~~2. Portable GM survey meter with a beta/gamma probe with an end window thickness of not more than 7 mg/cm^2, a Ludlum Model 3 survey meter with a Ludlum 44-38 probe or equivalent.~~

3. ~~Swipes for removable contamination surveys as required.~~

Survey equipment is calibrated annually or at the manufacturer's recommended frequency, whichever is more frequent. Surface contamination instruments are checked daily when in use. Alpha survey meters for personnel surveys are response checked before each use, with other checks performed weekly. For additional information see Section 3.3.

As recommended in RG 8.30, CBR conducts quarterly unannounced spot checks of personnel to verify the effectiveness of the surveys for personnel contamination. A spot check of the employees assigned to the satellite facility will be conducted, concentrating on facility operators and maintenance personnel. The purpose of the surveys is to ensure that employees are adequately surveying and decontaminating themselves prior to exiting the restricted areas.

The contamination control program for the satellite facility will be implemented in accordance with the SHEQMS Volume IV, Health Physics Manual.

As noted earlier, Cameco is evaluating the implications of short-lived beta-emitting isotopes to contamination control, for both personal contamination and for free release of objects at the CPF and will incorporate the results of that evaluation, as appropriate, into the Radiation Protection Program for both the CPF and the MEA.

5.7.7 Airborne Effluent and Environmental Operational Monitoring Programs

The operational baseline monitoring program is presented in **Table 5.7-1**.

5.7.7.1 Air Particulate Monitoring

Composite airborne particulate samples for natural uranium, radium-226, lead-210, and thorium-230 will be obtained quarterly from air monitoring locations MAR-1 through MAR-~~5~~6. The quality of sample collection and analysis shall be maintained by adhering to quality control (QC) procedures discussed in Section 5.7.9 and LLC concentration limits discussed in Section 2.9.2.4

The air particulate samplers described in Section 2.9.2 will continue to be used for the operational monitoring program.

5.7.7.2 Radon

The radon gas effluent released to the environment from satellite facility will be monitored at the same air monitoring locations (MAR-1 through MAR-6~~5~~) that were used for baseline determination of radon concentrations as described in Section 2.9.2. Sampling locations are shown on **Figure 2.9-2**. Monitoring will be performed using Track-Etch radon cups. The cups will be exchanged semiannually to achieve the required LLD. SHEQMS Volume IV, Health Physics Manual currently provides the instructions for environmental radon gas monitoring. In addition to the manufacturer's Quality Assurance program, CBR will expose one duplicate radon

Track Etch cup per monitoring period. The quality of sample collection and analysis shall be maintained by adhering to QC procedures discussed in Section 5.7.9 and LLC concentration limits discussed in Section 2.9.2.4.

Monitoring of radon gas releases from the satellite facility building and ventilation discharge points is not deemed to be practicable. Section 3.3 of RG 8.37 indicates that, where monitoring effluent points is not practicable, an estimate can be made of the magnitude of these releases, with such estimated releases used in demonstrating compliance with the annual dose limit. In 10 CFR 20.1302, allowance is made for demonstrating by measurement or calculation that the TEDE to the individual likely to receive the highest dose from licensed operations does not exceed the annual dose limit of 100 mRem.

The satellite facility would use pressurized downflow IX columns, which do not routinely release radon gas except during resin transfer and column backwashing. The design and operation of these systems result in the majority of the radon in the production fluid staying in solution and not being released from the columns. Radon may be released from occasional venting of process vessels and tanks, small leaks in IX equipment, and during maintenance of equipment. Therefore, releases via the vent stacks would not have a consistent concentration of radon or flow rate, making it impracticable to try to use such data for public exposure estimates.

CBR has used MILDOS-AREA to model the dose from facility operations resulting from releases of radon gas (Savignac 201~~3~~). MILDOS-AREA outputs are presented in **Appendix M,** and are discussed in Section 7.3.3. In determining the source term for MILDOS-AREA for the satellite facility, radon gas release was estimated at 25 percent of the radon-222 in the production fluid from the wellfields and an additional 10 percent in the IX circuit in the satellite building. The release of radon-222 at this concentration did not result in significant public dose.

Environmental monitoring and estimated release of radon from process operations will be reported in the semi-annual reports required by 10 CFR § 40.65 and License SUA-1534 License Condition Number 12.1.

5.7.7.3 Surface Soil

Surface soil will be sampled as described in Section 2.9. Surface soil samples will be taken at the monitoring locations (MAR-1 through MAR-~~6~~5) during operations. Following conclusion of operations, samples will be collected and compared to the results of the PPMP. Samples shall be analyzed for natural uranium, radium-226, thorium-230, and lead-210.

Surface soil will also be sampled at the satellite plant location as described in Section 2.9. Surface soil samples will be taken following conclusion of operations and compared to the results of the PPMP. The quality of sample collection and analysis shall be maintained by adhering to QC procedures and LLD concentration limits discussed in Section 2.9.6.1.

5.7.7.4 Subsurface Soil

Subsurface soil will be sampled at the facility location as described in Section 2.9. Subsurface soil samples will be taken following conclusion of operations and compared to the results of the PPMP. The quality of samples shall be maintained by following QC

procedures discussed in Section 5.7.9 and adhering to the LLC concentration limits discussed in Section 2.9.6.1.

5.7.7.5 Vegetation

Operational Environmental Monitoring Approach

At the existing Crow Butte Operation and its Smith Ranch Highland operation in Wyoming, Cameco provided long-term data and demonstrated to the NRC that annual vegetation sampling and surface soil sampling at the air monitor locations was not required because increases in concentrations above baseline levels were not occurring.

In light of that experience, Cameco is proposing to employ ~~surrogate~~ media sampling (soil and sediment, addressed above) to identify increasing concentration trends that may require additional dose evaluation and sampling. Given the pathway dynamics, increasing detectable concentrations in the soil and sediment media will occur earlier and to a larger extent than the more attenuated levels present in the contact media (forage, food crops, livestock, and fish).

Vegetation (Forage)

At Marsland, the wind transport/deposition mechanism for contaminants ends up either in the surface soil, surface water, or as folial deposition on forage. Forage may then uptake contaminates in surface soil and shallow subsurface soil. As an alternate approach to operational vegetation (forage) sampling at Marsland, Cameco proposes to use soil samples taken annually from gardens in the AOR ~~as surrogates~~ to identify uptake trends in foliage radionuclide concentrations. If increasing concentrations are noted, Cameco will further evaluate the dose implications and if appropriate propose additional forage sampling for NRC written verification.

Surface water flows at Marsland are not suitable for ongoing monitoring given the highly sporadic nature of flows in the otherwise dry drainages. Sediment is the best media ~~surrogate~~ to track wind transport and dispersion of contaminants in lieu of operational surface water sampling. Cameco proposes to use the annual sediment ~~as surrogates~~ samples to identify potential uptake trends in foliage radionuclide concentrations. If increasing concentrations are noted, Cameco will further evaluate the dose implications and, if appropriate, will propose additional forage sampling for NRC written verification.

Folial deposition is periodic in nature and occurs only for a portion of each year; any deposited contaminants are either grazed or harvested each year or the forage dies over the winter and the is eventually returned to the soil column. In contrast, surface soil samples collected annually ~~yearly~~ accumulate deposited contamination and increase the likelihood that rising trends will be detected.

As an alternate approach at Marsland, Cameco proposes to use the annual surface soil samples collected at the air monitoring locations a~~s surrogates~~ to identify trends in airborne deposition of radionuclides. If increasing concentrations are noted, Cameco will further evaluate the dose implications and, if appropriate, propose additional forage sampling to NRC for written verification.

5.7.7.6 Food Crops, Livestock, and Fish

Food Crops (garden vegetables)

As an alternate approach to operational food crop sampling at Marsland, Cameco proposes to use soil samples taken annually from gardens in the AOR ~~as surrogates~~ to identify trends in food crop radionuclide concentrations. If increasing concentrations are noted, Cameco will further evaluate the dose implications and, if appropriate, propose additional food crop sampling to the NRC for written verification.

Livestock

Similar to the above proposals, as an alternate approach for operational livestock sampling, Cameco proposes to use the approach described above for forage and crops to trigger further evaluation of the dose implications. If appropriate, Cameco will propose additional livestock sampling to NRC for written verification.

Fish

~~There are currently no plans to collect fish for tissue analysis of radiological constituents.~~ Due to the arid nature of the area in which the MEA is located, the dry drainages that traverse to MEA license boundary do not support a fish population. The two major ephemeral drainages eventually connect to the Niobrara River, which is the nearest stream with permanent water. The river is located south of the license boundary, flowing west to east. The Box Butte Reservoir is located on the Niobrara River approximately 3.5 miles (5.6 km) from the southeastern corner of the MEA license boundary. The storm water controls (berms) employed ~~by , tThe~~ at the Marsland operation~~s~~ will ~~not~~ prevent the discharge of~~any~~ liquids into the ephemeral drainages~~ or to any other areas of the proposed operations~~.. Any spills that could occur would be contained per the site spill control plans, and it is highly unlikely that any liquid spills would ever reach the Niobrara River. ~~Therefore, operational sampling of fish is not deemed to be of value.~~ However, at certain times of the year, the Niobrara River may gain flow from Brule or Arikaree groundwater. If those sources of groundwater were contaminated, it could impact fish. Therefore operational fish samples will be collected from Box Butte Reservoir per **Table 5.7-1**.

~~As an alternative, Cameco proposes that, if upward trends in radionuclide concentrations are observed in sediment samples or groundwater monitoring samples, further dose evaluation and, if appropriate, operational fish sampling will be proposed to NRC for written verification. This alternative is justified because surface water flow is absent and because contaminant releases will be significantly attenuated due to the distance to Box Butte Reservoir. Unlike the Niobrara River upstream, Box Butte Reservoir is the only location where sufficient fish mass exists to allow sampling and analysis.~~

5.7.7.7 Direct Radiation

Environmental gamma radiation levels will be monitored continuously at the air monitoring stations (MAR-1 through MAR-~~6~~5) during operations. Gamma radiation will be monitored using environmental dosimeters obtained from an NVLAP certified vendor. Dosimeters will be exchanged quarterly.

5.7.7.8 Sediment

~~Upstream and downstream s~~Sediment samples will be collected annually at the sample locations described in Section 2.9 and shown in **Figure 2.7-4**. Samples will be collected as described in Section 2.9.7 and analyzed for natural uranium, radium-226, thorium-230, and lead-210. The quality of sample collection and analysis shall be maintained by adhering to QC procedures as discussed in Section 5.7.9 and LLC concentration limits discussed in Section 2.9.7.1.

5.7.8 Groundwater/Surface Water Monitoring Program

5.7.8.1 Program Description

During operations at the satellite facility, a detailed water sampling program will be conducted to identify any potential impacts to water resources of the area. The CBR operational water monitoring program includes the regional evaluation of groundwater, groundwater within the permit or licensed area, and surface water on a regional and site-specific basis. The quality of sample collection and analysis shall be maintained by adhering to QC procedures discussed in Section 5.7.9.

5.7.8.2 Groundwater Monitoring

The groundwater excursion monitoring program is designed to detect excursions of lixiviant into the ore zone aquifer outside of the wellfield being leached and into the overlying water-bearing strata. Monitor wells will be placed in the basal sandstone of the Chadron Formation and in the overlying Brule and Arikaree aquifers. All monitor wells will be completed by one of the three methods discussed in Chapter L, developed prior to recovery solution injection. The development process for monitor wells includes establishing baseline water quality before the initiation of mining operations.

The Pierre Shale below the ore zone is more than 1,200 feet thick and contains no water-bearing strata. Therefore, it is not necessary to monitor any water-bearing strata below the ore zone.

5.7.9 Private Well Monitoring

During operations, on a quarterly basis, all active, operational and accessible private wells located within the MEA license boundary and within 0.62 mile (1 km) of the MEA license boundary will be monitored (**Figures 2.7-6 and 2.9-3**). Groundwater samples are taken in accordance with the instructions contained in SHEQMS Volume VI, Environmental Manual, and samples are analyzed for natural uranium and radium-226. Water well samples will be collected and analyzed as described in Section 2.9.3.1.

5.7.9.1 Monitor Well Baseline Water Quality

After delineation of the production unit boundaries, monitor wells are installed no further than 300 feet from the wellfield boundary and no further than 400 feet apart or as required by the NDEQ. After completion, wells are washed out and developed (by air-lifting or pumping) until pH and specific conductivity appear stable and consistent with the anticipated quality of the area. After development, wells are sampled to obtain baseline water quality data. For baseline