambient air. Individual airborne concentrations will be determined for the alpha emitters U-234, U-238, Th-230, Ra-226, and Po-210 from their activity fraction of the gross alpha activity of dust material, which has the potential for becoming airborne. Since these radionuclides are in secular equilibrium in uranium ore dust, the individual radionuclide airborne concentration will be determined by multiplying the airborne gross alpha activity by 0.20. The net airborne concentrations (downwind concentrations minus the background concentrations) will be compared to the air concentration values specified in Table 2 of Appendix B to 10 CFR Part 20. These calculations can be conducted following counting of the air sample filter, as needed for assessing effectiveness of control measures. An initial 24-hour decayed count of the loaded filters may be performed for informational purposes only to facilitate any operational adjustments needed at the beginning of the removal action. Final analysis will be performed after 72 hours. For the purpose of demonstrating compliance with the airborne effluent concentration limits, net concentrations will be averaged quarterly, but not for longer than a yearly period. The effluent concentration limits for assessment and control of dose to the public are based on annual dose limit as specified in 10 CFR 20, Appendix B, Table 2, thus the compliance with the limit could be demonstrated by yearly average of the concentrations. The quarterly average is used for the exposure control measure, which would be a conservative approach.

To evaluate potential internal airborne radon and radon progeny concentrations, track etch radon monitors will be continuously exposed at the perimeter air monitoring stations and submitted for laboratory analysis on a quarterly basis. The track etch monitors will be analyzed by the manufacturer quarterly or at the end of the project, whichever is shorter.

To evaluate potential external radiation exposure, environmental thermoluminescent dosimeters (TLDs) will be exposed continuously at the perimeter air monitoring stations and will be submitted for laboratory analysis on a quarterly basis. Until the TLD results have been received from the laboratory, external exposure from gamma radiation will be estimated based on area exposure rate field measurements using a calibrated micro-R-meter. This will be done weekly, or less frequently, based on changes in the gamma radiation source as determined by the Radiation Safety Officer (RSO).

The results and measurements will be compared against the limits presented in Section Q.4.1.2. If exceedances of the limits are observed, construction will stop, USEPA will be notified, and construction will not resume until the cause(s) for the exceedances were identified and rectified. The results of these monitoring activities will be transmitted to the USEPA with the monthly status reports.

Table Q.4-1: Summary of Perimeter Air Monitoring Plan

Type	Instrumentation	Location[1]	Frequency	Action Level	Analysis
Radiation Monitoring					
Internal Radiation	RAS-2 Sampling pump with 47-mm Type A/E glass fiber filter	1 upwind and 3 downwind	5 days/week the week for the first week, thereafter 3 days or less per week based on monitoring results.	U-234, U-238, Th-230, Ra-226, and Pb-210, air concentration values as specified in 10 CFR 20, Appendix B, Table 2 (annual total effective dose equivalent of 0.05 rem)	Analyzed by RSO using an Alpha Radiation Counting Instrument, such as L2929/43-10-1
Internal Radiation	Landauer Radtrak Alpha-track detector	1 upwind and 3 downwind	As above, then continuously during construction.	Rn-222 dose limits as specified in 10 CFR 20, Appendix B, Table 2	Analyzed by manufacturer quarterly or at end of project
External Radiation	Landauer InLight Dosimeter	1 upwind and 3 downwind	Continuously for duration of project.	Dose limits as specified in 10 CFR 20.1302(b)	Analyzed by manufacturer on a quarterly basis
External Radiation	Ludlum Model 19 Micro R Meter	1 upwind and 3 downwind	Estimate exposure rate weekly	Dose limits as specified in 10 CFR 20.1302(b)	Estimated by RSO
Airborne Dust Monitoring					
Airborne Dust	Model 8520 Dustrack Aerosol Monitor	1 upwind and 4 downwind	Starting 2 days prior to construction, 24 hrs/day for the first 3 days of significant earthmoving activities, then continuously during working hours thereafter.	24-hr TWAs for PM10 = 150 $\mu g/m^3$ & PM 2.5 = 35 $\mu g/m^3$ (40 CFR 50)	Direct read

Notes:

1. The downwind perimeter air monitoring location may be adjusted based on wind conditions and daily activities. The radtrak and dosimeter will be placed at fixed locations for the duration of construction.

2. TWA = time weighted average

Q.4.1.1 Background Monitoring

Mobilization for construction is expected to take approximately two to four weeks, with minimal earth moving activities occurring the first week. Mobilization activities will include fence removal, installation of erosion and sediment control measures, and vegetation removal. Baseline perimeter monitoring will be conducted the week prior to the start of earthwork, including the following:

- Airborne dust monitoring will be conducted for a minimum of two days prior to beginning earthwork
- Dust monitoring will be conducted 24 hours/day for the first 3 days of significant earthmoving activities (e.g., excavation/hauling) and then during working hours for the remainder of construction

Background airborne radionuclide concentrations for internal radiation exposure monitoring will simultaneously be conducted with downwind monitoring at the frequency specified in Section 4.1.4.1. Results of initial monitoring will be reviewed to evaluate whether adjustments need to be made to construction methods to ensure public and worker safety.

Q.4.1.2 Radiation Criteria

The individual airborne concentrations obtained from the gross alpha activity counts and estimates from the track etch monitors will be reviewed to assess compliance with the following airborne effluent concentration limits for Y lung classification averaged over a year. These airborne effluent concentrations, if inhaled continuously over the course of a year, will produce a total effective dose equivalent of 0.05 rem. This total dose equivalent coincides with the annual internal radiation dose limits for individual members of the public as specified in 10 CFR § 20.1302(b) Appendix B, and New Mexico Administration Code (NMAC) 20.3.4.414.

- U-234, Y: 5.0E-14 µCi/ml
- U-238, Y: 6.0E-14 µCi/ml
- Ra-226, W: 9.0E-13 µCi/ml
- Th-230, Y: 3.0E-14 µCi/ml
- Pb-210, D: 6.0E-13 µCi/ml
- Po-210, Y 9.0E-13 µCi/ml
- Rn-222 w/decay products 1.0E-10 µCi/ml

The airborne gross alpha activity at the Mine Site is expected to be from uranium ore dust. Thorium compounds in the uranium ore dust are likely to be insoluble oxides, which would fall under yearly lung classification as noted for thorium in the radionuclide table of Appendix B of 10 CFR Part 20. Therefore, 3.0E-14 µCi/ml airborne effluent concentration limit for Y Class is appropriate. In order not to exceed the effluent concentration limit of 3.0E-14 uCi/ml, the gross alpha activity would have to be less than 6.9E-14 µCi/ml, since Th-230 would represent 20 percent of the gross alpha activity. The 6.9E-14 µCi/ml gross alpha activity limit will assure that none of the above radionuclide effluent limit is exceeded and meet the unity rule for a mixture of radionuclides.

Q.4.1.3 External Radiation Criteria

Quarterly TLD laboratory results and weekly field gamma results will be reviewed by the RSO to assess compliance with the following external radiation dose limits for individual members of the public as specified in 10 CFR 20.1301 and NMAC 20.3.4.413 (see Table Q.4-1):

- Total effective dose equivalent of 0.1 rem (100 mrem) per year to individual members of the public
- Maximum dose rate of 0.002 rem/hour and 0.05 rem per/year in the unrestricted area from external radiation sources

If a member of the public enters a controlled area outside the restricted area, the above dose limits will apply.

Q.4.1.4 Monitoring Methods

Q.4.1.4.1 Internal Radiation

In order to demonstrate compliance with the dose limits, monitoring will be conducted for:

- Airborne gross alpha activity from air particulate inhalation
- Airborne radon and radon progeny inhalation

Airborne gross alpha activity will be monitored by collecting grab air particulate samples, approximately 8-hour (the potential maximum time of exposure based on the construction activities) at the monitoring stations shown on Figure Q.4-1 for field analysis at locations both downwind and upwind of the construction activities using air sampler, such as an Eberline RAS-2 (see Table Q.4-1). The air sampling flow rate, sampling time, and sample counting time will be determined to meet required Lower Limit of Detection (LLD) for the most restrictive effluent limit. Consistent with the prior Interim Removal Actions, air samples will be collected 5 days/week during the first week of excavation activities. After the first five days, sampling frequency will be reduced to three days/week if the monitoring results show airborne concentrations less than 0.25 times the most restrictive effluent limit. If the airborne concentrations are sustained at less than 0.25 times the most restrictive effluent limit, air sampling frequency will be reduced to a frequency of once per week. If sampling data indicate that gross alpha activity is greater than 0.25 times the most restrictive effluent limit, air sampling will be increased as necessary. The monitoring results will be reviewed to evaluate effectiveness of control measures and whether any adjustments need to be made to construction methods to ensure public and worker safety. The increased air sampling will be maintained until the airborne concentrations decline back to less than 0.25 of the limits. Gross alpha activity measurements will be measured at one location upwind of the construction activities to establish background and four downwind locations (See Figure Q.4-1). Two locations are downwind of the Mine Site, one is downwind of the proposed Repository at the tailings disposal area to monitor soil placement activities, and one is downwind of the borrow areas located north of the TDA.

To evaluate potential internal radiation exposure, the RAS-2 air filters will be counted on-site for gross alpha activity from uranium, Ra-226 and Th-230 after radon progeny from the particulate sample has decayed, generally 72 hours, using an Alpha Radiation Counting Instrument such as Ludlum 2929/43-10-1.

Airborne radon and radon progeny concentrations will be monitored continuously at the monitoring stations for the duration of excavation and soil placement activities with track etch radon monitors at one upwind and two downwind locations: one at the edge of NECR-1 and a second downwind of the Tailings Disposal Area; these locations will be fixed for the duration of construction activities. Track etch monitors will be replaced quarterly or at the end of the RA, and analyzed by the manufacturer (Landauer, Inc.).

Q.4.1.4.2 External Radiation

To evaluate external radiation exposure, both TLDs and direct gamma radiation exposure rate field measurements will be used. Exposure rate measurements will be made at approximately three feet from the ground surface, waist level, using a microroentgen (μR) gamma survey meter. Exposure rate measurements will be performed weekly at the location of the environmental TLDs and at additional perimeter locations based on construction activities and environmental conditions.

Environmental TLDs will be used continuously at monitoring stations for the duration of excavation and soil placement activities at upwind and downwind locations, as shown on Figure Q.4-1. Locations will be fixed for the duration of construction activities. The TLDs will be analyzed by the manufacturer on a quarterly basis.

Q.4.2 Nuisance Dust Monitoring

The perimeter AMP will include monitoring for respirable dust (PM10 and PM2.5), as per USEPA's Primary National Ambient Air Quality Standard (40 CFR 50) during this project, especially during the beginning stages of construction to determine any long-term measures that may be needed to protect employee health. Monitoring will be conducted at an upwind location and at four downwind locations (see locations on Figure Q.4-1). Dust monitoring will be conducted using a Model 8520 Dustrack Aerosol Monitor and will be conducted continuously during working hours (see Table Q.4-1).

The results of the dust monitoring will be reviewed by the RSO and assessed to determine potential health hazards or risks. Respirable dust standards shall be USEPA's Primary National Ambient Air Quality Standards at 24 hour Time Weighted Average (TWA) of:

- PM10: 150 micrograms/cubic meter (µg/m^3)
- PM2.5: 35 µg/m^3

Personal air space monitoring necessary for General Electric/United Nuclear Corporation employees and the CC's employees will be performed in accordance with their respective HASPs.

Q.5 QUALITY ASSURANCE QUALITY CONTROL

Quality assurance aspects, including Data Quality Objectives (DQOs) specified in Appendix T-3 Quality Assurance Project Plan, applicable to the air monitoring program will be implemented to ensure that it is reasonably valid and of defined quality. The quality assurance (QA) program for airborne effluent monitoring during the Mine Site RA will be consistent with the U.S. Nuclear Regulatory Commission (NRC) Regulatory Guide 4.15, Quality Assurance for Radiologic Programs - Effluent Streams and Environment (NRC, 2007). The Regulatory Guide is applicable to effluent monitoring performed for assessing compliance with dose limits for individual members of the public in accordance with 10 CFR 20, Appendix B, as specified in Section Q.4.1. The following presents specific QA elements that will be developed and implemented to ensure the quality of data/results for airborne radiological effluent monitoring program:

Q.5.1 Organization

The organization as it relates to the management and operation of the air monitoring program, including QA policy and functions, is defined in the Radiation Protection Program (RPP), which is included in the HASP for the Mine Site RA. The RSO will be responsible for the review and approval of written procedures and the preparation, review and evaluation of monitoring data and reports. The RSO and his/her staff performing QA functions will have the authority and organizational freedom to identify quality problems; to initiate, recommend, or provide solutions; and to verify implementation of solutions. Reporting will be at a management level that is independent of activity performance, costs, and schedule. Qualification of the RSO and his staff will be consistent with U.S. NRC Regulatory Guide 8.31.

Q.5.2 Operating Procedures

The air sampling and data generation, dose calculation/assessment, sample management, sample (filter) counting, reporting and filter storage/disposal procedures are described in Attachment Q.2, Standard Operating Procedure (SOP) for Airborne Particulate Monitoring, and in the RPP.

Q.5.3 Quality Control in Air Sampling and Analysis

The SOP in Attachment Q.2 specifies the measurement of sampling flow rates, volume, and calibration of air samplers with rotometers and the use of the rotometers to perform daily flow rate checks. The use of glass fiber filter papers will be used to efficiently collect air particulates. Air sampler with adequate airflow to collect sufficient air volume to meet minimum detectable concentration will be used.

The loaded air particulate filter paper will be counted using an alpha counting system calibrated using a certified source annually. Daily efficiency and operational function checks will be performed as specified in the SOP. A replicate count of 10 percent of the sample loaded filter paper will be performed.

Q.5.4 Verification and Validation

The RSO will review air sampling and counting data to validate the results. As indicated in Section Q.4, compliance with dose limits for individual members of the public will be demonstrated by comparing the airborne effluent concentrations with applicable effluent concentration limits. The RSO will perform periodic audits of the air sampling and filter counting system to verify that the air monitoring program is implemented properly. Any deficiency found will be corrected and documented.

Q.5.5 Records

All records, including forms generated as a result of this procedure, shall be maintained throughout the duration of the project and then retained in the permanent project file.

Q.6 GREEN AND SUSTAINABLE REMEDIATION CONSIDERATIONS

USEPA's Superfund Green Remediation Strategy Policy (USEPA, 2010) requires incorporation of BMPs for green remediation as listed in ASTM-E2893-16 (ASTM International, 2016). The 'BMP Process', as outlined in the 'Standard for Greener Cleanups' (ASTM, 2016), has been followed to select and prioritize BMPs for implementation during remedial action. The BMPs relating to Borrow Areas are listed below, for a complete description of the BMP Process and list of all GSR BMPs see Section 4 of the Main RD document and Appendix A (Section A.5).

GSR considerations as applicable to dust control focus on preservation of water as on-site water resources are restricted to a single well and importation of water from off-site sources would not be in-line with the GSR core elements, specifically: minimizing total energy use, air pollution, greenhouse gas emissions, water use and impact to water resources (ASTM 2893-13). Within the context of dust suppression, water conservation will be achieved by the following methods as described in Sections Q.3.1 & Q.3.2:

- Utilization of approved dust suppressants, such as magnesium chloride
- Enforcing maximum speed limit of 20 MPH
- Maintenance and protection of native vegetation where possible, through minimization of site disturbance
- Stabilization of inactive, disturbed work areas by longer term methods, such as matting, tack and mulch, or crusting agents
- Implementation of permanent stabilization on a regular basis when sufficient area exists for application.

Through these methods it is anticipated that no off-site water will be utilized and therefore no additional greenhouse emissions or fuel will be required to achieve dust suppression goals.

Q.7 REFERENCES

ASTM International, 2016. ASTM Standard E2893-16, "Standard Guide for Greener Cleanups," ASTM International, West Conshohocken, PA, 2016, DOI: 10.1520/E2893-16E01, www.astm.org.

Tannant, D.D. and B. Regensburg, 2001. Guidelines for Mine Haul Road Design.

US Environmental Protection Agency (USEPA), Region 6 and Region 9, 2011. Action Memorandum: Request for a Non-Time-Critical Removal Action at the Northeast Church Rock Site, McKinley County, New Mexico, Pinedale Chapter of the Navajo Nation. September 29.

US Environmental Protection Agency (USEPA) Region 6, 2013. Record of Decision, United Nuclear Corporation Site, McKinley County, New Mexico. Operable Unit OU2: Surface Soil Operable Unit. March 29.

US Environmental Protection Agency (USEPA), Region 6 and Region 9, 2015. Administrative Settlement Agreement and Order on Consent for Design and Cost Recovery, Appendix D: Statement of Work. April 27.

U.S. Nuclear Regulatory Commission (NRC), Office of Nuclear Regulatory Research, 2007. Regulatory Guide 4.15, Quality Assurance for Radiological Monitoring Programs - Effluent Streams and Environment. Revision 2. July.

FIGURE

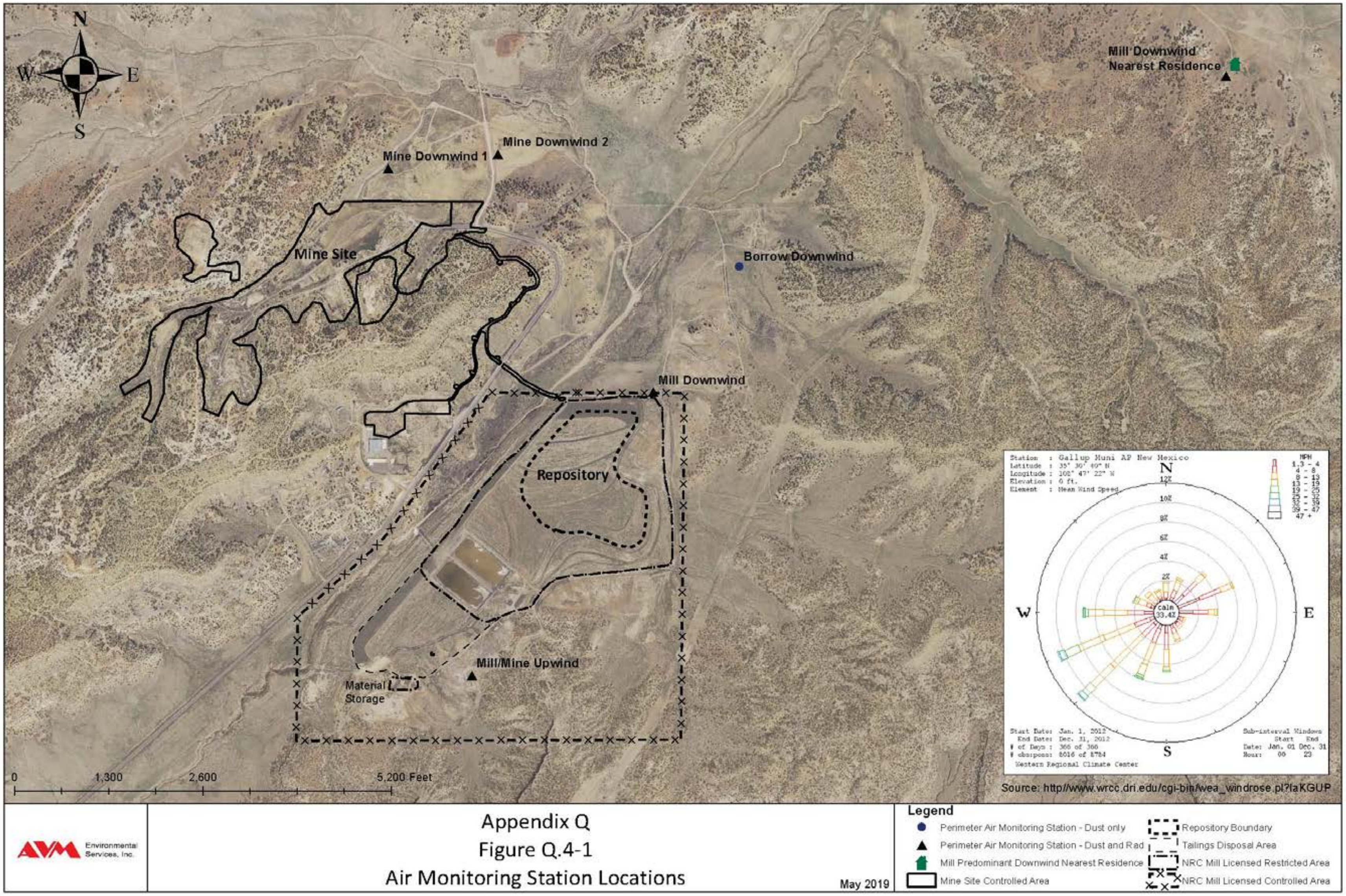

Figure Q.4-1: Proposed Air Monitoring Station Locations

ATTACHMENT Q.1
Calculation Brief - Dust Control Water Balance

MWH now part of Stantec

CALCULATIONS

Client:	General Electric/United Nuclear	**Sheet:**	1	of	3
Project:	NECR 95% Design	**Date:**	10/24/17		
Description:	Dust Control Water Balance	**Job No:**	10508639		

ATTACHMENT Q.1: DUST CONTROL WATER BALANCE

Revisioning

Rev.	Date	Description	By	Checked	Date
0	06/06/16	Preliminary (30%) Design	J. Coleman	J. Cumbers	06/08/16
1	07/01/16	Preliminary (30%) Design	J. Coleman	J. Cumbers	07/08/16
2	10/24/17	95% Design	J. Coleman	J. Cumbers	10/24/17

Revisions

Issue Date	Description
7/1/16	Recalculated including water demand for compaction of mine waste and cover material.
10/24/17	Recalculated with additional demand per EPA comments on 30% design and additional well information.

Location and Format

Electronic copies of these calculations are located on the project teamsite.

The following calculations were generated using the following software:

Microsoft Excel 2013

Table of Contents

Client:	*General Electric/United Nuclear*	**Sheet:** *2* **of** *3*	
Project:	*NECR 95% Design*	**Date:**	*10/24/17*
Description:	*Dust Control Water Balance*	**Job No:**	*10508639*

Objective

The objective of these calculations is to estimate daily water needs for dust control and verify the well yield and storage capacity required to provide adequate dust control water for the project.

Background

The onsite well was drilled in 1976 to 1,580 feet below ground surface (bgs) and the bottom of the well casing is set at 1,490 feet bgs; however, a pipe and pump became lodged in the well years ago and they are blocking the deeper part of the well. The well is constructed with an 8-inch diameter steel casing and is screened in a 20- and a 40-foot interval between 1,390 and 1,475 feet bgs. The existing well pump has a 2-inch discharge pipe, is 20HP, 3-Phase 480V, and is located about 700 feet bgs. The static water level is approximately 410 feet bgs. When pumping between 45 and 67 gallons per minute (gpm) the water level drops to about 525 feet bgs. Site personnel have reported the on-site well is capable of producing a constant flow (pumped 24/7 for weeks) of about 47 gpm when pumping water to the evaporation ponds over 1,000 feet away.

Calculations indicate that 100 gpm would be achieved with a 20HP pump and either a 4- or 6-inch discharge pipe.

Applicable Codes and Standards

The estimated dust control requirements for haul roads are taken from “Guideline for Mine Haul Road Construction” by D.D. Tannant and B. Regensburg, 2001. Excerpts attached.

Methods

Simple spreadsheet daily water balance.

Assumptions

The following assumptions were used:

Compaction water required at a rate of about 3 percent by mass of placed material based on sampling and analysis of mine and borrow materials.

Hourly Haul Road Dust Control Water Application: 25 Gal/KSF (LOW); 50 Gal/KSF (HIGH). See reference (KSF = 1000 SF).

Assume a high application rate is needed for the Mine Waste Haul Road as this will be a high visibility road that crosses a public highway. Low application rate used in mine area assuming lower speeds, distributed traffic, opportunity for other dust control measures (vegetated roads). Assumes low water use for borrow roads to control nuisance dust only. Additional assumptions listed in calculation tables.

Water balance calculations assume pumping 7 days per week to maintain storage.

Calculations

See Attachments A and B for water demand and storage.
See Attachment C for compaction water calculation.
See Attachment D for Total Discharge Head (TDH) calculation.

Max TDH = 529 Feet. Water Horsepower = Q(gpm) x H(ft)/3,960. Q=102 gpm; H =529; WHP = 13.62 HP.

Client:	General Electric/United Nuclear	**Sheet:** 3	of 3
Project:	NECR 95% Design	**Date:**	10/24/17
Description:	Dust Control Water Balance	**Job No:**	10508639

Pump HP Required = WHP/pump efficiency (75%)/motor efficiency (90%) = 13.62 / 0.75 / 0.9 = 20.2 HP

Results

If no additional dust suppressants are used, a 40-hour work week would require an estimated well production of 79 gpm and a 50-hour work week would require 102 gpm. These scenarios would require eleven and fourteen 21,000-gallon tanks for storage respectively, or 220,000 and 282,000 gallons of storage.

If additional dust suppressant additives are incorporated, the required well productions would be reduced to 64 gpm for a 40-hour week and 82 gpm for a 50-hour work week. Storage capacity of between 186,000 gallons and 240,000 gallons is required for these scenarios; which corresponds to nine and twelve 21,000-gallon tanks, respectively.

There is sufficient space in the Mill Yard for the required water storage scenarios.

A 20HP pump with 4-inch or 6-inch discharge piping is capable of producing 102 gpm.

Conclusions

The construction schedule is based on a 40 hour per week operation. The Construction Contractor can reduce water needs with the use of alternate dust suppression techniques (i.e. additives). A higher discharge pump and larger discharge piping will produce adequate water supply.

Import of water is not a viable option.

Attachments

Attachment A – Water balance for water only (no supplemental dust control)
Attachment B – Water balance with supplement dust control
Attachment C – Water for Compaction
Attachment D – Total Discharge Head Calculations
Attachment E – Typical water storage tank
Attachment F – Excerpt from *Guidelines for Mine Haul Road Design* (2001).

References

Tannant, D.D. and B. Regensburg, 2001. *Guidelines for Mine Haul Road Design*.

ATTACHMENT Q.2
SOP – Airborne Particulate Monitoring

Attachment Q.2
STANDARD OPERATING PROCEDURE
AIRBORNE PARTICULATE MONITORING
AVM Environmental Services, Inc.

1.0 SCOPE

1.1 Purpose

This procedure describes the method for determining the concentration of airborne radioactive particulate at the upwind and downwind boundary areas during the Removal Action at the North East Church Rock site activities. The procedure is intended to:

1.1.1 Demonstrate compliance with the intake limits for the general public specified in the Radiation Protection Program.

1.1.2 Determine whether exposures to radioactive materials are being maintained As Low As Reasonably Achievable (ALARA) as stated in the Radiation Protection Program.

1.2 Applicability

This procedure applies to all personnel under Radiation Safety Officer (RSO) supervision performing airborne particulate monitoring during the RA at NECR.

2.0 REFERENCES

2.1 10 CFR 20, "Standards for Radiation Protection"

2.2 NRC Regulatory Guide 8.30, Health Physics Surveys in Uranium Mills

2.3 NRC Regulatory Guide 8.25, Calibration and Error Limits of Air Sampling Instruments for Total Volume of Air Sampled

3.0 EQUIPMENT AND MATERIALS

3.1 Air Sampler: Eberline RAS-II Low Volume Air Sampler (40 – 60 liters per minute) or similar equipped with rotometer.

3.2 0.45 micron particulate GF 47 mm filter media. Envelopes for Filter Storage or Petri dishes.

3.3 Alpha radiation Counting Instrument (Ludlum 2929 with 43-10-1 detector or similar)

3.4 Certified Th-230 1.85 inch disc source

3.5 Air Particulate Sampling Field Data Form (Attached or equivalent).

3.6 Alpha-Beta Counting System Function Check Form (Attached or equivalent)

4.0 AIR SAMPLE COLLECTION INSTRUCTIONS

4.1 Select a suitable upwind or downwind location for sampling. The filter head should be situated at approximately five feet from the ground surface.

4.2 Select a calibrated regulated air sampler (RAS-II). Install a 0.45 micron glass fiber filter in the filter head. The sampling pump roto meter should be cross calibrated at least annually or when repaired.

4.3 Determine the time and flow rate necessary with consideration of counting instrument background count rate, efficiency and sample counting time to sample a volume sufficient to ensure that a required minimum detectable concentration (MDC) will be met.

4.4 Turn on the air sampling unit, adjust the flow rate to the desired calibrated flow rate, and record the starting time, flow rate, vacuum, totalizer flow meter reading, and initials of the technician on a field data sheet. Record any other pertinent comments.

4.5 Periodically check air sampler unit for proper operation.

4.6 After the minimum collection time to meet the MDC requirement in Step 4.3, record ending flow rate, vacuum and time, and turn off the air sampling unit. Remove the air filter and place in a sample envelope or Petri dish and label it. Record sampling data in the attached Air Particulate Sampling Field Data /Form

5.0 FILTER COUNTING INSTRUCTIONS

The counting efficiency for alpha radiation emitters are energy dependent. The alpha radiation energies of these radionuclides (U-234 @4.72 & 4.77 MeV, U-238 @4.15 & 4.20 MeV, Th-230 @4.62 & 4.69 MeV and Ra-226 4.60 and 4.78) MeV are within a tight range indicating they essentially have similar counting efficiencies. The Ludlum Measurements, Inc (LMI), the instrument manufacturer measured and reported 4π efficiencies of 36% for U-nat (U-238, U-234 and U-235), 38% for Th-230 and 39% for PU-239 (5.2 MeV) using certified sources. Ra-226 has alpha radiation energy of 4.60 & 4.78 MeV, similar to Th-230 @ 4.62 and 4.69, thus the Ra-226 alpha radiation would have similar counting efficiency as Th-230. The efficiencies for U-238, U-234, and Ra-226 alpha radiations are essentially the same as Th-230 alpha radiation. Therefore, using Th-230 efficiency would be appropriate to determine gross alpha activity from these radionuclides.

An initial 24-hour or 48-hour decayed count may be performed for informational purposes only. The only way to obtain true gross alpha activity for U-234, U-238, Th-230, Ra-226 and Po-210 for any exposure assessment is to allow alpha activity from radon progeny to decay, for at least 72 hours prior to counting the air filters. Please note that any alpha activity from the 24 hour count will be significantly overestimated, specifically depending on ambient radon progeny concentrations.

5.1 The alpha radiation counting system should at least annually with operational function check parameters (HV, threshold, efficiency, background counts, etc) established following the calibration.

5.2 The alpha radiation counting system should be calibrated at least annually with operational function check parameters (HV, threshold, efficiency, background counts, etc) established following the calibration. Perform and record function check of the counting system each day prior to use.

5.3 Allow a minimum of 72 hours from the end of sample collection before counting sample for decaying off the alpha emitting radon progeny collected on filters from ambient air. The MDC for gross alpha activity should be <6.9 x 10^{-15} µCi/ml, 10% of gross alpha activity limit of 6.94 x 10^{-14} µCi/ml for the final counting based on the most restrictive effluent concentration limit to consider unity rule.

5.4 Count the air sample filter and background filter (unexposed blank filter paper) for at least 60 minutes, or the necessary time period based on the volume of the air sample to meet required LLD for alpha activity counts using the Ludlum 2929 scaler/43-10-1 detector.

5.5 Record the background and air sample filter counts and the counting data in attached Air Particulate Sampling Survey Report/Form. Calculate the airborne gross alpha activity, uncertainty and Lower Limit of Detection as shown in the Air Particulate Sampling Survey Report/Form. After counting, store all loaded filters in appropriately labeled containers.

Calculate the individual radionuclide (U-234, U-238, Th-230, Ra-226 and Po-210) concentrations from gross alpha activity based on the site specific activity fraction ratio, if available. For airborne gross alpha activity from uranium ore dust, use 0.20 fractions for U-234, U-238, Th-230 and Ra-226 individual radionuclide airborne concentration calculation.

6.0 RECORDS

All forms generated as a result of this procedure shall be maintained throughout the duration of the project and then retained in the permanent project file.

AIR PARTICULATE SAMPLING FIELD DATA FORM

Sample #/Dish #______________________ Date:______________________________

SOP:_______________________________ Field Tech:_________________________

Area/Location/Assigned to:____

____

Sampler Used:________________________ Filter Used:________________________
Sampler Serial #:_____________________ Vac./Roto. Rdg(start)_________________

Sampling Rate(SR):_________________LPM Vac./Roto. Rdg(stop)_________________

Time Start:_____________Stop:_____________Break Time:_____________Elapsed(E):_______________(min)
Volume of Air Sampled____(ml)
(SR x E x 1000)

Initial Count

Alpha Counter___________________________ Efficiency____________________Bkg.____________________

Count Date and Time_______________________________
Gross Alpha Counts________________________ Count Time_______________________________________
Bkg. Counts______________________________ Count Time_______________________________________
Gross Alpha ______________________________ µCi/mL
MDC______________________________µCi/mL
% Effluent Concentration Limit_________________

Final Count (at least after 72 hours)

Alpha Counter___________________________ Efficiency____________________Background______________
Count Date and Time_______________________________
Gross Alpha Counts________________________ Count Time_______________________________________
Bkg. Counts______________________________ Count Time_______________________________________
Gross Alpha______________________________ µCi/mL
MDC______________________________µCi/mL
%Effluent Concentration Limit__________________

Gross Alpha Activity, µCi/ml = $\dfrac{\text{(Gross cpm–Background cpm)(FA*)}}{\text{FE** x 2.22E+6 (dpm/µCi) x Eff (cpm/dpm) x Sample Volume (ml)}}$

Estimated Error (uncertainty 95%), µCi/ml = $\dfrac{\text{1.96 x (FA*) x [(Gross cpm/t min,Gorss)+(Bkg cpm/t, min Bkg)]}^{0.5}}{\text{FE** x 2.22E+6 (dpm/µCi) x Eff (cpm/dpm) x Sample Volume (ml)}}$

MDC, µCi/ml = $\dfrac{\text{2.71+3.29 x (FA*) x [BKG cpm x Gross Count Time, min (1+ Gross Count Time, min/BKG Count Time, min)]}^{0.5}}{\text{FE** x Air Sample Volume (ml) x Counter Eff (cpm/dpm) x 2.22E+6 (dpm/µCi) x Gross Count Time (min)}}$

*Filter Absorption (FA) = 1.25 for glass fiber filters and 1.0 for Cellulose nitrate filters; ** FE = Fractional filter efficiency

Ludlum 2929 Scaler/43-10-1 Alpha-Beta Counting System Function Check Form

L2929 /43-10-1

Function Check Source ID: :_________________________________

Acceptable background Count (cp10m) Range (20%) _____________________ to ___________________

Acceptable Source Count (cp10m) Range (20%) _____________________ to ______________________

Date	Physical Check	Cal date	HV Volts	Alpha BKG Counts (CP10M)	Alpha Source Counts (CP10M)	Beta BKG Counts (CP10M)	Beta Source Counts (CP10M)	Within Acceptable Range Y or N	Comments	Tech

Note: (1) Calibration HV set @1000 V