Air Quality Permit Application
Chapter 6, Section 2
Wyoming Air Quality Standards and Regulations

Ross In-Situ Uranium Recovery Project
Crook County, Wyoming

Strata Energy, Inc.

STRATA energy

a subsidiary of
PENINSULA ENERGY LTD

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1.0 EXECUTIVE SUMMARY

Strata Energy, Inc. (Strata), a United States based company and wholly owned subsidiary of Peninsula Energy Ltd, an Australian based company, wishes to obtain an Air Quality Permit in order to construct and operate the Ross ISR Project, a uranium in-situ recovery (ISR) facility in northeastern Wyoming. This project will be a minor source of air emissions.

The project plan includes four phases: construction, operation, aquifer restoration and decommissioning/reclamation. Due to staggered sequencing, these phases will overlap. Construction of the facilities and initial wellfield is expected to take approximately one year. Overall construction activities will last from 3 to 5 years, while recovery operations are expected to last from 4 to 8 years. Aquifer restoration is expected to require from 1 to 2 years per wellfield module, including stability monitoring. Decommissioning will commence when the first wellfield module is completed and proceed through the end of the project.

The Ross ISR Project will include at least two mine units. The wellfields will be further divided into 15 to 25 modules, each containing 70 to 100 recovery and injection wells. Wells within each module will be individually piped to a module building where they will be manifolded together. Water from each module building will then be piped to the Central Processing Plant (CPP) for treatment. The project is projected to produce 750,000 pounds of yellowcake uranium (U_3O_8) annually over a 4 to 10-year period, although the CPP will have the capacity to process up to 3 million lbs of U_3O_8 per year. For purposes of this air quality permit application and the associated emissions inventory, the maximum production rate of 3 million lbs per year will be assumed.

In-situ recovery and processing of uranium at the Ross ISR Project will consist of two steps: recovering mineralized uranium from the ore body and processing the uranium-rich solution into yellowcake. Uranium will be oxidized and dissolved in-situ by injecting water, oxygen and carbon dioxide (and/or sodium bicarbonate) into the formation and pumping the pregnant solution back to the surface. An ion exchange system will transfer uranium complexes in the solution to resin beads. The elution circuit will separate uranium complexes from the resin and regenerate the resin. The resulting solution will undergo a precipitation, thickening and drying process to produce yellowcake.

Both radioactive and non-radioactive airborne effluents are anticipated in the proposed project area. The primary radioactive effluent will be radon gas. Emissions from internal combustion engines and natural gas-fired heaters will be the primary source of non-radioactive gaseous emissions. Fugitive dust will be generated during all project phases from activities such as the mechanical disturbance of the soil materials by heavy equipment, from transport vehicles traveling on access roads, and from wind blowing over disturbed areas and stockpiles.

This permit application includes a Best Available Control Technology (BACT) analysis for critical air emission sources. It presents a comprehensive emissions inventory and a

review of applicable state and federal regulations. It summarizes both air monitoring and modeling results as they relate to radioactive air contaminants resulting from the project. The modeling results demonstrate safe exposure levels to humans working at the site or residing near the site.

The foregoing summary, the process description in Section 3.0 below, the monitoring summary in Section 6.0 and the modeling summary in Section 7.0 are consistent with and draw heavily from three documents:

1. Ross ISR Project USNRC License Application, Technical Report (Strata Energy, 2010a)
2. Ross ISR Project USNRC License Application, Environmental Report (Strata Energy, 2010b)
3. Ross ISR Project WDEQ-LQD Permit to Mine Application (Strata Energy, 2011)

2.0 APPLICATION FORM

DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION

PERMIT APPLICATION FORM

Date of Application: June 27, 2011

1. Name of Firm or Institution Strata Energy, Inc.

2. Mailing Address P.O. Box 2318, Gillette, WY 82717

Number	Street	City	State
406	W. 4th Street	Gillette	Wyoming

County	Zip	Telephone
Campbell	82717	(307) 686-4066

3. Plant Location

Number	Street	City	State
2869	New Haven Rd	Oshoto	Wyoming

County	Zip	Telephone
Crook	82721-8803	(307) 467-5995

4. Name of owner or company official to contact regarding air pollution matters

Name	Title	Telephone
Anthony J. Simpson	Chief Operating Officer	(307) 686-4066

Number	Street	City	State	Zip
406	W. 4th Street	Gillette	Wyoming	82717

5. General nature of business
Uranium In Situ Recovery Facility

6. Permit application is made for: _X_ New Construction ___ Modification
___ Relocation ___ Operation

7. Type of equipment to be constructed, modified, or relocated. (List each major piece of equipment separately.)

See
attached
plant flow
diagrams

8. If application is being made for operation of an existing source in a new location, list previous location and new location:

Previous Location: N/A

New Location: N/A

9. If application is being made for a crushing unit, is there: (mark all appropriate boxes)

Primary Crushing	N/A	Control Equipment:
Secondary Crushing	N/A	Control Equipment:
Tertiary Crushing	N/A	Control Equipment:
Recrushing & Screening	N/A	Control Equipment:
Conveying	N/A	Control Equipment:
Drying	N/A	Control Equipment:
Other		Control Equipment:

Proposed dates of operation

(month/year)

10. Materials used in unit or process (include solid fuels):

Type of Material	Process Weight Average (lb/hr)	Process Weight Maximum (lb/hr)	Quantity/Year
See attached process description and storage tank inventory			

11. Air contaminants emitted:

Emission Point	Pollutant	lb/hr	ton/yr	Basis of Data
See attached air emissions inventory				

12. Air contaminant control equipment:

Emission Point	Type	Pollutant Removed	Efficiency
Road traffic	Water, magnesium chloride	Fugitive dust	Assumed 50%
Solid reagent handling facilities	Fabric filter	Particulate	99.9%
Acid tanks and process vent	Acid fume scrubber	Acid vapors	99%
Dryer exhaust	Indirect fired, vacuum dryer, filter and condenser	Particulates, radionuclides	100%

13. Type of combustion unit: (check if applicable):

A. Coal

1. *Pulverized* ___:

General ___; Dry Bottom ___; Wet Bottom ___; With Flyash Reinjection ___; Without Flyash Reinjection ___; Other _____

2. *Spreader Stoker* ___:

With Flyash Reinjection ___; Without Flyash Reinjection ___; Cyclone ___; Hand-Fired ___; Other

B. Fuel Oil ___

Horizontally Fired ___ Tangentially Fired ___

Type of combustion unit:(check if applicable):

C. Natural Gas _X__

D. If other, please specify _____

Hourly fuel consumption (estimate for new equipment)_____ /hr.

Size of combustion unit Dryer: 2 x 1.0 million BTU heat input/hour.
Heater: 4 x 1.2 million BTU heat input/hour

14. Operating Schedule: 24 hours/day; 7 days/week; 52 weeks/year.
Peak production season (if any): ____Continuous_____

15. Fuel analysis:

	COAL	FUEL OIL	NATURAL GAS
% Sulfur		15 ppm (500 ppm assumed for emissions inventory)	
% Ash			
BTU Value		140,000 btu/gallon	1,020 btu/scf

16. Products of process or unit:

Products	Quantity/Year
Yellowcake (U_3O_8)	3,000,000 lbs/yr (maximum permitted)

17. Emissions to the atmosphere (each point of emission should be listed separately and numbered so that it can be located on the flow sheet):

Emission Point	Stack Height (ft)	Stack Diameter (ft)	Gas Discharge SCFM	Exit Temp (^{O}F)	Gas Velocity (ft/s)
Dryer stack	65	0.41	416	300	75
Process vent	65	0.46	300	70	30
Backup generator	10	0.67	983	892	142
Space Heater stk.	65	0.63	998	300	75

18. Does the input material or product from this process or unit contain finely divided materials which could become airborne?

_X_ Yes ___ No

Is this material stored in piles or in some other way as to make possible the creation of dust problems?

___ Yes _X_ No

18. Continued:

List storage pile (if any):

Type of Material	Particle Size (Diameter or Screen Size)	Pile Size (Average Tons on Pile)	Pile Wetted (Yes or No)	Pile Covered (Yes or No)

19. Using a flow diagram: (see attached Process Flowsheet)

    (1) Illustrate input of raw materials.

    (2) Label production processes, process fuel combustion, process equipment, and air pollution control equipment.

    (3) Illustrate locations of air contaminant release so that emission points under items 11, 12 and 17 can be identified. For refineries show normal pressure relief and venting systems. Attach extra pages as needed.

20. A site map should be included indicating the layout of facility at the site. All buildings, pieces of equipment, roads, pits, rivers and other such items should be shown on the layout.

21. A location drawing should be included indicating location of the facility with respect to prominent highways, cities, towns, or other facilities (include UTM coordinates).

"I certify to the accuracy of the plans, specifications, and supplementary data submitted with this application. It is my Opinion that any new equipment installed in accordance with these submitted plans and operated in accordance with the manufacturer's recommendations will meet emission limitations specified in the Wyoming Air Quality Standards and Regulations."

Signature		Typed Name	Anthony J. Simpson
Title	Chief Operating Officer	Company	Strata Energy, Inc.
Mailing Address	P.O. Box 2318	Telephone No.	(307) 686-4066
City	Gillette	State	Wyoming Zip 82717
P.E. Registration (if applicable)			
State where registered			

3.0 PROCESS DESCRIPTION

3.1 Project Location and Setting

This Mine Plan was developed by Strata Energy, Inc. (Strata), a United States based company and wholly owned subsidiary of Peninsula Energy Ltd, an Australian based company. Strata wishes to obtain an Air Quality Permit (WAQSR Chapter 6, Section 2) in order to construct and operate the Ross ISR Project, a uranium in-situ recovery (ISR) facility in northeastern Wyoming.

The Ross ISR Project is located in Crook County, in northeastern Wyoming, adjacent to the ranching community of Oshoto and 21.5 miles north of the town of Moorcroft. Figure A-3.1 provides the general location of the site. The permit area occupies portions of Sections 7, 17, 18, and 19 of Township 53 North, Range 67 West, and portions of Sections 12, 13, and 24 of Township 53 North, Range 68 West. Figure A-3.2 shows the project area, permit boundary, and future wellfield extent. Access to the site is by County Road 68 (D Road) and County Road 164 (New Haven Road), which proceed north of Interstate 90 approximately 23 miles to the permit area. Use of this area for ISR uranium recovery has been declared compatible with Crook County land use and zoning regulations (see letter from Crook County Planning and Zoning Commission in Appendix C).

3.2 ISR Methods and Recovery Process

In-situ recovery and processing of uranium at the Ross ISR Project will consist of two steps: recovering mineralized uranium from the ore body and processing the uranium-rich solution into yellowcake.

Recovery of uranium complexes from the ore body will be accomplished by oxidation and dissolution. A recovery solution composed of native groundwater, an oxidant such as oxygen or hydrogen peroxide, and a complexing agent such as carbon dioxide or sodium bicarbonate will be injected into the ore-bearing sandstone formation through a series of injection wells. As the lixiviant moves through the formation and contacts the ore, uranium will be oxidized and then mobilized. The recovery solution, or pregnant lixiviant, will then be recovered by the recovery wells and pumped via pipeline to the central processing plant (CPP).

In the CPP the recovery solution or pregnant lixiviant will be transferred to ion exchange (IX) columns where uranium-specific resin will strip the uranium complexes from the solution. The loaded resin will then be conveyed to the elution circuit where a concentrated brine solution will remove the uranium and simultaneously regenerate the resin. The resultant eluate will then run through a precipitation circuit where hydrogen peroxide will precipitate uranium as uranium oxide slurry. The slurry will then be thickened, filtered, dried, and packaged as dry yellowcake in sealed containers for shipment.

3.3 Facilities

Facilities at the project will include a CPP, wellfield and ancillary facilities, two lined retention ponds, and up to five Class I deep disposal wells. A site facilities map showing the CPP, office, parking area, maintenance shop, warehouse, lined retention ponds, initial deep disposal well area, and storage areas is included as Figure A-3.3.

The CPP will be located in the NE¼ of the SE¼ of Section 18, Township 53N, Range 67W and will include a uranium recovery circuit, uranium elution circuit, uranium precipitation circuit, and yellowcake drying/packaging circuit. Adjacent buildings will house the administrative office, maintenance shop, and warehouse. The CPP will also include equipment for a restoration circuit with the capacity to treat groundwater from wellfield modules undergoing aquifer restoration. The conceptual general arrangement of the components of the CPP is illustrated in Figure A-3.4.

The Ross ISR Project will include at least two mine units. The wellfields will be further divided into 15 to 25 modules, each containing 70 to 100 recovery and injection wells. Wells within each module will be individually piped to a module building where they will be manifolded together. Water from each module building will then be piped to the CPP for uranium recovery. As the Ross ISR Project is developed, newly delineated ore trends may require additional wellfield modules and buildings. The production flow capacity of each wellfield module will range from 600 gpm to 1,000 gpm. Electrical power will be distributed to the module buildings by overhead power lines. Electrical distribution to the individual recovery and injection wells will be buried.

3.4 Operating Plans, Design Throughput, and Production

The project plan includes four phases: construction, operation, aquifer restoration and decommissioning. The final phase includes surface reclamation, decontamination and dismantling of project facilities, etc. Due to staggered sequencing, these phases will overlap. Construction of the facilities and initial wellfield is expected to take approximately one year. Overall construction activities will last from 3 to 5 years, while recovery operations are expected to last from 4 to 8 years. Aquifer restoration is expected to require from 1 to 2 years per wellfield module, including stability monitoring. A tentative schedule appears in Table 3-1.

Table 3-1 – Tentative Project Schedule

Year after License Issued	1	2	3	4	5	6	7	8	9	10
Construction Phase	■	■	■	■						
Operation Phase		■	■	■	■	■	■			
Aquifer Restoration Phase				■	■	■	■	■	■	
Decommissioning Phase						■	■	■	■	■

The project is projected to produce 750,000 pounds of uranium annually over a 4 to 10 year period. The ion exchange circuit of the CPP at the Ross ISR Project will be designed to handle a flow rate up to 7,500 gpm. The CPP will have the capacity to process up to 3 million lbs of U_3O_8 per year. For purposes of this air quality permit application, the maximum production rate of 3 million lbs per year will be assumed.

During production, the recovery flow rate will be higher than the injection flow rate. The difference between the recovery and injection flow rate is referred to as the production bleed and will establish a hydraulic gradient toward the recovery wells.

Restoration activities on wellfield modules where uranium recovery has been completed will be conducted concurrently with active uranium recovery. Restoration flows will total approximately 1,100 gpm. Aquifer restoration methods will include groundwater sweep, groundwater transfer, reverse osmosis, treatment with permeate injection, and groundwater recirculation, which will be followed by stability phase monitoring. Once aquifers have been restored in accordance with NRC license and WDEQ-LQD permit requirements, decommissioning will take place.

3.5 Roads

Figure A-3.6 shows the roads in the Ross ISR Project vicinity. Roads at the project are classified as county roads, primary access roads, secondary access roads, and light-use roads (tertiary access roads). Three county roads are located within the permit boundary: D Road, New Haven Road and Oshoto Road. The maintenance of these roads will remain the responsibility of the County, but Strata will work with Crook County according to a Memorandum of Understanding (MOU, see Appendix C) to control fugitive dust from county roads affected by the Ross ISR Project.

One primary access road to the CPP is planned. The primary access to the plant site will be from County Road 164 (New Haven Road) as shown in Figure A-3.6 and detailed in Figures A-3.3 and A-4.1. Secondary access roads will be used for the transportation of personnel and equipment within the permit area. Parking areas and roads within the central plant area and laydown areas are also classified as secondary access roads. Access road side slopes and disturbed areas will be seeded. The surfacing of the roads will be of a durable material (such as gravel).

Light-use, tertiary access roads are essentially non-constructed, two-track trails. Existing ranch or private roads established by previous land owners will be used to the extent possible. The primary use of these roads will be to access monitoring sites. Light-use roads will be maintained as necessary to minimize erosion. When no longer needed, these roads will be restored to the original land use and condition.

3.6 Description of Uranium Recovery

At the Ross ISR Project, uranium will be recovered from the host formations, which consist of inter-bedded sandstone, siltstone, and shale. The uranium is found in the permeable sand zones in stacked roll front deposits. The depth to the top of the ore

averages approximately 490 feet, ranging from 300 to 700 feet. The ore thickness averages 8.9 feet. Spatial distribution of economic mineralization across the permit area is shown on Figure A-3.2.

3.7 ISR Chemistry

The in-place uranium mineral (uraninite) is oxidized to change the uranium valence from the insoluble +4 state to the soluble +6 state using hydrogen peroxide or gaseous oxygen. Oxygen is usually used due to economic considerations and ease of use. The complexed uranium is uranyl dicarbonate or uranyl tricarbonate depending on pH conditions. Due to the excess carbonate in the system, the uranyl tricarbonate will be the dominant species with a minor amount of uranyl dicarbonate existing in the solutions. Additional chemicals that may be added prior to injection include carbon dioxide to adjust the pH and provide a carbonate source, sodium bicarbonate to provide a carbonate source (complexing agent) and chlorine to eliminate bacteria.

The chemical reactions for the in-situ recovery of uranium are shown below:

Oxidation: $UO_2 + \frac{1}{2} O_2 \rightarrow UO_3$ or $UO_2 + H_2O_2 \rightarrow UO_3 + H_2O$

Complexing: $UO_3 + 2HCO_3^- \leftrightarrow [UO_2(CO_3)_2]^{2-} + H_2O$ or

$UO_3 + CO_3^{2-} + 2HCO_3^- \leftrightarrow [UO_2(CO_3)_3]^{4-} + H_2O$

3.8 Ion Exchange

Figure A-3.5 shows the overall CPP process flowsheet. Recovery of uranium from the pregnant lixiviant will be accomplished through a pressurized downflow ion exchange (IX) process. Pregnant lixiviant from the wellfield modules will flow through the IX resin and the uranium complexes will be exchanged with chloride, bicarbonate, or sulfate ions on the resin surface as shown in the following chemical reaction where R is the IX resin:

$$2RCl + UO_2(CO_3)_2^{2-} \rightarrow R_2UO_2(CO_3)_2 + 2Cl^-$$

$$2RHCO_3 + UO_2(CO_3)_2^{2-} \rightarrow R_2UO_2(CO_3)_2 + 2HCO_3^-$$

$$4RCl + UO_2(CO_3)_3^{4-} \rightarrow R_4UO_2(CO_3)_3 + 4Cl^-$$

$$R_2SO_4 + UO_2(CO_3)_2^{2-} \rightarrow R_2UO_2(CO_3)_2 + SO_4^{2-}$$

Carbon dioxide will likely be added in the CPP, upstream of the resin vessels. The carbon dioxide will control the pH of the pregnant lixiviant to optimize the IX loading capacity for uranium and vanadium.

3.9 Resin Elution

The elution circuit will separate both the uranium complexes and the vanadium complexes from the resin as well as regenerate the resin capacity by replacing chloride

and bicarbonate ions on the resin exchange sites. The primary chemical reaction involved in elution is shown below. Similar reactions also occur for the displacement of uranyl dicarbonate (UDC) and for bicarbonate loading.

$$R_4[UO_2(CO_3)_3] + 4NaCl \rightarrow 4RCl + Na_4[UO_2(CO_3)_3]$$

The eluate solution, which will contain approximately 9% sodium chloride and 2% sodium carbonate, will be added to the elution vessels, stripping the resin of uranium and vanadium and regenerating the resin for further use. In some cases, it is necessary to add an additional regeneration stage by employing a rinse of hydrochloric acid. If chloride buildup in the lixiviant becomes a problem, a sodium bicarbonate rinse may be included in the elution process. Eluted resin, or barren resin, is then rinsed with fresh water and returned to IX vessels for further loading. The rinse water is then used to make up additional fresh eluate. The elution process will consist of four stages: three (3) eluant stages will contact one 500 ft^3 batch of resin with three bed volumes of eluant each and one (1) rinse stage will contact the batch with four bed volumes of fresh water. Uranium complexes (as uranyl carbonate) are then contained in the rich eluate solution. The pH of the solution will be approximately neutral.

3.10 Uranium Precipitation

The purpose of the precipitation circuit is to break the uranium complexes and precipitate the uranium. This process will produce uranium peroxide slurry. When a sufficient volume of rich eluate is collected, sulfuric acid or hydrochloric acid will be added to break down the uranyl carbonate and to bring the pH down to the range of 2-3. The drop in pH will cause the uranyl carbonate to break down, which will liberate carbon dioxide and free uranyl ions. The chemical reaction for this process is:

$$Na_4[UO_2(CO_3)_3] + 3\ H_2SO_4 \rightarrow UO_2SO_4 + 2\ Na_2SO_4 + 3\ CO_2\uparrow + 3\ H_2O$$

In the next stage, sodium hydroxide (caustic soda) or ammonia is added to raise the pH to the range of 4-5. After pH adjustment, hydrogen peroxide is added (0.36 lb H_2O_2/lb U_3O_8) in a continuous circuit to form an insoluble uranyl peroxide (UO_4) compound; this precipitation takes up to 8 hours. After precipitation, the pH is raised to approximately 7.

A second stage of precipitation is designed to remove impurities entrained in the first precipitate. The first yellowcake thickener underflow is fed to the re-dissolve tank, where the solids are contacted with sulfuric acid. The uranium is then re-precipitated in a series of precipitation tanks. The uranium precipitate slurry is pumped from the last precipitation tank to the second yellowcake thickener, where most of the solution is separated from the uranium oxide solids.

The precipitation reaction for the sulfuric acid acidified pregnant eluate is:

$$UO_2SO_4 + H_2O_2 + 2H_2O \rightarrow UO_4 \cdot 2H_2O\ \text{(precipitates)} + H_2SO_4$$

The reaction for pH adjustment with caustic soda is:

$$H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + H_2O$$

Hydrogen peroxide precipitation of uranium has been chosen for this project due to selectivity of the process for precipitating a clean uranium product in the presence of other metals, particularly vanadium in this case.

3.11 Yellowcake Drying

After precipitation, the uranium precipitate, or yellowcake slurry, is removed for washing, filtering, drying, and product packaging in a controlled area. The yellowcake from the thickener underflow is washed in a filter press to remove excess chlorides and other soluble contaminants. The filter cake is re-slurried with clean water, and then transferred by a slurry pump and piping to the yellowcake dryer. After drying, the yellowcake is packaged into 55-gallon drums for storage before transport to a conversion facility. The yellowcake dryer and storage areas will be located in a separate room in the CPP to reduce the possibility of airborne contamination to the rest of the plant.

The yellowcake will be dried in a low temperature (<300° F) vacuum dryer, which is completely enclosed during the drying cycle. By operating at low temperatures (<300° F), no measurable quantities of respirable uranium solids are produced, further reducing environmental and occupational risks. The use of modern, low-temperature vacuum dryers has proven to reduce potential yellowcake particulate emissions to virtually zero. As described by NRC (2009), "radon gas is emitted from ISL wellfields and processing facilities during operations and is the only radiological effluent for those facilities that use vacuum dryer technology." This drying technology requires a high purity feed stock because operating temperatures are not sufficient to volatilize contaminants.

3.12 Gaseous Emissions and Airborne Particulates

Both radioactive and non-radioactive airborne effluents are anticipated in the proposed project area. The primary radioactive effluent will be radon gas. Potential radioactive air particulate effluents also include dried yellowcake. Non-radioactive airborne effluents will include gases emitted from the operation of internal combustion engines and natural gas fired heaters, and airborne particulates released from unpaved roads, earth disturbing activities, and wind erosion. Minor non-radioactive airborne effluents might also include: small releases of salt and soda ash during reagent delivery, dust from cementing operations, welding fumes, particulates from grinding steel, and carbon dioxide, oxygen and water vapor vented from ISR facilities. Fumes from chemicals used in the laboratory will be minor but present as well.

3.13 Non-Radioactive Emissions and Control Measures

Emissions from internal combustion engines and natural gas fired heaters will be the primary source of gaseous effluent. Small releases are anticipated from the following: drilling rigs, drilling support equipment (backhoes, water trucks, pipe trucks, cement units), wellfield utility trucks (mechanical integrity testing units, workover units, swabbing

units), light vehicles associated with wellfield operations and construction and vehicles to transport staff to/from the site. These emissions will likely include CO, CO_2, SO_2, NO_x, $PM_{10}/PM_{2.5}$ and total hydrocarbon (THC). An inventory of combustion emissions is presented in Section 5 of this document.

Fugitive dust will be generated during all project phases from activities such as the mechanical disturbance of the soil materials by heavy equipment, from transport vehicles traveling on access roads, and from wind blowing over disturbed areas and stockpiles. An inventory of fugitive dust emissions is presented in Section 5 of this document. As discussed in Section 4 below, Strata will mitigate fugitive dust emissions during all project phases with the use of speed limits, strategically placed water loadout facilities near access roads, chemical dust suppressants such as magnesium chloride, selection of road surface materials which will minimize dust, and prompt revegetation of disturbed areas.

3.14 Radioactive Gaseous Emissions and Control Measures

Radon gas will be the primary source of radioactive gaseous effluent at the Ross ISR Project. Radon is a radioactive, colorless and odorless gas that occurs naturally as the decay product of radium. Radon is present in the lixiviant solution that is extracted from the wellfields and piped to the CPP for processing. Radon gas may potentially be released in the CPP as a result of solution spills, filter changes, IX resin transfer operations, and maintenance activities. Minor amounts of radon gas may be released outside of the CPP from the wellheads, module buildings, and lined retention ponds. Radon that is discharged from the Ross facilities will quickly disperse into the atmosphere. An inventory of radon gas emissions is presented in Section 5 of this document.

The recovery process will use pressurized downflow IX vessels with vents in the top of each vessel to minimize radon releases. Precipitation tank vents and filtration unit exhaust points will be ducted through a common system to a wet scrubber (see Section 4 below) then discharged to the atmosphere.

3.15 Radioactive Particulate Emissions and Control Measures

Potential radioactive particulate emissions will consist primarily of airborne yellowcake in the uranium drying and packaging circuit. Yellowcake drying will be done in a low temperature, vacuum-paddle dryer. This dryer will operate at a temperature of 300°F or less. Dryers of this type minimize generation of particulates and are very efficient at controlling particulate emissions because they are externally heated (no flame in contact with yellowcake) and the drying chamber is under vacuum. Accordingly, these dryers emit no airborne particulates to the environment (see Section 3.1 above). Vented off-gas from the drying procedure will be filtered through a baghouse filter, and then cooled and scrubbed to remove smaller entrained particles and water vapor. Entrained particles in the baghouse fabric and scrubber water will be returned to the process.

Upon drying, yellowcake will be packaged on a batch basis. A port in the bottom of the drying chamber will discharge yellowcake into 55-gallon drums. The yellowcake feed port will be fitted with a rotary air lock valve. The valve will create a sealed and pressurized system to guard against particulate contamination of the surrounding area.

4.0 BEST AVAILABLE CONTROL TECHNOLOGY (BACT)

4.1 Fugitive Dust

The primary sources of fugitive dust will be disturbed areas and project-related traffic on county roads and within the permit area.

Strata will mitigate fugitive dust emissions from wind erosion using the following best management practices:

- Stockpiles will be located on the leeward side of hills, when available, to minimize wind erosion.
- Exposed soil will be sprayed with water as needed during construction.
- Disturbed areas will be promptly restored and reseeded, typically within one construction season.

Strata will mitigate fugitive dust emissions from roads during all project phases with the use of:

- Speed limits for vehicle traffic
- Strategically placed water loadout facilities near access roads
- Chemical dust suppressants such as magnesium chloride
- Selection of road surface materials which will minimize dust

The main route for accessing the proposed project area will be north from Interstate 90 along D Road for 18.3 miles, then continuing north along the New Haven Road 3.0 miles to the proposed primary access road. The existing county infrastructure consists of 3 miles of chip seal along D Road until the surfacing becomes reclaimed asphalt pavement and gravel from that point to the north. The New Haven Road is also a gravel surfaced roadway. These two roadways may need minor improvements to improve the surfacing section and roadway top widths to increase roadway durability and safety along these routes to the primary access road. Roadway evaluation systems have been adopted as part of the Crook County MOU (Appendix C) to help standardize evaluation of roadway condition.

The primary access road from D Road to the central plant area will be 30 ft wide, with road surfacing atop 12" of road base (Figure A-4.1). Secondary access roads will include roads constructed within the central plant area and roads constructed between the central plant area and the wellfield modules. Within the CPP area, secondary access roads will be constructed with approximately the same roadway section as the primary access road. All secondary access roads will be constructed with an all-weather surface. Temporary wellfield access roads and monitor well access roads (tertiary roads) will generally be un-constructed, two-track trail roads approximately 8 to 10 feet wide. Temporary and tertiary access roads will typically not have any surfacing and will generally have no cut or fill associated with their construction. As these roadways become unused they will be reclaimed to their natural condition by replacing topsoil, if previously removed, ripping the soil as needed to reduce compaction, and re-seeding.

Estimated workers and traffic counts are shown in Table 4-1. During construction, the highest level of traffic is anticipated due to the relatively large workforce and due to material and equipment shipments. Based on an anticipated workforce of up to 200 during construction, the traffic increase on affected roads is estimated to be up to 400 vehicles per day (200 round trips or 400 one-way trips on affected roads), based on the conservative assumption that each worker will drive in a separate passenger vehicle. In addition, up to 12 heavy truck shipments are anticipated each day (24 one-way trips). These include primarily incoming shipments of materials, equipment, and fuel used to construct the CPP facilities, wellfield modules, access roads, etc. Infrequent outgoing shipments (approximately 1 per week) will include solid waste and small quantities of hazardous waste such as used oil.

Based on the estimated project-related traffic counts shown in Table 4-1 and a current average annual daily traffic of about 100 vehicles per day on affected portions of D Road and the New Haven Road, traffic on county roads may increase approximately five fold during construction of the proposed Ross ISR Project. Overall, potential traffic impacts during operation will be significantly less than those during construction due to a smaller workforce and reduced shipping frequency. It should be noted that the estimated impacts from passenger vehicles are conservatively high, since some workers will likely car pool. Nevertheless, projected traffic volumes during construction will have moderate to large impacts on the traffic levels on affected county roads. This could generate additional dust and road wear and tear. Mitigation measures for potential traffic impacts on these roads include assisting Crook County with county road assessment, maintenance, and upgrades; applying dust control to key sections of county roads; and developing and implementing a speed limit policy for Strata employees and contractors traveling on county roads. Strata currently has a speed limit policy for its employees and contractors, to be implemented not only for local access roads within the proposed project area but also for county roads used to access the site. Reduced speeds will lower the amount of fugitive dust generated.

Table 4-1 – Estimated Workers and Traffic Counts

Project Phase	Average Daily Workers	Passenger Vehicle Traffic (veh/day)	Heavy Truck Traffic (veh/day)
Construction	200	400	24
Operation	60	120	16
Aquifer Restoration	20	40	12
Decommissioning	90	180	10

Note: Vehicle counts are to and from the proposed project area (two one-way trips per vehicle).

Mitigation measures to reduce potential air quality impacts from vehicle emissions and dust include:

- Minimizing disturbed areas by minimizing access road widths, utilizing existing county and oilfield roads where possible, and implementing a one-way in/one-way out policy
- Implementing dust control Best Management Practices such as magnesium chloride on primary access roads and portions of county roads near the project or affronting residential properties
- Implementing dust abatement Best Management Practices such as wetting disturbed areas and primary, secondary and tertiary roads as needed
- Implementing speed limits on access roads within the proposed project area
- Increased speed limit signage and enforcement of speed limits on county roads for Strata employees and contractors

Chemical dust suppressant will be used on the primary access road and portions of county roads. Strata proposes to apply magnesium chloride to the following road sections once per year, or more frequently if needed (see Exhibit 1):

- 1.1 miles of primary access and CPP area roads.
- 0.6 mile of the more frequently traveled wellfield access roads
- 8.4 miles of county roads that fall within or adjacent to the permit area, including D Road and the New Haven Road.

In addition to these project area roads, Strata will also treat portions of D Road in accordance with a Memorandum of Understanding (MOU) with Crook County. In this MOU, Strata has agreed to supply dust control over ¼-mile stretches of county roads that front residential properties and are used to access the Ross ISR Project. The entire MOU is included in Appendix C of this document.

4.2 Acid Fumes

The proposed CPP will use sulfuric acid in the precipitation tanks, and may potentially use hydrochloric acid if needed for resin regeneration. These acids will be stored in tanks within the chemical storage area adjacent to the CPP. Recent BACT determinations for filling acid storage tanks have required closed loop systems by routing the displaced vapors from the acid storage tank back to the tank truck as the acid solution is transferred. Strata will adhere to this BACT standard.

In addition, Strata proposes to utilize acid fume scrubbers as BACT on all acid storage tanks. The fume scrubber will treat vapor return lines to capture any acid vapors remaining in the lines after the tank truck has offloaded the acid. For this purpose, Strata proposes the Heil Series 700 sulfuric acid scrubber (or equivalent) with integral fan, recirculation pump, packed bed, mist eliminator and sump (see specifications in Appendix B). In this system fume laden air is washed to scrub acid vapors, followed by a mist eliminator which removes 99% of the entrained moisture.

Sulfuric acid fumes may also be generated by the yellowcake precipitation process. The precipitation tanks will be vented to a common duct that will be routed through an acid fume scrubber similar to those discussed above. For BACT Strata proposes to use Heil's Model 702 scrubber (or equivalent) with a designed air flow capacity of 600 acfm and a water recirculation rate of 12 gpm. This scrubber is also rated at 99% H_2SO_4 removal efficiency. After being scrubbed, the vented air will be ducted to a roof-top exhaust.

4.3 Emergency Generator

The CPP will require a 300 kW backup electric generator to sustain critical processes in the event that utility power is lost or interrupted. Strata proposes as BACT a Tier 3, diesel generator limited to 500 hours of operation per year. This generator will comply with EPA standards for emergency generators set forth in Subpart IIII of 40 CFR Part 60 (see NSPS applicability discussion in Section 10 of this document). AQD has considered compliance with Subpart IIII as being representative of BACT.

4.4 Radon and Radionuclide Emissions

The primary source of radioactive gaseous emissions will be venting of radon-222 gas from occasional wellfield venting for sampling events, small unavoidable leaks in wellfield and IX equipment, resin transfer operations, water discharge to lined retention ponds, and maintenance of wellfield and IX equipment. The CPP will utilize fixed-bed, pressurized downflow IX systems with pressurized, closed-loop piping and sealed vessels to minimize radon emissions from the process. Since the CPP circuits and the wellfield will be operated under pressure, the majority of radon absorbed by the recovery solution will stay in solution and will not be released to the atmosphere.

Radon gas may potentially be released in the CPP as a result of solution spills, filter changes, IX resin transfer operations, and maintenance activities. Such releases will occur through vents located away from plant ventilation intakes, above the facilities roof, and on the leeward side of the CPP. Radon exposure risks to personnel in the CPP will be further reduced by the general plant area HVAC system. The ventilation system will circulate air within the CPP by exhausting air outside the building, forcing fresh air in. The general plant area HVAC system will be designed to provide a minimum of 6 air changes per hour. A fan performance monitoring station will be located at the exhaust fan point of discharge after the filtration equipment (wet scrubber).

Yellowcake slurry from the precipitation tanks will be dewatered in a thickener (or comparable solids separation device) and filter press before being sent to low-temperature (<300° F), indirect-heat vacuum dryers to remove moisture. Each dryer will be rated at approximately 1 million Btu/hr. Feed to the yellowcake dryers will be via an enclosed shaftless screw conveyor in order to prevent particulate matter from escaping. The natural gas-fired heating system in each dryer will be isolated from the yellowcake, ensuring that the combustion exhaust does not contain radioactive materials. Additionally, the dryers will be operated under a vacuum so that leaks will cause air to flow into the chamber. Airborne emissions within the drying chamber will be treated

using a bag filter to capture 100 percent of the airborne yellowcake particulates and a cooler to condense water vapor. A water sealed vacuum pump will provide ventilation while the dryers are being loaded and unloaded into drums by operators.

Based on this technology potential radioactive emissions from the Ross ISR Project will be limited to Rn-222 released from wellfields and processing facilities. The NRC states in its ISR GEIS (NRC, 2009), "Radionuclides can be released to the environment during ISL facility operation. Radon gas is emitted from ISL wellfields and processing facilities during operations and is the only radioactive airborne effluent for those facilities that use vacuum dryer technology."

In summary, Strata proposes as BACT for radioactive emissions a closed-loop uranium recovery process with a pressurized, downflow IX system, and vacuum dryers with filters to remove entrained particles.

4.5 Sodium Carbonate and Sodium Bicarbonate Handling

Dry sodium carbonate will be delivered by truck and will be blown into a storage tank using air pressure. The tank will store a saturated solution of sodium carbonate and solid crystals. The tank vent will be filtered with a dust vent bag, or fabric filter, to remove particulate emissions. The sodium carbonate solution will be kept above 100°F to prevent precipitation in the tank and piping. This will be accomplished by heating the water added to the tank, and continuously circulating liquid from the tank through a heat exchanger. An electric heater will be used to heat a thermal fluid to heat the exchanger.

Dry sodium bicarbonate will also be delivered by trucks and blown into a storage silo using air pressure. The silo vent will be filtered with a dust vent bag to remove particulate emissions. From the silo, the sodium bicarbonate will be conveyed pneumatically to a day tank, also equipped with a particulate filter. The day tank will periodically feed a mix tank that will hold the carbonate in solution for use in the process.

The sodium chloride brine tank will be filled in the same manner as the sodium carbonate and sodium bicarbonate tanks. It will also be equipped with the same dust control filter.

For these three systems, the fabric filter manufacturer estimates an emissions rate of 0.01 grains per acfm on dust particles greater than 3 microns. The bin vent dust collector has been conservatively sized at about 1.4:1 air-to-cloth ratio (180 acfm from the vacuum pump and 130 ft^2 of bag surface area), which will minimize particulate emissions. Based on the manufacturer's estimated emissions rate, total emissions from solid reagent unloading at the maximum yellowcake production rate are 2.4 lb/yr for NaCl, 0.5 lb/yr for Na_2CO_3, and 3.2 lb/yr for $NaHCO_3$. Strata proposes that the dust vent filters be accepted as BACT for sodium carbonate, sodium bicarbonate and sodium chloride handling.

5.0 EMISSIONS INVENTORY

Sources of air emissions at the Ross ISR Project will include fugitive dust from roads and disturbed areas, as well as emissions from combustion sources (engines, heaters, vacuum dryers), storage tanks, wellheads, and process vents. Strata calculated an emissions inventory from these sources for the construction, operation, restoration and decommissioning phases of the project. The emissions inventory includes:

- Particulates ($PM_{10}/PM_{2.5}$)
- Oxides of nitrogen (NO_x)
- Carbon monoxide (CO)
- Sulfur dioxide (SO_2)
- Total organic compounds (TOC) and volatile organic compounds (VOC)
- Hazardous air pollutants (HAPs)
- Carbon dioxide (CO_2)
- Hydrogen peroxide vapor (H_2O_2)
- Hydrochloric acid vapor (HCl)
- Radon gas (Rn-222)

Activity levels for each project phase assume a maximum annual production of 3 million pounds of yellowcake. Since emissions were calculated by project phase and these phases will overlap, annual emissions were developed by combining emissions from concurrent phases for each year in the project schedule. Table 5-1 is a reproduction of Table 3-1 showing the tentative schedule for each of the four project phases.

Table 5-1 – Tentative Project Schedule

Year after License Issued	1	2	3	4	5	6	7	8	9	10
Construction Phase	■	■	■	■						
Operation Phase		■	■	■	■	■	■			
Aquifer Restoration Phase				■	■	■	■	■	■	
Decommissioning Phase						■	■	■	■	■

Based on the schedule in Table 5-1, maximum annual emissions are summarized in Table 5-2. $PM_{2.5}$ emissions were calculated as 15% of PM_{10} emissions, based on an assumed ratio of $PM_{2.5}$ emissions to PM_{10} emissions. Ratios compiled from EPA AP-42 and the Western Regional Air Partnership (WRAP) are typically 0.15 or lower (Midwest Research Institute, 2006). The ratio for tailpipe emissions is 97%, but tailpipe emissions represent a small fraction of total particulate emissions from this project. For simplicity, the 15% figure was applied to all PM_{10} emissions.

Following is a discussion of each category of emissions, relevant sources and methods used to inventory these emissions. These individual categories were summed over the appropriate time periods to produce the summary in Table 5-2. Note that an emissions inventory, marked as "Preliminary," was submitted as Addendum 4.6-A to the Ross ISR Project USNRC License Application, Environmental Report (Strata Energy, 2010b). The summary in Table 5-2 reflects additional detail and refinements not included in the preliminary emissions inventory.

Table 5-2 – Emissions Summary

Units and Type of Emissions	Year after License Issuance									
	1	2	3	4	5	6	7	8	9	10
Tons PM_{10}	184.4	202.6	202.6	202.6	35.9	39.3	39.3	100.0	100.0	87.4
Tons $PM_{2.5}$	27.7	30.4	30.4	30.4	5.4	5.9	5.9	15.0	15.0	13.1
Tons NO_x	183.4	223.0	223.0	245.7	63.9	128.2	128.2	88.6	88.6	65.9
Tons CO	40.5	49.2	49.2	54.1	14.6	28.4	28.4	19.7	19.7	14.8
Tons SO_2	10.9	13.4	13.4	14.9	4.1	8.4	8.4	5.8	5.8	4.3
Tons TOC	13.4	16.6	16.6	18.4	5.1	10.3	10.3	7.1	7.1	5.3
Tons VOC	0.71	0.76	0.76	0.76	0.76	0.76	0.76	0.71	0.71	0.71
Tons HAP	3.61	4.24	4.24	4.57	1.85	2.43	2.43	1.74	1.74	1.40
Tons CO_2	7,130	12,245	12,245	13,087	6,072	8,457	8,457	3,343	3,343	2,500
Tons HCl	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.00	0.00	0.00
Tons H_2O_2	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.000
Curies Rn-222	0.0	316.2	316.2	631.4	631.4	631.4	631.4	631.4	631.4	0.0

5.1 Combustion Emissions

During construction, diesel emissions will be emitted from drill rigs, diesel-powered water trucks and other heavy equipment. During operation and restoration, diesel emissions from onsite operations and maintenance traffic will be less than emissions during construction. Vehicle combustion emissions will increase again during the decommissioning phase due primarily to surface reclamation activities. Since the predominant source of combustion emissions will be from industrial equipment, Strata did not calculate combustion emissions for passenger vehicles or shipments traveling to and from the site.

The AQD emission inventory guidance for minor sources (WDEQ/AQD, 2010) references EPA AP-42 guidance (EPA, 1995) for emission factors associated with construction and heavy equipment. Strata compared combustion emissions calculated using EPA's NONROAD2008 model with those calculated using emission factors in AP-42 Chapter 3, Stationary Internal Combustion Sources. Since the emissions calculated from AP-42 were generally higher than those calculated from NONROAD2008, the AP-42 factors were used in this analysis.

Emission factors from AP-42 Table 3.3-1 were applied to engines less than 600 HP in capacity, while emission factors for larger engines were obtained from AP-42 Table 3.4-1. Emissions for each pollutant were calculated using the following equations:

$$E = A \times EF \times LF \times U$$

Where:
- E = Emissions (tons/yr)
- A = Activity (hrs/yr)
- EF = Emission factor (g/hp-hr)
- LF = Load factor (fraction of available power)

U = Unit conversion (ton/2000 lb) (lb/453.6 g)

Strata estimated a 40 percent load factor for all emission calculations. This estimate is believed to be conservatively high based on actual engine loads and idling times. The results of the combustion emissions estimates are presented by project phase in Appendix D, Tables D-1a through D-1d.

5.2 Fugitive Dust Emissions

The Ross ISR Project will generate fugitive dust during construction, operation, restoration and decommissioning. Sources of fugitive dust include wind erosion on disturbed areas, earth moving activities, and traffic over the local road system.

Of the approximately 1,721 acres within the proposed project area, 280 acres are anticipated to be disturbed over the life of the project. Construction of the central plant area, along with water diversion control structures and topsoil stockpiles, will disturb approximately 55 acres. This disturbance will occur in the year preceding facility operation, and is conservatively assumed to remain exposed until the decommissioning phase (although much of it will be reclaimed within a year). Unimproved roads will account for roughly 10 acres of disturbance. The remaining 215 acres will constitute wellfield disturbance, with topsoil stripping and revegetation distributed more or less uniformly throughout the approximately 4-year construction phase of the mine. Final reclamation is assumed to proceed at a uniform rate when the decommissioning phase begins.

Accordingly, disturbed areas for each phase were calculated as follows:

- Construction: 55 acres for facilities, stockpiles, primary roads and drainage control plus 215/4 = 54 acres per yr for wellfield construction, for a total of 109 acres per year
- Operation and/or aquifer restoration: 10 acres for secondary and tertiary roads (each year)
- Decommissioning: 280/5 = 56 acres per year

Based on AP-42 Table 11.9-4, an emission factor of 0.38 tons/acre/yr (TSP) was applied to exposed acres for each year. From AQD guidance established for surface coal mines, 30% of the TSP emissions were assumed to be smaller than 10 microns (PM_{10}).

Traffic on project roads will consist of construction and ISR equipment, utility and maintenance equipment, and small vehicles. Fugitive dust emissions from traffic, characterized as PM_{10}, were estimated for each phase of the project using the following chapters from the EPA AP-42 guidance:

Chapter 11.9	Western Surface Coal Mining
Chapter 13.2.2	Unpaved Roads
Chapter 13.2.3	Heavy Construction Equipment

Chapter 13.2.4 Aggregate Handling and Storage Piles

The fugitive emissions calculations are presented in Appendix D. The operational basis for these calculations, including equipment hours and travel distances, is presented in Table D-2. For project-specific roads a 50% control factor was applied to the fugitive road dust emission factors to account for water spray and/or chemical dust suppression. For the construction and decommissioning phases, fugitive emissions were also calculated for activities associated with earthwork, including construction or reclamation of the wellfields, roads and central plant area. Tables D-3a through D-3d in Appendix D show the fugitive emission calculations and assumptions by project phase.

All access roads used by vehicles traveling to and from the project area will be maintained to minimize fugitive emissions. Mitigation measures discussed in Section 4 of this document include speed limit control, use of water and chemical dust suppression, and proper selection of road surface materials.

5.3 Non-Radioactive Gaseous Emissions

Non-radioactive emissions during uranium recovery operations will include gaseous effluents from the wellfield and CPP. Apart from mobile equipment tailpipe emissions discussed above, the primary sources of non-radioactive gaseous effluents will include process vents, storage tanks, yellowcake dryers, space heaters, and the emergency generator. Most of these sources will emit CO_2, the principal greenhouse gas (GHG) to be emitted by the Ross ISR Project. GHG emissions are discussed in Section 5.4 below.

Non-radioactive emissions will include venting of excess vapor pressure in pipelines and small amounts of chemical vapor released from the CPP ventilation system. These sources will be scrubbed for acid vapors prior to release to the atmosphere. Criteria pollutant emissions from these sources will be insignificant.

Storage tank emissions are summarized in Table 5-3. These emissions were calculated using EPA's Tanks 4.0.9d software. While the software is designed primarily for organic fluids, it provides a reasonable estimate of inorganic fluid emissions based on vapor pressures (EPA, 2005). As shown in Table 5-3, only certain tanks will generate quantifiable emissions. These include the hydrochloric acid, hydrogen peroxide, diesel and gasoline fuel tanks. Vapors emitted from the fuel tanks will constitute VOCs. In addition, the resin transfer tanks will emit small amounts of radon gas, discussed in Section 5.5 below. Sulfuric acid tanks were determined to generate insignificant vapor emissions based on characteristically low vapor pressures. Detailed output from the Tanks software is presented in Appendix D.

Table 5-3 – Storage Tanks Emissions Summary

Storage Tank	Qty	Height (ft)	Freeboard (ft)	Diam (ft)	Volume (gal)	Change outs/hr	Forced Ventilation (cfh)	Significant Air Emissions (tons/yr)
Fresh Eluant (9% NaCl, 2% $NaCO_3$)	2	18.0	2.0	12.0	13,536			-
Lean Eluant (9% NaCl, 2% $NaCO_3$)	1	18.0	2.0	12.0	13,536	4	905	-
Rich Eluant (9% NaCl, 2% $NaCO_3$)	1	18.0	2.0	12.0	13,536	4	905	-
Precip (1% H_2O_2, 1% NaOH, 5% H_2SO_4, 9% NaCl, 2% Na_2CO_3)	3	22.0	6.0	20.0	37,601	2	3,770	-
Resin Transfer (H_2O, Radon Source)	2	18.0	1.0	12.0	14,382	6	679	N/A
Caustic Soda (50% NaOH)	1	6.0	1.0	6.0	1,058			-
Sulfuric Acid (93% H_2SO_4)	1	14.0	2.0	12.0	10,152			-
Hydrochloric Acid (30% HCl)	1	14.0	2.0	12.0	10,152			0.024
Peroxide (50% H_2O_2)	1	14.0	2.0	12.0	10,152	0.008		0.001
NaCl Brine (Saturated NaCl)	1	18.0	2.0	12.0	13,536			-
Na_2CO_3 Brine (Saturated Na_2CO_3)	1	12.0	1.0	12.0	9,306			-
$NaHCO_3$ Day Tank (Saturated $NaHCO_3$)	1	16.0	2.0	14.0	16,121			-
$NaHCO_3$ Mix Tank (Saturated $NaHCO_3$)	1	12.0	1.5	12.0	8,883			-
Brine Holding Tank (H_2O)	1	16.0	1.0	8.0	5,640			-
Process Water (H_2O)	1	30.0	2.0	25.0	102,815			-
Domestic Water (H_2O)	1	18.0	1.0	12.0	14,382			-
Yellowcake Slurry Tank	1	10.0	3.0	7.0	2,015			-
Thickener Overflow	1	8.0	1.0	8.0	2,632			-
Diesel Fuel Storage	1	14.0	2.0	12.0	10,152			0.006
Gasoline Fuel Storage	1	12.0	2.0	6.0	2,115			0.649

An emergency generator will be required to supply power to critical CPP equipment in the event of a utility power failure. The emergency generator will be limited to 500 hours of operation per year. As discussed in Section 4, it will be powered by a Tier 3 diesel engine in accordance with NSPS and BACT requirements. Table 5-4 shows the emission factors, duty cycle, and estimated maximum gaseous and particulate emissions from the emergency generator. Aldehyde emissions were assumed to contribute to total HAP emissions from the project.

Table 5-4 – Emergency Generator Emissions

Operating Parameters	**Maximum Continuous HP**	400
	Quantity	1
	Hours/Year	500
Emission Factors (g/hp-hr)	**NO_x[1]**	3.00
	CO[1]	2.60
	PM_{10}[1]	0.150
	SO_2[3]	0.166
	TOC[1]	0.142
	CO_2[2]	522
	Aldehydes[2]	0.210
	HAPs[2]	0.216
Emissions (tpy)	**NO_x**	0.66
	CO	0.57
	PM_{10}	0.03
	SO_2	0.04
	TOC	0.03
	CO_2	115
	Aldehydes	0.05
	Total HAPs	0.05

Notes:
1. EPA Tier 3/Tier 4 Standards
2. EPA: AP-42 Table 3.3-1 Emission Factors for Uncontrolled Diesel Industrial Engines
3. Based on 500 ppm sulfur in diesel fuel, and standard fuel efficiency

The vacuum dryers and space heaters in the CPP will be fueled by natural gas. Dryers will run continuously with the process, while heaters will only be needed during the winter months. Emission factors for these sources were taken from AP-42, Chapter 1. NO_x and CO emission factors for uncontrolled residential furnaces were used (AP-42 Table 1.4-1). All other pollutant emission factors were taken from AP-42 Table 1.4-2. Table 5-5 shows the calculation of emissions from natural gas fired heaters and dryers.

Table 5-5 – Emissions from Natural Gas Burning Equipment

	Emission Factors (lb/MMscf)	
Pollutant	**Vacuum Dryer**	**Space Heater**
NO_x	94.0	94.0
CO	40.0	40.0
$PM_{10}/PM_{2.5}$	7.6	7.6
SO_2	0.6	0.6
TOC	11.0	11.0
VOC	5.5	5.5
Activity Levels		
Number of Units	2	4
Operating hours/yr	8,760	4,380
Maximum duty (MMBtu/hr)	1.00	1.20
Heating value (Btu/scf)	1,020	1,020
	Emissions (tons/yr)	
Pollutant	**Vacuum Dryer**	**Space Heater**
NO_x	0.81	0.97
CO	0.34	0.41
$PM_{10}/PM_{2.5}$	0.07	0.08
SO_2	0.01	0.01
TOC	0.09	0.11
VOC	0.05	0.06

5.4 Greenhouse Gas Emissions

The primary sources of GHG will be the diesel-powered engines, natural gas-fired combustion sources, and the uranium recovery process itself. CO_2 will be released from uranyl tricarbonate breakdown in the precipitation circuit. CO_2 will also be released during elution. Minor amounts of methane and nitrous oxides, both of which are considered greenhouse gases, will be emitted from natural gas combustion. The GHG potential or CO_2 equivalent of these emissions is a fraction of one percent of the CO_2 emissions, and has therefore been omitted from the calculations. A complete greenhouse gas inventory for the Ross ISR Project at the maximum yellowcake production rate of 3 million lbs/yr is provided in Table 5-6. The maximum GHG emissions year coincides with concurrent construction, operation and aquifer restoration (year 4).

Table 5-6 – Maximum Annual Greenhouse Gas Emissions

MAXIMUM-CASE YEAR	
CO_2 from Uranyl TriCarbonate Breakdown (tons)	705
CO_2 from Sodium BiCarbonate in Eluate (tons)	855
CO_2 from Product Drying (tons)	960
CO_2 from Space Heaters (tons)	1,156
CO_2 from Diesel Powered Equipment (tons)	9,296
CO_2 from Diesel Generator (tons)	115
TOTAL GHG Emissions (tons)	13,087

5.4 Radioactive Emissions

The Ross ISR Project has the potential to produce radioactive effluent in the form of radon gas (Rn-222) that is dissolved in the production and restoration fluid and is present as a result of the uranium decay series. It is assumed there will be no particulate emissions during routine operations of this facility as the facility will use modern, low temperature vacuum driers, the particulate release of which is considered to be zero by the NRC as provided in NUREG-1910 (NRC 2009). The Rn-222 releases result from the following sources during the lifespan of the Ross ISR Project:

- New Wells: The drilling process removes soil/drill cuttings which contain Rn-222. This soil is stored in mud pits until the wells are decommissioned. Rn-222 is released during the mud pit storage.

- Recovery and Injection Wells: Rn-222 may be released via leaks/venting in the well heads or the module buildings.

- CPP: The pressurized, closed system for the production fluids is opened at the point of IX column transfer and point of conveyance discharge points (MILDOS-AREA defines this as "purge water") to the lined retention ponds near the CPP.

- Aquifer Restoration Wells: Circulating water and discharged water from the restoration process also contains Rn-222 which may be released during the process.

For purposes of this analysis, it has been assumed that the Ross ISR Project will have two mine units that will be operated concurrently. In any areas of overlap, it was assumed that the part of the process that is active and produces the highest source term represents 100% of all wellfield operations (most conservative). For example, the operation phase of the project has a larger source term than the new wellfield construction phase. Accordingly, during the operation phase, it is assumed that the entirety of the wellfield is in operation even though in fact the source term will be smaller as portions of the mine units will be in construction or aquifer restoration.

The source term estimates for Rn-222 releases are summarized in Table 5-7. Details of the Rn-222 emissions calculations are presented in Appendix E.

Table 5-7 – Estimated Rn-222 Releases (Ci/yr) from the Ross ISR Facility

Location	Construction	Operation	Aquifer Restoration
Mine Unit 1	0.0213	122	122
Mine Unit 2	0.0213	123	123
CPP	N/A	71.2	70.2
TOTAL	0.0426	316.2	315.2

6.0 BASELINE AIR QUALITY MONITORING RESULTS

6.1 Air Particulate Sampling

The operational airborne radiation monitoring program utilized six air particulate sites established in the baseline monitoring plan. One of these sites includes a meteorological monitoring station. The monitoring plan was reviewed and approved by WDEQ-AQD. Both the plan and the AQD letter of approval are attached as Appendix F to this document.

Baseline monitoring and MILDOS-AREA modeling confirmed that the selected monitoring locations are consistent with NRC Regulatory Guide 8.30 (NRC, 2002). Additionally, the monitoring stations meet the recommendations of Regulatory Guide 4.14 (NRC, 1980), which states that:

> "Air particulate samples should be collected at (1) a minimum of three locations at or near the site boundary, (2) the residence or occupiable structure within 10 kilometers of the site with the highest predicted airborne radionuclide concentration, (3) at least one residence or occupiable structure where predicted doses exceed 5 percent of the standards in 40 CFR Part 190, and (4) a remote location representing background conditions."

Strata utilized F&J Specialty Products Models DF-40L-BL-AC and LV-1D air samplers collecting total suspended particulates. Filters (47 mm) were collected from each air-sampling unit on a weekly basis and analyzed for uranium, radium-226, thorium-230 and lead-210.

Table 6-1 summarizes the air particulate monitoring results for the one-year baseline period. The North site sampler was added in October of 2010 to improve coverage around the permit boundary. Therefore air particulates were not monitored (NM) at this site during the first three quarters. Results for the four quarters of data are consistent for all sites with no unusual anomalies or unexpected results. Most results, with the exception of Pb-210, were at or below lower limits of detection. No site appeared to demonstrate higher or lower concentrations than any others. There is no evidence from these data of seasonal variation, although the fourth-quarter Pb-210 results may be greater at most locations relative to the other three quarters. Overall, results indicate Pb-210 concentrations were consistently higher at all locations and in all quarters in comparison to other radionuclides. These results are typical and likely attributed to Pb-210 being a radon (gas) progeny making it more available and mobile in the atmosphere than the other particulate radionuclides which result from re-suspension of soil particles.

Table 6-1 – Baseline Air Particulate Sampling Results for Four Quarters

Site	Analyte	1Q2010		2Q2010		3Q2010		4Q2010	
		Sample Result (µCi/mL)	DL (µCi/mL)	Sample Result (µCi/mL)	DL (µCi/mL)	Sample Result (µCi/mL)	DL (µCi/mL)	Sample Result (µCi/mL)	DL (µCi/mL)
Met	Pb-210	3.87E-15	6.25E-17	1.64E-15	7.29E-17	4.77E-15	7.17E-17	1.83E-14	5.14E-16
	Ra-226	< DL	6.25E-17	< DL	7.29E-17	< DL	7.17E-17	< DL	2.57E-17
	Th-230	< DL	6.25E-17	< DL	7.29E-17	< DL	7.17E-17	2.57E-17	2.57E-17
	Uranium	< DL	3.12E-17	< DL	3.65E-17	3.59E-16	3.59E-17	< DL	2.57E-17
Southwest	Pb-210	4.19E-15	5.98E-17	1.51E-15	5.81E-17	9.44E-15	6.97E-17	2.54E-14	8.31E-16
	Ra-226	< DL	5.98E-17	< DL	5.81E-17	< DL	6.97E-17	< DL	4.16E-17
	Th-230	< DL	5.98E-17	< DL	5.81E-17	< DL	6.97E-17	8.31E-17	4.16E-17
	Uranium	8.02E-17	2.99E-17	1.17E-16	2.90E-17	< DL	3.48E-17	< DL	4.16E-17
South	Pb-210	4.39E-15	5.90E-17	1.64E-15	6.70E-17	8.74E-15	6.50E-17	1.61E-14	8.28E-16
	Ra-226	< DL	5.90E-17	< DL	6.70E-17	0.00E+00	6.50E-17	< DL	4.14E-17
	Th-230	< DL	5.90E-17	< DL	6.70E-17	9.74E-17	6.50E-17	2.07E-16	4.14E-17
	Uranium	< DL	2.95E-17	< DL	3.35E-17	< DL	3.25E-17	< DL	4.14E-17
East	Pb-210	4.20E-15	6.56E-17	1.64E-15	6.83E-17	1.11E-14	7.26E-17	2.20E-14	8.22E-16
	Ra-226	< DL	6.56E-17	< DL	6.83E-17	< DL	7.26E-17	< DL	4.11E-17
	Th-230	< DL	6.56E-17	< DL	6.83E-17	< DL	7.26E-17	1.23E-16	4.11E-17
	Uranium	< DL	3.28E-17	< DL	3.41E-17	< DL	3.63E-17	< DL	4.11E-17
Office	Pb-210	3.84E-15	2.31E-17	1.52E-15	2.01E-17	1.14E-14	1.88E-17	1.09E-14	2.08E-16
	Ra-226	< DL	2.31E-17	< DL	2.01E-17	< DL	1.88E-17	2.08E-17	1.04E-17
	Th-230	< DL	2.31E-17	< DL	2.01E-17	3.77E-17	1.88E-17	2.08E-17	1.04E-17
	Uranium	< DL	1.16E-17	4.04E-17	1.00E-17	6.59E-17	9.41E-18	1.04E-17	1.04E-17

Table 6-2 (Continued) – Baseline Air Particulate Sampling Results for Four Quarters

Site	Analyte	1Q2010		2Q2010		3Q2010		4Q2010	
		Sample Result (µCi/mL)	DL (µCi/mL)	Sample Result (µCi/mL)	DL (µCi/mL)	Sample Result (µCi/mL)	DL (µCi/mL)	Sample Result (µCi/mL)	DL (µCi/mL)
North	Pb-210	NM	NA	NM	NA	NM	NA	1.58E-14	7.01E-16
	Ra-226	NM	NA	NM	NA	NM	NA	< DL	1.05E-16
	Th-230	NM	NA	NM	NA	NM	NA	< DL	1.05E-16
	Uranium	NM	NA	NM	NA	NM	NA	< DL	3.50E-17

6.2 Radioactive Monitoring

Strata co-located radon detectors and thermoluminescent dosimeters (TLDs) with the air particulate samplers as well as 11 other points of interest, including the nearest residences and future locations of the CPP, lined retention ponds, and wellfields. For this purpose Strata utilized Landauer high sensitivity environmental radon Track-Etch detectors and environmental low-level TLDs. The radon detectors and TLDs were exchanged for unexposed detectors quarterly and analyzed by Landauer's laboratory. The results were used to assess quarterly radon concentrations and gamma exposure rates at each of the sites. Table 6-2 summarizes the radon monitoring results for the one-year baseline period.

Table 6-3 – Summary of Baseline Radon in Air Results for Four Quarters

#	Location ID	Average[1] Rn Conc Q1 (pCi/L)	Average[1] Rn Conc Q2 (pCi/L)	Average[1] Rn Conc Q3 (pCi/L)	Average[1] Rn Conc Q4 (pCi/L)	Location Average[2] for ALL Quarters (pCi/L)
1	Oshoto Office	1.7	0.7	0.8	0.5	0.9
2	Met Station	2.0	0.6	0.4	0.2	0.8
3	SW station	1.9	1.1	1.0	0.5	1.1
4	E Station	1.7	0.7	0.6	0.6	0.9
5	S Station	0.5	0.8	0.8	0.6	0.7
6	Wesley	0.9	1.0	0.9	0.5	0.8
7	Wood	1.1	0.9	1.3	0.5	1.0
8	Strong	0.8	0.7	0.9	0.5	0.7
9	E Evap Pond	0.3	0.9	0.8	0.9	0.7
10	E CPP	0.4	0.9	0.6	0.7	0.8
11	W Evap Pond	0.6	0.6	0.6	0.5	0.6
12	W CPP	0.5	0.8	0.7	0.4	0.6
13	Former R&D	1.7	0.8	1.2	0.7	1.1
14	N mineralized	0.8	0.6	0.8	0.6	0.7
15	S Mineralized	0.7	0.8	0.7	0.5	0.7
16	N CPP	NM	1.4	0.8	0.6	0.9
17	N Evap Pond	NM	1.4	0.8	0.5	0.9
	Average of all locations by Quarter	1.0	0.9	0.8	0.6	0.8[3]
	Standard Deviation	0.6	0.2	0.2	0.1	0.2
	Approximate Range	0.3 – 2.0	0.6 – 1.4	0.4 – 1.3	0.2 – 0.9	N/A

[1] Average based on total Radon exposure reported over entire exposure period
[2] Values represent the average of all 4 quarters of data received at each location
[3] *Value represents the average from all locations for all quarters*

In general, radioactive monitoring results were indicative of expected regional background for radon in air in mineralized environments in the range of 0.5 – 2.0 pCi/l. All data in Table 6-2 are in units of pCi/liter in air. No specific location appeared to be consistently high or low across all four quarters. The data suggest that in general, lower radon concentrations were evident during the fourth quarter of the study (10/22/10 – 1/12/11) as reflected by the lowest average result for the 17 locations.

Table 6-3 summarizes baseline gamma radiation monitoring for all four quarters. These results represent the long-term gamma exposure rate (in microroentgens per hour) as measured by the TLDs deployed throughout the project area.

Table 6-4 – Summary of Gamma Radiation Monitoring Results for Four Quarters

#	Location ID	Average Exposure Rate (μR/hr) 1Q2010	Average Exposure Rate (μR/hr) 2Q2010	Average Exposure Rate (μR/hr) 3Q2010	Average Exposure Rate (μR/hr) 4Q2010	Location Average[1] for ALL Quarters (μR/hr)
1	Oshoto Office	14.0	12.7	12.5	11.2	12.6
2	Met Station	12.5	12.8	14.0	10.9	12.5
3	SW station	12.1	12.4	12.8	9.7	11.7
4	E Station	11.3	14.0	11.9	10.3	11.9
5	S Station	12.5	11.0	10.3	9.6	10.9
6	Wesley	13.8	13.7	13.2	10.4	12.8
7	Wood	13.1	12.9	13.7	11.0	12.7
8	Strong	13.2	12.5	12.7	9.1	11.9
9	E Evap Pond	13.2	9.6	14.0	13.8	12.6
10	E CPP	14.2	8.9	12.8	13.4	12.3
11	W Evap Pond	13.6	13.2	11.7	10.4	12.3
12	W CPP	14.0	13.9	12.3	10.3	12.6
13	Former R&D	13.4	12.0	12.5	11.3	12.3
14	N mineralized	13.7	13.3	12.6	10.5	12.5
15	S Mineralized	12.8	13.2	13.0	9.9	12.2
16	N CPP	n/a	12.7	12.5	11.6	12.3
17	N Evap Pond	n/a	11.8	13.1	10.9	11.9
	Average[2] of all locations by Quarter	13.2	12.4	12.7	10.8	12.3[3]
	Standard Deviation	0.80	1.41	0.87	1.22	0.47
	Approximate Range	11.3 – 14.2	8.9 – 14.0	10.3 - 14	9.1 – 13.8	N/A

[1] *Values represent the average of all 4 quarters of data for each location; all exposure rates are based on "environmental exposure" as previously defined*

[2] Values represent the average from all locations during that quarter

[3] Average exposure rate for all locations over the 12 month study period

In general, the results in Table 6-3 are indicative of expected regional background for cosmic and terrestrial exposure rates in the range of approximately 9 to14 μR/hr and a mean of about 12 μR/hr.

No specific location appeared to be consistently high or low across the four quarters of data. The data suggest however that lower exposure rates were indicated during the fourth quarter of the study (10/22/10 – 1/12/11) as reflected by the lowest result when averaged for the 17 locations as compared to the average values for the other three quarters.

7.0 MILDOS-AREA MODELING RESULTS

Dose estimates from air pathways were made using MILDOS-AREA, the Argonne National Laboratory (ANL) computer code recommended by NRC in NUREG-1569, Section 7.3.1.2.2, for assessing radioactive impact to the public from air emissions at ISR facilities.

The Ross ISR Project will use modern vacuum dryer technology, therefore particulate emission will be considered negligible and the only airborne emissions from this facility will be radon gas, per guidance in NUREG 1569. Radon-222 will have the potential to be released into the atmosphere through a vent system in the CPP and from the wellfields.

The MILDOS-AREA computer code calculates the radioactive dose commitments received by individuals and the general population within an 80-km radius of an operating uranium recovery facility. In addition, air and ground concentrations of radionuclides are estimated for individual locations, as well as for a generalized population grid. Extra regional population doses resulting from transport of radon and export of agricultural produce can also be estimated. The transport of radioactive emissions from point and different area sources is predicted with a sector-averaged Gaussian plume dispersion model. Mechanisms such as radioactive decay, plume depletion by deposition, ingrowth of decay products, and resuspension of deposited radionuclides are included in the MILDOS-AREA transport model.

Inputs to the model included radioactive emissions (Rn-222) from the wellfield and CPP. Also inputted to the model were wind frequency data (Stability Array) from the on-site meteorological station. An 18-month wind rose for the project site provides a graphical view of wind frequency data and is presented in Figure A-7.1. Model receptors were placed at critical locations within and around the permit area and hypothetical human exposure times were assigned to each receptor (Table 7-1). Figure A-7.2 shows the locations of, and the maximum estimated Total Effective Dose Equivalent (TEDE) to the modeled members of the public.

Alterations in operation throughout the facility's lifetime were accounted for in the input stream. The exposure pathways considered were inhalation; external exposure from ground shine and cloud immersion; and ingestion of vegetables and meat. Dose commitments were calculated primarily on the basis of the recommendations of the International Commission on Radioactive Protection (ICRP). Only airborne releases of radioactive materials were considered in MILDOS-AREA; releases to surface water and to groundwater were not addressed.

In order to demonstrate compliance with the annual dose limit (100 mrem/yr) found in 10 CFR 20.1301, the MILDOS-AREA model was used to calculate the maximum TEDE that members of the public could receive as a result of the Ross ISR Project. The results, presented in Table 7-2, indicate that the TEDE to each of the 14 modeled members of the public is less than 1 mrem/yr. Overall, the highest TEDE is estimated at

the Wesley residence. At 0.78 mrem/yr, this represents less than 1% of the annual dose limit.

Table 7-1 – Potentially Exposed Members of the Public

Member of Public	Location[1] N/S (km)	Location[1] E/W (km)	Location[1] Z (m)	Activities	Annual Hours	Calculation of Total Hours of Exposure
Wood	0.32925	0.76825	4.8768	Resident	8400	50 wk/yr x 7 d/wk x 24 h/d
Strong	-0.46095	0.4829	0.6096	Resident	8400	50 wk/yr x 7 d/wk x 24 h/d
Oshoto Field Office	0.9192	0.6585	4.572	Potential Residence	8400	50 wk/yr x 7 d/wk x 24 h/d
Wesley	1.2704	0.1317	-10.668	Resident	8400	50 wk/yr x 7 d/w x 24 h/d
Burch	0.32925	-3.8551	47.244	Resident	8400	50 wk/yr x 7 d/w x 24 h/d
Rancher 1	0.06585	-0.32655	9.7536	Horse Pasture Grazing	50	10 h/d x 5d/y
Rancher 2	0.06585	0.4829	3.6576	Hay Production	100	10 h/d x 10 d/y
Rancher 3	-0.2195	0.06585	3.048	Cattle Grazing	50	10 h/d x 5d/y
Rancher 4	0.3512	0.06585	-6.096	Cattle Grazing/Hay Production	100	10 h/d x 10 d/y
Rancher 5	0.3512	0.4829	0.6096	Hay Production	100	10 h/d x 10 d/y
Oilfield Worker 1	0.06585	-0.32655	9.7536	Operation and Maintenance	175	Op: 0.5 h/d x 5 d/w x 50 w/y Maint: 10 h/d x 5 d/y
Oilfield Worker 2	-0.2195	0.439	1.524	Operation and Maintenance	175	Op: 0.5 h/d x 5 d/w x 50 w/y Maint: 10 h/d x 5 d/y
Courier	0.02195	0.15365	-2.4384	Package Delivery	90	20 min/d x 5 d/w x 52 w/y
Vendor	0	-0.06585	0	Equipment Delivery	260	1 h/d x 5 d/w x 52 w/y

[1] Locations are listed as kilometers from the CPP and meters above or below the elevation of the CPP

Table 7-2 – Estimated Annual Dose to Members of the Public

Member of the Public	Maximum TEDE (mrem/yr)		
	Construction	Operation	Aquifer Restoration
Wood residence	0.000045	0.470	0.468
Strong residence	0.000053	0.735	0.731
Wesley residence	0.000070	0.779	0.775
Burch residence	0.000013	0.090	0.089
Oshoto field office	0.000048	0.542	0.540
Rancher #1	0.000002	0.017	0.018
Rancher #2	0.000001	0.011	0.011
Rancher #3	0.000001	0.020	0.020
Rancher #4	0.000001	0.041	0.041
Rancher #5	0.000001	0.010	0.010
Oilfield worker #1	0.000005	0.049	0.049
Oilfield worker #2	0.000001	0.020	0.020
Courier	0.000001	0.049	0.049
Vendor	0.000004	0.548	0.542

8.0 MAJOR SOURCE APPLICABILITY

All criteria pollutant emissions from the Ross ISR Project will be less than 100 tpy each. Therefore, this project is not a "major source" as defined in Chapter 6, Section 3 of the Wyoming Air Quality Standards and Regulations (WAQSR).

9.0 PREVENTION OF SIGNIFICANT DETERIORATION

In-situ uranium recovery is not a named source under state and federal Prevention of Significant Deterioration (PSD) regulations. All criteria pollutant emission rates at the Ross ISR Project will be less than 250 tpy. Therefore, this project is not a "major stationary source" as defined in Chapter 6, Section 4 of the WAQSR, and a PSD analysis is not required.

10.0 NSPS APPLICABILITY

There are currently no NSPS standards for in-situ uranium recovery operations.

The diesel storage tank is not subject to NSPS for Volatile Organic Liquid Storage Vessels (40 CFR Part 60, Subpart Kb) due to the size of the tank (less than 75 cubic meters or 19,813 gallons).

The emergency diesel generator is subject to 40 CFR Part 60, Subpart IIII, Standards of Performance for Stationary Compression Ignition Internal Combustion Engines (EPA, 2006). Strata proposes a Tier 3 certified engine for the standby generator. Tier 3 engines for emergency generators comply with §60.4205(b), §60.4202(a)(2), and §89.112 Table 1, which shows emission standards for Tier 3 engines starting in model year 2006.

11.0 NESHAP APPLICABILITY

The Ross ISR Project is not a major source of Hazardous Air Pollutants (HAPs) as defined by the WAQSR. Total HAP emissions are less than 25 tpy and individual HAP emissions are less than 10 tpy.

The emergency diesel generator is not subject to 40 CFR Part 63, Subpart ZZZZ, National Emission Standards for Hazardous Air Pollutants for Reciprocating Internal Combustion Engines (EPA, 2008), because it will have a capacity less than 500 HP and it is not an existing stationary source located at an area source of HAP emissions.

12.0 REFERENCES

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APPENDIX A: FIGURES

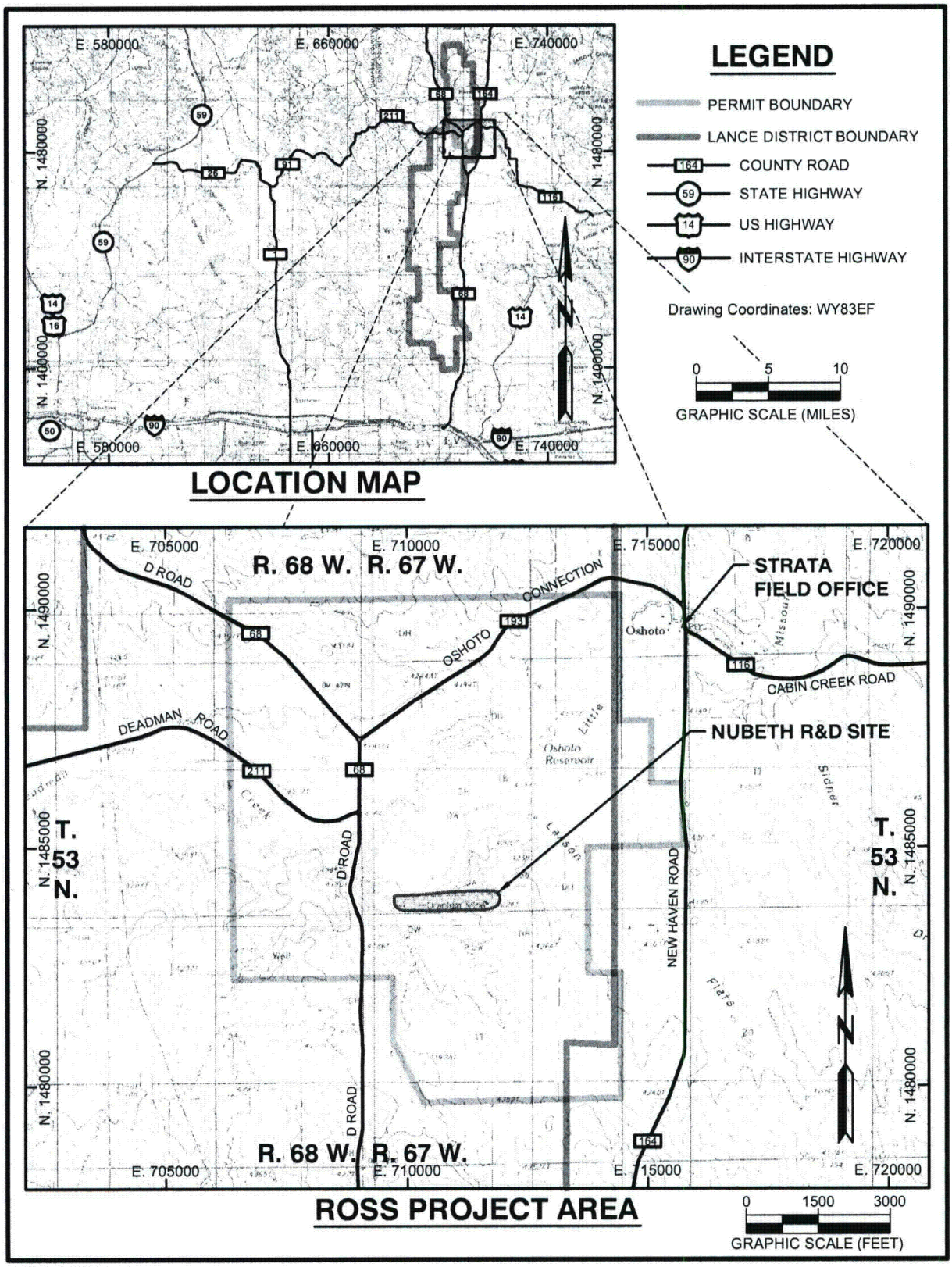
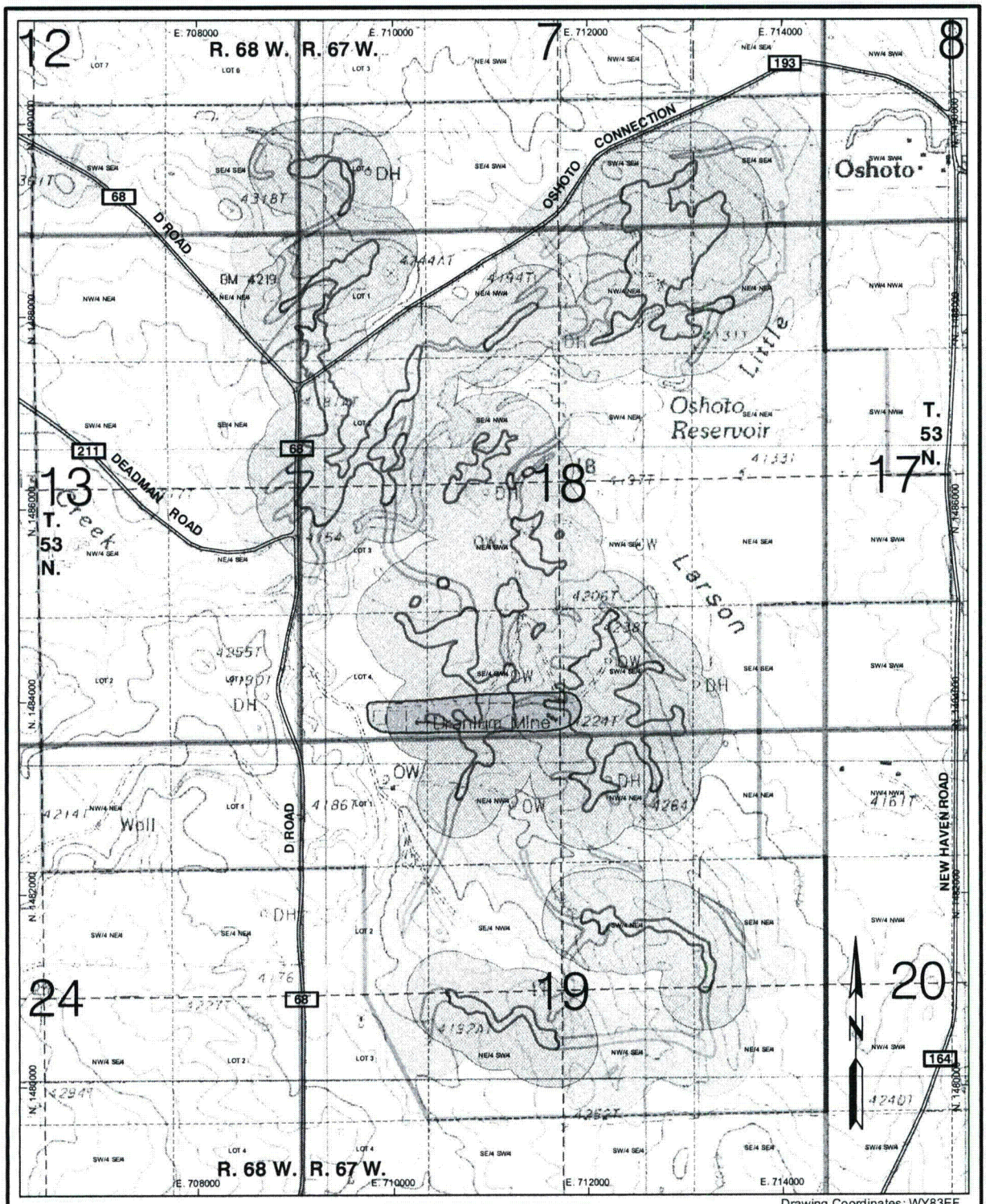


Figure A-3.1. Location Map.



Drawing Coordinates: WY83EF

ROSS PROJECT AREA

0 500 1000 2000

GRAPHIC SCALE (FEET)

LEGEND

- PERMIT BOUNDARY
- 164 COUNTY ROAD
- NUBETH R&D LOCATION
- AREAS OF KNOWN MINERALIZATION
- FUTURE DRILLING TARGET AREAS
- APPROXIMATE WELLFIELD PERIMETER
- WELLFIELD PERIMETER ACCOUNTING FOR FUTURE DRILLING

STRATA ENERGY

ROSS ISR PROJECT
CROOK COUNTY, WY
P.O. BOX 2318
GILLETTE, WY 82716

REVISIONS

Date	Description

FIGURE A-3.2
SITE MAP AND PERMIT BOUNDARY

Drawn By: MBM
Checked By: RS
Date: 6/8/11

WWC ENGINEERING
www.wwcengineering.com

FILE: ROSS MP MINERALS

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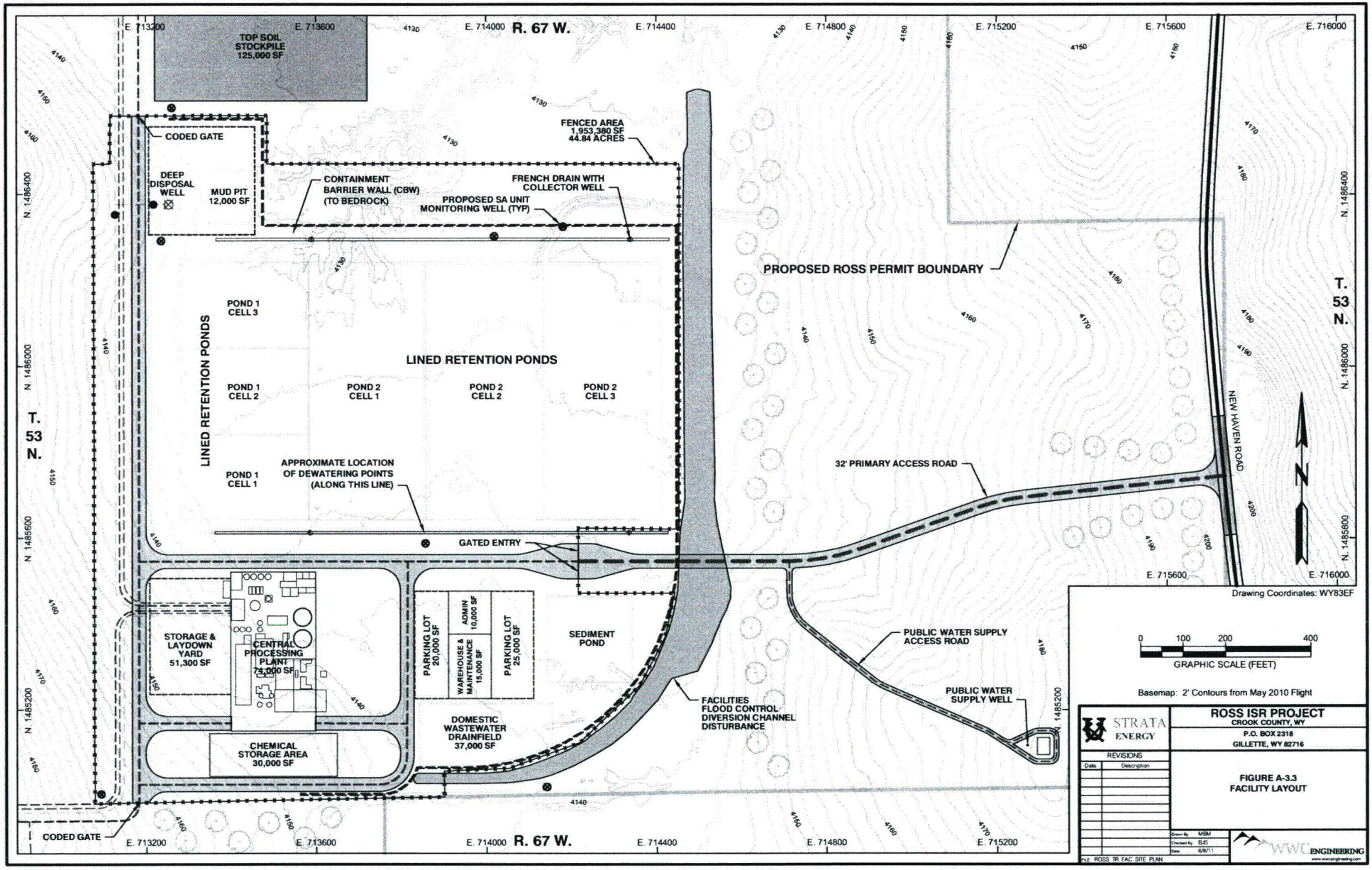

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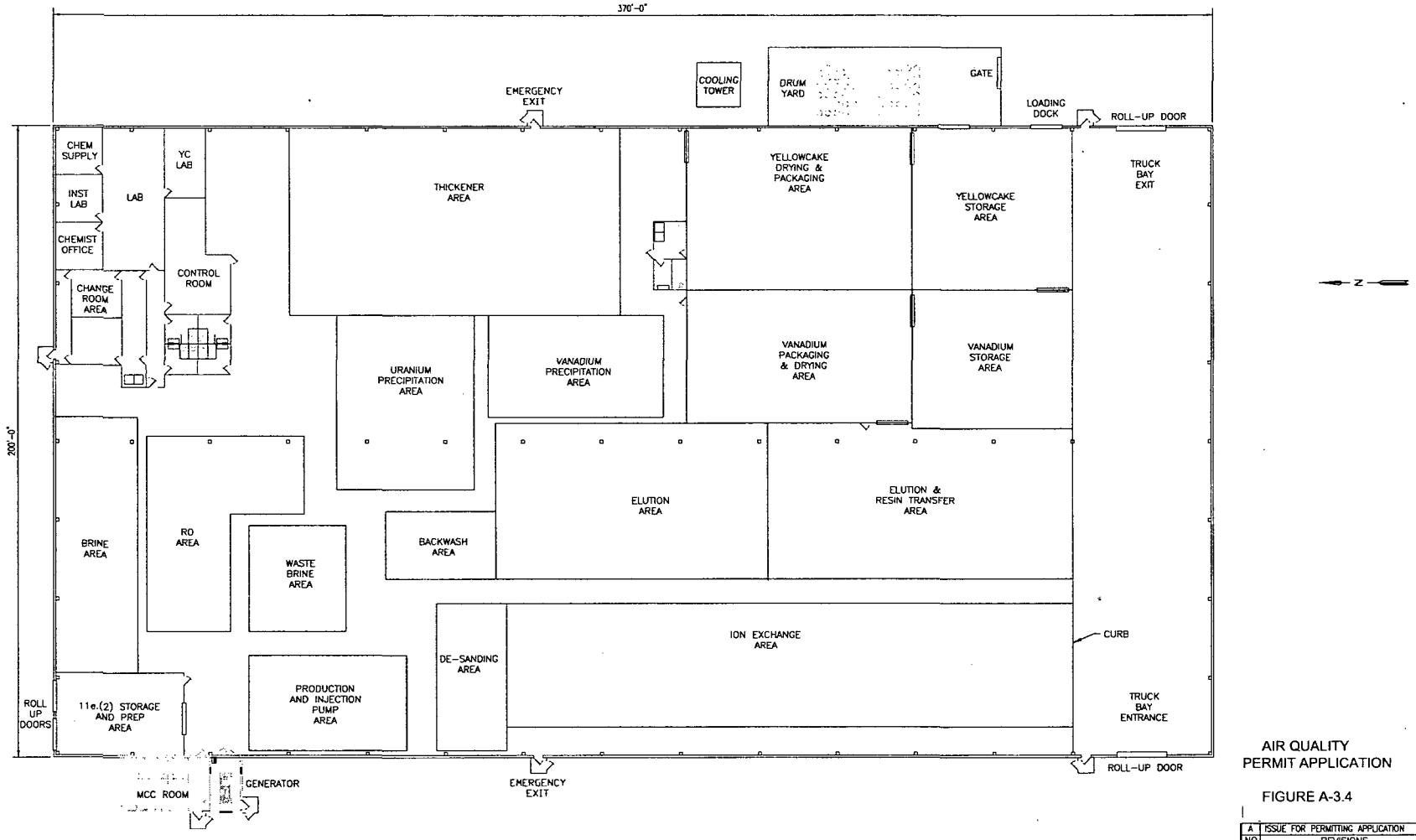


AIR QUALITY
PERMIT APPLICATION

FIGURE A-3.4

NO	REVISIONS	BY	APP	DATE
A	ISSUE FOR PERMITTING APPLICATION	JIK		12/14/10

STRATA ENERGY

ROSS ISR PROJECT
PLANT DESIGN

CONCEPTUAL GENERAL ARRANGMENT

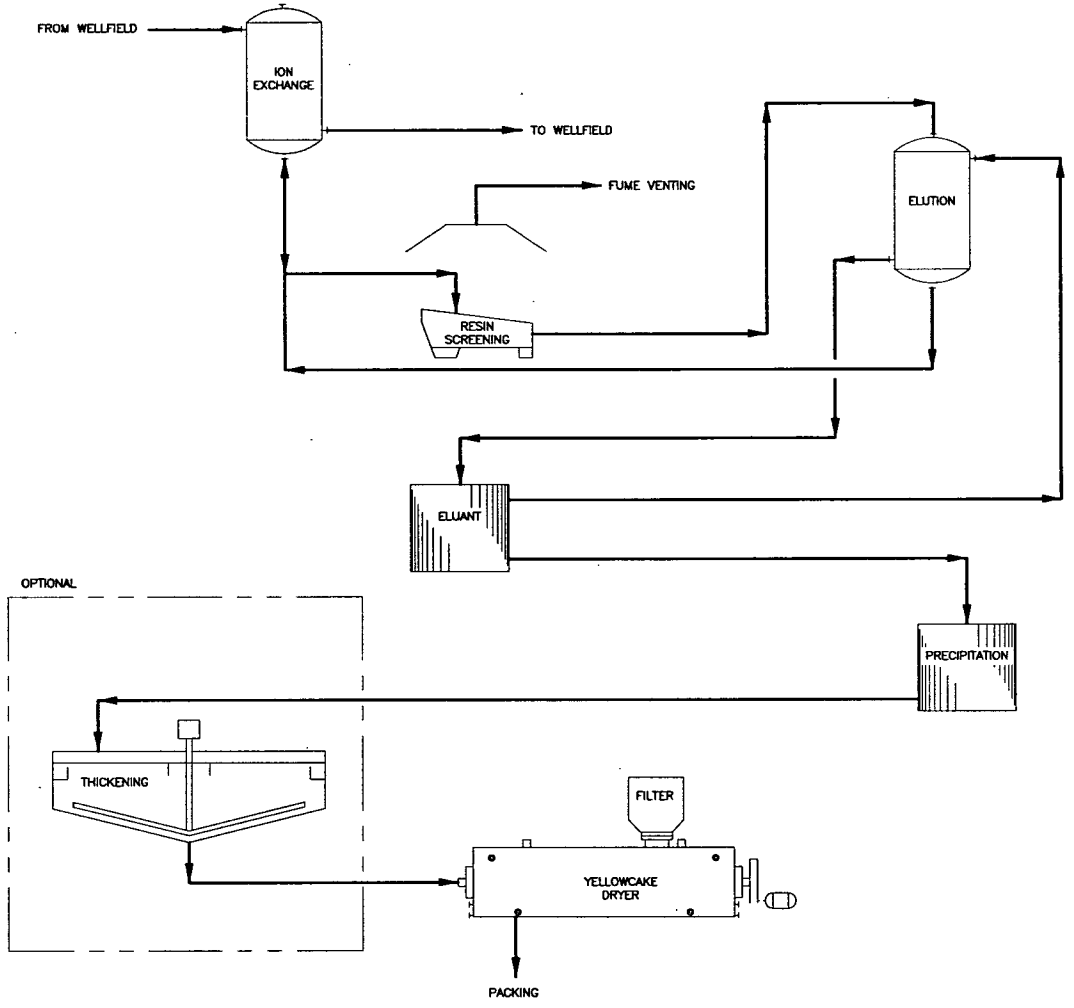
RELEASED FOR PERMITTING ONLY NOT FOR CONSTRUCTION

DRAWING NO.	DRAWING TITLE
REFERENCE DRAWINGS	

THIS DRAWING WAS PREPARED BY LYNTEK, ALL OF THE INFORMATION CONTAINED THEREIN IS THE PROPERTY OF LYNTEK AND NO REPRODUCTION CAN BE MADE WITHOUT THE PROPER WRITTEN AUTHORIZATION OF LYNTEK.

LYNTEK INCORPORATED

CAD-OP	C.SPICER	12/14/10	DATE,TIME LAST MODIFIED
CKD.			121410.0700
P.M.	J. KYLE		DRAWING NO. / REV.
SCALE:	(D) NONE		09046-G-08 / A



DRAWING NO.	REFERENCE DRAWING TITLE	NO	REVISIONS	BY	APP	DATE	NO	REVISIONS	BY	APP	DATE
							J	ISSUED FOR FINAL COMMENTS	OC	RH	13/07/11
							I	ISSUED FOR REVIEW	OC	RH	11/07/11

THIS DRAWING WAS PREPARED BY LYNTEK. ALL OF THE INFORMATION CONTAINED THEREIN IS THE PROPERTY OF LYNTEK AND NO REPRODUCTION CAN BE MADE WITHOUT THE PROPER WRITTEN AUTHORIZATION OF LYNTEK.

ENGINEER		
DRAWN BY	O.CHAVEZ	11/07/11
P.M. CHECK	R. HAWKINS	11/07/11
PROCESS CHECK		
MECH. CHECK.		
STRUCT. CHECK		
ELECT. CHECK		
INST. CHECK		
CLIENT APPROVAL		

STRATA ENERGY

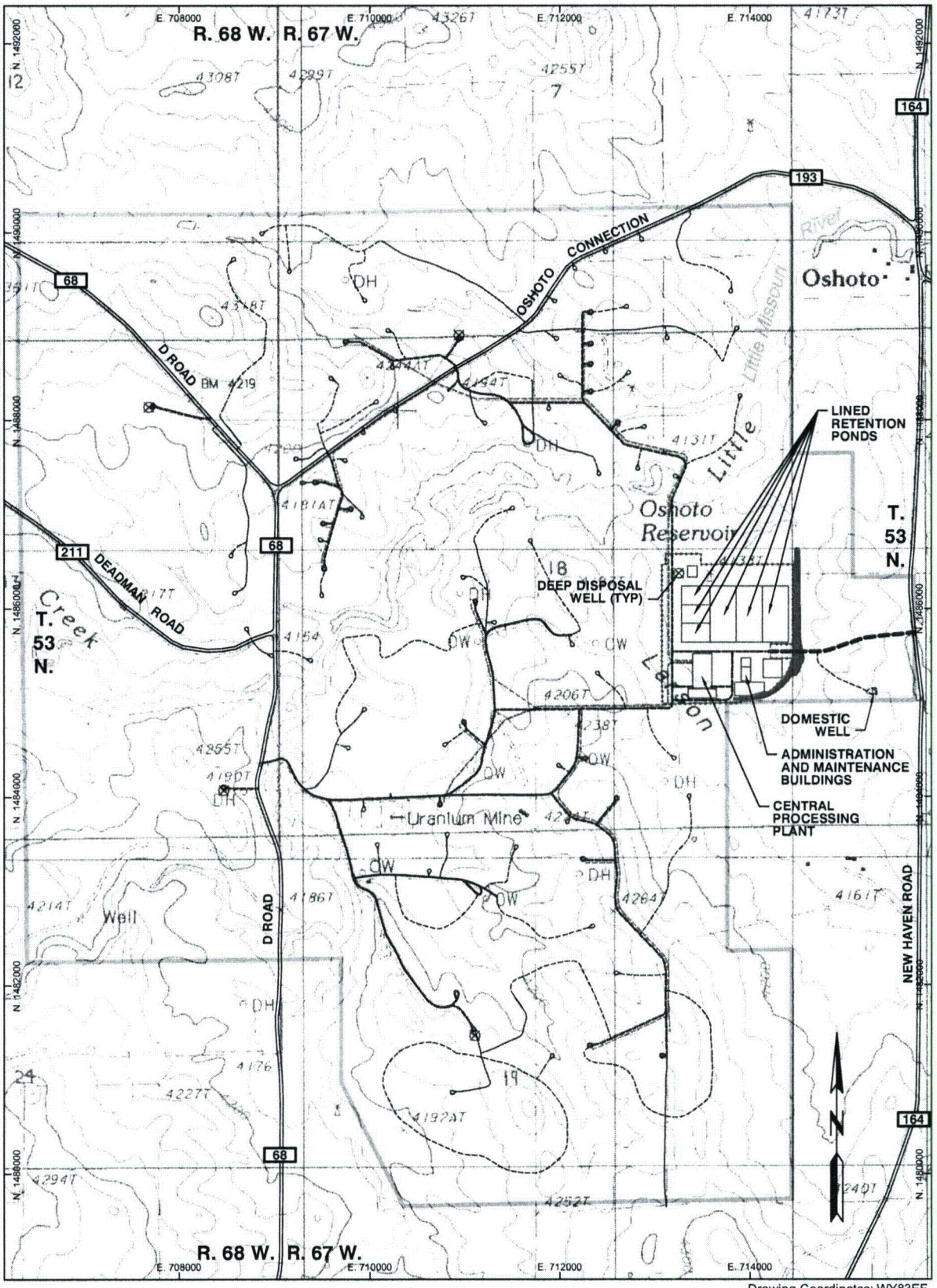
LYNTEK INCORPORATED

ROSS ISR PROJECT
PLANT DESIGN

AIR QUALITY PERMIT
APPLICATION FIGURE A-3.5

DATE.TIME LAST MODIFIED: 13 JUL 2011 – 1354
SCALE: (0) NTS

DRAWING NO.: 10037-F-00
REV.: J



ROSS PROJECT AREA

Drawing Coordinates: WY83EF

LEGEND

PROPOSED ROSS PERMIT BOUNDARY

164 EXISTING COUNTY ROAD

0 500 1000 2000

GRAPHIC SCALE (FEET)

FACILITIES

PROPOSED CONVEYANCE PIPELINE

PROPOSED DEEP DISPOSAL WELL PIPING

PROPOSED PRIMARY ACCESS ROAD

EXISTING SECONDARY ACCESS ROAD

PROPOSED SECONDARY ACCESS ROAD

EXISTING 2-TRACK ROAD

PROPOSED TERTIARY ROAD

PROPOSED DEEP DISPOSAL WELL

STRATA ENERGY

ROSS ISR PROJECT
CROOK COUNTY, WY
P.O. BOX 2318
GILLETTE, WY 82716

REVISIONS

Date	Description

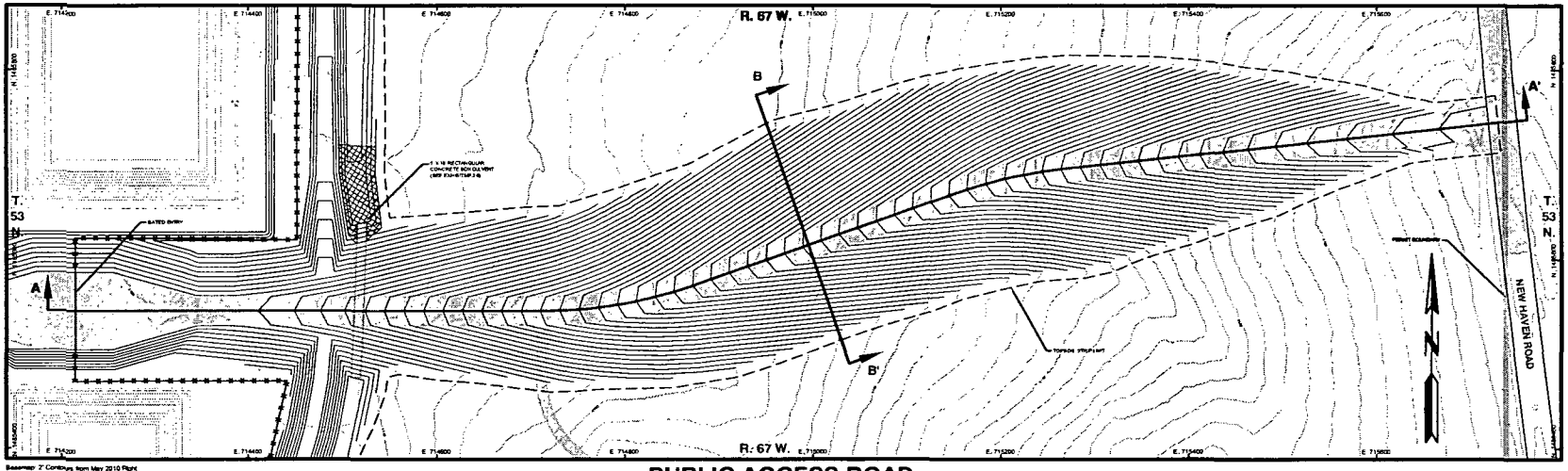
FIGURE A-3.6
PROJECT ROADS

Drawn By: MBM
Checked By: JWF
Date: 6/8/11

FILE: ROSS ER TRAN RDS

WWC ENGINEERING
www.wwcengineering.com

K:\Permits\Minerals\0914\DWGS_ROSS_REVISIONS\ROSS_ER_TRAN_RDS.dwg IML FIGURE_A-3.6 6/8/2011 2:18:57 PM mbmcg

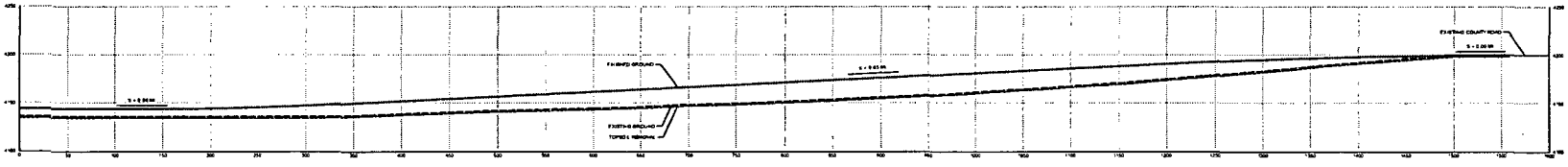


Basemap: 2' Contours from May 2010 Flight

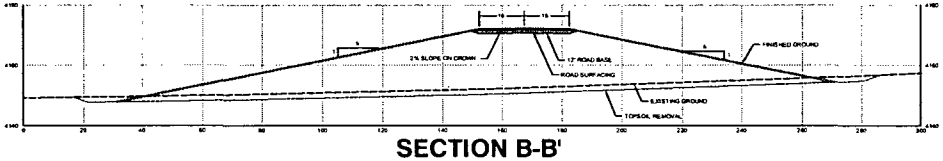
PUBLIC ACCESS ROAD

0 60 120 180 240

GRAPHIC SCALE (FEET)



SECTION A-A'



SECTION B-B'

STRATA ENERGY

ROSS ISR PROJECT
CROOK COUNTY, WY
P.O. BOX 2318
GILLETTE, WY 82716

REVISIONS

Date	Description

FIGURE A-4.1
PRIMARY ACCESS ROAD DESIGN

Drawn By: MBM
Checked By: BJS
Date: 6/8/11

File: ROSS_MP_FAC ACCESS

WWC ENGINEERING

K:\Peninsula_Minerals\09142\DWGS_ROSS_REVISIONS\ROSS_MP_FAC_ACCESS.dwg IML_FIGURE_A 4 1, 6/9/2011 9:18:45 AM, mbmcg

FIGURE A-6.1

Ross ISR Project Air Quality, Meteorological, and Radiological Monitoring Sites

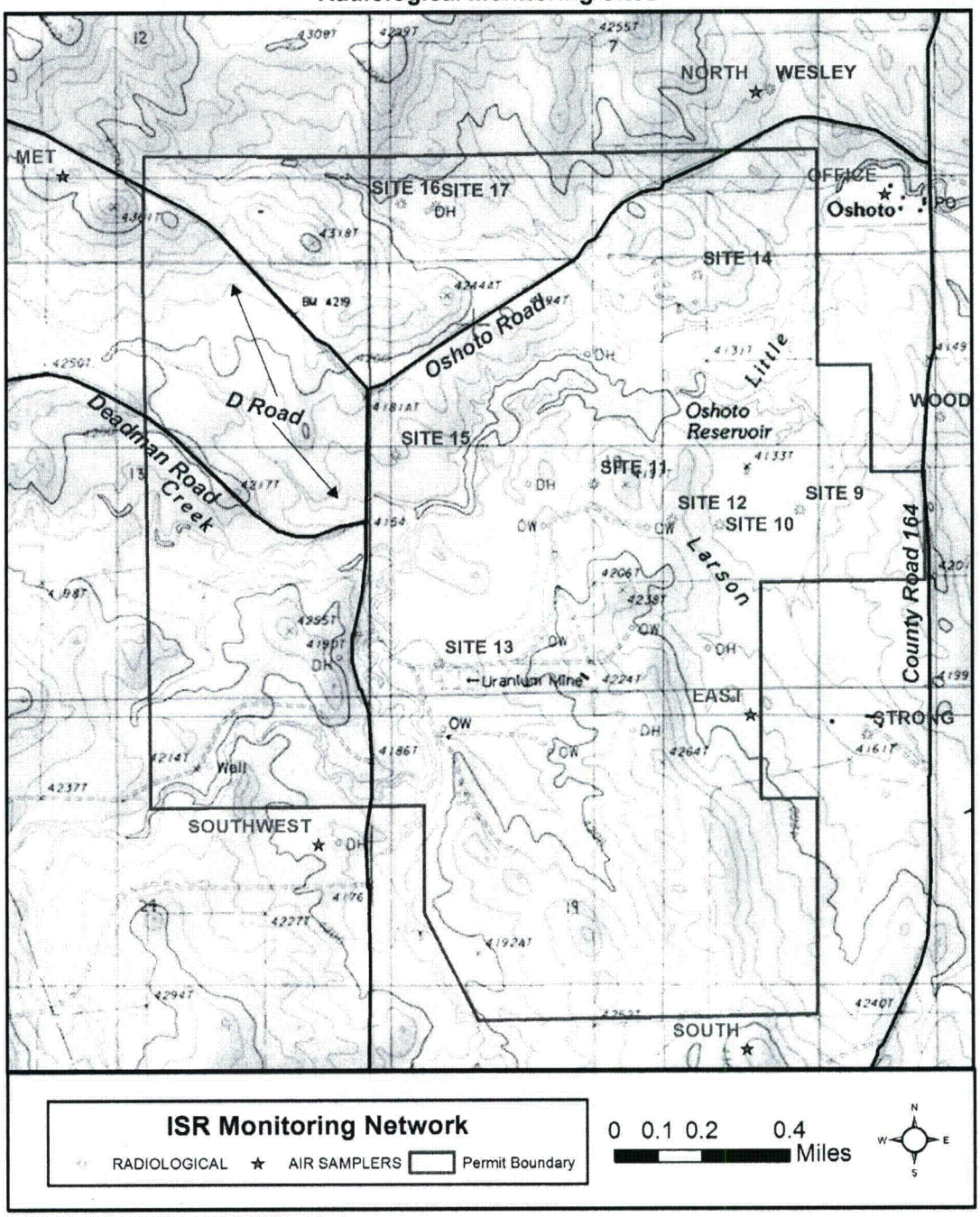
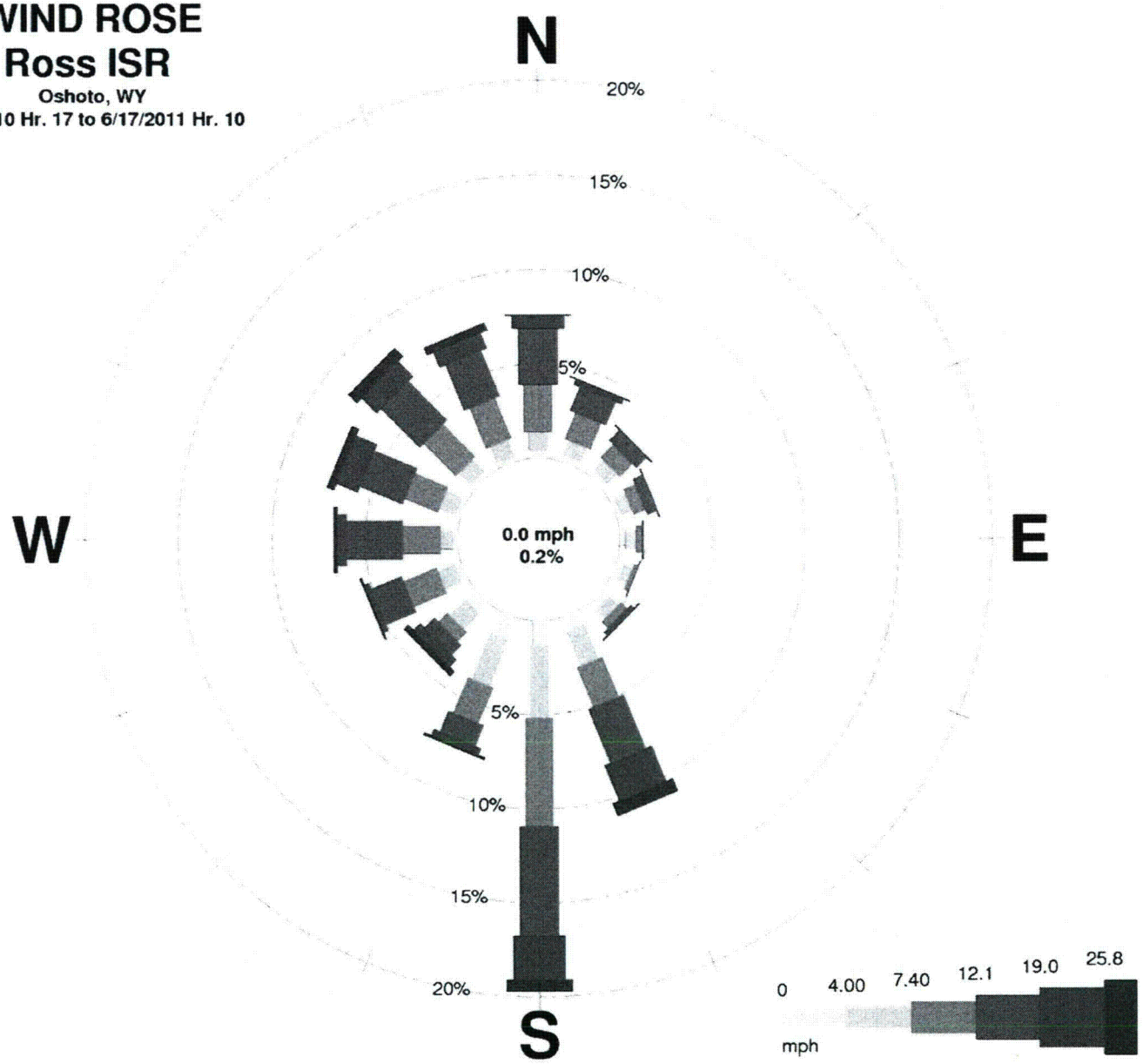


FIGURE A-7.1

WIND ROSE
Ross ISR

Oshoto, WY
1/5/2010 Hr. 17 to 6/17/2011 Hr. 10



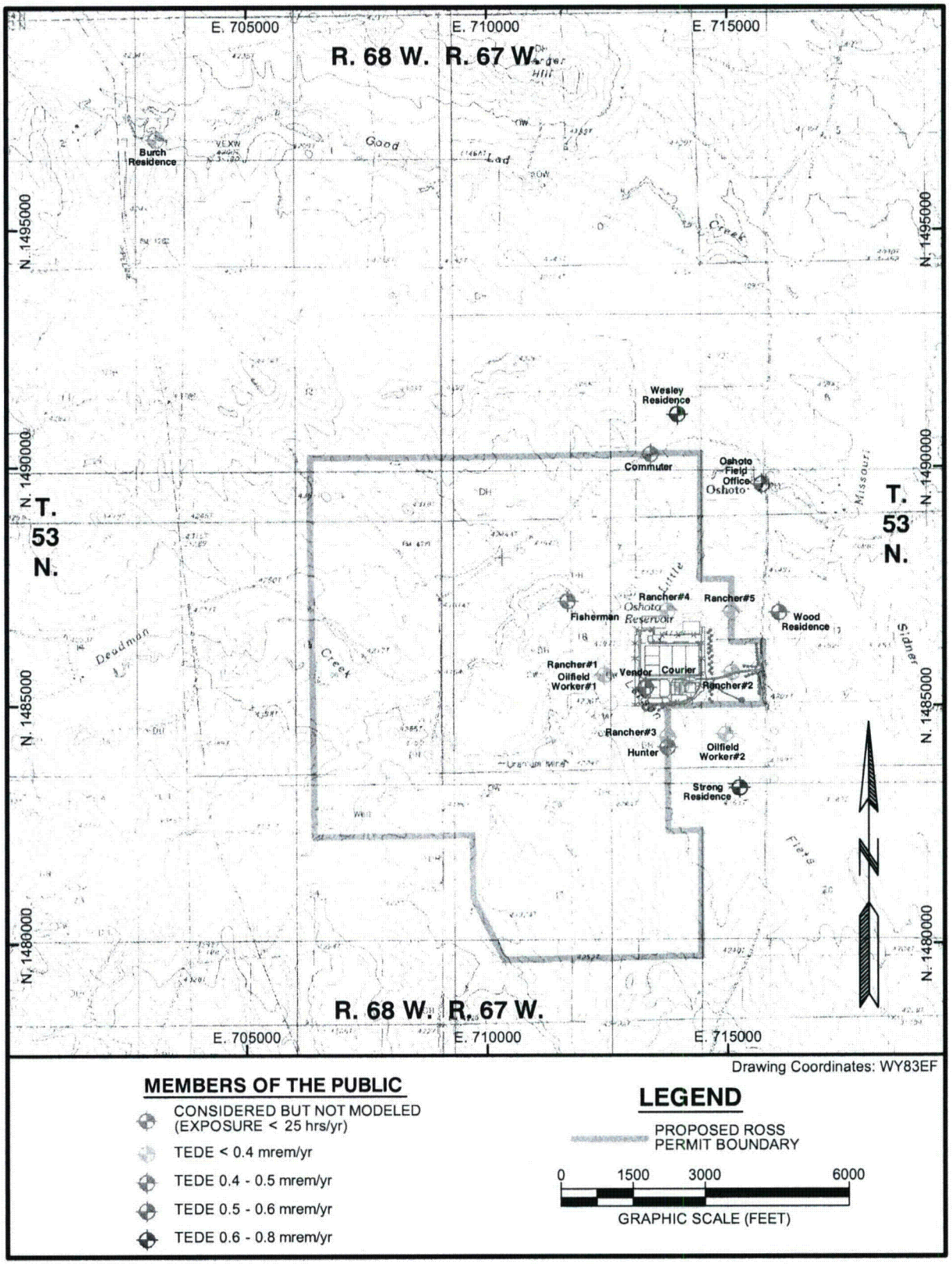


Figure A-7.2. Maximum TEDE to Members of the Public

K:\Peninsula Minerals\09142\DWGS ROSS REVISIONS\ROSS ER IMP POT EXP.dwg IML FIGURE A-7.2 6/22/2011 1:37:35 PM mbmcg

APPENDIX B: BACT SUPPORTING DETAIL

700 Series Fume/Mist Washers

Heil 700 impingement washers remove acids and alkali from plating, anodizing, pickling and similar operations. Units typically achieve 99% removal efficiencies of liquid entrainment or mists 1 or 2 microns or larger. The entering gas stream is initially washed with an aqueous spray prior to final demisting in a mesh-type eliminator. 700 Scrubbers come complete with an integral direct drive fan. The top section may be repositioned for discharge connection to existing duct and is accessible for maintenance. Installation requires connection of inlet fume and utility lines for operation. Units are available in 2' thru 5' diameters with capacities up to 12,000 cfm per unit. Static pressure loss of 1.25" we and irrigation rates as low as 0.5 gpm per 1000 cfm result in low operating costs.

Many Outstanding Advantages

Inexpensive. Heil Series 700 Fume Washers combine efficient fume removal, low initial cost, low installation cost and low operating cost. Medium and small size plants in all industries, laboratories and others producing corrosive fumes can avoid both in-plant and exterior corrosion effectively, easily and at low cost.

Compact. Series 700 Fume Washers require minimum space. The base of the No. 702 Washer is just 25" square, and the unit is only 62" high overall including the motor. These washers can be mounted at or near the end of a tank to eliminate long ducts. Because they are light in weight and have little vibration, they are often mounted on building trusses above a collecting hood. Special structural considerations are normally not required. They fit easily, anywhere.

Complete Unit. Furnished complete including the motor. There are no additional parts to buy and no assembly, fitting or adjustments on the job.

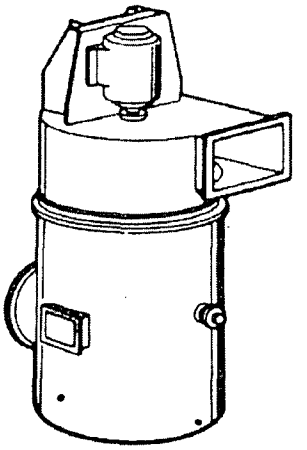
Easy To Install. Simply connect the inlet fume duct, the water and electric lines and you are ready to operate. Installation is quick, easy and inexpensive.

Efficient Fume Removal. Highly efficient for washing fumes from plating, anodizing, pickling, laboratory hoods and other similar type operations producing corrosive fumes. The fume laden air receives two separate washings. The cleaned, washed air then passes through a mist entrainment removal operation removing more than 99% of the entrained moisture. Not recommended for vapor absorption.

Selective Discharge Direction. The top section including the motor and discharge fan can be unbolted and rotated so the clean air is discharged in any direction desired.

This construction often permits easy connection to existing ducts with additional savings in installation costs.

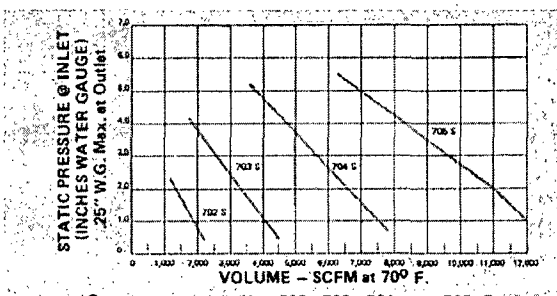
SERIES 700 FUME WASHER



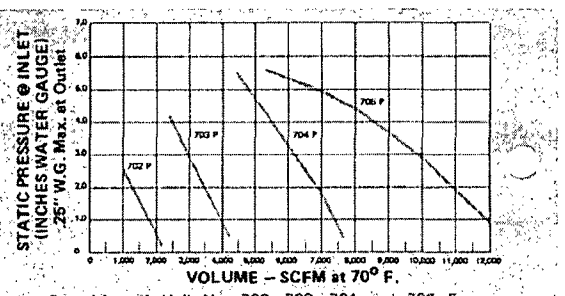
Low Power Requirement. Just one small motor, usually about one-half the H.P. required by other types of washers, operates the entire unit. The power requirement, and consequently the operating costs, are extremely low. The motor is direct connected to the discharge blower wheel and is readily accessible. Maintenance is negligible.

Four Sizes - with capacities of 1,800, 4,000, 7,500, and 12,000. Two or more units can be used together to provide any CFM required.

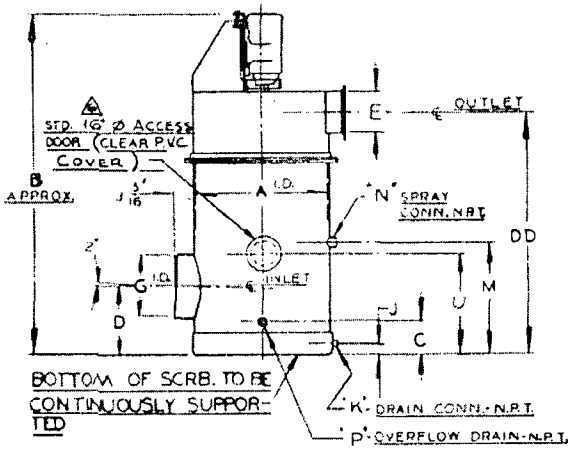
www.heilprocessequipment.com

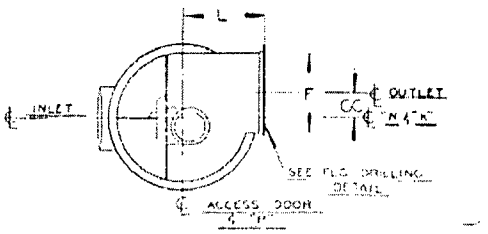


Capacities of Heil No. 702, 703, 704 and 705 Fume Washers Fabricated of Plain Steel, or Stainless Steel.



Capacities of Heil No. 702, 703, 704 and 705 Fume Washers Fabricated of Heil Rigidon® Solid Plastic.





DIMENSIONS (IN INCHES) · HEIL NO. 702, 703, 704 and 705 FUME WASHERS

MODEL	C.F.M.	H.P.	G.P.M.	A	B	C	D	E	F	G	J	K	L	M	N	P	U	CC	DD	WT.
702	1800	2	4	24	62	5	13¾	7½	15	12	2	1½	15	24	1	1½	17	4 5/8	44½	225
703	4800	5	4	36	75	6	18	12	22	18	2	1½	21	31	1	1½	24½	7 1/8	54 1/8	420
704	7500	10	4	48	92	7	22	14	28	24	2	1½	27	40	1	1½	33	10 1/8	64 7/8	690
705	12,000	15	6	60	117	8	22	20	32		2	1½	33	49	1	1½	40	16	78½	1060

*705 unit only has rectangular inlet. Use Dimension E and F.

HEIL PROCESS EQUIPMENT

Heil Process Equipment®

34250 Mills Rd.
Avon, OH 44011
PH: 440-327-6051
FX: 440-327-7088

Important - The data and information represented herein refers to typical values by the methods or apparatuses indicated and should be so considered. Since processing variables are a major factor in product performance, this information should serve only as a guide. Any information presented herein should not be assumed to be free of patent coverage nor taken as an inducement or encouragement to infringe if patents exist claiming the methods, apparatuses or products herein described. No warranty, therefore, is thereby given concerning the existence or non-existence of any patents claiming any pertinent subject matter presented herein. The company assumes no obligation, express or implied, or liability for use of the information and data presented.

APPENDIX C: AGREEMENTS WITH CROOK COUNTY

Crook County Land Use Planning & Zoning Commission
P.O. Box 37
Sundance, WY 82729

Jeanne Whalen
Chairman

Nels J. Smith
Vice-Chairman

RECEIVED
DEC 17 2010

December 13, 2010

Ben Schiffer, P.G.
Project Manager
WWC Engineering
1849 Terra Ave.
Sheridan, WY 82801

Dear Mr. Schiffer:

The Crook County Land Use Planning & Zoning Commission is responding to your request submitted on behalf of Strata Energy, Inc. for a letter of approval from the county zoning authority stating that the proposed mining project is in conformity with Crook County Zoning Regulations.

From your letter we understand that this request is made to fulfill the WDEQ/LQD permit application requirement; and that the application is for an in-situ recovery of uranium and vanadium on a project site referred to as the Ross ISR Project located near Oshoto in western Crook County as illustrated on Map Exhibit 1 and further described by Exhibit C1 that accompanied your request.

The Crook County Land Use Planning & Zoning Commission submits this letter to inform you that: the site is in the unincorporated area of Crook County; and that Crook County has not adopted any Zoning Regulations; therefore the proposed Ross ISR Project would not be in violation of any Zoning Regulations.

Crook County does have various Land Use and County Road policies, regulations and permits. These include but are not limited to: 1998 Land Use Plan Amended February 5, 2003, Resolution No. 9-2004 Crook County Small Wastewater Treatment Facility Installation Rules and Regulations, Crook County Rural Addressing Rules and Regulations Amended May 6, 2009, Agreement for Installation for of Cattleguards, Policy on the Redevelopment of County Roads, Rules and Regulations Construction of Access Driveways and Turnouts to Crook County Roadways Amended January 7, 2009, Private Water Line License, Utility License Upon County Road, Resolution No. 12-2007 Setting Size and Weight Limits on County Roads in Crook County, Wyoming, Policy on Set Backs from County Road Right of Ways and Crook County Snow Removal and Sanding Policy. The above listed policies, regulations and permits are available on line at www.crookcounty.wy.gov or can be obtained from the Crook County Growth & Development Office located in the Crook County Courthouse, P. O. Box 848, Sundance, WY 82729, 307-283-4548.

We are also concerned about fire, hazardous materials, dust control, and road maintenance responsibilities and wish to begin discussions concerning the establishment of an internal hazardous materials response team, funded, trained, and equipped by Strata Energy, Inc. and an agreement for dust control and county road maintenance.

7.5.4 of TR

Sincerely,

Jeanne Whalen

Jeanne Whalen, Chairman
Crook County Land Use Planning & Zoning Commission

This letter has been reviewed and approved by the Crook County Board of County Commissioners.

John A. Moline Jr.

John A. Moline, Jr., Chairman
Crook County Board of County Commissioners

MEMORANDUM OF UNDERSTANDING
FOR IMPROVEMENT AND MAINTENANCE OF CROOK COUNTY ROADS PROVIDING ACCESS TO THE ROSS ISR PROJECT

THIS MEMORANDUM OF UNDERSTANDING (MOU) is made on the undersigned date, between Strata Energy, Inc. ("Strata") and the County of Crook, of the State of Wyoming, whose mailing address is P.O. Box 37, Sundance, WY 82729, ("County").

Whereas, Strata is engaged generally in the business of uranium recovery and processing; and

Whereas, Strata is seeking permits for in-situ recovery of uranium in Section 17,18 and 19 of Township 53 North, Range 67 West and in Section 13 and 24 of Township 53 North, Range 68 West near the community of Oshoto on New Haven Road in Crook County ("Ross ISR Project"); and

Whereas, said in-situ uranium recovery may continue from said location for as long as thirty (30) years; and

Whereas, Strata has filed application for the necessary permits with the proper agencies; and

Whereas, Crook County has several County roads that provide access to the Ross ISR Project and that are used the public, including D Road (Crook County Road No. 68), New Haven Road (Crook County Road No. 164), Deadman Road (Crook County Road No. 211), Oshoto Connection (Crook County Road No. 193) and Cabin Creek Road (Crook County Road No. 116); and

Whereas, the County and Strata mutually desire for Strata to mitigate potential impacts to the citizens of Crook County caused by its mining and exploration activities;

Whereas, it is the desire of the County and Strata to work cooperatively;

In consideration of the mutual covenants hereinafter set forth, Strata and County agree as follows:

SECTION ONE
IMPROVEMENT and MAINTENANCE

A. Strata agrees to:

i. Educate and emphasize speed limits, potential hazards for sightseers, local

traffic and wildlife with their employees, contractors, truckers and all contracted trucking firms and to assist the County in speed limit modifications by providing technical information when requested by the County.

ii. Provide dust control for existing and increased traffic caused by the Ross ISR Project as dictated and required by Wyoming Department of Environmental Quality permit. In addition, Strata agrees to apply dust control over ¼ mile of County roadways fronting residential properties along any road designated by the County for access to the Ross ISR Project in order to minimize dust impacts on area residents beyond the project permit area.

iii. Designate a single point of authority contact with respect to road issues in order to maintain a high level of communication with the County.

iv. Properly permit for industrial use all access roads to County roads associated with the Ross ISR Project. Strata agrees to review all potential accesses to County roads from its planned building sites before the structures and roads are built to ensure safe access, giving consideration to the use of extra width lanes where appropriate for merging truck traffic into faster traffic.

v. Comply with the County's Set Back Policy, ensuring that structures, wind breaks and screening are set back far enough from County roads to prevent snow drifting and to prevent blocking the view of access roads to County roads.

vi. Require that its employees, contractors and vendors comply with the County Size and Weight Limit Resolution, and to assist the County in weight limit modifications by providing technical information when requested by the County.

vii. Obtain appropriate permits to cross the County road with pipelines or other utilities and to comply with County standards for installation of said crossings.

viii. Provide electronic warning signs with suitable battery back up to be activated by Strata or the Crook County Sheriff to close County roads into the Ross ISR Project area in case of an emergency.

ix. Enlarge cattle guards from 16 foot to 24 feet to accommodate passing truck traffic on County roads that provide access to the Ross ISR Project.

x. Maintain and repair damage caused by Strata trucks or contracted trucks as a result of their use as dictated and regulated by the County.

xi. Work with the county to repair reported damage and provide related maintenance within fifteen (15) days of notice as described in Paragraph B(v) below.

xii. Coordinate emergency management and hazardous materials management with the Crook County Homeland Security Director.

xiii. Coordinate fire suppression planning with the Crook County Fire Warden and Fire Zone Warden.

xiv. Coordinate traffic control with the Crook County Sheriff and Road and Bridge Supervisor.

B. The County is responsible for the general administration of County Roads within Crook County, WY. The County agrees to:

i. Collect taxes.

ii. Monitor and maintain the roads as allowed by limited County funds.

iii. Monitor complaints and convey them to Strata.

iv. Impose rules and monitor existing rules.

v. Inspect the county roads from time to time and report to Strata, in writing, all concerns about necessary repairs and maintenance caused by Strata or its ancillaries.

vi. Post speed limit, stop sign and other control signs as necessary on roads leading to the Ross ISR Project.

vii. The Crook County Homeland Security Director shall coordinate emergency management and hazardous materials management with Strata.

viii. The Crook County Fire Warden shall coordinate fire suppression planning with Strata.

ix. The Road and Bridge Supervisor shall coordinate traffic control with the Strata and request assistance from the Crook County Sheriff if necessary.

SECTION TWO
NO AGENCY RELATIONSHIP CREATED

Nothing in this MOU shall be interpreted as authorizing Strata or its agents, contractors and or employees to act as agents or representatives of or on behalf of the County or to incur any obligation of any kind on behalf of the County, nor shall anything in this agreement shall be interpreted as authorizing the County or its agents, contactors and or employees to act as agents or representatives of or on behalf of Strata or to incur any obligation of any kind on behalf of Strata.

SECTION THREE
NON EXCLUSIVE AGREEMENT

This MOU does not grant Strata an exclusive right to improve or maintain County Roads.

SECTION FOUR
DISPUTE RESOLUTION

The County and Strata agree that they shall cooperate in good faith with each other regarding all matters necessary to carry out this MOU. Any concerns shall be directed to the County Road and Bridge Superintendant. The County will pursue a solution to the concern by contacting the parties involved. If a mutual solution cannot be agreed upon the party disagreeing with the results may ask the Board of County Commissioners resolve the dispute. The Boards decision is final and not appealable.

SECTION FIVE
INDEPENDENT CONTRACTOR

The parties intend that an independent contractor relationship shall exist between the parties to this MOU.

SECTION SIX
GENERAL PROVISIONS

A. **Termination of MOU.** This MOU may be terminated by the County on 60 days written notice by the County to Strata.

B. **Compliance with Applicable Laws and Industry Standards.** The parties agree to comply with all applicable federal, state, and local laws, rules and regulations in

the performance of this MOU.

C. **Wyoming Law Governs.** The construction, interpretation and enforcement of this MOU shall be governed by the laws of the State of Wyoming. The District Court of Crook County, Wyoming shall have jurisdiction over any action arising out of this MOU.

D. **No Kick-backs.** The Company certifies and warrants that no gratuities, kick-backs or contingency fees were paid, sought or solicited in connection with this MOU, nor were any fees, commissions, gifts or other considerations contingent upon the award of this MOU.

E. **Third Party Beneficiaries.** The Parties do not intend to create in any other individual or entity the status of a third party beneficiary, and this MOU shall not be construed so as to create such status. The rights, duties and obligations contained in this MOU shall operate only between the parties to this MOU, and shall inure solely to the benefit of the parties to this MOU. The provisions of this MOU are intended only to assist the parties in determining and performing their obligations under this MOU. The parties to this MOU intend and expressly agree that only parties signatory to this MOU shall have any legal or equitable right to seek to enforce this MOU, to seek any remedy arising out of a party's performance or failure to perform any term or condition of this MOU, or to bring an action for the breach of this MOU.

F. **Amendments.** Any changes, modifications, revisions or amendments to this MOU which are mutually agreed upon by the parties to this MOU shall be incorporated by written instrument, executed and signed by all parties to this MOU.

G. **Assignment/Contract Not Used as Collateral.** Neither party shall assign or otherwise transfer any of the rights or delegate any of the duties set forth in this MOU without the prior written consent of the other party. Neither party shall use this MOU, or any portion thereof, for collateral for any financial obligation without the prior written permission of the other.

H. **Force Majeure.** Neither party shall be liable for failure to perform under this MOU if such failure to perform arises out of causes beyond the control and without the fault or negligence of the nonperforming party. Such causes may include, but are not limited to, acts of God or the public enemy, fires, floods,

epidemics, quarantine restrictions, freight embargoes, and unusually severe weather. This provision shall become effective only if the party failing to perform immediately notifies the other party of the extent and nature of the problem, limits delay in performance to that required by the event, and takes all reasonable steps to minimize delays. This provision shall not be effective unless the failure to perform is beyond the control and without the fault or negligence of the nonperforming party.

I. **Indemnification.** Neither the County nor Strata shall assume the risk of any liability arising from, and shall not be liable for, any activity associated with the repair, improvement or maintenance of County Roads or the acts or omissions of the other party. It does not, and is not expected to, insure, defend or indemnify the County for any liabilities which are associated with or occur as a result of the County's repair, improvement or maintenance of County Roads. The County and Strata may insure their own risk as each sees fit.

J. **Notices.** All notices arising out of, or from, the provisions of this MOU shall be by fax, e-mail or in writing and given to the parties at the address provided under this MOU, or by certified mail, postage prepaid and return receipt requested.

K. **Severability.** Should any portion of this MOU be judicially determined to be illegal or unenforceable, the remainder of this MOU shall continue in full force and effect, and either party may renegotiate the terms affected by the severance.

L. **Time is of the Essence.** Time is of the essence in all provisions of the MOU.

M. **Titles Not Controlling.** Titles of sections are for reference only, and shall not be used to construe the language in this MOU.

N. **Waiver.** The waiver of any breach of any term or condition in this MOU shall not be deemed a waiver of any prior or subsequent breach.

O. **Signatures.** The parties to this MOU, either personally or through their duly authorized representatives, have executed this MOU on the dates set out below, and certify that they have read, understood, and agreed to the terms and conditions of this MOU.

SECTION SEVEN
CONTACT PERSON and NOTICES

The following named persons shall be the point of contact for any issues concerning the MOU:

County: Crook County, Wyoming
% Morgan Ellsbury
Road and Bridge Superintendant
PO Box 995
Sundance, WY 82729
Telephone: (307) 283-1441
Cell Phone (307) 290-2614
Fax: (307) 283-2323
E-mail: morgane@crookcounty.wy.gov

Company Strata Energy, Inc.
% Anthony J. Simpson
Chief Operating Officer
406 West 4th Street
P.O. Box 2318
Gillette, WY 82716
Telephone: (307) 686-4066
Cell Phone (307) 689-6080
Fax: (307) 686-4066
E-mail: ajs@pel.net.au

IN WITNESS WHEREOF, the parties have executed this MOU on the undersigned dates.

COMPANY: STRATA ENERGY, INC.

By A. J. Simpson 4/6/2011
Date

Physical Address 406 W. 4th Street Gillette WY 82717

Mailing Address PO Box 2318 Gillette WY 82717

Tax ID No. 20-5686205

Approved by the Crook County Road and Bridge Superintendant:

Morgan Ellsbury 4-6-11
By: Morgan Ellsbury Date

BOARD OF COUNTY COMMISSIONERS IN AND FOR CROOK COUNTY, WYOMING

J. W. HADLEY Chairman

KELLY B. DENNIS, Vice Chairman

JEANNE WHALEN, Member

State of Wyoming }
}
County of Crook }

Signed or attested before me on (date) April 6, 2011
by J. W. HADLEY, Chairman and KELLY B. DENNIS, Vice Chairman, and JEANNE A. WHALEN, Member of the Board of County Commissioners in and for Crook County, WY

(Seal)

My commission expires:

MY TERM EXPIRES THE FIRST MONDAY IN JANUARY 2015

CONNIE D. TSCHETTER, COUNTY CLERK

APPENDIX D: NON-RADIOACTIVE EMISSIONS CALCULATIONS

Table D-1a. Operating Phase Equipment Tailpipe Emissions

Equipment Type	Total Operating Hours	AP-42 Combustion Emissions (tons/yr)[2]					
		TOC	NO_x	CO	PM_{10}	SO_2	CO_2
Cementing Unit	4,939	0.18	2.30	0.49	0.16	0.15	85.2
Drilling rig	13,376	3.14	39.39	8.49	2.80	2.60	1,461.3
Deep Drilling rig	3,600	0.71	24.19	5.54	0.71	0.41	1,169.3
Pulling Unit	4,459	0.17	2.07	0.45	0.15	0.14	76.9
Backhoe	22,235	1.11	13.92	3.00	0.99	0.92	516.5
Bulldozer	2,120	0.25	3.09	0.67	0.22	0.20	114.6
Front end loader	1,940	0.10	1.21	0.26	0.09	0.08	45.1
Grader	2,830	0.26	3.21	0.69	0.23	0.21	119.1
Roller compactor	1,390	0.17	2.18	0.47	0.15	0.14	80.9
Scraper	3,080	0.50	6.30	1.36	0.45	0.42	233.8
Trackhoe	3,030	0.22	2.78	0.60	0.20	0.18	103.1
Trencher	3,540	0.21	2.63	0.57	0.19	0.17	97.7
Dump truck	1,715	0.22	2.76	0.60	0.20	0.18	102.5
Hydraulic crane	560	0.05	0.60	0.13	0.04	0.04	22.4
Mix truck	1,410	0.18	2.27	0.49	0.16	0.15	84.3
Semi-haul truck	3,032	0.39	4.89	1.05	0.35	0.32	181.3
Water truck	15,256	1.96	24.59	5.30	1.75	1.63	912.3
Disc tractor	760	0.04	0.48	0.10	0.03	0.03	17.7
Seed drill tractor	576	0.03	0.36	0.08	0.03	0.02	13.4
Forklift	5,799	0.24	2.98	0.64	0.21	0.20	110.7
Manlift	2,000	0.05	0.57	0.12	0.04	0.04	21.2
Picker	1,280	0.09	1.12	0.24	0.08	0.07	41.5
Skid-steer loader	576	0.02	0.30	0.06	0.02	0.02	11.1
Welding machine	6,909	0.03	0.43	0.09	0.03	0.03	15.9
Air compressor	780	0.01	0.12	0.03	0.01	0.01	4.5
Generator	3,789	0.02	0.21	0.05	0.02	0.01	7.8
Integrity testing unit	4,459	0.77	9.68	2.08	0.69	0.64	358.9
Flat bed truck	209	0.04	0.51	0.11	0.04	0.03	18.7
Logging truck	3,344	0.58	7.26	1.56	0.51	0.48	269.2
Pickup truck	8,919	1.54	19.35	4.17	1.37	1.28	718.0
TOTAL		**13.27**	**181.77**	**39.50**	**11.89**	**10.83**	**7,014.9**

Table D-1b. Construction Phase Equipment Tailpipe Emissions

Equipment Type	Total Operating Hours	AP-42 Combustion Emissions (tons/yr)[2]					
		TOC	NO_x	CO	PM_{10}	SO_2	CO_2
Pulling unit	1,300	0.05	0.60	0.13	0.04	0.04	22.4
Backhoe	1,820	0.09	1.14	0.25	0.08	0.08	42.3
Grader	520	0.05	0.59	0.13	0.04	0.04	21.9
Water truck	520	0.07	0.84	0.18	0.06	0.06	31.1
Forklift	1,040	0.04	0.54	0.12	0.04	0.04	19.9
Welding machine	780	0.00	0.05	0.01	0.00	0.00	1.8
Generator	780	0.00	0.04	0.01	0.00	0.00	1.6
Integrity testing unit	3,120	0.54	6.77	1.46	0.48	0.45	251.2
Pickup truck	8,840	1.53	19.18	4.13	1.36	1.27	711.6
Swab rig	4,160	0.72	9.03	1.95	0.64	0.60	334.9
TOTAL		**3.09**	**38.78**	**8.36**	**2.75**	**2.56**	**1,438.6**

Table D-1c. Construction Phase Equipment Tailpipe Emissions

Equipment Type	Total Operating Hours	AP-42 Combustion Emissions (tons/yr)[2]					
		TOC	NO_x	CO	PM_{10}	SO_2	CO_2
Pulling unit	1,300	0.05	0.60	0.13	0.04	0.04	22.4
Backhoe	1,820	0.09	1.14	0.25	0.08	0.08	42.3
Grader	520	0.05	0.59	0.13	0.04	0.04	21.9
Water truck	520	0.07	0.84	0.18	0.06	0.06	31.1
Forklift	520	0.02	0.27	0.06	0.02	0.02	9.9
Welding machine	780	0.00	0.05	0.01	0.00	0.00	1.8
Generator	780	0.00	0.04	0.01	0.00	0.00	1.6
Integrity testing unit	1,560	0.27	3.39	0.73	0.24	0.22	125.6
Pickup truck	5,200	0.90	11.28	2.43	0.80	0.75	418.6
Swab rig	2,080	0.36	4.51	0.97	0.32	0.30	167.4
TOTAL		**1.8**	**22.7**	**4.9**	**1.61**	**1.50**	**842.6**

Table D-1d. Construction Phase Equipment Tailpipe Emissions

Equipment Type	Total Operating Hours	AP-42 Combustion Emissions (tons/yr)[2]					
		TOC	NO_x	CO	PM_{10}	SO_2	CO_2
Cementing unit	4,360	0.16	2.03	0.44	0.14	0.13	75.2
Pulling unit	2,320	0.09	1.08	0.23	0.08	0.07	40.0
Backhoe	5,872	0.29	3.68	0.79	0.26	0.24	136.4
Bulldozer	2,256	0.26	3.29	0.71	0.23	0.22	121.9
Grader	1,892	0.17	2.15	0.46	0.15	0.14	79.6
Roller compactor	585	0.07	0.92	0.20	0.07	0.06	34.1
Scraper	3,140	0.51	6.42	1.38	0.46	0.42	238.3
Trackhoe	4,096	0.30	3.76	0.81	0.27	0.25	139.4
Semi-haul truck	12,488	1.60	20.13	4.34	1.43	1.33	746.8
Water truck	3,888	0.50	6.27	1.35	0.44	0.41	232.5
Disc tractor	716	0.04	0.45	0.10	0.03	0.03	16.6
Seed drill tractor	475	0.02	0.30	0.06	0.02	0.02	11.0
Skid-steer loader	1,464	0.06	0.76	0.16	0.05	0.05	28.3
Generator	6,656	0.03	0.37	0.08	0.03	0.02	13.8
Pickup truck	4,000	0.69	8.68	1.87	0.62	0.57	322.0
TOTAL		**5.1**	**64.3**	**13.9**	**4.56**	**4.25**	**2,385.0**

Inputs:

CPP Area Material Moisture Content (%) - Overburden	11.7	Ross 2010 Soil Survey
CPP Area Material Moisture Content (%) - Topsoil	9.8	Ross 2010 Soil Survey
CPP Area Material Silt Content (%) - Overburden	39.8	Ross 2010 Soil Survey
CPP Area Material Silt Content (%) - Topsoil	38.6	Ross 2010 Soil Survey
Mean Vehicle Speed (mph)	5	WWC Estimate
Wellfield Material Moisture Content (%) - Overburden	9.5	Ross 2010 Soil Survey
Wellfield Material Moisture Content (%) - Topsoil	8.1	Ross 2010 Soil Survey
Wellfield Material Silt Content (%) - Overburden	29	Ross 2010 Soil Survey
Wellfield Material Silt Content (%) - Topsoil	23.8	Ross 2010 Soil Survey
Average Wind Speed (mph)	11.5	IML (1/5-11/13/10)
Scraper Mean Vehicle Weight (tons)	41	CAT Spec Sheet
Road Base Material Moisture Content (%)	15	WWC Estimate

Site Preparation Central Plant Area

Activity	TSP <30 µm	< 15 µm	Scaling Factor <10 µm	Scaling Factor <2.5 µm	<10 µm	<5 µm	<2.5 µm	Rating Adjustment (Table 13.2.3-1)
Bulldozing Overburden (Table 11.9-1) lb/hr	19.37	8.02	0.52	0.03	4.17		0.58	-1/-2
Scrapers unloading topsoil (13.2.4) lb/ton	0.0008	0.0005			0.0010	0.0006	0.0002	-1
Scrapers in travel (13.2.2 Eqn 1a) lb/VMT	15.62				4.76		0.48	-0/-1
Scrapers removing topsoil (Table 13.2.3-1) lb/VMT					20.20			E
Truck dumping of fill material, road base, or other material (13.2.4) lb/ton	0.0012	0.0008			0.0006	0.0003	0.0001	-0/-1
Compacting (Table 11.9-1) lb/hr	19.37	8.02	0.52	0.03	4.17		0.58	-1/-2
Motor grading (11.9-1) lb/VMT	2.24	1.28	0.60	0.03	0.77		0.07	-1/-2

VMT - vehicle mile traveled

Site Preparation Wellfield

Activity	TSP <30 µm	< 15 µm	Scaling Factor <10 µm	Scaling Factor <2.5 µm	<10 µm	<5 µm	<2.5 µm	Rating Adjustment (Table 13.2.3-1)
Bulldozing Overburden (Table 11.9-1) lb/hr	17.37	6.68	0.52	0.03	3.47		0.52	-1/-2
Scrapers unloading topsoil (13.2.4) lb/ton	0.0029	0.0019			0.0014	0.0008	0.0002	-1
Scrapers in travel (13.2.2 Eqn 1a) lb/VMT	13.50				3.94		0.39	-0/-1
Scrapers removing topsoil (Table 13.2.3-1) lb/VMT					20.20			E
Truck dumping of fill material, road base, or other material (13.2.4) lb/ton	0.0012	0.0008			0.0006	0.0003	0.0001	-0/-1
Compacting (Table 11.9-1) lb/hr	17.37	6.68	0.52	0.03	3.47		0.52	-1/-2
Motor grading (11.9-1) lb/VMT	2.24	1.28	0.60	0.03	0.77		0.07	-1/-2

VMT - vehicle mile traveled

Vehicles Traveling Unpaved Roads (AP-42, 13.2.2 Eqn 1a)

Unpaved Surfaces at Industrial Sites, lb/VMT

Equipment	Mean Vehicle Weight (tons)	Emission Factor (lb/VMT)		
		$PM_{2.5}$	PM_{10}	PM_{30}
Backhoe	8	0.516027	5.160268	14.1297
Bulldozer	28	0.906782	9.06782	24.8293
Cementing unit	20	0.779373	7.793728	21.3406
Disc tractor	4	0.377754	3.777537	10.3436
Drilling rig	20	0.779373	7.793728	21.3406
Dump truck	20	0.779373	7.793728	21.3406
Forklift	14	0.663803	6.638033	18.1761
Front end loader	8	0.516027	5.160268	14.1297
Grader	18	0.743283	7.432833	20.3524
Hydraulic crane	36	1.015355	10.15355	27.8022
Manlift	10	0.570534	5.705343	15.6222
Mix truck	20	0.779373	7.793728	21.3406
Picker	18	0.743283	7.432833	20.3524
Pulling unit	8	0.516027	5.160268	14.1297
Roller compactor	23	0.829964	8.299641	22.7259
Scraper	41	1.076551	10.76551	29.4779
Seed drill tractor	4	0.377754	3.777537	10.3436
Semi-haul truck	20	0.779373	7.793728	21.3406
Skid-steer loader	4	0.377754	3.777537	10.3436
Trackhoe	17	0.724409	7.244089	19.8356
Trencher	7	0.485932	4.859324	13.3057
Water truck	20	0.779373	7.793728	21.3406

Vehicles Traveling Unpaved Roads (AP-42, 13.2.2 Eqn 1b) - Light Duty Vehicles

Unpaved Surfaces on Publicly Accessible Roads, lb/VMT

Surface silt content (%)	23.8	Ross 2010 Soil Survey
Surface moisture content (%)	11	Estimate
Speed Limit (mph)	15	Planned

Equipment	Emission Factor (lb/VMT)		
	$PM_{2.5}$	PM_{10}	PM_{30}
Light duty vehicle	0.1356806	1.359936	3.823471

Wind Erosion From Exposed Areas (AP-42, Table 11.9-4)

Activity	Emission Factor (ton/yr/acre)		
	$PM_{2.5}$	PM_{10}	PM_{30}
Wind erosion on disturbed acreage	0.017	0.114	0.380

Table D-3a. Fugitive Emissions from Construction Phase

Heavy Construction Operations (AP-42)

Activity		Site Preparation Central Plant Area	Wellfield and Roads Preparation
Bulldozing	Emission Factor (lb/hr)	4.17	3.47
	Activity (hr/yr)	680	2,080
	Control Efficiency (%)[1]	50	50
	PM_{10} Emissions (tons/yr)	**0.71**	**1.81**
Scraper Unloading Topsoil	Emission Factor (lb/ton)	0.0010	0.0014
	Area (ac/yr)	55	160
	Stripping Depth (ft)	2	2
	Topsoil (CY/yr)	177,467	516,267
	Density of Topsoil (tons/CY)	1.25	1.25
	Control Efficiency (%)[1]	50	50
	PM_{10} Emissions (tons/yr)	**0.06**	**0.22**
Scrapers in Travel	Emission Factor (lb/VMT)	4.76	3.94
	Scraper VMT (mi/day)	15	15
	Scraper Operation (day/yr)	200	185
	Control Efficiency (%)[1]	50	50
	PM_{10} Emissions (tons/yr)	**3.57**	**2.74**
Scrapers Removing Topsoil	Emission Factor (lb/VMT)	20.2	20.2
	Scraper VMT (mi/day)	5	5
	Scraper Operation (day/yr)[2]	200	185
	Control Efficiency (%)[1]	50	50
	PM_{10} Emissions (tons/yr)	**5.05**	**4.67**
Truck Dumping Fill Material	Emission Factor (lb/ton)	0.0006	0.0006
	Aggregate Material (CY)	2,800	16,000
	Material Density (tons/CY)	1.5	1.5
	Control Efficiency (%)[1]	50	50
	PM_{10} Emissions (tons/yr)	**1.20**	**6.87**
Compacting	Emission Factor (lb/hr)	4.17	3.47
	Activity (hr/yr)	910	480
	Control Efficiency (%)[1]	50	50
	PM10 Emissions (tons/yr)	**0.95**	**0.42**
Grading	Emission Factor (lb/hr)	0.77	0.77
	Activity (hr/yr)	790	3,960
	Control Efficiency (%)[1]	50	50
	PM_{10} Emissions (tons/yr)	**0.15**	**0.76**
Heavy Contstruction Fugitvie PM_{10} Emissions (tons/yr)		**11.69**	**17.48**

[1] Assume 50% control efficiency

[2] Based on 8 hr work days

Wind Erosion of Exposed Areas

Activity		
Wind Erosion	Emission Factor (tons/acre/yr)	0.11
	Exposed Area (acres)	109
	Control Efficiency (%)	0
	PM_{10} Emissions (tons/yr)	**12.40**

Fugitive Emissions from Vehicles Traveling Unpaved Roads (AP-42 13.2.2 Eqn 1a)

Equipment[1]	PM_{10} Emission Factor (lb/VMT)	Est Max Distance Traveled (mi/day)	Equipment Operating Days (days/yr)	VMT (mi/yr)	PM_{10} Emissions (tons/yr)
Cementing unit	7.79	0.5	617	309	0.60
Drilling rig	7.79	0.5	1,672	836	1.63
Pulling unit	5.16	0.5	557	279	0.36
Backhoe	5.16	3	2,779	8,338	10.76
Bulldozer	9.07	5	265	1,325	3.00
Front end loader	5.16	5	243	1,213	1.56
Grader	7.43	20	354	7,075	13.15
Roller compactor	8.30	10	174	1,738	3.61
Trackhoe	7.24	2	379	758	1.37
Trencher	4.86	2	443	885	1.08
Dump truck	7.79	15	214	3,215	6.26
Hydraulic crane	10.15	0.2	70	14	0.04
Mix truck	7.79	2	176	353	0.69
Semi-haul truck	7.79	15	379	5,685	11.08
Water truck	7.79	20	1,907	38,140	74.31
Disc tractor	3.78	10	95	950	0.90
Seed drill tractor	3.78	10	72	720	0.68
Forklift	6.64	0.5	725	362	0.60
Manlift	5.71	0.25	250	63	0.09
Picker	7.43	0.25	160	40	0.07
Skid-steer loader	3.78	5	72	360	0.34
Integrity testing unit	1.36	1	557	557	0.19
Flat bed truck	1.36	10	26	261	0.09
Logging truck	1.36	5	418	2,090	0.71
Pickup truck	1.36	25	1,115	27,871	9.48
Vehichle Traveling Unpaved Roads Fugitive PM_{10} Emissions (tons/yr)					**142.64**

[1] Scraper not included, accounted for in Heavy Construction Operations Fugitive Emissions

Table D-3b. Fugitive Emissions from Operation Phase

Fugitive Emissions from Vehicles Traveling Unpaved Roads (AP-42 13.2.2 Eqn 1a)

Equipment	PM_{10} Emission Factor (lb/VMT)	Est Max Distance Traveled (mi/day)	Annual Operation[1] (hrs/yr)	Activity (mi/yr)	PM_{10} Emissions (tons/yr)
Pulling unit	5.16	5	1,300	813	1.05
Backhoe	5.16	5	1,820	1,138	1.47
Grader	7.43	5	520	325	0.60
Water truck	7.79	20	520	1,300	2.53
Forklift	6.64	0.5	1,040	65	0.11
Integrity testing unit	1.36	1	3,120	390	0.13
Pickup truck	1.36	20	8,840	22,100	7.51
Swab rig	1.36	5	4,160	2,600	0.88
Vehichle Traveling Unpaved Roads Fugitive PM_{10} Emissions (tons/yr)					**14.29**

[1] Based on 8 hr work days

Wind Erosion of Exposed Areas

Activity		
Roads	Emission Factor (tons/acre/yr)	0.11
	Exposed Area (acres)	10
	Control Efficiency (%)	0
	PM_{10} Emissions (tons/yr)	**1.14**

Year 5		
Facilities	Emission Factor (tons/acre/yr)	0.11
	Exposed Area (acres)	55
	Control Efficiency (%)	0
	PM_{10} Emissions (tons/yr)	**6.27**

Table D-3c. Fugitive Emissions from Aquifer Restoration Phase

Fugitive Emissions from Vehicles Traveling Unpaved Roads (AP-42 13.2.2 Eqn 1a)

Equipment	PM^{10} Emission Factor (lb/VMT)	Est Max Distance Traveled (mi/day)	Annual Operation[1] (hrs/yr)	Activity (mi/yr)	PM_{10} Emissions (tons/yr)
Pulling unit	5.16	1	1,300	163	0.21
Backhoe	5.16	5	1,820	1,138	1.47
Grader	7.43	5	520	325	0.60
Water truck	7.79	20	520	1,300	2.53
Forklift	6.64	0.5	520	33	0.05
Integrity testing unit	1.36	1	1,560	195	0.07
Pickup truck	1.36	20	5,200	13,000	4.42
Swab rig	1.36	5	2,080	1,300	0.44
Vehichle Traveling Unpaved Roads Fugitive PM_{10} Emissions (tons/yr)					**9.80**

[1] Based on 8 hr work days

Wind Erosion of Exposed Areas

Activity		
Wind Erosion	Emission Factor (tons/acre/yr)	0.11
	Exposed Area (acres)	10
	Control Efficiency (%)	0
	PM_{10} Emissions (tons/yr)	**1.14**

Table D-3d. Fugitive Emissions from Decommissioning Phase

Heavy Construction Operations (AP-42)

Activity		Site Preparation Central Plant Area	Wellfield and Roads Preparation
Bulldozing	Emission Factor (lb/hr)	4.17	3.47
	Activity (hr/yr)	496	1760
	Control Efficiency (%)[1]	50	50
	PM_{10} Emissions (tons/yr)	**0.52**	**1.53**
Scraper Unloading Topsoil	Emission Factor (lb/ton)	0.0010	0.0014
	Area (ac/yr)	55	160
	Stripping Depth (ft)	2	2
	Topsoil (CY/yr)	177467	516267
	Density of Topsoil (tons/CY)	1.25	1.25
	Control Efficiency (%)[1]	50	50
	PM_{10} Emissions (tons/yr)	**0.06**	**0.22**
Scrapers in Travel	Emission Factor (lb/VMT)	4.76	3.94
	Scraper VMT (mi/day)	10	10
	Scraper Operation (day/yr)[2]	120	273
	Control Efficiency (%)[1]	50	50
	PM_{10} Emissions (tons/yr)	**1.43**	**2.69**
Compacting	Emission Factor (lb/hr)	4.17	3.47
	Activity (hr/yr)	152	433
	Control Efficiency (%)[1]	50	50
	PM_{10} Emissions (tons/yr)	**0.16**	**0.38**
Grading	Emission Factor (lb/hr)	0.77	0.77
	Activity (hr/yr)	272	1620
	Control Efficiency (%)[1]	50	50
	PM_{10} Emissions (tons/yr)	**0.05**	**0.31**
Heavy Contstruction Fugitvie PM_{10} Emissions (tons/yr)		**2.21**	**5.12**

[1] Assume 50% control efficiency

[2] Based on 8 hr work days

Fugitive Emissions from Vehicles Traveling Unpaved Roads (AP-42 13.2.2 Eqn 1a)

Equipment[1]	PM10 Emission Factor (lb/VMT)	Est Max Distance Traveled (mi/day)	Annual Operation[2] (hrs/yr)	Activity (mi/yr)	PM10 Emissions (tons/yr)
Cementing unit	7.79	5	4360	2725	5.31
Pulling unit	5.16	5	2320	1450	1.87
Backhoe	5.16	5	5872	3670	4.73
Bulldozer	9.07	5	2256	1410	3.20
Front end loader	5.16	5	1144	715	0.92
Grader	7.43	10	1892	2365	4.39
Roller compactor	8.30	2	585	146	0.30
Trackhoe	7.24	0.5	4096	256	0.46
Trencher	4.86	0.5	40	3	0.00
Dump truck	7.79	5	1600	1000	1.95
Semi-haul truck	7.79	10	12488	15610	30.42
Water truck	7.79	20	3888	9720	18.94
Disc tractor	3.78	10	716	895	0.85
Seed drill tractor	3.78	10	475	593	0.56
Manlift	5.71	0.25	1440	45	0.06
Picker	7.43	0.25	320	10	0.02
Skid-steer loader	3.78	2	1464	366	0.35
Pickup truck	1.36	20	4000	10000	3.40
Vehichle Traveling Unpaved Roads Fugitive PM_{10} Emissions (tons/yr)					**77.73**

[1] Scraper not included, accounted for in Heavy Construction Operations Fugitive Emissions

[2] Based on 8 hr work days

Wind Erosion of Exposed Areas

Activity		
Wind Erosion	Emission Factor (tons/acre/yr)	0.11
	Exposed Area (acres)	56
	Control Efficiency (%)	0
	PM_{10} Emissions (tons/yr)	**6.38**

TANKS 4.0.9d

Hydrochloric Acid Tank Emissions Report - Detail Format

Tank Identification and Physical Characteristics

Identification		
User Identification:	002	
City:	Oshoto	
State:	Wyoming	
Company:	Strata Energy	
Type of Tank:	Vertical Fixed Roof Tank	
Description:	Hydrochloric Acid	
Tank Dimensions		
Shell Height (ft):		14.00
Diameter (ft):		12.00
Liquid Height (ft) :		12.00
Avg. Liquid Height (ft):		6.00
Volume (gallons):		10,152.36
Turnovers:		52.00
Net Throughput(gal/yr):		527,922.48
Is Tank Heated (y/n):	N	
Paint Characteristics		
Shell Color/Shade:	Gray/Light	
Shell Condition	Good	
Roof Color/Shade:	Gray/Light	
Roof Condition:	Good	
Roof Characteristics		
Type:	Cone	
Height (ft)		2.00
Slope (ft/ft) (Cone Roof)		0.00
Breather Vent Settings		
Vacuum Settings (psig):		-0.03
Pressure Settings (psig)		0.03

Meterological Data used in Emissions Calculations: Casper, Wyoming (Avg Atmospheric Pressure = 12.14 psia)

002 - Vertical Fixed Roof Tank

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
hydrochloric acid	All	52.26	42.14	62.37	47.29	0.0906	0.0385	0.1050	36.4600			36.46	

TANKS 4.0.9d
Hydrochloric Acid Tank Emissions Report - Detail Format
Detail Calculations (AP-42)

002 - Vertical Fixed Roof Tank

Annual Emission Calcaulations	
Standing Losses (lb):	16.4317
Vapor Space Volume (cu ft):	980.1769
Vapor Density (lb/cu ft):	0.0006
Vapor Space Expansion Factor:	0.0796
Vented Vapor Saturation Factor:	0.9600
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	980.1769
Tank Diameter (ft):	12.0000
Vapor Space Outage (ft):	8.6667
Tank Shell Height (ft):	14.0000
Average Liquid Height (ft):	6.0000
Roof Outage (ft):	0.6667
Roof Outage (Cone Roof)	
Roof Outage (ft):	0.6667
Roof Height (ft):	2.0000
Roof Slope (ft/ft):	0.0000
Shell Radius (ft):	6.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0006
Vapor Molecular Weight (lb/lb-mole):	36.4600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0906
Daily Avg. Liquid Surface Temp. (deg. R):	511.9257
Daily Average Ambient Temp. (deg. F):	45.0542
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	506.9642
Tank Paint Solar Absorptance (Shell):	0.5400
Tank Paint Solar Absorptance (Roof):	0.5400
Daily Total Solar Insulation Factor (Btu/sqft day):	1,394.0844
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0796
Daily Vapor Temperature Range (deg. R):	40.4526
Daily Vapor Pressure Range (psia):	0.0665
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0906
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0385
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.1050
Daily Avg. Liquid Surface Temp. (deg R):	511.9257
Daily Min. Liquid Surface Temp. (deg R):	501.8126
Daily Max. Liquid Surface Temp. (deg R):	522.0389

Daily Ambient Temp. Range (deg. R):	26.9083
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9600
Vapor Pressure at Daily Average Liquid:	
Surface Temperature (psia):	0.0906
Vapor Space Outage (ft):	8.6667
Working Losses (lb):	30.8744
Vapor Molecular Weight (lb/lb-mole):	36.4600
Vapor Pressure at Daily Average Liquid	
Surface Temperature (psia):	0.0906
Annual Net Throughput (gal/yr.):	527,922.4848
Annual Turnovers:	52.0000
Turnover Factor:	0.7436
Maximum Liquid Volume (gal):	10,152.3555
Maximum Liquid Height (ft):	12.0000
Tank Diameter (ft):	12.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	47.3061

TANKS 4.0.9d
Hydrochloric Acid Tank Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

002 - Vertical Fixed Roof Tank

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
hydrochloric acid	30.87	16.43	47.31

TANKS 4.0.9d

Hydrogen Peroxide Tank Emissions Report - Detail Format

Tank Identification and Physical Characteristics

Identification		
User Identification:	003	
City:	Oshoto	
State:	Wyoming	
Company:	Strata Energy	
Type of Tank:	Vertical Fixed Roof Tank	
Description:	Hydrogen Peroxide	
Tank Dimensions		
Shell Height (ft):		14.00
Diameter (ft):		12.00
Liquid Height (ft) :		12.00
Avg. Liquid Height (ft):		6.00
Volume (gallons):		10,152.36
Turnovers:		74.00
Net Throughput(gal/yr):		751,274.31
Is Tank Heated (y/n):	N	
Paint Characteristics		
Shell Color/Shade:	Gray/Light	
Shell Condition	Good	
Roof Color/Shade:	Gray/Light	
Roof Condition:	Good	
Roof Characteristics		
Type:	Cone	
Height (ft)		2.00
Slope (ft/ft) (Cone Roof)		0.33
Breather Vent Settings		
Vacuum Settings (psig):		-0.03
Pressure Settings (psig)		0.03

Meterological Data used in Emissions Calculations: Casper, Wyoming (Avg Atmospheric Pressure = 12.14 psia)

003 - Vertical Fixed Roof Tank
Oshoto, Wyoming

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Hydrogen Peroxide	All	52.26	42.14	62.37	47.29	0.0021	0.0002	0.0031	34.0100			34.01	

TANKS 4.0.9d
Emissions Report - Detail Format
Hydrogen Peroxide Tank Detail Calculations (AP-42)

003 - Vertical Fixed Roof Tank
Oshoto, Wyoming

Annual Emission Calcaulations	
Standing Losses (lb):	0.3453
Vapor Space Volume (cu ft):	980.1769
Vapor Density (lb/cu ft):	0.0000
Vapor Space Expansion Factor:	0.0743
Vented Vapor Saturation Factor:	0.9990
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	980.1769
Tank Diameter (ft):	12.0000
Vapor Space Outage (ft):	8.6667
Tank Shell Height (ft):	14.0000
Average Liquid Height (ft):	6.0000
Roof Outage (ft):	0.6667
Roof Outage (Cone Roof)	
Roof Outage (ft):	0.6667
Roof Height (ft):	2.0000
Roof Slope (ft/ft):	0.3300
Shell Radius (ft):	6.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0000
Vapor Molecular Weight (lb/lb-mole):	34.0100
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0021
Daily Avg. Liquid Surface Temp. (deg. R):	511.9257
Daily Average Ambient Temp. (deg. F):	45.0542
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	506.9642
Tank Paint Solar Absorptance (Shell):	0.5400
Tank Paint Solar Absorptance (Roof):	0.5400
Daily Total Solar Insulation Factor (Btu/sqft day):	1,394.0844
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0743
Daily Vapor Temperature Range (deg. R):	40.4526
Daily Vapor Pressure Range (psia):	0.0029
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0021
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0002
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0031
Daily Avg. Liquid Surface Temp. (deg R):	511.9257

Daily Min. Liquid Surface Temp. (deg R):	501.8126
Daily Max. Liquid Surface Temp. (deg R):	522.0389
Daily Ambient Temp. Range (deg. R):	26.9083
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9990
Vapor Pressure at Daily Average Liquid:	
Surface Temperature (psia):	0.0021
Vapor Space Outage (ft):	8.6667
Working Losses (lb):	0.7308
Vapor Molecular Weight (lb/lb-mole):	34.0100
Vapor Pressure at Daily Average Liquid	
Surface Temperature (psia):	0.0021
Annual Net Throughput (gal/yr.):	751,274.3052
Annual Turnovers:	74.0000
Turnover Factor:	0.5721
Maximum Liquid Volume (gal):	10,152.3555
Maximum Liquid Height (ft):	12.0000
Tank Diameter (ft):	12.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	1.0762

TANKS 4.0.9d
Hydrogen Peroxide Tank Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

003 - Vertical Fixed Roof Tank
Oshoto, Wyoming

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Hydrogen Peroxide	0.73	0.35	1.08

TANKS 4.0.9d
Diesel Fuel Tank Emissions Report - Detail Format
Tank Identification and Physical Characteristics

Identification		
User Identification:	004	
City:	Oshoto	
State:	Wyoming	
Company:	Strata Energy	
Type of Tank:	Vertical Fixed Roof Tank	
Description:	Diesel Fuel	
Tank Dimensions		
Shell Height (ft):		14.00
Diameter (ft):		12.00
Liquid Height (ft) :		12.00
Avg. Liquid Height (ft):		6.00
Volume (gallons):		10,152.36
Turnovers:		159.00
Net Throughput(gal/yr):		1,614,224.52
Is Tank Heated (y/n):	N	
Paint Characteristics		
Shell Color/Shade:	Gray/Light	
Shell Condition	Good	
Roof Color/Shade:	Gray/Light	
Roof Condition:	Good	
Roof Characteristics		
Type:	Cone	
Height (ft)		2.00
Slope (ft/ft) (Cone Roof)		0.33
Breather Vent Settings		
Vacuum Settings (psig):		-0.03
Pressure Settings (psig)		0.03

Meterological Data used in Emissions Calculations: Casper, Wyoming (Avg Atmospheric Pressure = 12.14 psia)

004 - Vertical Fixed Roof Tank
Oshoto, Wyoming

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	52.26	42.14	62.37	47.29	0.0050	0.0034	0.0071	130.0000			188.00	Option 1: VP50 = .0045 VP60 = .0065

TANKS 4.0.9d
Diesel Fuel Tank Emissions Report - Detail Format
Detail Calculations (AP-42)

004 - Vertical Fixed Roof Tank
Oshoto, Wyoming

Annual Emission Calcaulations	
Standing Losses (lb):	3.1107
Vapor Space Volume (cu ft):	980.1769
Vapor Density (lb/cu ft):	0.0001
Vapor Space Expansion Factor:	0.0744
Vented Vapor Saturation Factor:	0.9977
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	980.1769
Tank Diameter (ft):	12.0000
Vapor Space Outage (ft):	8.6667
Tank Shell Height (ft):	14.0000
Average Liquid Height (ft):	6.0000
Roof Outage (ft):	0.6667
Roof Outage (Cone Roof)	
Roof Outage (ft):	0.6667
Roof Height (ft):	2.0000
Roof Slope (ft/ft):	0.3300
Shell Radius (ft):	6.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0001
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0050
Daily Avg. Liquid Surface Temp. (deg. R):	511.9257
Daily Average Ambient Temp. (deg. F):	45.0542
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	506.9642
Tank Paint Solar Absorptance (Shell):	0.5400
Tank Paint Solar Absorptance (Roof):	0.5400
Daily Total Solar Insulation Factor (Btu/sqft day):	1,394.0844
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0744
Daily Vapor Temperature Range (deg. R):	40.4526
Daily Vapor Pressure Range (psia):	0.0037
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0050
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0034
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0071
Daily Avg. Liquid Surface Temp. (deg R):	511.9257

Daily Min. Liquid Surface Temp. (deg R):	501.8126
Daily Max. Liquid Surface Temp. (deg R):	522.0389
Daily Ambient Temp. Range (deg. R):	26.9083
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9977
Vapor Pressure at Daily Average Liquid:	
Surface Temperature (psia):	0.0050
Vapor Space Outage (ft):	8.6667
Working Losses (lb):	8.7905
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid	
Surface Temperature (psia):	0.0050
Annual Net Throughput (gal/yr.):	1,614,224.5207
Annual Turnovers:	159.0000
Turnover Factor:	0.3553
Maximum Liquid Volume (gal):	10,152.3555
Maximum Liquid Height (ft):	12.0000
Tank Diameter (ft):	12.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	11.9013

TANKS 4.0.9d
Diesel Fuel Tank Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

004 - Vertical Fixed Roof Tank
Oshoto, Wyoming

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	8.79	3.11	11.90

TANKS 4.0.9d
Gasoline Fuel Emissions Report - Detail Format
Tank Identification and Physical Characteristics

Identification		
User Identification:	005	
City:	Oshoto	
State:	Wyoming	
Company:	Strata Energy	
Type of Tank:	Vertical Fixed Roof Tank	
Description:	Gasoline Fuel	
Tank Dimensions		
Shell Height (ft):		12.00
Diameter (ft):		6.00
Liquid Height (ft) :		10.00
Avg. Liquid Height (ft):		5.00
Volume (gallons):		2,115.07
Turnovers:		159.00
Net Throughput(gal/yr):		336,296.78
Is Tank Heated (y/n):	N	
Paint Characteristics		
Shell Color/Shade:	Gray/Light	
Shell Condition	Good	
Roof Color/Shade:	Gray/Light	
Roof Condition:	Good	
Roof Characteristics		
Type:	Cone	
Height (ft)		2.00
Slope (ft/ft) (Cone Roof)		0.67
Breather Vent Settings		
Vacuum Settings (psig):		-0.03
Pressure Settings (psig)		0.03

Meterological Data used in Emissions Calculations: Casper, Wyoming (Avg Atmospheric Pressure = 12.14 psia)

005 - Vertical Fixed Roof Tank
Oshoto, Wyoming

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Gasoline (RVP 10)	All	52.26	42.14	62.37	47.29	4.4524	3.6229	5.4284	66.0000			92.00	Option 4: RVP=10, ASTM Slope=3

TANKS 4.0.9d
Gasoline Fuel Emissions Report - Detail Format
Tank Identification and Physical Characteristics

005 - Vertical Fixed Roof Tank
Oshoto, Wyoming

Annual Emission Calcaulations	
Standing Losses (lb):	461.2977
Vapor Space Volume (cu ft):	216.7699
Vapor Density (lb/cu ft):	0.0535
Vapor Space Expansion Factor:	0.3062
Vented Vapor Saturation Factor:	0.3560
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	216.7699
Tank Diameter (ft):	6.0000
Vapor Space Outage (ft):	7.6667
Tank Shell Height (ft):	12.0000
Average Liquid Height (ft):	5.0000
Roof Outage (ft):	0.6667
Roof Outage (Cone Roof)	
Roof Outage (ft):	0.6667
Roof Height (ft):	2.0000
Roof Slope (ft/ft):	0.6700
Shell Radius (ft):	3.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0535
Vapor Molecular Weight (lb/lb-mole):	66.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	4.4524
Daily Avg. Liquid Surface Temp. (deg. R):	511.9257
Daily Average Ambient Temp. (deg. F):	45.0542
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	506.9642
Tank Paint Solar Absorptance (Shell):	0.5400
Tank Paint Solar Absorptance (Roof):	0.5400
Daily Total Solar Insulation Factor (Btu/sqft day):	1,394.0844
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.3062
Daily Vapor Temperature Range (deg. R):	40.4526
Daily Vapor Pressure Range (psia):	1.8055
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	4.4524
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	3.6229
Vapor Pressure at Daily Maximum Liquid	

Surface Temperature (psia):	5.4284
Daily Avg. Liquid Surface Temp. (deg R):	511.9257
Daily Min. Liquid Surface Temp. (deg R):	501.8126
Daily Max. Liquid Surface Temp. (deg R):	522.0389
Daily Ambient Temp. Range (deg. R):	26.9083
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.3560
Vapor Pressure at Daily Average Liquid:	
Surface Temperature (psia):	4.4524
Vapor Space Outage (ft):	7.6667
Working Losses (lb):	836.1163
Vapor Molecular Weight (lb/lb-mole):	66.0000
Vapor Pressure at Daily Average Liquid	
Surface Temperature (psia):	4.4524
Annual Net Throughput (gal/yr.):	336,296.7751
Annual Turnovers:	159.0000
Turnover Factor:	0.3553
Maximum Liquid Volume (gal):	2,115.0741
Maximum Liquid Height (ft):	10.0000
Tank Diameter (ft):	6.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	1,297.4140

TANKS 4.0.9d
Gasoline Fuel Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

005 - Vertical Fixed Roof Tank
Oshoto, Wyoming

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Gasoline (RVP 10)	836.12	461.30	1,297.41

APPENDIX E: RADIOACTIVE EMISSIONS CALCULATIONS

APPENDIX E – Radiological Emissions Calculations

For modeling purposes the two Mine Units at the Ross ISR project were assigned point locations based on the centroid of each unit. Source terms were calculated using equations provided in NUREG 1569, Appendix D and the ISR specific patch to the MILDOS-AREA code. The following calculations were performed for each source type and project phase.

New Wells

The primary source of Rn-222 during the construction process was identified as the mud pits. Construction source terms were calculated at the centroid of both Mine Units using the following equation:

$$Rn_{nw} = (10^{-12})(E)(L)([Ra])(T)(M)(N)$$

where:

- Rn_{nw} =Rn-222 release rate from new wellfield (Ci/yr)
- 10^{-12} =unit conversion factor (Ci/pCi)
- [Ra] =concentration of Ra-226 in ore (pCi/g)
- E =emanating power (Assumed 0.25)
- L =decay constant of Rn-222 (0.181/day)
- T =storage time in mud pits (days)
- M =average mass of ore material in mud pits (g)
- N =number of mud pits generated per year

This calculation provided a source term of 0.0213 Ci/yr Rn-222 released into the atmosphere for each Mine Unit resulting in a total of 0.0426 Ci/yr released as a result of new wellfield construction.

Production Wells

The total operation source term is the sum of three terms that represent Rn-222 releases as a result of occasional venting and leaking of wellheads and pipes at module buildings, purge water release and unloading IX columns. The Rn-222 release associated with leaking and venting of wellheads was calculated with the following equations:

$$Rn_v = (3.65^{-10})(v)(C_{Rn})(V)$$

where:

- Rn_v = Rn-222 release from venting (Ci/yr)
- v = rate of radon venting from piping and valves during circulation (day^{-1})
- V = volume of water in circulation (L)

where:

$$C_{Rn} = \frac{(10^6)([Ra])(A)(D)(\rho)(E)(L)(f)}{(L+v)\,V + F_p + F_i}$$

where:

C_{Rn}	= Rn-222 concentration in the process water (pCi/L)
[Ra]	= concentration of Ra-226 in the ore (pCi/g)
A	= active area of ore zone (m^2)
D	= average thickness of the ore zone (m)
ρ	= density of ore material (g/cm^3)
E	= emanating power (assumed 0.25)
L	= decay constant of Rn-222 (0.181/d)
M	= average mass of ore material in mud pits (g)
N	= number of mud pits generated per year
F_p	= purge rate of treated water (L/day)
F_i	= water discharge rate, resin unloading of IX columns (L/day)
V,v	= as previously defined

The wellfield operation source terms were calculated for both Mine Units resulting in a source term of 122 Ci/yr at Mine Unit 1 and 123 Ci/yr at Mine Unit 2.

CPP

The contribution of Rn-222 from unloading IX columns and water discharge to lined retention ponds were modeled as the CPP source term. The following equation was used to calculate the contribution to the CPP source term from water discharge to lined retention ponds:

$$Rn_w = (3.65^{-10})(C_{Rn})(F_p)$$

where

Rn_w	= Rn-222 release rate from water discharge to lined retention ponds (Ci/yr)
F_p	= purge rate of treated water (L/day)

While the following equation was used to calculate the contribution to the CPP source term as a result of IX column unloading:

$$Rn_x = (3.65^{-10})(C_{Rn})(F_i)$$

where:

Rn_x	=annual Rn-222 discharge from unloading IX column contents
F_i	=water discharge rate from resin unloading of IX columns (L/day)

The Rn-222 source term as a result of water discharge to lined retention ponds was 70.2 Ci/yr, while the source term as a result of IX column unloading was 1.0 Ci/yr for a total source term at the CPP of 71.2 Ci/yr.

Aquifer Restoration

During aquifer restoration, radon will continue to be vented through surface well heads and released via water discharge to lined retention ponds. However, there will no longer be a component from IX column unloading. The equations used for source term production at both production Mine Units and CPP were applied for aquifer restoration resulting in a source term of 70.2 Ci/yr for the CPP and 122 and 123 Ci/yr for Mine Units 1 and 2, respectively.

APPENDIX F: BASELINE AIR MONITORING PLAN

Department of Environmental Quality

To protect, conserve and enhance the quality of Wyoming's environment for the benefit of current and future generations.

Dave Freudenthal, Governor

John Corra, Director

February 23, 2010

Ms. Dalene Ruby
Strata Energy, Inc.
P.O. Box 2318
Gillette, WY 82717

RE: Ross ISR Uranium Project Meteorological Monitoring and Air Sampling Plan

Dear Ms. Ruby:

This letter is written to provide approval from the Air Quality Division (AQD) Monitoring Section and the AQD New Source Review (NSR) Group of the preliminary baseline monitoring plan for the Ross ISR Uranium Project. No additional air quality or meteorological monitoring beyond what is currently in place for the project will be required for the air quality permitting of the project.

Our letter dated February 16, 2010 that requested a revision to the monitoring plan in preparation for AERMOD dispersion modeling was in error. Prior conversations between project representatives and the NSR Group had already established that AERMOD dispersion modeling would not be required for the air quality permit.

We do require that you submit the locations (UTM coordinates) of the monitoring sites for the project. If you have any questions, please contact Amber Potts (Monitoring Project Advisor) at (307) 777-2489.

Sincerely,

Cara Keslar
Ambient Monitoring Supervisor
Air Quality Division

Cc: Tanner Shatto/AQD District Engineer
Mark Taylor/LQD (proj ref #TFN5 6\110)
Ronn Smith/IML
Monitoring File

Ross ISR Uranium Project
Strata Energy

Meteorological Monitoring and Air Sampling Plan

Updated November 13, 2010

Prepared by:

Air Science
a division of Inter-Mountain Laboratories, Inc.
555 Absaraka
Sheridan, Wyoming 82801
(307) 674-7506
www.imlairscience.co

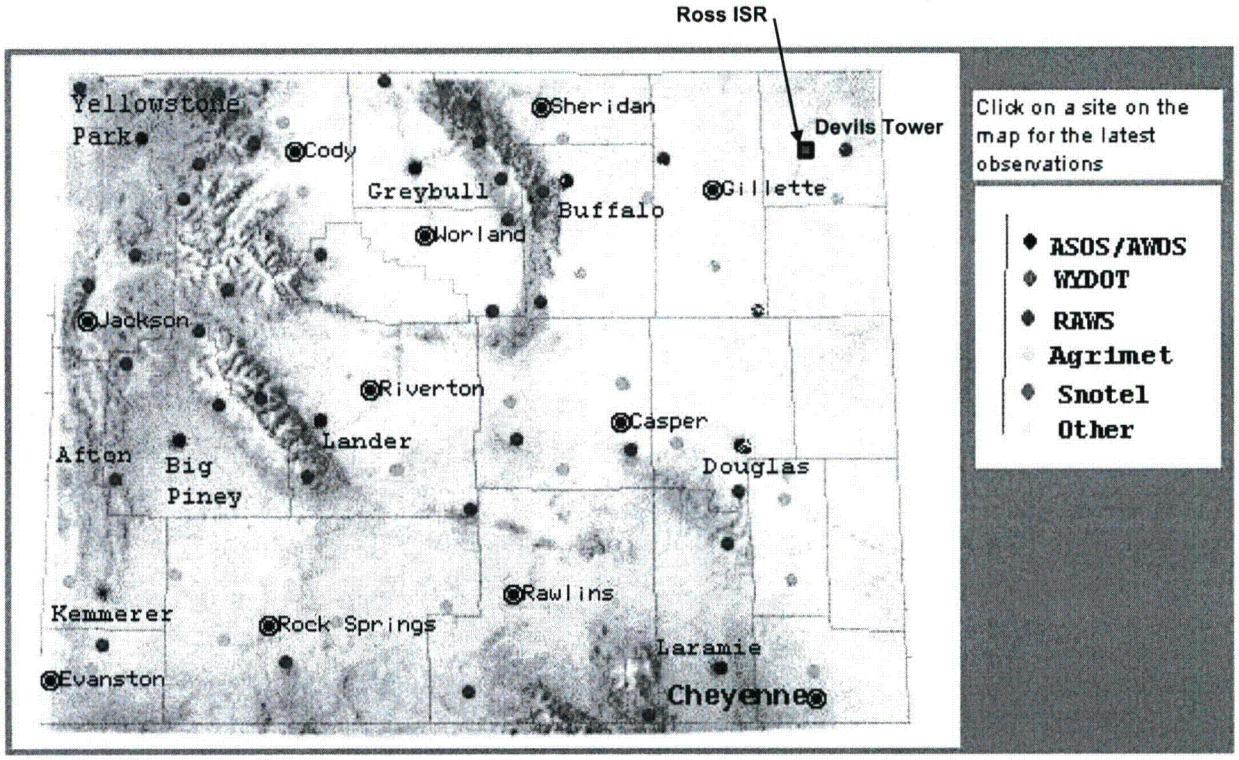
Introduction

The following baseline meteorological monitoring and ambient air sampling plan is being followed at the Ross ISR Project in conformance with published NRC standards and guidelines. The results of this monitoring program will be:

1. Twelve months of on-site hourly meteorological data to support NRC licensing, air permitting through the Wyoming Department of Environmental Quality, Air Quality Division (WDEQ-AQD), and dispersion modeling.
2. Four quarters of particulate sampling and radionuclide analysis for five project locations, to support NRC licensing. A sixth location was added in October of 2010, after cumulative wind monitoring made it clear that prevailing winds are from the South.

Meteorological monitoring will be supplemented with hourly National Weather Service (NWS) data available from two Meteorological data sources within 80 kilometers of the project area. These include a NWS station at the Gillette, Wyoming airport (approximately 35 miles from the project), and a Remote Automated Weather Station (RAWS) station operated by the Bureau of Land Management near Devils Tower (approximately 15 miles from the project). Figure 1 shows NWS stations in Wyoming. The Gillette and Devils Tower sites are labeled on the map. The nearest available upper air data will be obtained from the NWS station in Rapid City, South Dakota (approximately 100 miles from the project).

FIGURE 1 – National Weather Service Stations in Wyoming



Hourly meteorological data from surface coal mines in the region will be compared to data from the Ross ISR meteorological station. For at least the past 15 years, IML Air Science has operated meteorological stations at Dry Fork Mine, located 25 miles west-southwest of the project site, and Buckskin Mine, located 30 miles west-southwest of the project site. In addition, some hourly meteorological data are available from the Thunder Basin National Grassland monitoring station, located 18 miles west of the project site.

On-Site Meteorological Monitoring Plan

Meteorological data collection, management and reporting methods conform to NRC atmospheric dispersion modeling requirements for uranium milling operations, and meet the acceptance criteria established in the NRC's NUREG-1569. The on-site monitoring program has been developed according to NRC Regulatory Guide 3.63, "Onsite Meteorological Measurement Program For Uranium Recovery Facilities – Data Acquisition and Reporting." The meteorological monitoring program will also meet the Wyoming Department of Environmental Quality requirements for land and air quality permit applications and compliance.

The project site meteorology is being monitored for a minimum of 12 months, at the site labeled "Met Station" in Figure 3. A collocated air sampler will collect air particulates as part of the air quality baseline monitoring program (see below). Prevailing winds at the Gillette airport are typically from the southwest and northwest, as shown in Figure 4. According to Section 2.5.3 of the original Nubeth application to NRC for an exploration license just south of the project site, winds are predominantly westerly. Based on these information sources, the "Met Station" location was chosen to represent conditions upwind from the project area. It is situated on an unobstructed knoll roughly two miles northwest of the proposed plant site. The meteorological station is approximately 150 feet higher in elevation than the plant site. The terrain in the area is characterized by mildly rolling hills and ephemeral drainages. There are no pronounced topographic features in the area that would create weather conditions significantly different between the meteorological station and the plant site. Figure 2 shows a view from the meteorological station looking to the east, and a view of the meteorological site from a point north of the site. Figure 3 shows a map of the project area, including permit boundary and monitoring locations. The site labeled "MET" in the northwest corner of the map is the meteorological monitoring station.

FIGURE 2 – Meteorological (Met Station) Site

Hourly meteorological values are recorded for wind speed, wind direction, standard deviation of wind direction (sigma theta), ambient temperature, relative humidity, precipitation, evaporation, and evaporation pan temperature. These values are generated by field instruments and recorded by a continuous data logger, all operated and maintained by IML Air Science. The data logger polls all instruments every second, and invalidates any hourly record for which an instrument output is missing for more than 10 seconds during that hour. This assures continuous temporal representation and surpasses the NRC requirement of at least 15 minutes of data in each hour.

Meteorological Data Quality Assurance

The Ross ISR Project meteorological station is inspected on a weekly basis. Meteorological instruments were calibrated upon installation in January, 2010 and again in July of 2010, according to the requirements of NRC Regulatory Guide 3.63. Appendix 1 to this document contains calibration and audit records for all meteorological instruments, along with specified tolerances for each parameter. These instruments meet the accuracy and threshold specifications listed in the EPA's "On-Site Meteorological Program Guidance for Regulatory Modeling Applications," which match or exceed NRC requirements in Regulatory Guide 3.63. Table 1 presents specifications for each instrument. Audit procedures are specified in EPA's Quality Assurance Handbook for Air Pollution Measurement Systems, Volume 4: Meteorological Measurements. The Standard Operation Procedure (SOP) employed by IML Air Science appears in Appendix 3 to this document.

All hourly data are downloaded weekly from the data logger to IML Air Science's relational database. The database software provides for quality assurance, invalidation of suspect or erroneous data, and various forms of data presentation. Data are summarized in weekly reports, which also include data recovery statistics and diagnosis of invalidated records. The level of rigor associated with collecting and validating on-site meteorological data is comparable, or superior to National Weather Service standards. Data recovery for the Ross ISR Project so far has been over 95% for wind data and over 97% for other parameters. This is typical of meteorological monitoring conducted by IML Air Science in Wyoming.

FIGURE 3

Ross ISR Air and Radiological Monitoring Sites

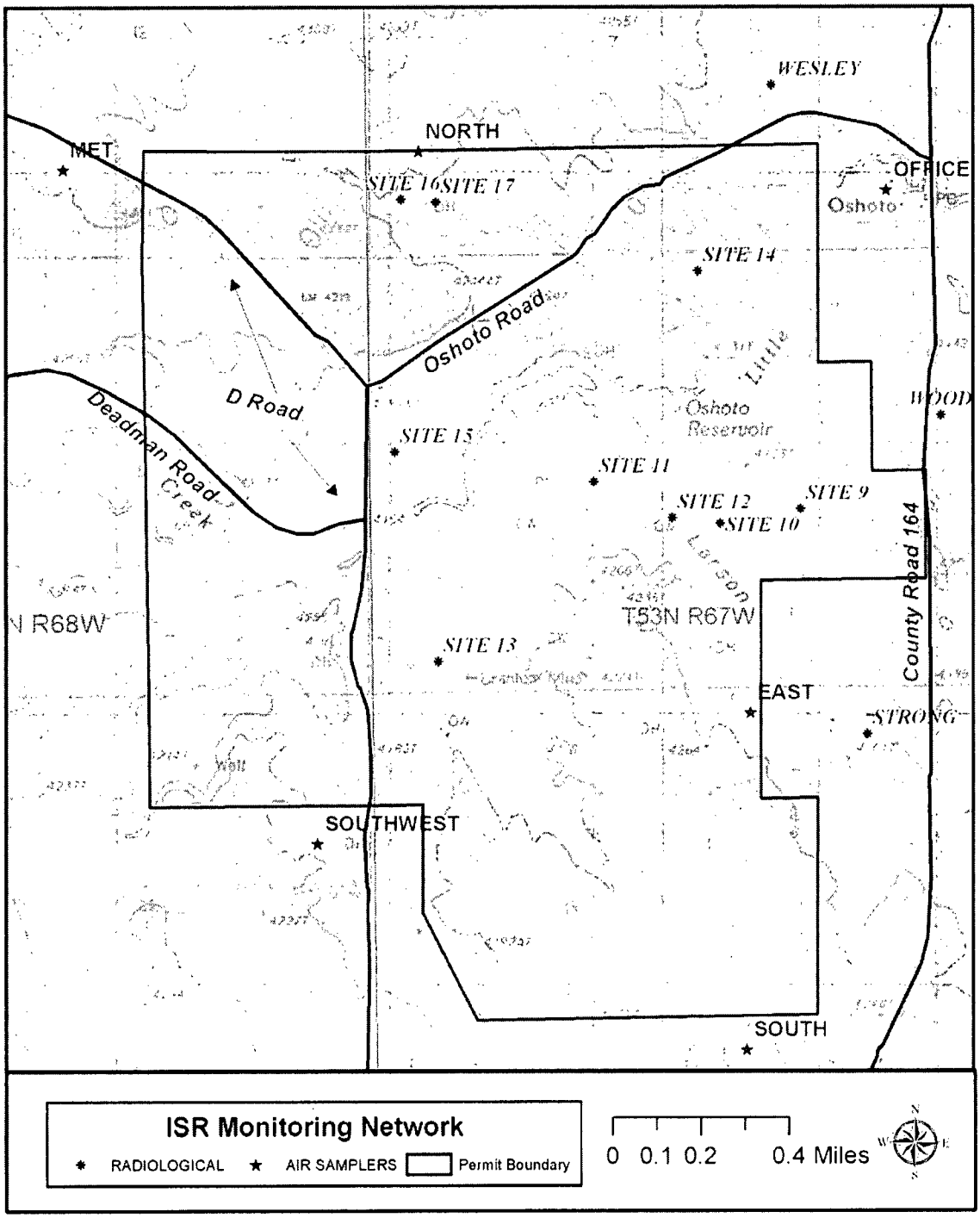
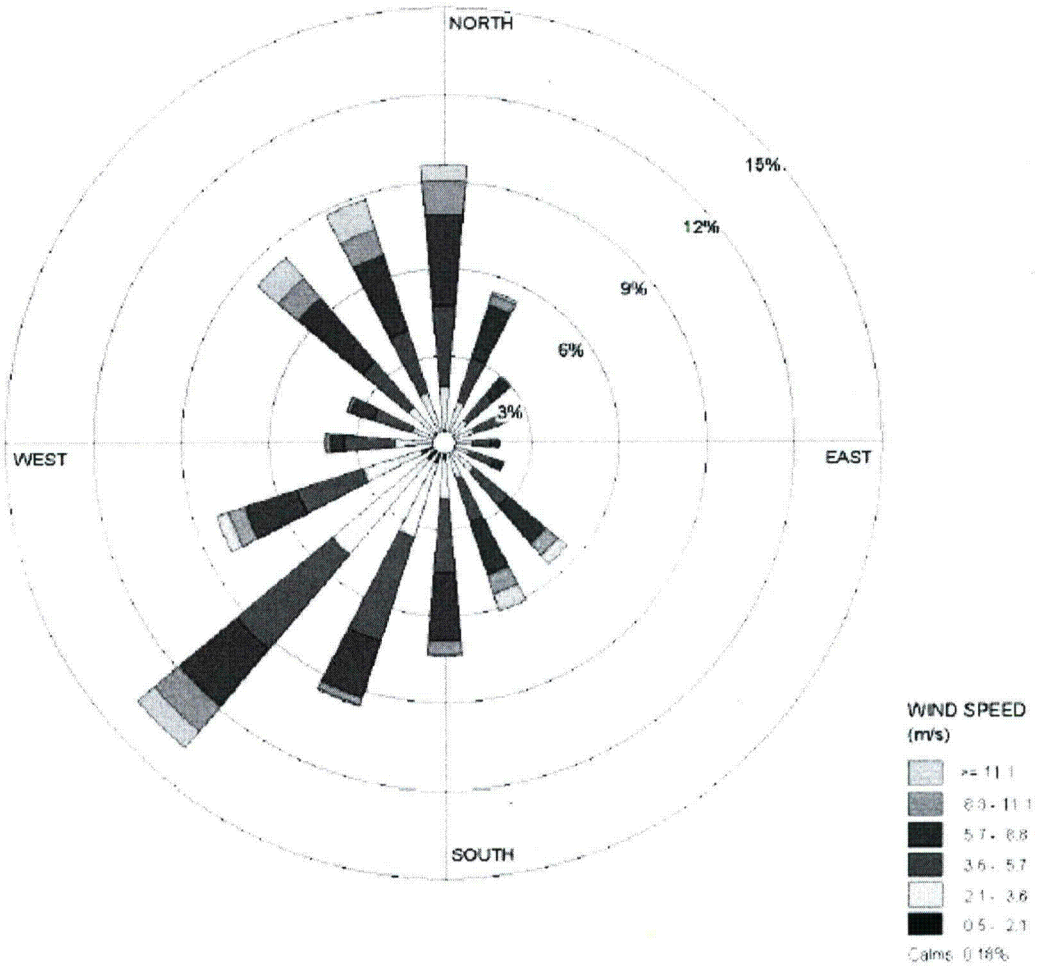


TABLE 1

Ross ISR Met Station					
Parameter	**Instrument**	**Range**	**Accuracy**	**Threshold**	**Instrument Height**
Wind Speed	RM Young 05305 Winder Monitor AQ	0 to 112 mph	±0.4 mph or 1% of reading	0.9 mph	10 meters
Wind Dir	RM Young 05305 Winder Monitor AQ	0 to 360°	±3°	1.0 mph	10 meters
Temp	Vaisalla HMP50-L15 Temp and RH Probe	-25° to 50° C	±0.5° C @ given range	-- ° C	2 meters
Rel Humidity	Vaisalla HMP50-L15 Temp and RH Probe	0 to 98%	±3% at 20 ° C	--	2 meters
Precip	Hydrologic Services TB3/0.01P Tipping Bucket Rain Gauge	Temp: -20°to 50° C	±0.5% @ 0.5 in/hr rate	--	1 meter
Evaporation	Novalynx 255-100 Evaporation Gauge	0 to 944"	0.25%	--	1 meter
Evaporation Pan Temperature Gauge	Fenwal 107 Temperature Probe	-35° to 50° C	±0.2° C @ 0 - 60° C, ±0.4° C @ -35° C	--	1 meter
Data Logger	Campbell Scientific CR1000 Data Logger	--	--	--	--

FIGURE 4 – Gillette, Wyoming Wind Rose (2000 – 2007)

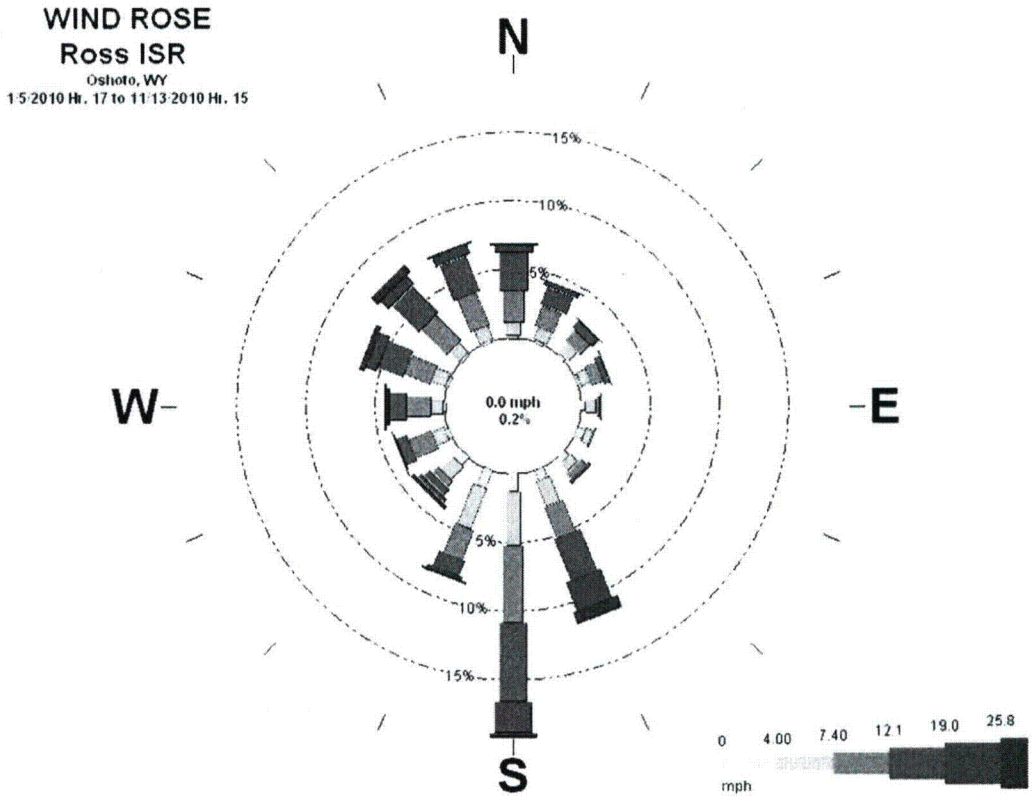


Baseline Air Sampling Plan

IML Air Science conducts baseline air quality sampling in accordance with NRC Regulatory Guide 4.14. Ambient air is sampled continuously for total suspended particulates (TSP), using low-volume air samplers positioned at five sites in the project vicinity. Figure 3 shows the locations of these sites. Three of these are situated near the permit boundary, labeled "Southwest", "East" and "South" on the Figure 3. As recommended in NRC Regulatory Guide 4.14, the East site was positioned where the air at the permit boundary is closest to, or most likely to be impacted by the proposed milling operation. A fourth sampler was placed at the Met Station site, along with the meteorological monitoring tower and instruments. AC power is not available at any of the above sites, necessitating solar power supplies and battery operation. The fifth site was located in Oshoto, near the Ross ISR project office (labeled "Office"). At less than 400 meters from the Ross ISR permit boundary, this site originally represented the nearest dwelling or occupiable structure outside the permit boundary as stipulated in NRC Regulatory Guide 4.14. AC power, available at this location, is used to operate the air sampler.

Historical data from the northeast Wyoming region indicate that the dominant winds are from the west or northwest, with a secondary mode from the southwest. Six months of meteorological monitoring at the Ross ISR Project, however, demonstrated that prevailing winds in this locale are from the south, with a secondary mode from the northwest. This pattern has persisted through the latter part of 2010 (Figure 5).

FIGURE 5 – Ross ISR Wind Rose (Jan - Nov 2010)



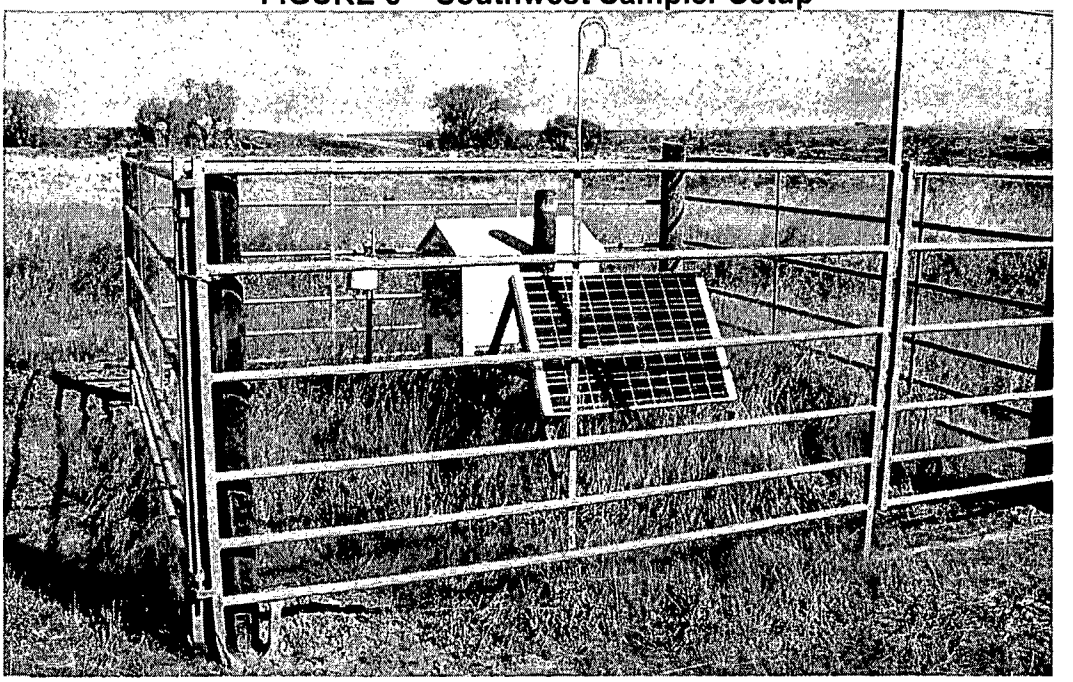
Since there is a residence a few hundred meters north of the permit boundary (and in a northerly direction from the proposed plant site), a decision was made to install a sixth air sampler at this residence ("North" site on Figure 3) to comply with the intent of Regulatory Guide 4.14:

> "Air particulate samples should be collected continuously at a minimum of three locations at or near the site boundary. If there are residences or occupiable structures within 10 kilometers of the site, a continuous outdoor air sample should be collected at or near the structure with the highest predicted airborne radionuclide concentration due to milling operations and at or near at least one structure in any area where predicted doses exceed 5 percent of the standards in 40 CFR Part 190. A continuous air sample should also be collected at a remote location that represents background conditions at the mill site; in general, a suitable location would be in the least prevalent wind direction from the site and unaffected by mining or other milling operations."

The North site is intended to account for prevailing south winds that could impact airborne radionuclide concentrations at the Wesley residence (Figure 3). The secondary mode of northwest winds is covered by the East sampler, located on the permit boundary a few hundred meters from the Strong residence. The Southwest site is least likely to be impacted either by the primary or secondary wind direction mode, and is therefore intended to represent the area unaffected by mining or milling operations.

Air particulates are sampled continuously by a low-volume, continuous air sampler installed at each of the five monitoring sites. The air samplers pull ambient air continuously through 47-millimeter, Teflon filters. The samplers are housed in weather enclosures and equipped with gooseneck inlets to insure unobstructed access to ambient air (Figure 6). The exposed filters are collected and replaced with clean filters on a weekly basis. After each quarter (13 weeks) all exposed filters from a given site are combined into a composite sample and analyzed for the radionuclides specified in NRC Guide 4.14: Uranium-238, Thorium-230, Radium-226 and Lead-210. Teflon membrane filters are used to minimize radiological interference during laboratory analysis.

FIGURE 6 – Southwest Sampler Setup



Sampler flow rates range from 20 to 30 liters/minute for the solar-operated samplers (F&J Specialty Products, Model DF-40L-AC) and from 60 to 80 liters/minute for the AC-powered sampler (F&J Specialty Products, Model LV-1D). Sampler flow rates are recorded for the AC-powered sampler before and after the weekly filter exchange. The air volume associated with this sample is calculated as the average sampler flow rate multiplied by the elapsed time between change-outs. The DC-powered samplers display cumulative time and flow volume directly; these data are recorded at each filter change-out. Each sampler is checked for air flow rate every week. All sampler calibrations are performed by the manufacturer and are represented as valid for one year. Calibration records for the air samplers appear in Appendix 2 to this document.

Data Reporting and Analysis

At the conclusion of the baseline monitoring period, meteorological data will be presented in the form of a 1-year meteorological summary, wind rose, wind speed frequency graph, precipitation and evaporation summaries, and diurnal graphs of temperature and wind speed. The report will also include a Joint Frequency Distribution for the mine sites using Pasquill atmospheric stability classes. Data recovery statistics will be reported for all logged parameters. The information from this report, along with NWS data from the region, will provide the basis for the baseline meteorological analysis submitted in the NRC License Application.

Air particulate sampling results will be reported for each of the four quarters sampled, as well as in summary fashion. This report will include air volumes sampled by each sampler, results from composite filter analysis, and implied radio-isotope concentrations (if detectable) at each of the five sampler sites. A demonstration will be made that sampled air volumes, coupled

with laboratory detection limits, meet the requirement for minimum detectable ambient concentrations of radionuclides as specified in Regulatory Guide 4.14. The information from this report will provide the basis for the baseline air quality analysis submitted in the NRC License Application.

A draft of this monitoring plan was submitted to WDEQ-AQD, the state agency responsible for issuing an air quality permit as necessary to construct a uranium mining and milling facility. A letter from WDEQ-AQD approving this monitoring plan is presented in Appendix 4 to this document.

References

1. Quality Assurance Handbook for Air Pollution Measurement Systems: Volume IV. Meteorological Measurements; EPA/600/4-90/003; August 1989; U.S. Environmental Protection Agency

2. Quality Assurance Handbook for Air Pollution Measurement Systems: Volume V. Precipitation Measurement Systems; EPA/600/R-94/038e; April 1994; U.S. Environmental Protection Agency

3. On-Site Meteorological Program Guidance for Regulatory Modeling Applications; EPA-450/4-87-013; June, 1987; U.S. Environmental Protection Agency

4. Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD); EPA-450/4-87-007; May, 1987; U.S. Environmental Protection Agency