4 EFFLUENT CONTROL SYSTEMS

The proposed MEA will generate both radioactive and non-radioactive airborne effluents during construction and/or operations. The primary effluents of concern at the proposed MEA are the release of radon gas (radon-222) and the potential for accumulation of radon progeny. As with the existing CPF, effective ventilation will be the primary effluent control at the MEA.

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Yellowcake will be processed and dried nearby at the CPF and not at the MEA. Loaded IX resin from the satellite facility will be transported to the CPF for elution, precipitation, drying, and packaging. As such, emissions from these sources will not occur at the MEA.

4.1 Gaseous and Airborne Particulates

Deleted: **<#>Effluent control systems will be used at the satellite facility to control the release of radioactive materials to the atmosphere.¶ <#>The yellowcake drying facilities at the current CPF currently consists of one operational vacuum dryer. A second dryer was installed in 2012. By design, vacuum dryers do not discharge any uranium when operating. Effluent controls for yellowcake drying at the current CPF have been reviewed by NRC and approved in the current license.¶**

4.1.1 Non-radioactive Airborne Emissions

The operation of internal combustion engines will be the primary source of non-radioactive gaseous airborne emissions. The majority of the combustion emissions are expected to be diesel emissions, which will be limited. Other minor releases may include: drilling rigs and support equipment (e.g., pipe trucks, water trucks, cement units, haul trucks, and pipe and other well completion equipment); maintenance vehicles; wellfield utility vehicles (e.g., work-over units, mechanical integrity testing units, and swabbing units); and light vehicles used during operations, construction, and travel to and from the site. Non-radioactive emissions that can be expected from such activities include CO_2, carbon monoxide, nitrogen dioxide, sulfur dioxide, PM_{10}, and total hydrocarbon (THC).

One of the primary non-radioactive emissions will be fugitive dust generated during all project phases (construction, operation, and decommissioning). Minor non-radioactive airborne effluents may include: dust from small releases of particulates during delivery and unloading of dry bicarbonate powder to a storage silo; CO_2, O_2, and water vapor vented from process operations; and dust generated during cementing operations, building construction activities (e.g., welding fumes and grinding), and various maintenance activities.

There are no significant combustion-related emissions from the process facility, as commercial electrical power is available at the site. The primary types of non-radiological pollutants that could occur during operations at the MEA site are discussed in Section 7.2. The satellite facility operational building would not house combustion devices, except for the propane heaters.

Mitigation measures to address airborne emissions are discussed in Sections 7.1, 7.2 and 7.4.

4.1.2 Radioactive Airborne Emissions

The principal radioactive airborne gaseous radiological effluent at the MEA will be radon-222 gas. Processing at the satellite facility will produce water-based solutions and loaded resins (no yellowcake processing or drying); therefore, airborne uranium concentrations are expected to be at or near background levels.

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Deleted: Airborne releases from uranium ISR facilities normally are radon-222 and its daughters from process fluids and particulates from yellowcake drying and packaging operations (NRC 2001).

4.1.2.1 Airborne Uranium Emissions

One process area at the proposed MEA where small quantities of airborne uranium particulates have the potential for occurring is the resin transfer station, where minor spills may occur. The loaded IX resin is transferred to a truck for transport to the CPF for completion of uranium recovery. Spills can occur during resin transfer, and this is where exposure to uranium particulates is possible. All spills will be cleaned up as soon as possible to prevent the wet materials from drying and creating the potential for airborne particulates. Spills associated with resin transfer would involve the impregnated resin itself. The uranium is still bound to the resin at this stage, reducing the potential of employee exposure.

Maintenance activities on piping containing pregnant lixiviant could also result in the release of radon and uranium. Any spills or releases during maintenance of these potential sources would be cleaned up promptly to prevent drying of the material and creation of particulates subject to dispersion. All non-routine operations or maintenance activities where the potential exists for significant exposure to radioactive materials, and for which there is no SOP, require a Radiation Work Permit (RWP). The RWP ensures that the applicable radiological safety measures are used by the workers, and identifies the type of personnel monitoring that would be required for determining radiation exposure (i.e., internal and external radiation).

One stationary sample point would be established near the resin transfer station and sampled monthly for potential airborne uranium particulates. Monitoring activities for routine operations, maintenance activities, and spill cleanups are discussed in Section 5.7.

4.1.2.2 Wellfield Radon Emissions

Injection wells are generally closed and pressurized, but are periodically vented, releasing radon to the atmosphere. Production wells will be continually vented to the surface, but water levels will typically be low and radon venting will be minimal. All of the well releases will be outside of buildings and directly vented to the atmosphere.

Wellhouses are vented, with exhaust fans located in the wall directly opposite the entryway. This allows personnel to immediately verify that the vent is operational. In addition, all wellhouse vents are inspected daily. Direct release to the atmosphere from the wellhouses results in rapid dispersion of the radon emissions. For the majority of the year (except during extreme cold weather), the doors will remain opened when the buildings are accessed, allowing for additional ventilation of the building during entry by personnel.

Wellfield and wellhouse offgassing is not considered a significant source of radon or a safety issue. This statement is supported by monitoring at the current CPF. Radon individual exposure levels from 1994 through 2006 for Crow Butte employees ranged from 5 to 16 percent of the occupational exposure limit of 4 working level months. Exposure to radon is reported as working level months, a unit commonly used in occupational environments and refers to exposure to a set concentration of radon and its associated progeny. Radiological exposure pathways are discussed in Section 7.3.

4.1.2.3 Satellite Plant Radon Emissions

At the CPF, a combination of passive and active ventilation systems keeps radon and radon progeny levels ALARA. An evaluation of these systems is presented in **Appendix Y**. The

Deleted: Radon-222 is found in the pregnant lixiviant that comes from the wellfield into the satellite facility. The uranium is then separated from the lixiviant by passing the solution through fixed-bed IX units operated in a pressurized downflow mode. Vessel vents from the individual IX vessels will be directed to a manifold that is exhausted to atmosphere outside the satellite building. Venting any released radon-222 gas to the atmosphere outside the satellite facility via high-volume exhaust fans minimizes employee exposure. Small amounts of radon-222 may be released via solution sampling and spills, filter changes, IX resin transfer, RO system operation during groundwater restoration, and maintenance activities. These are minimal, infrequent radon gas releases. The general l ... [16]

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evaluation noted that the large overhead doors may be open or closed at any time in the course of a day. Most important, even when all the overhead doors are closed, there is sufficient air intake capacity to maintain the desired negative pressure.

As at the CPF, in addition to exhaust fans installed in the walls, hard-piped ventilation systems will be installed for all indoor non-sealed process tanks and vessels where radon-222 or process fumes would be expected. The system consisting of air ducts or piping system connected to the top of each of the process tanks that could produce radon will include:

- IX tanks
- resin transfer tanks
- bicarbonate mix tanks

Separate hard-piped ventilation systems will be installed for areas known to emanate especially large amounts radon, such as the bicarbonate mix tanks, to ensure that exposures are maintained ALARA.

Exhaust fans will direct collected gases to discharge piping that will exhaust fumes to the outside atmosphere. The fans will be designed such that the system will be capable of limiting employee exposures with the failure of any single fan. Discharge stacks will be located away from building ventilation intakes to prevent introducing exhausted radon into the facility as recommended in RG 8.31 (NRC 2002). Airflow through any openings in the vessels will be from the process area into the vessel and into the ventilation system, controlling any releases that occur inside the vessel. These exhaust fans would be located at different levels to ensure sufficient ventilation of areas where radon could accumulate. The exhaust fans will create negative pressure, ensuring that air will not enter the process areas from vessels and systems within the satellite building. Separate ventilation systems may be used as needed for the functional areas within the satellite facility.

A tank ventilation system of this type is used in the existing CPF. An evaluation of that system is provided in **Appendix Y.** Operational radiological in-plant monitoring for radon concentrations and recent upgrades have demonstrated this system to be an effective method for minimizing employee exposure. The ventilation system at the proposed Marsland facilities would be similar to that used at the CPF. Separate and independent local ventilation systems may be used temporarily as needed for non-routine activities such as maintenance.

As discussed above for the CPF, radon daughter monitoring at the proposed satellite facility would be used to verify that radon daughters are maintained below the 25 percent Derived Air Concentration (DAC) action level. Ongoing operations would ensure that the ventilation system operates satisfactorily and as designed through the use of SOPs.

4.1.3 Response to Emergency Events Associated with Effluent Control Systems

Elevated radon levels are the primary health and safety impact of ventilation system failure. Given the redundant fans and Cameco's use of additional PPE and engineering controls, the dose impacts from ventilation system failures are maintained ALARA.

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The work area ventilation system would be designed to force air to circulate within the satellite facility process areas.¶
<#>Marsland Ventilation System¶
The ventilation system at the proposed Marsland facilities would be similar to that used at the CPF. Exhaust fans would exhaust air within the building outside to the top of the building, drawing in fresh air. The discharge stacks will be located away from the building ventilation intakes and positioned on the leeward side of the satellite building (based on predominant wind direction) to prevent introducing exhausted emissions into the facility. These exhaust fans would be located at different levels to ensure that areas where radon could accumulate are ventilated sufficiently to prevent accumulation. The exhaust fans will create a negative flow, ensuring that air will not enter the process areas from vessels and systems within the satellite building. There will be redundant fans of the same size and capacity, which will operate only when the primary fans are inoperative due to maintenance or repair.¶
Storage tanks with the potential for radon emissions would also be vented to the outside of the building. Separate and independent local ventilation systems may be used temporarily as needed for non-routine activities such as maintenance. As discussed above for the CPF, radon daughter monitoring at the proposed satellite facility would be used to verify that radon daughters are maintained below the 25 percent Derived Air Concentration (DAC) action level. Ongoing operations would ensure that the ventilation system operates satisfactorily and as designed through the use of SOPs.¶
Minor radon emissions may occur in a wellfield from wellheads and wellhouses. Vents will not be installed on wellhead enclosures, but SOPs will be followed when accessing a wellhead enclosure in order to ensure minimal exposures to personnel. Wellhouse buildings will be ventilated with ventilation systems of either a roof- or wall-mounted fan. When the buildings are accessed, the doors will be opened, allowing for additional ventilation of the building prior to entry by personnel. Radon emissions associated with wellfield operations will quickly disperse into the atmosphere.¶
Other emissions to the air are limited to exhaust and dust from limited vehicular traffic. There are no significant amounts of process chemicals that will be used at the satellite facility. There are no significant combustion-related emissions from the proc ... [21]

In response to shutdown of a fan, Cameco immediately begins a process to return the fan to service. In the meantime, Cameco can respond with additional personal protective equipment, fans and by setting up a radon progeny monitors in the vicinity for real time radon progeny levels during the maintenance or repair process.

Currently, Crow Butte adheres to requirements in the SHEQMS Volume VIII, Emergency Manual (CBR 2010a) and SOP P.16 when responding to ventilation system failures. The Marsland project will also be subject to the requirements of the manual and SOP.

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The emergency manual is a guideline. The individuals responsible for responding and managing emergencies must use their best judgment when making decisions related to the emergency. In the event of a failure of an effluent control device or other mishap that could result in exposure of an individual to elevated quantities of radiation present in gases, liquids, or solids, emergency procedures outlined in the emergency manual and other applicable procedural manuals will be implemented. Guidelines in these manuals, on which employees receive training, will be implemented to minimize individual exposures. The emergency manual addresses emergency situations such as medical emergencies, fires, explosions, radiological emergencies, chemical emergencies, transportation emergencies, natural disasters, and security threats. Appendix A of the SHEQMS Emergency Manual provides detailed instructions for responding to an emergency involving bulk, petrochemical, and compressed gases used at the site. If needed, CBR maintains emergency evacuation procedures that all employees, contractors, and visitors are trained to follow.

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At the CPF and Marsland, all ventilation fans run continuously and will be inspected daily. Fan failures at the CPF have been rare and have been readily observable. Replacement fan motors can be quickly sourced, and failures can be quickly remedied. When a fan fails or is shut down for maintenance, negative pressure remains within the building by virtue of the fans that continue to operate. Failure of the largest single fan (#5 Duct) at the CPF would result in only a 13 percent reduction in total capacity.

Deleted: CBR also maintains the SHEQMS Volume III, Operating Manual (CBR 2010b), which addresses proper operations of effluent control devices as well as procedures to follow in the event of non-emergency failures of effluent control devices.¶
The implementation of the operational and emergency manuals supports CBR efforts to eliminate exposures under both normal and accident conditions. Effluent control techniques are discussed in Subsection 5.7.1.¶

SOP P.16 for the CPF addresses repair and maintenance of current ventilation systems. This SOP will be revised to also address MEA ventilation systems. A copy of the SOP and associated inspection form has been provided to the NRC for information under a request for confidentiality.

SOP P.16 addresses:

- Restart after power bump or power outage
- Alarm response
- Evacuation requirements
- RSO notification
- Use of Prism radon progeny monitors
- System maintenance
    - Biannual roof vent inspections
    - Filter replacement
    - Blower and vent duct washing

4.1.4 ALARA Evaluations of Effluent Control Systems

As with the CPF, CBR will operate the effluent controls so that all airborne effluent releases are maintained ALARA. The recent addition of a hard-piped ventilation system dedicated to the bicarbonate mix tank at the CPF will also be incorporated into the Marsland design to ensure that employee exposures remain ALARA.

CBR maintains a strict ALARA policy to keep exposures to all radioactive material and other hazardous material as low as possible and to as few personnel as possible, as defined in the SHEQMS Volume IV, Health and Physics Manual (CBR 2010c). The project radiation control program and ALARA program are comprehensively reviewed annually. Such a review would include exposures associated with the effluent control systems.

4.2 Liquids and Solids

4.2.1 Liquid Waste

ISR mining will produce several sources of liquid waste. The potential wastewater sources that exist at the satellite facility include the following:

4.2.1.1 Water and Drill Cuttings Generated during Well Drilling and Development

Well drilling and development will generate the following wastewaters:

- "well drilling fluids" (fluids used while drilling in order to lubricate and cool the drill bit, remove drill cuttings from the borehole, and to seal the borehole walls to minimize fluid loss into the surrounding formation)
- "well development water" (generated during the under-reaming, air-lifting, and well rehabilitation phases of well installation)

Well Drilling Fluid

Well drilling fluid is drilling fluid and recovered groundwater that has not been exposed to any mining process or chemicals. However, the fluid may contain elevated concentrations of naturally occurring radioactive material from the mineralized zone. Well drilling fluid is discharged to the drilling pit where it is allowed to evaporate.

Drill cuttings will be captured within earthen drill pits during drilling. Upon completion of the hole, and the drilling fluid has evaporated, the pits will be filled in and the dirt mounded to allow for subsidence. Later, topsoil will be applied, and the site and any surface disturbance will be leveled to conform with the surrounding area. Disposal of drilling cuttings in an approved disposal pit is allowed by Nebraska Administrative Code (NAC) Title 135, Chapter 5, paragraph 002.02E.

Well Development Water

Once a well has been cased, any water generated during under-reaming, air-lifting, or other subsequent rig work that results in removing water from the cased well will be captured in water trucks specifically labeled for such purpose and equipped with signage indicating that these trucks may only discharge their contents to the MEA wastewater disposal system. The development waters collected in water trucks will be discharged into a cone bottom tank (well work-over fluid tank) at the satellite plant. That tank will feed a belt filter or other separation equipment to separate solids from water. Filtered water will be discharged to the DDW water supply tank for disposal in the onsite DDWs. Solids will be bagged for 11e.(2) disposal. This will allow treatment and disposal of the fluids without the accumulation of waste solids.

As a backup to this system, the well fluids would be transported to the existing evaporation ponds at the CPF. This option would only be used if there were equipment issues with the separation system.

4.2.1.2 Liquid Process Waste

The operation of the satellite facility results in one primary source of liquid waste, a production bleed, as previously discussed in Section 3. This bleed will be routed to wastewater tanks housed in the satellite building and then pumped from the tanks to the DDW.

4.2.1.3 Waste Petroleum Products and Chemicals

Small quantities of waste petroleum products and chemicals typical of ISR facilities will be generated and will include items such as waste oil and out-of-date or partially used reagents/chemicals. All such wastes that are non-hazardous will be temporarily stored in appropriate sealed containers above ground prior to disposal by a contracted waste disposal entity at an approved waste disposal or recycling facility. Such wastes are not considered to be affiliated with the processing or generation of 11e.(2) byproduct material and will not be classified as Atomic Energy Act-regulated waste. It is estimated that less than 50 gallons of waste petroleum products and chemicals will be disposed of annually. Any used oil that may be generated will be recycled by employing an approved commercial recycler, and such materials are not classified as a hazardous waste. Hazardous waste generation is discussed in Section 4.2.2.4.

4.2.1.4 Aquifer Restoration Waste

Following mining operations, restoration of the affected aquifer results in the production of wastewater. The current groundwater restoration plan consists of four activities:

1. Groundwater transfer
2. Groundwater sweep
3. Groundwater treatment
4. Wellfield circulation

Only the groundwater sweep and groundwater treatment activities will generate wastewater.

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<#>ISR mining will produce several sources of liquid waste. The potential wastewater sources that exist at the satellite facility include the following:¶
<#>Water Generated during Well Development¶
<#>generate,This water is recovered groundw thatand has not been exposed to any mining p or chemicals. However, the water may contai elevated concentrations of naturally occurring radioactive material if the development water is collected from the mineralized zone.wellWell development water will be captured in water trucks specifically labeled for such purpose and equipped with signage indicating that these trucks may only discharge their contents to the MEA wastewater disposal system. As described below, well development water may be transported to the CPF site for disposal in the lined evaporation ponds.trucks willWell Development water at Marsland will be discharged into a cone bottom tank (well work-over fluid tank) at the satellite plant. That tank will feed a belt filter or other separation equipment to separate solids from water. Filtered water will be discharged to the DDW water supply tank for disposal in the onsite DDWs. Solids will be bagged for 11e.(2) disposal. This will allow treatment and disposal of the fluids without the accumulation of waste solids.-,removing ,¶

During groundwater sweep, water would be extracted from the mining zone without injection, causing an influx of baseline quality water to sweep the affected mining area. The extracted water must be sent to the wastewater disposal system during this activity. As has been the case with past operations at Crow Butte, it is anticipated that, during restoration, groundwater at the MEA will be treated using IX and RO. Using this method, there would be no water consumption, and only the bleed has to be disposed, with the rest of the treated water being reinjected.

Groundwater treatment activities involve the use of process equipment to lower the ion concentration of the groundwater in the affected mining area. An RO unit will be used to reduce the TDS in the groundwater. The RO unit produces clean water (permeate) and brine. The permeate is either injected into the formation or disposed of in the wastewater disposal system. The brine is sent to the wastewater disposal system.

4.2.1.5 Stormwater Runoff

Stormwater may be contaminated by contact with industrial materials. Stormwater management is controlled under permits issued by the NDEQ. CBR is subject to stormwater NPDES permitting requirements for industrial facilities and construction activities. The NDEQ NPDES regulatory program contained in Title 119 (NDEQ 2010a) requires that procedural and engineering controls be implemented so that runoff will not pose a potential source of pollution. The design and engineering controls for the proposed MEA facilities will be such that any potentially contaminated stormwater runoff or snowmelt (e.g., any tankage diking or curbing outside of the satellite building) will be collected and disposed of in the DDW. Engineering and procedural controls contained in a Stormwater Pollution Prevention Plan (SWPPP), in combination with the design of the project facilities, will ensure that stormwater runoff is not a potential source of pollution.

4.2.1.6 Domestic Liquid Waste

Domestic liquid wastes from the restroom, toilets and lavatories and the sink in the lunchroom/break area will be disposed of in an approved septic system that meets the requirements of the State of Nebraska. The septic system will be designed with a capacity sufficient to handle the projected number of employees, contractors, and visitors. CBR currently maintains a Class V UIC Permit issued by the NDEQ for operation of the septic system at the current license area. A similar permit will be required for the satellite facility.

CBR will employ an estimated 10 to 12 employees at the proposed MEA satellite facility. Assuming 13 gallons per day (gpd) for each employee (based on estimate for industrial employees by EPA), a total of approximately 130 to 160 gpd of sanitary waste would be generated (EPA 2002). An assumed additional 50 gpd of miscellaneous sanitary wastewater (e.g., lavatories and sink in lunchroom/break area) would result in approximately 180 to 210 gpd of sanitary wastewater being discharged to the septic system.

The number of temporary construction employees for the proposed satellite facility is estimated at 10 to 15 personnel. An assumed an average of five to 10 full-time employees during construction would result in a total of 15 to 25 employees on site for some periods. This would result in approximately 200 to 325 gpd of sanitary waste generation. During initial construction, portable sanitary units will be used, which will be provided and serviced by a third-party contractor. The

septic system will be designed, constructed, operated, and permitted as per applicable NDEQ Title 124 regulations.

4.2.1.7 Liquid Waste Disposal

As discussed in Section 3.1.7, from 2015 through 2021, the majority of the wastewater produced at the MEA satellite facility requiring disposal will be the production bleed (25 to 65 gpm over the life of project). Starting in 2022, the wastewater flows will rise sharply as the bleed from the RO process used during restoration must be addressed.

Other liquid production wastewater will consist of process liquids (e.g., affected well development water, laundry water, and plant washdown water). These waste streams will account for an intermittent discharge with a maximum average of 1 to 2 gpm. The disposal water balance discussed below is of such a magnitude that these small quantities of wastewaters will be easily managed in the proposed disposal system. The well development water will be collected using a dedicated vacuum truck and delivered to the well work-over fluid tank located in the satellite building (**Figure** 5.7-2). The other liquid wastes (i.e., laundry and plant washwater originated in restricted areas) will flow to plant sumps and be transferred to a wastewater tank located within the satellite building. All of the above waste streams and tankage will be disposed of through the DDWs. The satellite building will not have a laboratory and a septic system will be used for discharges from toilets, lavatories and a sink in the lunchroom/break area. The MEA water balance is discussed in Section 3.1.7, with discussions on the management of the production and restoration waste streams.

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Upon well completion, all water generated during baseline or operational monitoring, is discharged to the surface with the exception of well rehabilitation work and excursions. When a monitor well is on excursion, the purge water is collected and disposed in the wastewater disposal system or taken to the evaporation ponds at the CPF. All water and solids resulting from well rehabilitation will be captured in water trucks and discharged into the wastewater disposal system or taken to the evaporation ponds at the CPF.

Restoration for MU-1will begin approximately in the sixth year of operation. Two major waste streams generated during restoration that will require disposal will be RO bleed and brine. The RO bleed will be disposed of over the life of the project (2021 through 2037) at an average rate of 80 to 250 gpm. The amount of brine to be disposed of will range from 167 to 250 gpm beginning in the year 2022 and continuing until 2037.

4.2.1.8 Deep Disposal Well

Like the CPF, CBR will initially use two DDWs as the primary liquid waste disposal system at the MEA site. The basic components of the system include:

- Alarmed and ventilated equalization/storage tanks in the satellite plant
- Underground piping to the deep disposal well
- A deep disposal wellhouse containing a set of filters, flowmeters, check valve, and annulus fluid tank

The DDWs will be operated without the need for surge tanks or surge/evaporation ponds.

CBR currently operates two non-hazardous Class I injection wells in the CPF license area for disposal of wastewater (DDW-1 and DDW-2). The wells are permitted under NDEQ regulations in Title 122 (NDEQ 2010b) and operated under a Class I UIC Permit. CBR has operated the initial DDW-1 at the current license area for more than 10 years with excellent results and no serious compliance issues. The second disposal well (DDW-2) started up on November 30, 2011. CBR expects that the liquid waste stream at the satellite facility will be chemically and radiologically similar to the waste disposed of in the current DDWs. Radiological data for the years 2008 and 2012 for DDW-1 injection stream are shown in **Table 4.2-1,** and radiological data for DDW-2 for the year 2012 in **Table 4.2-2.** The non-radiological data for DDW-1 and DDW-2 injection stream for 2010 are presented in **Table 4.2-3**.

Deleted: The proposed project at Marsland is the third project to be developed by CBR in Nebraska that uses DDWs to dispose of a non-hazardous waste stream associated with ISR Uranium mining operations from the basal sandstone of the Chadron Formation. ¶

The DDW at Marsland will be designed, constructed and operated like those at the CPF. The primary potential environmental impacts are surface spills from pipe failure and casing failures that release injection fluid into drinking water aquifers or the mining zone. To minimize these potential impacts the DDWs are:

- Monitored and alarmed 24-hours per day, 365 days per year to quickly detect and respond to above ground pipeline failures
- Double cased into the Pierre Shale formation with continuous flow and pressure monitoring of the injection fluid and pressure monitoring in the casing annulus
- Located inside the monitor well rings in the overlying aquifers and the mining zone
- Subject to Mechanical Integrity Testing every 2 years.

This combination of controls has and will effectively control the potential impacts to the environment.

CBR has submitted an application to the NDEQ for an Area Permit to install and operate Class I Nonhazardous Waste Injection Wells on private lands within the MEA license boundary. When approved, the Class I area permit:

- Allows initial construction and operation of two deep disposal wells
- Provides requirements for construction, monitoring, reporting, operation, abandonment, and aquifer restoration
- Allows Cameco to construct and operate additional, similarly constructed injection wells in the same injection zone, provided:
    - The NDEQ is notified of Cameco's intent to construct additional well as specified in the area permit
    - Plans and specifications for the additional wells accompany the NDEQ notification to the NDEQ
    - The additional proposed well(s) meet the requirements specified in the area permit and are approved by the NDEQ

The purpose of establishing an Area Permit is to allow for multiple injection wells to be installed at the MEA site over the expected multi-year life of the project. This permit application is for the initial two Class I Nonhazardous Waste Injection Wells to be installed under the Area Permit.

Cameco is aware that a permit modification would be required for any wells added to the Area Permit at a later date. The permit application was prepared in accordance with regulatory requirements presented in the NDEQ Assessment Section, Title 122 Rules and Regulations for Underground Injection and Mineral Production Wells (Effective April 02, 2002). The formation receiving the injected waste fluids (Injection Zone) shall be restricted to the Lower Dakota, Morrison, and Sundance Formations, which have been demonstrated to be located below the lowermost underground source of drinking water. In addition, the Lower Dakota, Morrison, and Sundance Formations exhibit water quality that is not considered under state and federal regulations to be underground sources of drinking water due to measured concentrations of their total dissolved solids.

CBR plans to install the DDWs at the satellite facility as the primary liquid waste disposal method. CBR has found that permanent deep disposal is preferable to evaporation in ponds. The basic reasons for this position are as follows:

- The potential for human contact while using a DDW is lower because the waste is handled in enclosed systems.
- The potential for emissions from the pond surface is higher than the enclosed DDW system.
- Evaporation ponds carry the potential for leaks and impacts to the environment.
- Use of evaporation ponds creates a larger amount of 11e.(2) byproduct waste.

Similar to the CPF, two DDWs at Marsland will be located in the vicinity of the satellite building (**Figure 1.7-5**). All tankage, filtration, and process equipment will be located in the satellite facility. Wastewater feed from the satellite facility will pass through a set of bag filters and will be pumped via a PVC/HDPE pipeline to the wellhouse. At the DDW wellhouse, there will be a set of filters, flowmeters, check valves, and an annulus fluid tank. In accordance with NDEQ permitting requirements, CBR will use a computer-based system to continually monitor and record the wellhead injection pressure, injection flowrate, and annulus pressure. Wellhead injection pressure and annulus pressure have audible alarms.

Two dedicated storage tanks located in the satellite building will supply feed to the DDWs. One tank will serve as the primary DDW supply tank, with all makeup water to the DDW flowing to this tank (e.g., RO brine, wellfield bleed, plant sump, and filtered well work-over fluid). At the CPF, a similar DDW water supply tank is operated at a 66 percent level and the primary DDW supply tank at the MEA site is expected to be operated in a similar fashion. All flow to the DDWs will pass through a set of bag filters at the satellite building and the DDW wellhouse. Current plans are to use the second tank for managing special wastewaters that are periodically generated, such as collecting filtered water from the well work-over fluid tank, which is then sent to the primary DDW tank for disposal. This second tank would also be used for surge capacity for the DDW well system when needed. Based upon existing operations, this occurs very infrequently.

The surge capacity will be designed to only handle short-term flows and not for long-term periods when additional capacity is needed and/or the DDWs may not be available. It is important to note that the "surge" does not happen quickly, and the flow balance is rarely disrupted. In addition, the DDW tanks are continuously monitored, and a two-level alarm system is used. Like the CPF, the discharge pump from the DDW tank will be computer-controlled. The pump speeds up and slows down automatically to maintain a 66 percent level. At all times, tank levels can be visually

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Deleted: based on CPF operations).

Deleted: Under normal operations, this tank will be operated with water levels sufficient to allow use for surge capacity.

assessed on a computer display with graphical readout. When and if the levels become high enough, the lower level and then the higher level audible alarms will sound. If further adjustments do not extinguish the lower and/or higher level alarms, the operators can curtail flows until the upset is resolved. Section 3.1.7 (MEA water balance) discusses actions that will be taken to address longer-term shutdown of the DDWs.

As noted above, the MEA DDW system will be designed and operated similar to that currently used at the CPF. Radiation exposures associated with the tanks in the MEA satellite plant will remain ALARA, as the ventilation system will be designed to incorporate the recent CPF ventilation upgrades described in Section 4.1.2.3. Radiation exposures associated with access to the DDW wellhouses are maintained at ALARA levels, as described in Section 4.1.2.2.

Deleted: In the event there is insufficient capacity of the DDW tanks to receive additional flows, such as during upset conditions, the commercial process will be immediately curtailed to allow for processing of the fluids. See

Deleted: for discussions of

Deleted: The size and detailed operations of the wastewater tanks will be defined in the detailed engineering phase of the project. ¶

Deleted: The deep well will be installed in sufficient time to be used for wastewater disposal allowed by the permit. Details of the DDW operations, controls, monitoring, waste management, and spill issues will be addressed in a future NDEQ permit application. No wastewaters will be discharged to the land surface or surface water of the State of Nebraska.

4.2.1.9 Disposal of Other Radioactive Liquids as per NRC License SUA-1534.

In addition to the use of DDWs as a disposal method, the NDEQ has issued CBR an NPDES permit for the CPF license area that allows land application of treated wastewater. CBR has not used this waste disposal method at the current operation. At this time, CBR does not intend to apply for an NPDES permit to allow land application at the satellite facility. It is expected that liquid waste generated in the MEA can be satisfactorily managed with deep disposal. If needed in an emergency situation, contaminated wastewater can be collected and trucked to an approved commercial disposal facility for disposal.

4.2.1.10 Potential Pollution Events Involving Liquid Waste

Although there are a number of potential sources of pollution present at the CPF, existing regulatory requirements from the NRC and NDEQ and provisions of the SHEQMS have established a framework that significantly reduces the possibility of a pollution incident. Extensive training of all personnel is standard policy at the existing Crow Butte facility and will be implemented at the satellite facility. Waste management facilities and systems will be inspected frequently. Detailed procedures are included in the SHEQMS, which will be adapted for use at the satellite facility.

Potential sources of pollution include the following:

4.2.1.11 Wellfield Buildings and Piping

Wellfield buildings are not considered to be a potential source of pollutants during normal operations, as there will be no process chemicals or effluents stored within. The only instance in which a wellfield building could contribute to pollution would be in the event of a release of injection or recovery solutions due to pipe failure. The possibility of such an occurrence is considered to be minimal, as the piping will be leak-checked before initial placement into service. Piping from the wellfield will generally be buried, minimizing the possibility of an accident. In addition, the flows through the wellfield, piping and manifold pressure gauges in the wellhouses are monitored 24 hours per day, 7 days per week by control room operators using visual and audible alarms. Flow monitoring systems will alarm in the event of a significant piping failure, which will allow flow to be stopped, preventing any significant migration of process fluids. Wellfield buildings will also be equipped with wet alarms for early detection of leaks.

4.2.1.12 Satellite Facility

The satellite facility will serve as a central hub for the mining operations in the MEA. Therefore, the satellite facility carries the greatest potential for spills or accidents resulting in the release of potential pollutants. Spills could result from a release of solutions due to a piping failure or a process storage tank failure.

The satellite facility building will be designed so that any release of liquid waste would be contained within the structure. A concrete curb will be built around the entire process building. This pad will be designed with a capacity equal to that of the largest tank within the building in the event of a rupture. In the event of a piping failure, the pump system will immediately shut down, limiting any release. Liquid inside the building, either from a spill or from washdown water, will be drained through a sump and sent to the liquid waste disposal system.

4.2.1.13 Deep Well Pumphouse and Wellhead

The deep well pumphouse and wellhead will be designed so that any release of liquids will be contained within the building or in a bermed containment area surrounding the facilities. Liquid inside the building will be contained and managed as appropriate.

4.2.1.14 Transportation Vehicles

The release of pollutants to the environment could occur due to accidents involving transportation vehicles. This could involve either vehicles transporting IX resin to and from the satellite facility, to the CPF, or transporting radioactive contaminated waste from the satellite facility to an approved disposal site.

All chemicals and products delivered to or transported from the satellite facility will be carried in DOT-approved packaging. In the event of an accident, procedures are currently in place in the SHEQMS Volume VIII, Emergency Manual, to ensure a rapid response.

The uranium-loaded resin will be transported from the satellite facility to the CPF processing building in a specially designed, low profile, 4,000-gallon capacity tanker trailer. The primary access route is approximately 30 miles (48.3 km) long, of which approximately 11.6 miles (18.7 km) are on county or private roads (**Figure 4.2-1**). The Alternate A access route is approximately 14 miles (22.5 km) long, with all of the roads being unpaved county and private roads. In the event of an accident, each resin transport vehicle will be equipped with an emergency contingency package whereby the driver could initiate containment of any spilled material. Because the uranium adheres to the resin and the resin is wet when transferred, the radiological and environmental impacts of a spill due to an accident would be minimal. Finally, each resin transfer vehicle will be equipped with a radio for communications with the CPF. This allows quick response and implementation of the emergency response plan for transportation accidents.

4.2.1.15 Spills

Spills can take two forms within an *in-situ* facility. These are surface spills (e.g., pond leaks, piping ruptures) and subsurface releases (e.g., well casing failure, pond liner leak) resulting in a release of waste solutions. Spill contingency plans are discussed in Section 5.7.1.3.

Engineering and administrative controls are in place at the CPF and will be implemented at the satellite facility to prevent both surface and subsurface releases to the environment, and to mitigate the effects should an accident occur. The most common form of surface release from *in-situ* mining operations occurs from breaks, leaks, or separations within the piping that transfers mining fluids from the satellite processing building to the wellfield and back. With the current CBR monitoring system, these release are generally, small, quickly discovered, and promptly mitigated.

In general, piping from the satellite facility to and within the wellfield will be constructed of HDPE with butt-welded joints or equivalent. All pipelines will be pressure-tested before final operation. A break in a buried section of line would be unlikely because no additional stress is placed on the pipes. In addition, underground pipelines will be protected from vehicles driving over the lines, which is the major cause of failure. Typically, the only exposed pipes will be at the satellite facility, at the wellheads, and in the wellhouses in the wellfield. Trunkline flows and manifold pressures will be monitored for spill detection and process control.

4.2.2 Solid Waste

Any facility or process with the potential to generate industrial waste should practice good housekeeping. This activity generally consists of keeping facilities, equipment, and process areas clean and free of industrial waste or other debris. Good housekeeping includes promptly cleaning any spillage or process residues on floors or other areas that could be spread and collecting solid wastes in designated containers or areas until proper disposal.

Solid waste generated at the satellite facility is expected to include spent resin, resin fines, empty reagent containers, miscellaneous pipe and fittings, waste oil, out-of-date reagents and domestic trash. Solid wastes will be classified as contaminated or non-contaminated waste according to survey results. The solid waste will be segregated based on whether it is clean or has the potential for contamination with 11(e).2 byproduct materials. These non-hazardous wastes will be stored in appropriate containers prior to disposal by a contracted waste disposal operator, at an approved off-site waste disposal facility.

The largest volume of solid wastes requiring disposal at the MEA site will be produced during facility decommissioning. Soils would be included in decommissioning surveys, and any soils exceeding NRC release limits at 10 CFR Part 40, Appendix A, Criterion 6 would be removed and disposed of as 11e.(2) byproduct waste. Proposed decommissioning and reclamation activities are discussed in Section 6.

4.2.2.1 Non-contaminated Solid Waste

Non-contaminated solid waste is waste which is not contaminated with 11(e).2 byproduct material or which can be decontaminated and re-classified as non-contaminated waste. This type of waste may include trash, piping, valves, instrumentation, equipment, and any other items that are not contaminated or that may be successfully decontaminated. Release of contaminated equipment and materials is discussed in further detail in Section 5.

CBR has recently estimated that the CPF produces approximately 1,055 cubic yards (yd^3) of non-contaminated solid waste per year. This estimate is based on the number of collection containers on site and the experience of the contract waste hauler. CBR estimates that the proposed satellite

facility would produce approximately 700 yd^3 of non-contaminated solid waste per year. Non-contaminated solid waste will be collected on the site in designated areas and disposed of in the nearest permitted sanitary landfill.

4.2.2.2 11(e).2 Byproduct Material

Solid 11e.(2) byproduct wastes consists of solid waste contaminated with 11e.(2) byproduct material that cannot be decontaminated.

11(e).2 byproduct material generated at ISR facilities consists of filters, personal protective equipment (PPE), spent resin, piping, and other materials. CBR has recently estimated that the CPF produces approximately 60 to 90 yd^3 of 11(e).2 byproduct material waste per year. This estimate is based on the historical number of shipments to the licensed disposal facilities. CBR estimates that the proposed satellite facility would produce approximately 60 yd^3 of 11(e).2 byproduct materials per year. These materials will be stored on site until a full shipment can be shipped to a licensed waste disposal site or licensed mill tailings facility. CBR currently maintains an agreement for waste disposal at a properly licensed facility as a License Condition for SUA-1534. CBR is required to notify NRC in writing within 7 days if the disposal agreement expires or is terminated, and to submit a new agreement for NRC approval within 90 days of the expiration or termination.

If decontamination is possible, surveys for residual surface contamination will be made prior to releasing the material. Decontaminated materials carry activity levels lower than those specified in NRC guidance (NRC 1987). An area will be maintained inside the restricted area boundary for storage of contaminated materials prior to their disposal.

4.2.2.3 Septic System Solid Waste

Domestic liquid wastes from the toilets, lavatories and a sink in the lunchroom/break areas will be disposed of in an approved septic system that meets the requirements of the State of Nebraska. The satellite building will not have a laboratory. Solid materials collected in septic systems must be disposed of by companies or individuals licensed by the State of Nebraska. NDEQ regulations for control of these systems are contained in Title 124 (NDEQ 2010c).

4.2.2.4 Hazardous Waste

The potential exists for any industrial facility to generate hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). In the State of Nebraska, hazardous waste is governed by the regulations contained in Title 128 (NDEQ 2010d). Based on waste determinations conducted by CBR as required in Title 128, CBR is a Conditionally Exempt Small Quantity Generator. To date, CBR only generates universal hazardous wastes such as fluorescent light tubes, used waste oil, and batteries. CBR recently estimated that the current operation generates approximately 1,325 liters of waste oil per year. CBR estimates that the proposed satellite facility would produce approximately 800 liters of waste oil per year. Waste oil is disposed of by a licensed waste oil recycler. CBR has management procedures in place in the SHEQMS Volume VI, Environmental Manual, to control and manage these types of wastes.

4.3 References

Cameco Resources, Crow Butte Operation (CBR). 2010a. *Safety, Health, Environment and Quality Management System. Volume VIII. Emergency Manual.*

CBR. 2010b. *Safety, Health, Environment and Quality Management System. Volume III. Operating Manual.*

CBR. 2010c. *Safety, Health, Environment and Quality Management System. Volume IV. Health Physics Manual.*

Nebraska Department of Environmental Quality (NDEQ). 2010a. Title 119, *Rules and Regulations Pertaining to the Issuance of Permits under the National Pollutant Discharge Elimination System.*

NDEQ. 2010b. Title 122, *Rules and Regulations for Underground Injection and Mineral Production Wells.*

NDEQ. 2010c Title 124, *Rules and Regulations for the Design, Operation, and Maintenance of On-site Wastewater Treatment Systems.*

NDEQ. 2010d. Title 128, *Nebraska Hazardous Waste Regulations.*

U.S. Environmental Protection Agency (EPA). 2002. Onsite Wastewater Treatment Systems Manual. EPA/625/R-00/008. February.

U.S. Nuclear Regulatory Commission. (NRC). 1980. Regulatory Guide 3.11.1, *Operational Inspection and Surveillance of Embankment Retention Systems for Uranium Mill Tailings* (Revision 1, October 1980).

NRC. 1987. *Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for By-Product, Source or Special Nuclear Material* (May 1987).

NRC. 2001. Regulatory Guide/CR-6733, *A Baseline Risk-Informed, Performance-Based Approach for In Situ Leach Uranium Extraction Licensees.* (September 2001).

NRC. 2002. Regulatory Guide 8.31, *Information Relevant to Ensuring That Occupational Radiation Exposures at Uranium Recovery Facilities Will Be As Low As Reasonably Achievable* (Revision 1, May 2002).

NRC. 2008. Regulatory Guide 3.11, *Design, Construction, and Inspection of Embankment Retention Systems at Uranium Recovery Facilities* (Revision 3, November 2008).

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Table 4.2-1 Deep Disposal Well No. 1 Injection Radiological Data for Crow Butte Central Processing Facility (2008-2012)

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Table 4.2-2 Deep Disposal Well No. 2 Injection Radiological Data for Crow Butte Central Processing Facility 2012

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Table 4.2-3 Deep Disposal Wells Injection Non-Radiological Data for Current Crow Butte Operations for 2012

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Figure 4.2-1 Proposed Access Route between Marsland Expansion Area Satellite Facility and Crow Butte Central Processing Facility

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