PROPOSED DEVELOPMENT OF NEW TAILINGS CELL 4B FOR THE WHITE MESA URANIUM MILL

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EXECUTIVE SUMMARY

Denison Mines (USA) Corp. (DUSA) operates the White Mesa Uranium Mill (hereafter referred to as the "mill") in San Juan County, Utah, approximately 6 miles (9.6 km) south of the city of Blanding. The mill is located on a parcel of land and mill site claims covering approximately 5,415 acres (2,191 ha). The mill is licensed by the State of Utah Division of Radiation Control (DRC) to process uranium ore and selected alternate feed materials.

In February 2007, SENES prepared a dose assessment for DUSA in support of the license renewal application for the mill (SENES 2007, also referred to as the previous report). MILDOS-AREA was used to estimate the dose commitments that could potentially be received by individuals and the general population within a 50 mile (80 km) radius for processing of conventional ores. The assessment was prepared for scenarios in which Colorado Plateau (0.25% U_3O_8 and 1.5% V_2O_5) or Arizona Strip (0.637% U_3O_8 and no V_2O_5) ores are processed at the mill.

This dose assessment extends the analyses of the previous report of February 2007 to incorporate the dose from the proposed development of new tailings Cell 4B, anticipated to be completed for use in 2009, in support of a license amendment application by DUSA for construction and operation of that cell. In doing the dose assessment for Cell 4B, we have updated the assumptions we used in February 2007 for modeling tailings Cells 1, 2, 3 and 4A to reflect the current operational status of the site, including the re-commissioning of Cell 4A for use in 2008. For purposes of modeling mill operations, we have separated operations into two phases. Phase 1 involves the continued use of Cell 1 for solution evaporation, the continued use of Cell 3 for solution evaporation and the disposal of tailings solids, and the use of Cell 4A for disposal of tailings solids and solution evaporation. Phase 2 occurs after Cell 3 is full and is no longer an active cell. During Phase 2, Cells 4A and 4B are used for disposal of tailings solids and solution evaporation, and Cell 1 is used for solution evaporation. In each Phase, Cell 2, with interim soil cover over the entire cell area, is included in the model, and in Phase 2, Cell 3, with interim soil cover over the entire cell area, is included in the model.

The United States Nuclear Regulatory Commission (NRC)-approved MILDOS-AREA was used to estimate the dose commitments received by individuals and the general population within a 50 mile (80 km) radius of the site for the processing of either Colorado Plateau or Arizona Strip ore separately. In each scenario, the doses arising from emissions of dust and radon from the mill area (excluding the tailings cells) and ore pads were assumed to be the same as the previous 2007 report since the scenarios both involve the processing of Colorado Plateau and Arizona Strip ores. Therefore, MILDOS-AREA runs from the previous report were revised to exclude the tailings cells. The doses from the tailings cells were estimated in separate MILDOS-AREA runs

and added to the dose from the mill area and ore pads. Table ES-1 provides a summary of the source terms included in Phases 1 and 2 of the development of new tailings cells.

TABLE ES-1
SOURCE TERMS INCLUDED IN PHASES 1 AND 2

Source Term	Phase 1	Phase 2
Mill area	included	included
Ore Pads	included	included
Tailings Cell 2 with Interim Soil Cover	included	included
Tailings Cell 3	active	interim soil cover
Tailings Cell 4A	active	active
Tailings Cell 4B	excluded	active

The wind erosion and radon release rates from the tailings cells (active and with interim soil cover) were modelled by using a maximal worst case approach.

Each active tailings cell was modelled to have an active exposed (non-solution) tailings solids area of 10 acres (i.e., the maximum uncovered tailings solids area at any time allowed under NESHAPs Regulation 40 CFR 61.252(b), Subpart W) since it is not possible to predict the distribution of uncovered tailings between the active cells at any given time. As a result, the release rate of wind-eroded tailings dust was estimated at 10 acres at all times for each active cell. We understand that during the active life of each cell, the average exposed tailings solids will be less than 10 acres, so this assumption is considered to be conservative. The total annual radon release rate was estimated by assuming a radon release rate of 20 pCi/m^2s (i.e., maximum radon-222 emissions to ambient air from an existing uranium mill pile) over the entire area of each cell consistent with NESHAPs. Actual radon emission rates from the tailings cells have historically been well below 20 pCi/m^2s, so this assumption is also considered to be conservative.

Emissions from the tailings cells (2 and 3) with interim soil cover were assumed to occur over the entire area of each cell; however, only radon is released at a rate of 10 pCi/m^2s after the application of the soil cover.

The calculated total annual effective dose commitments (including radon) calculated using MILDOS-AREA were compared to the Utah Administrative Code R313-15-301(1)(a) requirement that the dose to individual members of the public shall not exceed 100 mrem/yr (radon included). For the processing of Colorado Plateau ore, the maximum total annual effective dose commitments was calculated to be a maximum of 1.4 mrem/yr for an infant at the nearest potential resident, BHV-1 (Tables 6.1-1 and 6.1-3) (i.e., effective dose) and is about 1.4% of the R313-15-301(1)(a) limit of 100 mrem/yr (radon included) to an individual member

of the public, for Phases 1 and 2. For the processing of Arizona Strip ore, the total annual effective dose commitments were calculated to be a maximum of 3.1 mrem/yr for an infant at the nearest potential resident, BHV-1 (Tables 6.2-1 and 6.2-3) (i.e., effective dose) and is about 3.1% of the 100 mrem/yr limit (radon included) to an individual member of the public, for Phases 1 and 2. Overall, using conservative assumptions, the predicted annual effective dose commitments for Phases 1 and 2 comply with R313-15.

In addition, our MILDOS-AREA calculated 40 CFR 190 annual dose commitments (excluding radon) were compared to the 40 CFR 190 criterion, which is 25 mrem/yr to the whole body (excluding the dose due to radon) and 25 mrem/yr to any other organ to any member of the public (EPA 2002). The 40 CFR 190 doses were also used to demonstrate compliance with the ALARA (As Low As Reasonably Achievable) goal set out in R313-15-101(4) (10 CFR 20.1101(d)) (i.e., the ALARA goal is to demonstrate that total effective dose equivalent to the individual member of the public likely to receive the highest total effective dose equivalent will not exceed 10 mrem/yr (absent of the radon dose)). For the processing of Colorado Plateau ore, the 40 CFR 190 annual dose commitments were calculated to be a maximum of 4.8 mrem/yr for a teenager at the nearest potential resident, BHV-1 (Tables 6.1-5 and 6.1-8) (i.e., dose to the bone) and is about 19% of the 40 CFR 190 dose criterion of 25 mrem/yr, for Phases 1 and 2. Further, the 40 CFR 190 annual effective dose commitments demonstrate compliance with the R313-15-101(4) (10 CFR 20.1101(d)) ALARA goal of 10 mrem/yr to the individual member of the public likely to receive the highest total effective dose equivalent (the maximum total effective dose equivalent (radon excluded) during Phases 1 and 2 was 0.545 mrem/yr for an infant at BHV-1.). For Arizona Strip ore, the 40 CFR 190 annual dose commitments were at most 12 mrem/yr for a teenager at the nearest potential resident, BHV-1 (Tables 6.2-5 and 6.2-8) (i.e., dose to the bone) and is about 49% of the 40 CFR 190 dose criterion of 25 mrem/yr for Phases 1 and 2. Further, the 40 CFR 190 annual effective dose commitments demonstrate compliance with the R313-15-101(4) (10 CFR 20.1101(d)) ALARA goal of 10 mrem/yr to the individual member of the public likely to receive the highest total effective dose equivalent (the maximum total effective dose equivalent (radon excluded) during Phases 1 and 2 was 1.39 mrem/yr for an infant at BHV-1). Overall, using conservative assumptions, ore processing in Phases 1 and 2 comply with the requirements of 40 CFR 190 and the ALARA goal set out in R313 -15-101(4).

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ACRONYMS & ABBREVIATIONS

ALC	Allowable Concentration
ANL	Argonne National Laboratory
ALARA	As Low As Reasonably Achievable
Avg.	average
ASCII	American Standard Code for Information Interchange
Bi-210	bismuth-210
Bi-214	bismuth-214
CCD	Counter Current Decantation
CFR	Code of Federal Regulations
Ci	curie
DCF	Dose Conversion Factor
DRC	State of Utah Division of Radiation Control
DUSA	Denison Mines (USA) Corp.
EPA	United States Environmental Protection Agency
E_W	Process Emission Factor
F	Radon Release Rate
FES	Final Environmental Statement
F_S	annual frequency of occurrence of wind group S
ft	feet
ft^3	cubic feet
g	grams
g ore	grams of ore
GPS	Global Positioning System
GUI	Graphical User Interface
ha	hectares
hr	hours
ICRP	International Commission on Radiological Protection
ID	Induced Draft
lbs	pounds
km	kilometers
kts	knots
NESHAPs	National Emission Standards for Hazardous Air Pollutants
NRC	United States Nuclear Regulatory Commission
NUREG	Regulatory Guide
m	meters
m^2	square meters
mrem	millirem
MPC	Maximum Permissible Concentration

Pb-210	lead-210
Pb-214	lead-214
pCi	picocurie
Po-210	polonium-210
Po-218	polonium-218
Ra-226	radium-226
Rn-222	radon-222
R_S	Resuspension rate for wind group S
s	seconds
S	Radionuclide Emission Rate
SENES	Specialists in Energy, Nuclear and Environmental Sciences
TGLM	Task Group on Lung Dynamics Lung Model
Th-230	thorium-230
tpy	tons per year
U_3O_8	triuranium octoxide ("Yellowcake")
Unat	natural uranium
U-234	uranium-234
U-235	uranium-235
U-238	uranium-238
V_2O_5	vanadium pentoxide
yd^3	cubic yards
yr	year

1.0 INTRODUCTION

1.1 BACKGROUND

Denison Mines (USA) Corp. (DUSA) operates the White Mesa Uranium Mill (hereafter referred to as the "mill") in San Juan County, Utah, approximately 6 miles (9.6 km) south of the city of Blanding. The mill is located on a parcel of land and mill site claims covering approximately 5,415 acres (2,191 ha). The mill was built in 1979 and licensed by the United States Nuclear Regulatory Commission (NRC) to process uranium ore and selected alternate feed materials. The mill began operations in July 1980. In August 2004, the State of Utah became an Agreement State for the regulation of uranium mills, and primary regulatory authority over the mill was assumed by the State of Utah Division of Radiation Control (DRC) at that time.

The mill is a standard design with both uranium and vanadium circuits and uses the acid leach-solvent extraction process for uranium recovery from uranium ores and uranium/vanadium ores. Vanadium in uranium/vanadium-bearing ores is partially solubilized during leaching, and the dissolved vanadium present in uranium raffinate is further processed for recovery of vanadium before recycling (NRC1979).

In the early 1990s, the mill began receiving "alternate feed material" (uranium-bearing materials other than conventionally mined ores) for processing. From 1999 to present, the mill has relied solely on alternate feed materials. The mill goes on standby for periods of time and then it processes the stockpiled alternate feeds for the recovery of uranium. The residual tailings from these processes are stored in the tailings cells on-site. DUSA has commenced mining activities in the Colorado Plateau district and conventional ores are being hauled and stockpiled at the mill. In addition, DUSA has mining assets in the Arizona Strip, and mining of those ores is expected to commence in 2008. Milling of conventional ore is scheduled for Spring 2008, when the milling of currently available alternate feed material is completed (DUSA 2007a).

In February 2007, SENES prepared a dose assessment for DUSA in support of the license renewal application for the mill (SENES 2007, also referred to as the previous report). MILDOS-AREA was used to estimate the dose commitments that could potentially be received by individuals and the general population within a 50 mile (80 km) radius for the processing of Colorado Plateau or Arizona Strip ores separately. (MILDOS-AREA is an NRC approved code designed as a tool to provide input on regulatory and compliance evaluations for various uranium recovery operations.) The following assumptions were used in the previous report:

- Colorado Plateau ore contains an average of 0.25% U_3O_8 and 1.5% V_2O_5 (NRC 1980). The vanadium content in the ore is further processed for recovery before recycling.
- Arizona Strip ore contains 0.637% U_3O_8 and no vanadium (Landau 2007).

- The activity concentrations of U-238 in Colorado Plateau and Arizona Strip ore were 700 and 1783 pCi U-238/g ore, respectively.
- The proposed ore process rate was assumed to be 730,000 tons per year (tpy) (an average of 2,000 tons per day). Therefore, assuming that the average uranium recovery would be at the historical recovery yield of 94%, approximately 1,715 tons (3,431,000 lbs) of U_3O_8 per year would be recovered from Colorado Plateau ore at the proposed ore process rate. Similarly, approximately 4,371 tons (8,742,000 lbs) of U_3O_8 per year would be recovered from Arizona Strip ore at the proposed ore process rate.

1.2 OBJECTIVE

The objective of this report is to extend the analyses of the previous report of February 2007 to incorporate the dose from the proposed development of new tailings Cell 4B, anticipated to be completed for use in 2009, in support of a license amendment application by DUSA for construction and operation of that cell. In doing the dose assessment for Cell 4B, we have updated the assumptions we used in February 2007 for modeling tailings Cells 1, 2, 3 and 4A to reflect the current operational status of the site, including the re-commissioning of Cell 4A for use in 2008. Otherwise, we have made as few changes to the 2007 calculations as possible. MILDOS-AREA was used to estimate the dose commitments that could potentially be received by individuals and the general population within a 50 mile (80 km) radius of the site for the processing of Colorado Plateau or Arizona Strip ores using the assumptions provided in Section 1.1.

1.3 APPROACH

The approach used for this assessment was to extend the previous report to incorporate the dose from the proposed development of Cell 4B, with as few changes to the calculations as possible. For purposes of modeling mill operations, we have separated operations into two phases. Phase 1 involves the continued use of Cell 1 for solution evaporation, the continued use of Cell 3 for solution evaporation and the disposal of tailings solids and the use of Cell 4A for disposal of tailings solids and solution evaporation. Phase 2 occurs after Cell 3 is full and is no longer an active cell. Phase 2 involves the use of Cell 1 for solution evaporation and Cells 4A and 4B for disposal of tailings solids and solution evaporation. In each Phase, Cell 2, with interim soil cover over the entire cell area, is included in the model, and in Phase 2, Cell 3, with interim soil cover over the entire cell area, is included in the model.

Since there are two types of ore, MILDOS-AREA runs were created to assess the dose from processing of the Colorado Plateau and Arizona Strip ores separately (hereafter referred to as Scenario 1 and 2, respectively). Each scenario/ore was analyzed with the following separate MILDOS-AREA runs:

- Tailing Cell 2 with Interim Soil Cover;
- Tailings Cell 3 with Interim Soil Cover;
- Tailings Cell 3;
- Tailings Cell 4A;
- Tailings Cell 4B; and
- All source terms (at the mill including the ore pads) except for tailings cells (hereafter referred to as the mill area).

The dose from each tailings cell was calculated in separate MILDOS-AREA runs to allow for the flexibility of calculating the incremental doses from the different combination of tailings cells to the mill area and ore pads for the two anticipated development Phases. Table 1.3-1 provides a summary of the source terms included in Phases 1 and 2 of the development of new tailings cells.

TABLE 1.3-1
SOURCE TERMS INCLUDED IN PHASES 1 AND 2

Source Term	Phase 1	Phase 2
Mill area	included	included
Ore Pads	included	included
Tailings Cell 2 with Interim Soil Cover	included	included
Tailings Cell 3	active	interim soil cover
Tailings Cell 4A	active	active
Tailings Cell 4B	excluded	active

1.4 CONTENTS OF THIS REPORT

The remainder of this report is arranged into seven sections.

Section 2.0, **Regulatory Compliance**, provides a description of the regulatory framework pertaining to the applicable dose limits to members of the public from licensed activities at the mill.

Section 3.0, **Radiation Dose Assessment**, describes the method used to estimate the radiation doses to members of the public and how MILDOS-AREA was used.

Section 4.0, **Source Terms**, describes the source terms and source emission rates related to the ore processing operations and other input parameters required (i.e., meteorological data and population data) for the MILDOS-AREA runs. The source emission rates were calculated for processing Colorado Plateau and Arizona Strip ores based on the ore grade, ore process rate and uranium recovery yield described in Section 1.1.

Section 5.0, **Receptors**, describes the receptors used in the MILDOS-AREA runs.

Section 6.0, **Radiation Dose Estimates**, provides the dose results from the MILDOS-AREA runs using the parameters described in Sections 4.0 and 5.0.

Section 7.0, **Overviews**, provides a summary of the dose estimates for the two Phases in each scenario.

Section 8.0, **References**, provides a list of reference material used to prepare this report.

Appendix A: **History of MILDOS-AREA,** describes how the MILDOS-AREA software has evolved, highlighting some of the key differences between the updated version, MILDOS-AREA (ANL 1998a), and the original version of MILDOS.

Appendix B: **Emissions Calculations,** describes the basis of the emission estimates for each source.

Appendix C: **MILDOS-AREA Results,** provides the dose estimates for MILDOS-AREA runs for the mill area (including the ore pads) and each tailings cell.

2.0 REGULATORY COMPLIANCE

DRC has the regulatory authority over the license issued for the site. As required by Utah Administrative Code R313-15-101(2), the mill shall, to the extent practical, employ procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are as low as reasonably achievable (ALARA). Under R313-15-301(1)(a), the licensee is required to demonstrate that the total dose equivalent to individual members of the public from the licensed operation does not exceed 0.1 rem (100 mrem) in a year (including radon), exclusive of the dose contribution from natural background and medical sources. Under 10 CFR 20.1301 (NRC 1991), NRC has adopted the provisions of the United States Environmental Protection Agency (EPA) environmental radiation standards in 40 CFR 190 (EPA 2002). This subpart requires that the licensee provide reasonable assurance that the radiation attributed to mill operations does not exceed the annual dose of 25 mrem/yr to the whole body, 75 mrem/yr to the thyroid and 25 mrem/yr to any other organ of any member of the public (radon and it daughters excepted). In addition, 10 CFR 20.1301 (d) (R313-15-101(4)) sets an ALARA goal on air emissions of radioactive material to the environment, excluding radon-222 and its daughters such that the individual member of the public likely to receive the highest total effective dose equivalent will not exceed 10 mrem/yr.

3.0 RADIATION DOSE ASSESSMENT

3.1 GENERAL INFORMATION ABOUT MILDOS-AREA

MILDOS-AREA only considers airborne releases of radioactive materials; releases to surface water and groundwater are not addressed. The U-238 decay chain was assumed to be the only significant source of radiation from uranium milling operations (the radioactivity contribution from the U-235 chain is less than 5% of that from the U-238 chain). The particulate releases include U-238, Th-230, Ra-226 and Pb-210. The gaseous releases are defined for Rn-222 with in-growth of short-lived daughter products also considered. These Rn-222 daughters include Po-218, Pb-214, Bi-214, Pb-210 and Po-210. The model accounts for the releases and in-growth of other radionuclides using the assumption of secular equilibrium within the U-238 decay chain.

The transport of model radiological emissions from the point and area sources is predicted using a sector-averaged Gaussian plume dispersion model. The dispersion model uses the meteorological data provided by the user and also includes mechanisms of dry deposition of particulates, re-suspension, radioactive decay and progeny in-growth and plume reflection. Deposition build-up and in-growth of radioactive progeny are considered in estimating ground concentrations.

The impacts to humans through various pathways are estimated based on the calculated annual average air concentrations of radionuclides. The pathways considered in this analysis include: inhalation, external exposure from ground concentrations, external exposure from cloud immersion, and ingestion of meat and vegetables.

3.2 THE USE OF MILDOS-AREA IN THIS ASSESSMENT

As described in Section 1.3, the approach for this assessment was to extend the previous report (SENES 2007) to incorporate the dose from the proposed development of Cell 4B, with as few changes to the calculations as possible. MILDOS-AREA (version 2.20β (ANL 1998a)) was used to estimate potential radiation doses to members of the public estimated from the processing of Colorado Plateau or Arizona Strip ores, with separate runs for each scenario/ore. (Information about the history of MILDOS-AREA is provided in Appendix A). In Scenario 1, 1,715 tons (3,430,100 lbs) of U_3O_8 per year of Colorado Plateau ore would be recovered at the proposed ore process rate of 730,000 tpy (assuming that the average uranium recovery is 94%). Similarly in Scenario 2, 4,371 tons (8,742,000 lbs) of U_3O_8 per year of Arizona Strip ore would be recovered.

In order design a conceptual model of the mill, MILDOS-AREA requires the user to define source and receptor locations and source emissions. The locations of sources and receptors are defined in MILDOS-AREA by providing Cartesian coordinates of the source/receptor relative to

a reference point. The coordinates of a point source are entered directly while the user must enter vertex coordinates for an area source.

In this assessment, the location of all sources (except for the tailings cells) and receptors were taken from the previous report. The coordinates relative to the vanadium stack (i.e., the reference point for the site) were determined by plotting the GPS coordinates (provided by DUSA (Turk 2007a)) in Google Earth Pro (Google 2005). A description of the tailings cells is provided in Section 4.0. The source emissions were calculated using guidance from NRC Regulatory Guide 3.59 (NRC 1987) and NUREG-0706 (NRC 1980). Radionuclide emission for radioactive particulates and radon are entered directly for point sources. For area sources, MILDOS-AREA calculates the radionuclide emission for radioactive particulates and radon based on the release rates and source area.

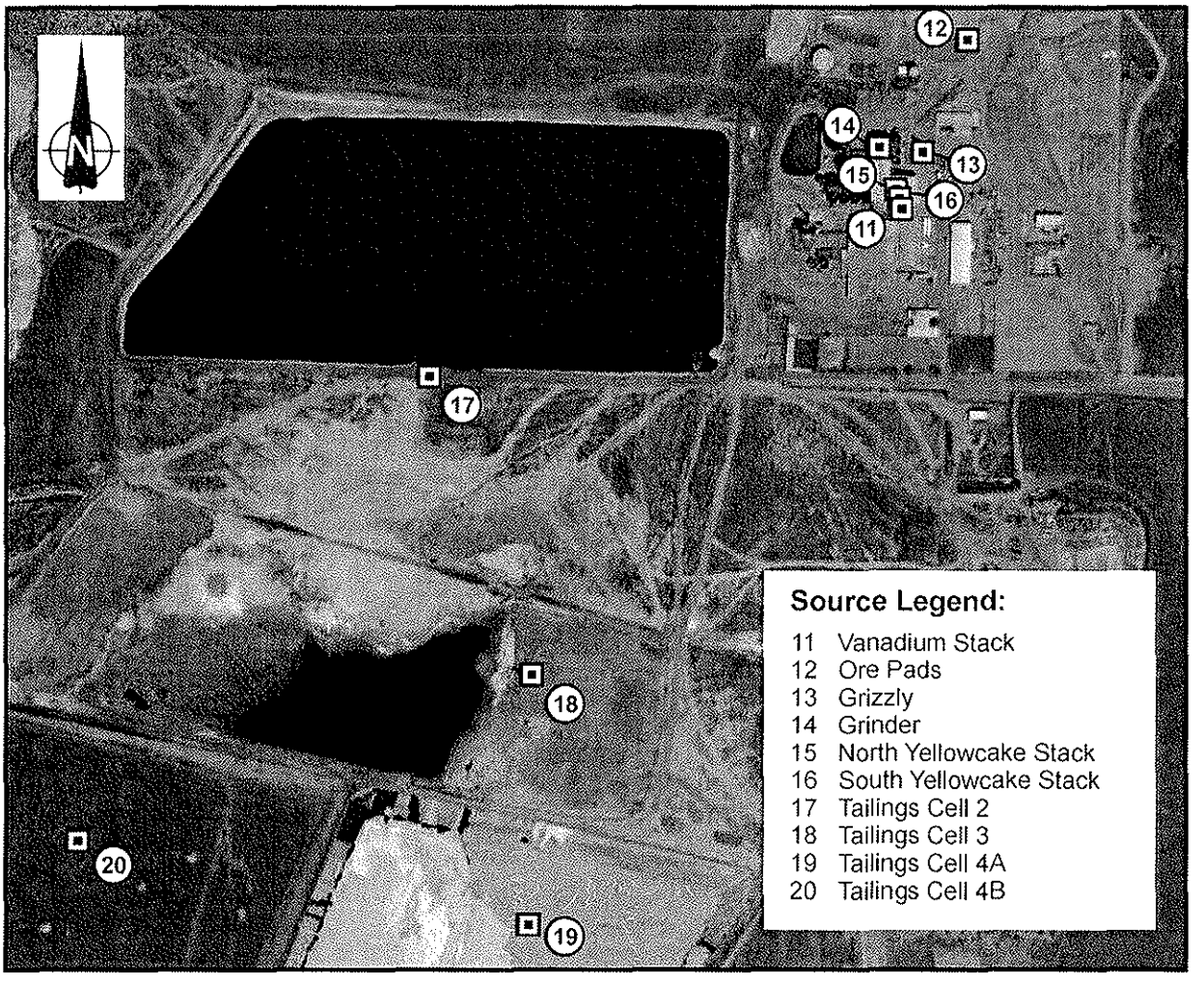
Since all source terms except for the tailings cells were taken from the previous report, the MILDOS-AREA run (from the previous report) for each scenario was revised to include all source terms except for the tailings cells. (Descriptions and emission rates for each source are provided in Section 4.0, and detailed emission estimates can be found in Appendix B.) The tailings cells were re-modelled individually in MILDOS-AREA as large area sources. Descriptions and emission rates for each cell are provided in Section 4.0, and detailed emission estimates are provided in Appendix B.

4.0 SOURCE TERMS

The radionuclides of concern for the MILDOS-AREA model include: U-238 and its daughters Th-230, Ra-226, Pb-210 and Rn-222, which were assumed to be in secular equilibrium with the ore. The radioactive particulates and radon are emitted from airborne radioactive releases related to dust generation during ore handling (unloading ore from truck to ore pads and loading ore to the grizzly), point sources (grinder, yellowcake stacks and vanadium stack (only Scenario 1)) and area source dusting from ore pad stockpiles and the tailings cells. As mentioned in Section 3.2, all source terms except for the tailing cells were taken from the previous report. The locations of all point sources except for the grinder were determined by plotting the GPS coordinates (provided by DUSA (Turk 2007a)) in Google Earth Pro; and then using the measuring tool to measure the easting, northing and elevation of each source relative to a reference point at the mill (i.e., the vanadium stack).

The tailings cells were modelled as large area sources in MILDOS-AREA and located at the top centre of each cell. Figure 4.1 shows the locations (plotted in Google Earth) of all sources used in this assessment.

FIGURE 4.1
SOURCE LOCATIONS



The doses to members of the public were estimated for the processing of Colorado Plateau or Arizona Strip ore in separate scenarios/runs. Therefore, the emission calculations are provided for each ore type based on the activity concentration of U-238 in the ore, expected ore grade, average uranium recovery and the proposed ore process rate. The MILDOS-AREA model for Colorado Plateau ore has an additional point source (i.e., vanadium stack) since the ore may contain vanadium (assumed at 1.5% V_2O_5). The approaches used to calculate the emissions from the point and area sources are described in Sections 4.1 and 4.2, respectively. Detailed source emissions calculations for all source terms are provided in Appendix B.

4.1 POINT SOURCES

Mill point sources used in this assessment include the grinder, loading ore to the grizzly and yellowcake stacks (north and south). The vanadium stack described in Section 4.1.4 is exclusive to the processing of Colorado Plateau ore. A description of the approach used to calculate the emissions from point sources is provided in this section.

4.1.1 Grinder

There is no on-site crushing of the ore, only a wet grinding operation. The ore dust emissions are controlled because the material is wet during the grinding operations. The particulate emission control from the grinding operation was assumed to be 99.9% (EnecoTech 1991a and 1991b). With these assumptions, U-238 and its decay daughters (assuming secular equilibrium) would be emitted at a rate of 9.27E-05 and 2.36E-04 Ci/yr for Colorado Plateau and Arizona Strip ore, respectively. The emission rates for Rn-222 released during wet grinding was calculated assuming that only 20% of the radon is available for release or emanation from the mineral grains in which it is produced (NRC 1980). The Rn-222 concentration in the ore was assumed to be equal to the U-238 concentration. The Rn-222 released during wet grinding is 92.7 and 236 Ci/yr for Colorado Plateau and Arizona Strip ore, respectively.

4.1.2 Grizzly

The emissions from trucks dumping ore onto the grizzly are highly controlled; the truck dump area is enclosed on three sides and has a negative pressure on it during dumping activities. The ore is delivered wet with an average moisture content of 10%. The exhaust from the induced draft (ID) fans used on the grizzly is ducted through a baghouse (EnecoTech 1991a and 1991b). The combined particulate dust control on this operation was assumed to be 99.9% (EnecoTech 1991a and 1991b). With these assumptions, U-238 and its decay daughters (assuming secular equilibrium) would be emitted at a rate of 9.27E-05 and 2.36E-04 Ci/yr for Colorado Plateau and Arizona Strip ore, respectively.

4.1.3 Yellowcake Stacks

The mill has two yellowcake dryers (north and south yellowcake dryers). From the EnecoTech analysis, stack tests on the yellowcake dryer yielded a yellowcake emission rate of 0.06 lbs/hr U_3O_8 when the process rate was 1300 lbs/hr. This yields an emission rate of 0.092 lbs/hr of yellowcake per ton of feed (EnecoTech 1991a and 1991b). The emission rate is with all the particulate emissions controls. Since there are north and south yellowcake dryers, the stack emissions from U-238 and its decay daughters are assumed to be divided equally between the two (i.e., north and south yellowcake stacks). With these assumptions, U-238 would be emitted at a rate of 1.01E-02 and 2.36E-04 Ci/yr for Colorado Plateau and Arizona Strip ore, respectively.

Based on field measurements, the decay daughters of U-238 (Th-230, Ra-226 and Pb-210) are processed along with yellowcake at 0.22%, 0.13% and 0.78% of U-238, respectively (EnecoTech 1991a and 1991b). Therefore, the decay daughters Th-230, Ra-226 and Pb-210 are emitted at a rate of 2.22E-05, 1.31E-05 and 7.88E-05 Ci/yr, respectively for Colorado Plateau ore. Similarly, the decay daughters Th-230, Ra-226 and Pb-210 are emitted at a rate of 5.67E-05, 3.35E-05 and 2.01E-04 Ci/yr, respectively for Arizona Strip ore.

Since the ore processing steps reject nearly all the radium to the tailings, very little radon is released during the production of yellowcake. No significant radon releases occur during yellowcake drying and packaging, since only about 0.1% of the original Ra-226 in the ore is found in yellowcake. Therefore, the amount of Rn-222 emitted from the yellowcake stack was assumed to be negligible.

4.1.4 Vanadium Stack

The vanadium stack source term was only used in the MILDOS-AREA run for Colorado Plateau ore. The vanadium present in the Colorado Plateau ore is partially solubilized during leaching. The dissolved vanadium is present in uranium raffinate. Depending on its vanadium content, the uranium raffinate will either be recycled to the counter-current decantation step or further processed for recovery of vanadium before recycling. The product from the vanadium recovery contains less than 0.005% U_3O_8 (NRC 1980). Therefore, the emission rate for the vanadium stack was calculated to be 0.005% of the total emission rate from the yellowcake stacks (north and south yellowcake stack) and U-238 was assumed to be emitted at a rate of 1.01E-06 Ci/yr.

Based on the EnecoTech (1991a and 1991b) measurements for the decay daughters of U-238 (Th-230, Ra-226 and Pb-210) processed along with yellowcake of 0.22%, 0.13% and 0.78% of U-238, respectively, the emissions from the remaining radionuclides were assumed to be negligible and in any event would likely be discharged to the tailings cells.

4.2 AREA SOURCES

Mill area sources used in this assessment include the ore pads and the tailings cells. A description of the approach used to calculate the emissions from area sources is provided in this section.

4.2.1 Ore Pads

The ore pad storage operation has two different sources of emissions, namely unloading ore from trucks to the ore pad and wind emissions. Approximately 300,000 tons of ore were assumed to be temporarily stockpiled at the mill's ore pads at any given time. Using a bulk ore density of 1.47 tons/yd^3 (DUSA, Feb. 6/07), the quantity of ore would create a pile 30 ft. (9.1 m) tall covering approximately 4 acres (17,000 m^2) stockpile area.

With respect to the truck unloading emissions, a process emission factor of 0.04 lbs of ore is emitted per cubic yard handled (for a truck end and assuming no control (NRC 1987)) and a bulk ore density of 1.47 tons/yd^3 was used in the calculations. With these assumptions, U-238 and its decay daughters (assuming secular equilibrium) would be emitted at a rate of 1.58E-02 and 4.02E-02 Ci/yr for Colorado Plateau and Arizona Strip ore, respectively.

Wind erosion from the ore pad was assumed to have a 50% control factor due to the active watering program in place (EnecoTech 1991a and 1991b). This is conservative, in that actual dust control on the ore pads may be better than this. The annual dust loss from the ore pad is 21.29 g/m^{2}yr; this was calculated using the method from NRC Regulatory Guide 3.59 (NRC 1987) on the basis of the meteorological data (provided by DUSA (Turk 2007b)) presented in Appendix B; the annual dust loss from the ore pads is 10% that of the tailings piles since the particulates in the ore pads are coarse material (1 to 6 inch) because the ore has not yet been ground. U-238 and its decay daughters (assuming secular equilibrium) were all assumed to be emitted at a rate of 3.17E-04 and 8.07E-04 Ci/yr for Colorado Plateau and Arizona Strip ore, respectively. Therefore, the total emission rate of U-238 and its daughter from truck dumping and wind erosion is 1.61E-02 and 4.10E-02 Ci/yr for Colorado Plateau and Arizona Strip ore, respectively.

Rn-222 will be produced in the ore pads from the decay of Ra-226. The estimated annual radon release rate from the ore pads is 375 and 956 Ci/yr for Colorado Plateau and Arizona Strip ore, respectively.

4.2.2 Tailings Cells

The characteristics of each tailings cell included in Phases 1 and 2 of the proposed development of new tailings cell 4B are provided in Tables 4.2-1 and 4.2-2, respectively.

TABLE 4.2-1
CHARACTERISTICS OF TAILINGS CELLS IN PHASE 1

Tailings Cell	Interim Soil Cover (Inactive)	Active
2	●	○
3	○	●
4A	○	●
4B	○	○

TABLE 4.2-2
CHARACTERISTICS OF TAILINGS CELLS IN PHASE 2

Tailings Cell	Interim Soil Cover (Inactive)	Active
2	●	○
3	●	○
4A	○	●
4B	○	●

Active Tailings Cells

Wind erosion of tailings and radon release rates from the active tailings cell were estimated using a maximal worst cast approach. However, since it is not possible to predict the distribution of uncovered tailings between active cells at any given time, the active tailings cells were modelled by using a maximal worst case approach. The following assumptions were used for the active tailings cells:

- Each tailings cell was assumed to have a maximum area of 10 acres for uncovered tailings material (this assumptions is considered to be conservative, because the average area of uncovered tailings in a cell is expected to be less than 10 acres).
- Wind-eroded tailings dust would arise from the 10 acres of uncovered tailings.
- The total annual radon release rate for each tailings cell was calculated by assuming a radon release rate of 20 pCi/m^2s (i.e., maximum radon-222 emissions to ambient air from an existing uranium mill pile that is allowed under the regulations) over the entire area of each cell. However, this total annual radon release rate was assumed to be released from the 10 acre area that was modelled. The area of tailings cell 3 was assumed to be 70 acres while tailing cells 4A and 4B were assumed to be 40 acres each.

Using the onsite wind data generated over the last three years (provided by DUSA (Turk 2007b)), the annual dust loss from the tailings cells was estimated to be approximately 213 g/m^{2}yr; this was calculated using the method from NRC Regulatory Guide 3.59 (NRC 1987). An average uranium recovery rate of 94% was assumed. In addition, a process emission control factor of 70% was assumed, based on 1) the active watering (tailings solutions spraying) program on exposed areas of tailings beaches in active areas; 2) solutions cover other tailings areas; and 3) crusting agents from the sprayed solutions act to minimize the erosion of the tailings beaches by wind (EnecoTech 1991a and 1991b).

With these assumptions and the particulate emission factor, U-238 would be emitted at a rate of 2.71E-04 Ci/yr and the decay daughters Th-230, Ra-226 and Pb-210 would be emitted at a rate of 4.52E-03 Ci/yr from each active cell for Colorado Plateau ore. These total annual emission rates assume operation at the proposed ore process rate of 730,000 tpy and an ore specific activity of 700 pCi/g. Similarly, for Arizona Strip ore, U-238 is emitted at a rate of 6.91E-04 Ci/yr and the decay daughters Th-230, Ra-226 and Pb-210 are emitted at a rate of 1.15E-02 Ci/yr from each active cell. These total annual emission rates assume the proposed ore process rate of 730,000 tpy and an ore specific activity of 1783 pCi/g.

In this assessment, the total annual radon release rates for active tailings cell 3 and 4A and 4B were estimated to be 179 Ci/yr for tailings cell 3 and 102 Ci/yr for each of tailings cells 4A and 4B. These estimates are extremely conservative because it was assumed that the radon release rate of 20 pCi/m^{2}s (i.e., maximum radon-222 emissions to ambient air from an existing uranium mill tailings impoundment) occurred over the entire area of each cell. Actual measurements collected annually at the tailings cells to determine compliance with the NESHAPs radon emanation standard have confirmed that the 20 pCi/m^{2}s release rate utilized for this assessment is a conservative estimate.

Interim Soil Cover (Inactive Tailings Cells)

The tailings cells (2 and 3) with interim soil cover were assumed to be the entire areas of each cell. The following assumptions were used for the tailings cells with interim soil covers:

- The area of tailings cell 2 with interim soil cover is 66.8 acres;
- The area of tailings cell 3 with interim soil cover is 70 acres;
- A nominal value of 10 pCi/m^{2}s was used for radon flux based on historical values for the Mill's tailings cells; and,
- No tailings dust will be released.

Using the assumptions above, the total annual radon release from the tailings cells 2 and 3 with interim soil covers were 85.3 and 89.4 Ci/yr, respectively.

4.3 METEOROLOGICAL DATA

Meteorological conditions influence re-suspension and dispersion of radionuclides from point sources and area sources. The mill has an on-site weathering monitoring station that records wind speed, wind direction and stability class. This data is used to formulate a joint frequency distribution which is a required input for MILDOS-AREA. The joint frequency distribution used in this assessment was provided by DUSA (Turk 2007b) using the most recent three years (2004 to 2006) of recorded data.

4.4 POPULATION DATA

The population data was obtained from the year 2000 U.S. census and was used to complete demographic and population dose projections. Census data is only available in 10 year intervals for population centers of less than 65,000 residents, and local demographics have experienced little change since the 2000 census.

4.5 URANIUM MILL SOURCE EMISSION RATES

4.5.1 Colorado Plateau Ore

The calculated mill radioactive particulate and radon emission rates from point sources and area sources described in Sections 4.1 and 4.2, respectively for Colorado Plateau ore are provided in Table 4.5-1.

TABLE 4.5-1
RADIOACTIVE PARTICULATE AND RADON EMISSION RATES
(COLORADO PLATEAU ORE)

		Grinding	Ore Dump to Grizzly	Ore Pads	North YC Stack	South YC Stack	Interim Soil Cover		Active			Vanadium Stack[b]
							Tailings Cell 2	Tailings Cell 3	Tailings Cell 3	Tailings Cell 4A	Tailings Cell 4B	
Emission Rate (Ci/yr)	U-238	9.27E-05	9.27E-05	1.61E-02	1.01E-02	1.01E-02	0.00E+00	0.00E+00	2.71E-04	2.71E-04	2.71E-04	1.01E-06
	Th-230	9.27E-05	9.27E-05	1.61E-02	2.22E-05	2.22E-05	0.00E+00	0.00E+00	4.52E-03	4.52E-03	4.52E-03	2.22E-09
	Ra-226	9.27E-05	9.27E-05	1.61E-02	1.31E-05	1.31E-05	0.00E+00	0.00E+00	4.52E-03	4.52E-03	4.52E-03	1.31E-09
	Pb-210	9.27E-05	9.27E-05	1.61E-02	7.88E-05	7.88E-05	0.00E+00	0.00E+00	4.52E-03	4.52E-03	4.52E-03	7.88E-09
	Rn-222	9.27E+01	Note a	3.75E+02	Note a	Note a	8.53E+01	8.94E+01	1.79E+02	1.02E+02	1.02E+02	Note a

Notes:

a) No significant release during this process.

b) Source is exclusive to the processing of Colorado Plateau ore.

4.5.2 Arizona Strip Ore

The calculated mill radioactive particulate and radon emission rates from point sources and area sources described in Sections 4.1 and 4.2, respectively for Arizona Strip ore are provided in Table 4.5-2.

TABLE 4.5-2
RADIOACTIVE PARTICULATE AND RADON EMISSION RATES
(ARIZONA STRIP ORE)

		Grinding	Ore Dump to Grizzly	Ore Pads	North YC Stack	South YC Stack	Interim Soil Cover		Active		
							Tailings Cell 2	Tailings Cell 3	Tailings Cell 3	Tailings Cell 4A	Tailings Cell 4B
Emission Rate (Ci/yr)	U-238	2.36E-04	2.36E-04	4.10E-02	2.58E-02	2.58E-02	0.00E+00	0.00E+00	6.91E-04	6.91E-04	6.91E-04
	Th-230	2.36E-04	2.36E-04	4.10E-02	5.67E-05	5.67E-05	0.00E+00	0.00E+00	1.15E-02	1.15E-02	1.15E-02
	Ra-226	2.36E-04	2.36E-04	4.10E-02	3.35E-05	3.35E-05	0.00E+00	0.00E+00	1.15E-02	1.15E-02	1.15E-02
	Pb-210	2.36E-04	2.36E-04	4.10E-02	2.01E-04	2.01E-04	0.00E+00	0.00E+00	1.15E-02	1.15E-02	1.15E-02
	Rn-222	2.36E+02	Note a	9.56E+02	Note a	Note a	8.53E+01	8.94E+01	1.79E+02	1.02E+02	1.02E+02

Note:

a) No significant release during this process.

5.0 RECEPTORS

The receptors used in this assessment were provided by DUSA. The receptors used in this assessment were as follows:

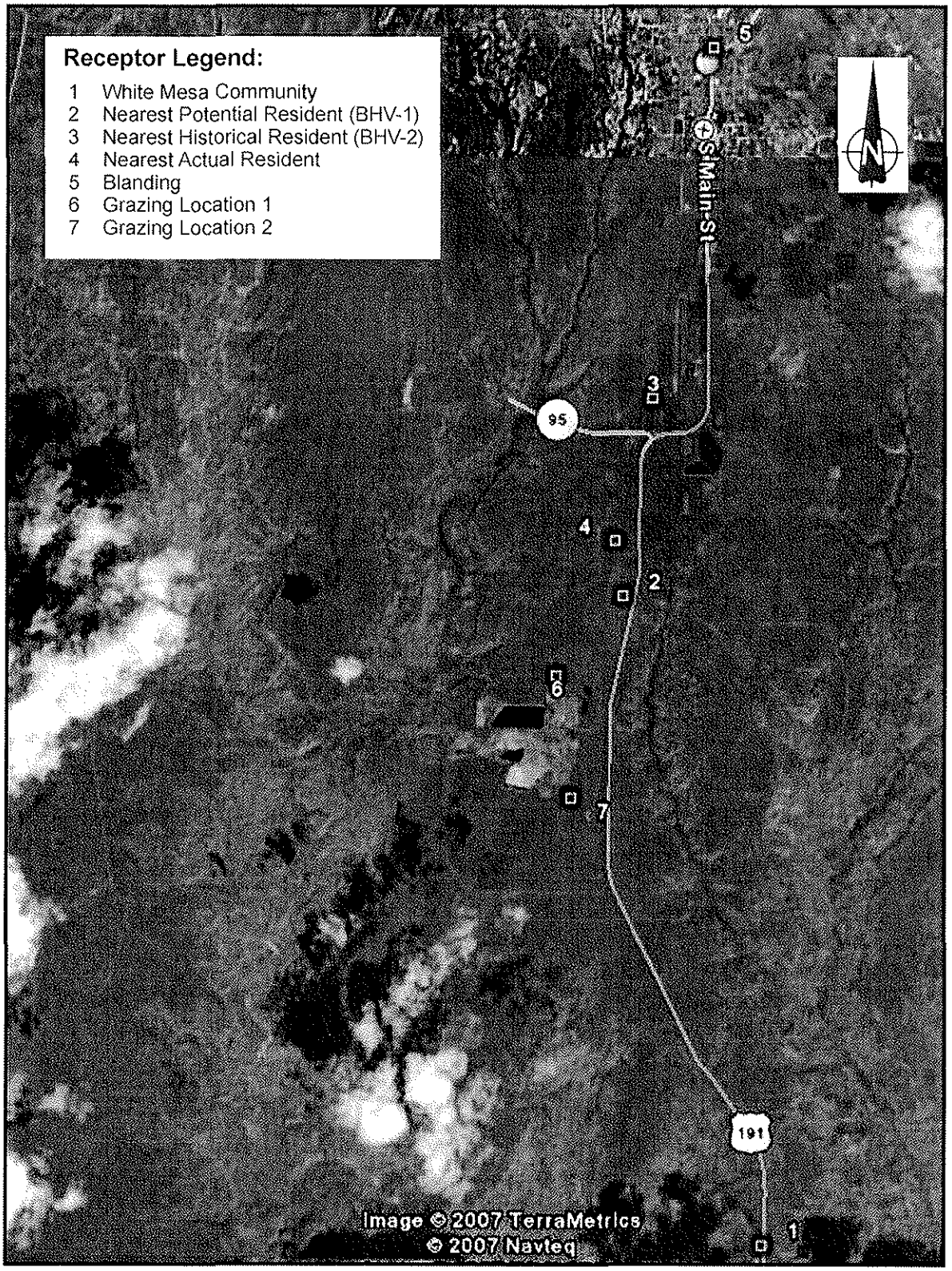
- Nearest Historical Resident (BHV-2);
- Nearest Actual Resident;
- Nearest Potential Resident (BHV-1);
- White Mesa Ute Community;
- Blanding, Utah.

In addition, two grazing locations 1 and 2 were considered as a possible source of meat.

As mentioned in Section 3.2, the receptor locations were determined using GPS coordinates provided by DUSA (Turk 2007a). The GPS coordinates were used for all the receptors except for Grazing locations 1 and 2 where the easting and northing for Grazing locations 1 and 2 were taken as nominal "mid-points" in Google Earth for these two receptor locations.

The receptor locations (plotted in Google Earth) with respect to the vanadium stack are shown in Figure 5.1.

FIGURE 5.1
RECEPTOR LOCATIONS



At the time of the 1979 Final Environmental Statement (FES) (NRC 1979) for the mill, the nearest resident lived approximately 4.8 miles (4.5) km north-north east of the mill building, near the location of air monitoring station BHV-2 (also referred to as the historical nearest resident.) Currently, the nearest "potential" resident is approximately 1.2 miles (1.9 km) north of the Mill, near the location of air monitoring station BHV-1. The nearest actual resident is located approximately 1.6 miles (2.5 km) north of the mill. Nearby population groups include the community of White Mesa, about 8.5 km south east and the city of Blanding, approximately 6 miles (10 km) from the mill.

The area to the immediate north of the mill (Grazing location 1) is believed to be used only for grazing of meat animals (beef) (NRC 1979). A second location (Grazing location 2) to the east and south of the mill is also used for the grazing of meat animals (beef) as was assumed in the EnecoTech analysis (EnecoTech 1991a and 1991b). Although considered unlikely, in one worst case scenario, it is possible that the meat animals grazed at Grazing location 1 and 2 would be eaten by the residents near the mill. A scenario which supports dairy cattle grazing at Grazing locations 1 and 2 was not included because the prospect of supporting dairy cattle in those locations is not credible, given the arid climate and the much larger feed requirements of dairy cattle as opposed to beef cattle. DUSA has also indicated that there are no dairy cattle grazed in Grazing locations 1 and 2. It should be noted, however, that in all of the MILDOS-AREA model runs in this report, it was assumed, conservatively, that individuals at each receptor location drink all of their milk from cows and eat all of their beef from cattle that graze at the receptor locations (but not at Grazing locations 1 or 2). This is thought to be a very conservative assumption.

6.0 RADIATION DOSE ESTIMATES

This section describes the MILDOS-AREA results of the mill's potential radiological impacts on the population in the vicinity of the Mill. This analysis was primarily based on the estimated annual releases of radioactive materials and assumptions discussed in Sections 4.0 and 5.0. All potential exposure pathways which are likely to impact individuals near the mill were included in the MILDOS-AREA model.

MILDOS-AREA calculates the total annual effective dose commitment (including radon). The calculated total annual effective dose commitments were compared to the 10 CFR 20 (R313-15) requirements that the dose to individual members of the public shall not exceed 100 mrem/yr (radon included). In addition, MILDOS-AREA calculates 40 CFR 190 doses (excludes radon). The 40 CFR 190 Criterion is 25 mrem/yr to the whole body (excluding the dose due to radon) and 25 mrem/yr to any other organ to any member of the public (EPA 2002). The 40 CFR 190 doses were also used to demonstrate compliance with 10 CFR 20.1101(d) (R313-15-101(4)). Under 10 CFR 20.1101(d) (R313-15-101(4) the licensee must demonstrate as an ALARA goal that the total effective dose equivalent to the individual member of the public likely to receive the highest total effective dose equivalent will not exceed 10 mrem/yr (absent of the radon dose).

In this assessment, a worst-case scenario in which there is a possibility that individuals near the mill ingest meat from cattle grown at Grazing Location 1 or 2 was considered. It was assumed that the cattle will graze at Grazing location 1 or 2 for two months of the year (due to the arid nature of the region and the lack of forage). Therefore, the meat ingestion dose to individuals near the mill who might consume beef grazed at Grazing Location 1 or 2 was assumed to be one-sixth of the MILDOS-AREA calculated meat ingestion dose from these grazing locations.

As mentioned in Section 1.3, MILDOS-AREA was run separately for Colorado Plateau and Arizona Strip ore. Total annual dose commitments and 40 CFR 190 annual dose commitments were estimated for locations in which individual members of the public might reside (Nearest Potential Resident (BHV-1), Nearest Historical Resident (BHV-2), Nearest Actual Resident, White Mesa Ute Community and Blanding, Utah) for two development Phases of the new tailings cells. The total annual dose commitments and 40 CFR 190 annual dose commitments for Phases 1 and 2 are provided in Sections 6.1 and 6.2 for Colorado Plateau and Arizona Strip ore, respectively. In addition, total annual dose commitments and 40 CFR 190 annual dose commitments from the meat ingestion pathway that is estimated for Grazing location 1 and 2 are provided in Sections 6.1 and 6.2, respectively.

6.1 MILDOS-AREA RESULTS FOR COLORADO PLATEAU ORE

The potential annual doses to the people living close to the mill and to the population living within 50 miles (80 km) as a result of processing Colorado Plateau ore was calculated using MILDOS-AREA.

The MILDOS-AREA-calculated total annual dose commitments (including radon) and 40 CFR 190 total annual dose commitment for processing of Colorado Plateau ore are provided in Sections 6.1.1 and 6.1.2, respectively

6.1.1 R313-15-301(1)(a) Regulatory Compliance

The MILDOS-AREA calculated total annual dose commitments (including radon) for Phases 1 and 2 are provided in this section. These doses are regulated by R313-15-301(1)(a) which requires that the dose to an individual member of the public shall not exceed 100 mrem/yr (radon included).

Phase 1

Table 6.1-1 presents a summary of the individual dose commitments for the residential receptors for the age group of infant, child, teenage and adult for Phase 1.

TABLE 6.1-1
PHASE 1-COMPARISON OF ANNUAL DOSE COMMITMENTS TO APPLICABLE RADIATION PROTECTION STANDARDS (COLORADO PLATEAU ORE)

Location	Age Group	Organ	Estimated Dose (mrem/yr)	Applicable Limit (mrem/yr)	Fraction of Limit
Nearest Potential Resident (BHV-1)	Infant	Effective	1.37E+00	100	1.37E-02
		Bone	1.92E+00	-	-
		Avg. Lung	5.31E-01	-	-
		Bronchi	1.30E+01	-	-
	Child	Effective	1.05E+00	100	1.05E-02
		Bone	1.37E+00	-	-
		Avg. Lung	7.10E-01	-	-
		Bronchi	1.30E+01	-	-
	Teenage	Effective	1.10E+00	100	1.10E-02
		Bone	4.84E+00	-	-
		Avg. Lung	5.68E-01	-	-
		Bronchi	1.30E+01	-	-
	Adult	Effective	9.84E-01	100	9.84E-03
		Bone	2.13E+00	-	-
		Avg. Lung	3.97E-01	-	-
		Bronchi	1.30E+01	-	-
Nearest Historical Resident (BHV-2)	Infant	Effective	3.10E-01	100	3.10E-03
		Bone	3.05E-01	-	-
		Avg. Lung	1.06E-01	-	-
		Bronchi	3.52E+00	-	-
	Child	Effective	2.66E-01	100	2.66E-03
		Bone	2.33E-01	-	-
		Avg. Lung	1.29E-01	-	-
		Bronchi	3.52E+00	-	-
	Teenage	Effective	2.72E-01	100	2.72E-03
		Bone	7.63E-01	-	-
		Avg. Lung	1.05E-01	-	-
		Bronchi	3.52E+00	-	-
	Adult	Effective	2.55E-01	100	2.55E-03
		Bone	3.53E-01	-	-
		Avg. Lung	7.69E-02	-	-
		Bronchi	3.52E+00	-	-

TABLE 6.1-1 (Cont'd)
PHASE 1-COMPARISON OF ANNUAL DOSE COMMITMENTS TO APPLICABLE RADIATION PROTECTION STANDARDS (COLORADO PLATEAU ORE)

Location	Age Group	Organ	Estimated Dose (mrem/yr)	Applicable Limit (mrem/yr)	Fraction of Limit
Nearest Actual Resident	Infant	Effective	8.78E-01	100	8.78E-03
		Bone	1.13E+00	-	-
		Avg. Lung	3.17E-01	-	-
		Bronchi	8.78E+00	-	-
	Child	Effective	6.95E-01	100	6.95E-03
		Bone	8.12E-01	-	-
		Avg. Lung	4.21E-01	-	-
		Bronchi	8.78E+00	-	-
	Teenage	Effective	7.21E-01	100	7.21E-03
		Bone	2.83E+00	-	-
		Avg. Lung	3.39E-01	-	-
		Bronchi	8.78E+00	-	-
	Adult	Effective	6.55E-01	100	6.55E-03
		Bone	1.26E+00	-	-
		Avg. Lung	2.40E-01	-	-
		Bronchi	8.78E+00	-	-
White Mesa Community	Infant	Effective	2.45E-01	100	2.45E-03
		Bone	1.45E-01	-	-
		Avg. Lung	6.72E-02	-	-
		Bronchi	3.18E+00	-	-
	Child	Effective	2.25E-01	100	2.25E-03
		Bone	1.08E-01	-	-
		Avg. Lung	6.47E-02	-	-
		Bronchi	3.18E+00	-	-
	Teenage	Effective	2.26E-01	100	2.26E-03
		Bone	2.86E-01	-	-
		Avg. Lung	5.26E-02	-	-
		Bronchi	3.18E+00	-	-
	Adult	Effective	2.20E-01	100	2.20E-03
		Bone	1.48E-01	-	-
		Avg. Lung	4.27E-02	-	-
		Bronchi	3.18E+00	-	-

TABLE 6.1-1 (Cont'd)
PHASE 1-COMPARISON OF ANNUAL DOSE COMMITMENTS TO APPLICABLE RADIATION PROTECTION STANDARDS (COLORADO PLATEAU ORE)

Location	Age Group	Organ	Estimated Dose (mrem/yr)	Applicable Limit (mrem/yr)	Fraction of Limit
Blanding	Infant	Effective	1.07E-01	100	1.07E-03
		Bone	8.94E-02	-	-
		Avg. Lung	3.36E-02	-	-
		Bronchi	1.25E+00	-	-
	Child	Effective	9.38E-02	100	9.38E-04
		Bone	6.78E-02	-	-
		Avg. Lung	3.91E-02	-	-
		Bronchi	1.25E+00	-	-
	Teenage	Effective	9.55E-02	100	9.55E-04
		Bone	2.10E-01	-	-
		Avg. Lung	3.23E-02	-	-
		Bronchi	1.25E+00	-	-
	Adult	Effective	9.08E-02	100	9.08E-04
		Bone	1.00E-01	-	-
		Avg. Lung	2.47E-02	-	-
		Bronchi	1.25E+00	-	-

From Table 6.1-1, the total annual effective dose commitments are at most 1.4% (effective dose for infant at BHV-1) of the R313-15-301(1)(a) limit of 100 mrem/yr (radon included) to an individual member of the public. Therefore, the predicted annual effective dose commitments comply with R313-15-301(1)(a).

In the worst case scenario in which there is a possibility that individuals near the mill ingest meat from cattle grown at Grazing Location 1 or 2. It was assumed that the cattle will graze at Grazing location 1 or 2 for 2 months of the year. The meat ingestion dose to individuals near the mill who might consume beef grazed at Grazing Location 1 or 2 was assumed to be one-sixth of the MILDOS-AREA calculated meat ingestion dose from these grazing locations. Table 6.1-2 presents a summary of the annual dose commitments from the meat ingestion pathway for Grazing location 1 and 2. Even in the very unlikely event that a resident were to consume meat from one of the grazing locations, the total dose would remain well below regulatory limits.

TABLE 6.1-2
PHASE 1-TOTAL ANNUAL DOSE COMMITMENTS FOR MEAT INGESTION PATHWAY (COLORADO PLATEAU ORE) (mrem/yr)

Location	Age Group	Organ[b]		
		Effective[a]	Bone[a]	Avg. Lung[a]
Grazing Location 1	Infant	0.00E+00	0.00E+00	0.00E+00
	Child	1.08E-02	5.40E-02	4.91E-02
	Teenage	1.70E-02	2.80E-01	4.30E-02
	Adult	1.23E-02	1.52E-01	3.55E-02
Grazing Location 2	Infant	0.00E+00	0.00E+00	0.00E+00
	Child	7.35E-04	3.65E-03	3.12E-03
	Teenage	1.14E-03	1.92E-02	2.72E-03
	Adult	8.13E-04	1.01E-02	2.25E-03

Note:
a) Assumes cattle will graze at the particular Grazing location for 2 months of the year.

Phase 2

Table 6.1-3 presents a summary of the individual dose commitments for the residential receptors for the age group of infant, child, teenage and adult for Phase 2.

TABLE 6.1-3
PHASE 2-COMPARISON OF ANNUAL DOSE COMMITMENTS TO APPLICABLE RADIATION PROTECTION STANDARDS (COLORADO PLATEAU ORE)

Location	Age Group	Organ	Estimated Dose (mrem/yr)	Applicable Limit (mrem/yr)	Fraction of Limit
Nearest Potential Resident (BHV-1)	Infant	Effective	1.35E+00	100	1.35E-02
		Bone	1.90E+00	-	-
		Avg. Lung	5.20E-01	-	-
		Bronchi	1.28E+01	-	-
	Child	Effective	1.04E+00	100	1.04E-02
		Bone	1.35E+00	-	-
		Avg. Lung	6.93E-01	-	-
		Bronchi	1.28E+01	-	-
	Teenage	Effective	1.08E+00	100	1.08E-02
		Bone	4.75E+00	-	-
		Avg. Lung	5.54E-01	-	-
		Bronchi	1.28E+01	-	-
	Adult	Effective	9.68E-01	100	9.68E-03
		Bone	2.09E+00	-	-
		Avg. Lung	3.87E-01	-	-
		Bronchi	1.28E+01	-	-

TABLE 6.1-3 (Cont'd)
PHASE 2-COMPARISON OF ANNUAL DOSE COMMITMENTS TO APPLICABLE RADIATION PROTECTION STANDARDS (COLORADO PLATEAU ORE)

Location	Age Group	Organ	Estimated Dose (mrem/yr)	Applicable Limit (mrem/yr)	Fraction of Limit
Nearest Historical Resident (BHV-2)	Infant	Effective	3.10E-01	100	3.10E-03
		Bone	3.03E-01	-	-
		Avg. Lung	1.05E-01	-	-
		Bronchi	3.52E+00	-	-
	Child	Effective	2.66E-01	100	2.66E-03
		Bone	2.31E-01	-	-
		Avg. Lung	1.28E-01	-	-
		Bronchi	3.52E+00	-	-
	Teenage	Effective	2.72E-01	100	2.72E-03
		Bone	7.57E-01	-	-
		Avg. Lung	1.04E-01	-	-
		Bronchi	3.52E+00	-	-
	Adult	Effective	2.55E-01	100	2.55E-03
		Bone	3.50E-01	-	-
		Avg. Lung	7.63E-02	-	-
		Bronchi	3.52E+00	-	-
Nearest Actual Resident	Infant	Effective	8.70E-01	100	8.70E-03
		Bone	1.12E+00	-	-
		Avg. Lung	3.11E-01	-	-
		Bronchi	8.69E+00	-	-
	Child	Effective	6.88E-01	100	6.88E-03
		Bone	7.98E-01	-	-
		Avg. Lung	4.13E-01	-	-
		Bronchi	8.69E+00	-	-
	Teenage	Effective	7.13E-01	100	7.13E-03
		Bone	2.78E+00	-	-
		Avg. Lung	3.32E-01	-	-
		Bronchi	8.69E+00	-	-
	Adult	Effective	6.48E-01	100	6.48E-03
		Bone	1.23E+00	-	-
		Avg. Lung	2.35E-01	-	-
		Bronchi	8.69E+00	-	-

TABLE 6.1-3 (Cont'd)
PHASE 2-COMPARISON OF ANNUAL DOSE COMMITMENTS TO APPLICABLE RADIATION PROTECTION STANDARDS (COLORADO PLATEAU ORE)

Location	Age Group	Organ	Estimated Dose (mrem/yr)	Applicable Limit (mrem/yr)	Fraction of Limit
White Mesa Community	Infant	Effective	2.47E-01	100	2.47E-03
		Bone	1.45E-01	-	-
		Avg. Lung	6.69E-02	-	-
		Bronchi	3.20E+00	-	-
	Child	Effective	2.26E-01	100	2.26E-03
		Bone	1.07E-01	-	-
		Avg. Lung	6.45E-02	-	-
		Bronchi	3.20E+00	-	-
	Teenage	Effective	2.28E-01	100	2.28E-03
		Bone	2.85E-01	-	-
		Avg. Lung	5.25E-02	-	-
		Bronchi	3.20E+00	-	-
	Adult	Effective	2.22E-01	100	2.22E-03
		Bone	1.48E-01	-	-
		Avg. Lung	4.27E-02	-	-
		Bronchi	3.20E+00	-	-
Blanding	Infant	Effective	1.08E-01	100	1.08E-03
		Bone	8.94E-02	-	-
		Avg. Lung	3.36E-02	-	-
		Bronchi	1.26E+00	-	-
	Child	Effective	9.46E-02	100	9.46E-04
		Bone	6.79E-02	-	-
		Avg. Lung	3.92E-02	-	-
		Bronchi	1.26E+00	-	-
	Teenage	Effective	9.62E-02	100	9.62E-04
		Bone	2.10E-01	-	-
		Avg. Lung	3.23E-02	-	-
		Bronchi	1.26E+00	-	-
	Adult	Effective	9.15E-02	100	9.15E-04
		Bone	1.00E-01	-	-
		Avg. Lung	2.48E-02	-	-
		Bronchi	1.26E+00	-	-

From Table 6.1-3, the total annual effective dose commitments are at most 1.4% (effective dose for infant at BHV-1) of the R313-15-301(1)(a) limit of 100 mrem/yr (radon included) to an individual member of the public. Therefore, the predicted annual effective dose commitments comply with R313-15-301(1)(a).

In addition, Table 6.1-4 presents a summary of the annual dose commitments from the meat ingestion pathway for Grazing location 1 and 2. As before, in the very unlikely event that a

resident were to consume meat from one of the grazing locations, the total do se would remain well below regulatory limits.

TABLE 6.1-4
PHASE 2-TOTAL ANNUAL DOSE COMMITMENTS FOR MEAT INGESTION PATHWAY (COLORADO PLATEAU ORE) (mrem/yr)

Location	Age Group	Organ[b]		
		Effective[a]	Bone[a]	Avg. Lung[a]
Grazing Location 1	Infant	0.00E+00	0.00E+00	0.00E+00
	Child	1.07E-02	5.35E-02	4.87E-02
	Teenage	1.68E-02	2.78E-01	4.26E-02
	Adult	1.22E-02	1.50E-01	3.51E-02
Grazing Location 2	Infant	0.00E+00	0.00E+00	0.00E+00
	Child	6.73E-04	3.34E-03	2.82E-03
	Teenage	1.04E-03	1.76E-02	2.46E-03
	Adult	7.41E-04	9.22E-03	2.03E-03

Note:
a) Assumes cattle will graze at the particular Grazing location for 2 months of the year.

6.1.2 40 CFR 190 Regulatory Compliance

MILDOS-AREA calculated 40 CFR 190 doses (excludes radon). These doses are regulated by the 40 CFR 190 criterion of 25 mrem/yr to the whole body (excluding the dose due to radon) (EPA 2002) or to any organ of the body. The 40 CFR 190 doses are also used to demonstrate compliance with R313-15-101(4) (10 CFR 20.1101(d)). The licensee must demonstrate as an ALARA goal, that total effective dose equivalent to the individual member of the public likely to receive the highest total effective dose equivalent will not exceed 10 mrem/yr (absent of the radon dose).

Phase 1

Table 6.1-5 presents a summary of the 40 CFR 190 individual dose commitments for residential receptors for the age group of infant, child, teenage and adult for Phase 1.

TABLE 6.1-5
PHASE 1-COMPARISON OF 40 CFR 190 ANNUAL DOSE COMMITMENTS WITH APPLICABLE RADIATION PROTECTION STANDARDS (COLORADO PLATEAU ORE)

Location	Age Group	Organ	Estimated Dose (mrem/yr)	Applicable Limit (mrem/yr)	Fraction of Limit
Nearest Potential Resident (BHV-1)	Infant	Effective	5.45E-01	25	2.18E-02
		Bone	1.86E+00	25	7.45E-02
		Avg. Lung	4.85E-01	25	1.94E-02
		Bronchi	9.73E-04	no limit given	-
	Child	Effective	2.32E-01	25	9.28E-03
		Bone	1.33E+00	25	5.30E-02
		Avg. Lung	6.62E-01	25	2.65E-02
		Bronchi	9.73E-04	no limit given	-
	Teenage	Effective	2.76E-01	25	1.10E-02
		Bone	4.79E+00	25	1.92E-01
		Avg. Lung	5.22E-01	25	2.09E-02
		Bronchi	9.73E-04	no limit given	-
	Adult	Effective	1.63E-01	25	6.50E-03
		Bone	2.09E+00	25	8.35E-02
		Avg. Lung	3.51E-01	25	1.40E-02
		Bronchi	9.73E-04	no limit given	-
Nearest Historical Resident (BHV-2)	Infant	Effective	8.07E-02	25	3.23E-03
		Bone	2.82E-01	25	1.13E-02
		Avg. Lung	8.56E-02	25	3.42E-03
		Bronchi	1.39E-04	no limit given	-
	Child	Effective	3.61E-02	25	1.44E-03
		Bone	2.09E-01	25	8.37E-03
		Avg. Lung	1.07E-01	25	4.29E-03
		Bronchi	1.39E-04	no limit given	-
	Teenage	Effective	4.26E-02	25	1.71E-03
		Bone	7.30E-01	25	2.92E-02
		Avg. Lung	8.31E-02	25	3.32E-03
		Bronchi	1.39E-04	no limit given	-
	Adult	Effective	2.55E-02	25	1.02E-03
		Bone	3.26E-01	25	1.30E-02
		Avg. Lung	5.62E-02	25	2.25E-03
		Bronchi	1.39E-04	no limit given	-

TABLE 6.1-5 (Cont'd)
PHASE 1-COMPARISON OF 40 CFR 190 ANNUAL DOSE COMMITMENTS WITH APPLICABLE RADIATION PROTECTION STANDARDS (COLORADO PLATEAU ORE)

Location	Age Group	Organ	Estimated Dose (mrem/yr)	Applicable Limit (mrem/yr)	Fraction of Limit
Nearest Actual Resident	Infant	Effective	3.17E-01	25	1.27E-02
		Bone	1.09E+00	25	4.37E-02
		Avg. Lung	2.81E-01	25	1.12E-02
		Bronchi	5.62E-04	no limit given	-
	Child	Effective	1.35E-01	25	5.40E-03
		Bone	7.73E-01	25	3.09E-02
		Avg. Lung	3.84E-01	25	1.54E-02
		Bronchi	5.62E-04	no limit given	-
	Teenage	Effective	1.60E-01	25	6.42E-03
		Bone	2.78E+00	25	1.11E-01
		Avg. Lung	3.02E-01	25	1.21E-02
		Bronchi	5.62E-04	no limit given	-
	Adult	Effective	9.46E-02	25	3.78E-03
		Bone	1.21E+00	25	4.86E-02
		Avg. Lung	2.03E-01	25	8.12E-03
		Bronchi	5.62E-04	no limit given	-
White Mesa Community	Infant	Effective	3.36E-02	25	1.35E-03
		Bone	1.19E-01	25	4.74E-03
		Avg. Lung	4.55E-02	25	1.82E-03
		Bronchi	4.25E-05	no limit given	-
	Child	Effective	1.31E-02	25	5.22E-04
		Bone	7.80E-02	25	3.12E-03
		Avg. Lung	3.85E-02	25	1.54E-03
		Bronchi	4.25E-05	no limit given	-
	Teenage	Effective	1.38E-02	25	5.51E-04
		Bone	2.31E-01	25	9.26E-03
		Avg. Lung	2.72E-02	25	1.09E-03
		Bronchi	4.25E-05	no limit given	-
	Adult	Effective	8.69E-03	25	3.48E-04
		Bone	1.11E-01	25	4.42E-03
		Avg. Lung	1.91E-02	25	7.63E-04
		Bronchi	4.25E-05	no limit given	-

TABLE 6.1-5 (Cont'd)
PHASE 1-COMPARISON OF 40 CFR 190 ANNUAL DOSE COMMITMENTS WITH APPLICABLE RADIATION PROTECTION STANDARDS (COLORADO PLATEAU ORE)

Location	Age Group	Organ	Estimated Dose (mrem/yr)	Applicable Limit (mrem/yr)	Fraction of Limit
Blanding	Infant	Effective	2.21E-02	25	8.84E-04
		Bone	7.69E-02	25	3.08E-03
		Avg. Lung	2.39E-02	25	9.57E-04
		Bronchi	3.49E-05	no limit given	-
	Child	Effective	9.23E-03	25	3.69E-04
		Bone	5.38E-02	25	2.15E-03
		Avg. Lung	2.69E-02	25	1.08E-03
		Bronchi	3.49E-05	no limit given	-
	Teenage	Effective	1.06E-02	25	4.24E-04
		Bone	1.81E-01	25	7.25E-03
		Avg. Lung	2.05E-02	25	8.19E-04
		Bronchi	3.49E-05	no limit given	-
	Adult	Effective	6.38E-03	25	2.55E-04
		Bone	8.16E-02	25	3.27E-03
		Avg. Lung	1.39E-02	25	5.57E-04
		Bronchi	3.49E-05	no limit given	-

From Table 6.1-5, the 40 CFR 190 annual dose commitments are at most 19.2% (dose to the bone for the teenage at BHV-1) of the 40 CFR 190 dose criterion of 25 mrem/yr. In addition, the 40 CFR 190 annual effective dose commitments demonstrate compliance with the R313-15-101(4) (10 CFR 20.1101(d)) ALARA goal of 10 mrem/yr to the individual member of the public likely to receive the highest total effective dose equivalent. The maximum total effective dose equivalent was 0.545 mrem/yr (infant at BHV-1), or 5.45% of the 10 mrem/yr goal.

In addition, Table 6.1-6 presents a summary of the 40 CFR 190 annual dose commitments from the meat ingestion pathway for Grazing Locations 1 and 2. As before, in the unlikely event a receptor were to eat meat from cattle grazing in areas 1 or 2, the total dose would remain well below regulatory limits.

TABLE 6.1-6
40 CFR 190 ANNUAL DOSE COMMITMENTS FOR MEAT INGESTION PATHWAY (COLORADO PLATEAU ORE)(mrem/yr)

Location	Age Group	Organ[b]		
		Effective[a]	Bone[a]	Avg. Lung[a]
Grazing Location 1	Infant	0.00E+00	0.00E+00	0.00E+00
	Child	1.08E-02	5.40E-02	4.91E-02
	Teenage	1.70E-02	2.80E-01	4.30E-02
	Adult	1.23E-02	1.52E-01	3.55E-02
Grazing Location 2	Infant	0.00E+00	0.00E+00	0.00E+00
	Child	7.33E-04	3.63E-03	3.10E-03
	Teenage	1.13E-03	1.91E-02	2.72E-03
	Adult	8.10E-04	1.01E-02	2.24E-03

Note:
a) Assumes cattle will graze at the particular Grazing location for 2 months of the year.
b) Exclusive of radon.

The annual doses to the population estimated within 50 miles (80 km) of the site are provided in Table 6.1-7.

TABLE 6.1-7
PHASE 1-ANNUAL POPULATION DOSE COMMITMENTS WITHIN 50 MILES (80 km) OF THE MILL FOR COLORADO PLATEAU ORE

Organ	ANNUAL POPULATION DOSE COMMITMENTS, PERSON-REM PER YEAR
	Mill Operations
Effective	1.47E-01
Bone	1.12E+00
Avg. Lung	1.53E-01
Bronchi	8.60E+00

The population dose arising from processing Colorado Plateau ore during Phase 1 is estimated at 0.15 person-rem. This can be compared to the dose from natural background sources of radiation.

In the United States, nominal average levels of natural background radiation are as follows (NCRP 1987):

Cosmic and Cosmogenic	28 mrem/yr
Terrestrial	28 mrem/yr
Inhaled (Radon)	200 mrem/yr
Ingested	40 mrem/yr
Total (Average)	**296 mrem/yr (96 mrem/yr excluding radon)**

In the area of the White Mesa Mill, natural background radiation was measured at two sites in 1977: the project site (Blanding) and the Hanksville site. At the Blanding site, the average dose equivalent from external radiation was about 142 mrem/yr. Of this 142 mrem/yr, 68 mrem/yr came from cosmic radiation, while 74 mrem/yr came from terrestrial radiation. (Dames & Moore 1978). At the Hanksville site, the corresponding average dose equivalent was about 122 mrem/yr (68 mrem/yr from cosmic radiation and 54 mrem/yr from terrestrial radiation). (Dames & Moore 1978).

Ingested radionuclides would contribute (about) a further 18 mrem/yr (NRC 1979). This brings the total background dose from external radiation and ingested radioactivity, but exclusive of the dose from radon-222, to about 161 mrem/yr; which is higher than both the U.S. averages of 96 mrem/yr.

If the nominal U.S. dose from radon of about 200 mrem per year is added, then the total dose from natural background in the area of the mill is 360 mrem/yr (or more assuming the dose from radon would increase along with that from terrestrial source).

The current population of San Juan County is about 14,400 people. Assuming everyone living in San Juan County receives an annual dose of (about) 360 mrem/yr, then the total dose due to natural background is approximately 5184 person-rem. The theoretical incremental dose of 0.15 person-rem is clearly inconsequential by comparison.

Phase 2

Table 6.1-8 presents a summary of the 40 CFR 190 individual dose commitments for the residential receptors for the age group of infant, child, teenage and adult for Phase 2.

TABLE 6.1-8
PHASE 2-COMPARISON OF 40 CFR 190 ANNUAL DOSE COMMITMENTS WITH APPLICABLE RADIATION PROTECTION STANDARDS (COLORADO PLATEAU ORE)

Location	Age Group	Organ	Estimated Dose (mrem/yr)	Applicable Limit (mrem/yr)	Fraction of Limit
Nearest Potential Resident (BHV-1)	Infant	Effective	5.40E-01	25	2.16E-02
		Bone	1.84E+00	25	7.36E-02
		Avg. Lung	4.75E-01	25	1.90E-02
		Bronchi	9.63E-04	no limit given	-
	Child	Effective	2.28E-01	25	9.11E-03
		Bone	1.30E+00	25	5.20E-02
		Avg. Lung	6.46E-01	25	2.58E-02
		Bronchi	9.63E-04	no limit given	-
	Teenage	Effective	2.70E-01	25	1.08E-02
		Bone	4.70E+00	25	1.88E-01
		Avg. Lung	5.09E-01	25	2.03E-02
		Bronchi	9.63E-04	no limit given	-
	Adult	Effective	1.59E-01	25	6.36E-03
		Bone	2.04E+00	25	8.17E-02
		Avg. Lung	3.42E-01	25	1.37E-02
		Bronchi	9.63E-04	no limit given	-
Nearest Historical Resident (BHV-2)	Infant	Effective	8.03E-02	25	3.21E-03
		Bone	2.81E-01	25	1.12E-02
		Avg. Lung	8.47E-02	25	3.39E-03
		Bronchi	1.38E-04	no limit given	-
	Child	Effective	3.58E-02	25	1.43E-03
		Bone	2.07E-01	25	8.29E-03
		Avg. Lung	1.06E-01	25	4.24E-03
		Bronchi	1.38E-04	no limit given	-
	Teenage	Effective	4.22E-02	25	1.69E-03
		Bone	7.23E-01	25	2.89E-02
		Avg. Lung	8.21E-02	25	3.29E-03
		Bronchi	1.38E-04	no limit given	-
	Adult	Effective	2.53E-02	25	1.01E-03
		Bone	3.23E-01	25	1.29E-02
		Avg. Lung	5.56E-02	25	2.22E-03
		Bronchi	1.38E-04	no limit given	-

TABLE 6.1-8 (Cont'd)
PHASE 2-COMPARISON OF 40 CFR 190 ANNUAL DOSE COMMITMENTS WITH APPLICABLE RADIATION PROTECTION STANDARDS (COLORADO PLATEAU ORE)

Location	Age Group	Organ	Estimated Dose (mrem/yr)	Applicable Limit (mrem/yr)	Fraction of Limit
Nearest Actual Resident	Infant	Effective	3.15E-01	25	1.26E-02
		Bone	1.08E+00	25	4.32E-02
		Avg. Lung	2.75E-01	25	1.10E-02
		Bronchi	5.57E-04	no limit given	-
	Child	Effective	1.33E-01	25	5.31E-03
		Bone	7.59E-01	25	3.04E-02
		Avg. Lung	3.76E-01	25	1.50E-02
		Bronchi	5.57E-04	no limit given	-
	Teenage	Effective	1.58E-01	25	6.30E-03
		Bone	2.73E+00	25	1.09E-01
		Avg. Lung	2.95E-01	25	1.18E-02
		Bronchi	5.57E-04	no limit given	-
	Adult	Effective	9.28E-02	25	3.71E-03
		Bone	1.19E+00	25	4.77E-02
		Avg. Lung	1.99E-01	25	7.94E-03
		Bronchi	5.57E-04	no limit given	-
White Mesa Community	Infant	Effective	3.35E-02	25	1.34E-03
		Bone	1.18E-01	25	4.71E-03
		Avg. Lung	4.50E-02	25	1.80E-03
		Bronchi	4.23E-05	no limit given	-
	Child	Effective	1.29E-02	25	5.17E-04
		Bone	7.72E-02	25	3.09E-03
		Avg. Lung	3.80E-02	25	1.52E-03
		Bronchi	4.23E-05	no limit given	-
	Teenage	Effective	1.36E-02	25	5.46E-04
		Bone	2.29E-01	25	9.17E-03
		Avg. Lung	2.69E-02	25	1.08E-03
		Bronchi	4.23E-05	no limit given	-
	Adult	Effective	8.60E-03	25	3.44E-04
		Bone	1.09E-01	25	4.37E-03
		Avg. Lung	1.88E-02	25	7.54E-04
		Bronchi	4.23E-05	no limit given	-

TABLE 6.1-8 (Cont'd)
PHASE 2-COMPARISON OF 40 CFR 190 ANNUAL DOSE COMMITMENTS WITH APPLICABLE RADIATION PROTECTION STANDARDS
(COLORADO PLATEAU ORE)

Location	Age Group	Organ	Estimated Dose (mrem/yr)	Applicable Limit (mrem/yr)	Fraction of Limit
Blanding	Infant	Effective	2.21E-02	25	8.83E-04
		Bone	7.69E-02	25	3.07E-03
		Avg. Lung	2.39E-02	25	9.55E-04
		Bronchi	3.49E-05	no limit given	-
	Child	Effective	9.22E-03	25	3.69E-04
		Bone	5.37E-02	25	2.15E-03
		Avg. Lung	2.68E-02	25	1.07E-03
		Bronchi	3.49E-05	no limit given	-
	Teenage	Effective	1.06E-02	25	4.23E-04
		Bone	1.81E-01	25	7.24E-03
		Avg. Lung	2.04E-02	25	8.18E-04
		Bronchi	3.49E-05	no limit given	-
	Adult	Effective	6.37E-03	25	2.55E-04
		Bone	8.15E-02	25	3.26E-03
		Avg. Lung	1.39E-02	25	5.56E-04
		Bronchi	3.49E-05	no limit given	-

From Table 6.1-8, the 40 CFR 190 annual dose commitments are at most 18.8% (dose to the bone for the teenage at BHV-1) of the 40 CFR 190 dose criterion of 25 mrem/yr. In addition, the 40 CFR 190 annual effective dose commitments demonstrate compliance with the R313-15-101(4) (10 CFR 20.1101(d)) ALARA goal of 10 mrem/yr to the individual member of the public likely to receive the highest total effective dose equivalent. The maximum total effective dose equivalent was 0.540 mrem/yr (infant at BHV-1), or 5.4% of the 10 mrem/yr goal.

In addition, Table 6.1-9 presents a summary of the 40 CFR 190 annual dose commitments from the meat ingestion pathway for Grazing Locations 1 and 2. As before, in the unlikely event a receptor were to eat meat from cattle grazing in areas 1 or 2, the total dose would remain well below regulatory limits.

TABLE 6.1-9
PHASE 2-40 CFR 190 ANNUAL DOSE COMMITMENTS) FOR MEAT INGESTION PATHWAY (COLORADO PLATEAU ORE) (mrem/yr)

Location	Age Group	Organ[b]		
		Effective[a]	Bone[a]	Avg. Lung[a]
Grazing Location 1	Infant	0.00E+00	0.00E+00	0.00E+00
	Child	1.07E-02	5.35E-02	4.87E-02
	Teenage	1.68E-02	2.78E-01	4.26E-02
	Adult	1.22E-02	1.50E-01	3.51E-02
Grazing Location 2	Infant	0.00E+00	0.00E+00	0.00E+00
	Child	6.71E-04	3.32E-03	2.80E-03
	Teenage	1.03E-03	1.75E-02	2.46E-03
	Adult	7.39E-04	9.20E-03	2.03E-03

Note:
a) Assumes cattle will graze at the particular Grazing location for 2 months of the year.
b) Exclusive of radon.

The annual doses to the population estimated within 50 miles (80 km) of the site are provided in Table 6.1-10.

TABLE 6.1-10
PHASE 2-ANNUAL POPULATION DOSE COMMITMENTS WITHIN 50 MILES (80 km) OF THE MILL FOR COLORADO PLATEAU ORE

Organ	ANNUAL POPULATION DOSE COMMITMENTS, PERSON-REM PER YEAR
	Mill Operations
Effective	1.50E-01
Bone	1.15E+00
Avg. Lung	1.56E-01
Bronchi	8.66E+00

The population dose arising from processing Colorado Plateau ore during Phase 2 is estimated at 0.15 person-rem. This can be compared to the dose from natural background sources of radiation of about 360 mrem/yr as previously discussed in Phase 1.

The current population of San Juan County is about 14,400 people. Assuming everyone living in San Juan County receives an annual dose of (about) 360 mrem/yr, then the total dose due to natural background is approximately 5184 person-rem. The theoretical incremental dose of 0.15 person-rem is clearly inconsequential by comparison.

6.2 MILDOS-AREA RESULTS FOR ARIZONA STRIP ORE

The potential annual doses to the people living close to the mill and to the population living within 50 miles (80 km) as a result of processing Arizona Strip ore was calculated using MILDOS-AREA.

The MILDOS-AREA calculated total annual dose commitments (including radon) and 40 CFR 190 total annual dose commitments for processing of Arizona Strip ore are provided in Sections 6.2.1 and 6.2.2, respectively.

6.2.1 R313-15-301 (1)(a) Regulatory Compliance

The MILDOS-AREA calculated total annual dose commitments (including radon) for Phases 1 and 2 are provided in this section. These doses are regulated by R313-15-301(1)(a) which requires that the dose to an individual member of the public shall not exceed 100 mrem/yr (radon included).

Phase 1

Table 6.2-1 presents a summary of the individual dose commitments for the residential receptors for the age group of infant, child, teenage and adult for Phase 1.

TABLE 6.2-1
PHASE 1-COMPARISON OF ANNUAL DOSE COMMITMENTS WITH APPLICABLE RADIATION PROTECTION STANDARDS (ARIZONA STRIP ORE)

Location	Age Group	Organ	Estimated Dose (mrem/yr)	Applicable Limit (mrem/yr)	Fraction of Limit
Nearest Potential Resident (BHV-1)	Infant	Effective	3.12E+00	100	3.12E-02
		Bone	4.86E+00	-	-
		Avg. Lung	1.34E+00	-	-
		Bronchi	2.72E+01	-	-
	Child	Effective	2.32E+00	100	2.32E-02
		Bone	3.48E+00	-	-
		Avg. Lung	1.79E+00	-	-
		Bronchi	2.72E+01	-	-
	Teenage	Effective	2.43E+00	100	2.43E-02
		Bone	1.23E+01	-	-
		Avg. Lung	1.43E+00	-	-
		Bronchi	2.72E+01	-	-
	Adult	Effective	2.14E+00	100	2.14E-02
		Bone	5.42E+00	-	-
		Avg. Lung	9.94E-01	-	-
		Bronchi	2.72E+01	-	-
Nearest Historical Resident (BHV-2)	Infant	Effective	6.60E-01	100	6.60E-03
		Bone	7.65E-01	-	-
		Avg. Lung	2.58E-01	-	-
		Bronchi	6.93E+00	-	-
	Child	Effective	5.46E-01	100	5.46E-03
		Bone	5.80E-01	-	-
		Avg. Lung	3.17E-01	-	-
		Bronchi	6.93E+00	-	-
	Teenage	Effective	5.63E-01	100	5.63E-03
		Bone	1.92E+00	-	-
		Avg. Lung	2.55E-01	-	-
		Bronchi	6.93E+00	-	-
	Adult	Effective	5.19E-01	100	5.19E-03
		Bone	8.85E-01	-	-
		Avg. Lung	1.85E-01	-	-
		Bronchi	6.93E+00	-	-

TABLE 6.2-1 (Cont'd)
PHASE 1-COMPARISON OF ANNUAL DOSE COMMITMENTS WITH APPLICABLE RADIATION PROTECTION STANDARDS (ARIZONA STRIP ORE)

Location	Age Group	Organ	Estimated Dose (mrem/yr)	Applicable Limit (mrem/yr)	Fraction of Limit
Nearest Actual Resident	Infant	Effective	1.96E+00	100	1.96E-02
		Bone	2.86E+00	-	-
		Avg. Lung	7.91E-01	-	-
		Bronchi	1.81E+01	-	-
	Child	Effective	1.50E+00	100	1.50E-02
		Bone	2.05E+00	-	-
		Avg. Lung	1.06E+00	-	-
		Bronchi	1.81E+01	-	-
	Teenage	Effective	1.56E+00	100	1.56E-02
		Bone	7.18E+00	-	-
		Avg. Lung	8.50E-01	-	-
		Bronchi	1.81E+01	-	-
	Adult	Effective	1.40E+00	100	1.40E-02
		Bone	3.18E+00	-	-
		Avg. Lung	5.96E-01	-	-
		Bronchi	1.81E+01	-	-
White Mesa Community	Infant	Effective	4.68E-01	100	4.68E-03
		Bone	3.51E-01	-	-
		Avg. Lung	1.56E-01	-	-
		Bronchi	5.72E+00	-	-
	Child	Effective	4.16E-01	100	4.16E-03
		Bone	2.53E-01	-	-
		Avg. Lung	1.46E-01	-	-
		Bronchi	5.72E+00	-	-
	Teenage	Effective	4.19E-01	100	4.19E-03
		Bone	6.90E-01	-	-
		Avg. Lung	1.16E-01	-	-
		Bronchi	5.72E+00	-	-
	Adult	Effective	4.04E-01	100	4.04E-03
		Bone	3.51E-01	-	-
		Avg. Lung	9.18E-02	-	-
		Bronchi	5.72E+00	-	-

TABLE 6.2-1 (Cont'd)
PHASE 1-COMPARISON OF ANNUAL DOSE COMMITMENTS WITH APPLICABLE RADIATION PROTECTION STANDARDS (ARIZONA STRIP ORE)

Location	Age Group	Organ	Estimated Dose (mrem/yr)	Applicable Limit (mrem/yr)	Fraction of Limit
Blanding	Infant	Effective	2.18E-01	100	2.18E-03
		Bone	2.20E-01	-	-
		Avg. Lung	7.98E-02	-	-
		Bronchi	2.39E+00	-	-
	Child	Effective	1.85E-01	100	1.85E-03
		Bone	1.64E-01	-	-
		Avg. Lung	9.22E-02	-	-
		Bronchi	2.39E+00	-	-
	Teenage	Effective	1.89E-01	100	1.89E-03
		Bone	5.16E-01	-	-
		Avg. Lung	7.49E-02	-	-
		Bronchi	2.39E+00	-	-
	Adult	Effective	1.78E-01	100	1.78E-03
		Bone	2.44E-01	-	-
		Avg. Lung	5.64E-02	-	-
		Bronchi	2.39E+00	-	-

From Table 6.2-1, the total annual effective dose commitments are at most 3.1% (effective dose for infant at BHV-1) of the R313-15-301(1)(a) limit of 100 mrem/yr (radon included) to an individual member of the public. Therefore, the predicted annual effective dose commitments comply with R313-15-101(1)(a).

In addition, Table 6.2-2 presents a summary of the annual dose commitments from the meat ingestion pathway for Grazing location 1 and 2. As before in the unlikely event that a receptor consumed beef from one of the grazing locations, the total dose would remain well below regulatory limits.

TABLE 6.2-2
PHASE 1-TOTAL ANNUAL DOSE COMMITMENTS FOR MEAT INGESTION PATHWAY (ARIZONA STRIP ORE) (mrem/yr)

Location	Age Group	Organ[b]		
		Effective[a]	Bone[a]	Avg. Lung[a]
Grazing Location 1	Infant	0.00E+00	0.00E+00	0.00E+00
	Child	2.75E-02	1.37E-01	1.25E-01
	Teenage	4.33E-02	7.16E-01	1.09E-01
	Adult	3.13E-02	3.87E-01	9.03E-02
Grazing Location 2	Infant	0.00E+00	0.00E+00	0.00E+00
	Child	1.87E-03	9.29E-03	7.93E-03
	Teenage	2.90E-03	4.89E-02	6.94E-03
	Adult	2.07E-03	2.57E-02	5.73E-03

Note:
a) Assumes cattle will graze at the particular Grazing location for 2 months of the year.

Phase 2

Table 6.2-3 presents a summary of the individual dose commitments for the residential receptors for the age group of infant, child, teenage and adult for Phase 2.

TABLE 6.2-3
PHASE 2-COMPARISON OF ANNUAL DOSE COMMITMENTS WITH APPLICABLE RADIATION PROTECTION STANDARDS (ARIZONA STRIP ORE)

Location	Age Group	Organ	Estimated Dose (mrem/yr)	Applicable Limit (mrem/yr)	Fraction of Limit
Nearest Potential Resident (BHV-1)	Infant	Effective	3.10E+00	100	3.10E-02
		Bone	4.81E+00	-	-
		Avg. Lung	1.31E+00	-	-
		Bronchi	2.70E+01	-	-
	Child	Effective	2.30E+00	100	2.30E-02
		Bone	3.42E+00	-	-
		Avg. Lung	1.74E+00	-	-
		Bronchi	2.70E+01	-	-
	Teenage	Effective	2.40E+00	100	2.40E-02
		Bone	1.21E+01	-	-
		Avg. Lung	1.40E+00	-	-
		Bronchi	2.70E+01	-	-
	Adult	Effective	2.12E+00	100	2.12E-02
		Bone	5.31E+00	-	-
		Avg. Lung	9.71E-01	-	-
		Bronchi	2.70E+01	-	-

TABLE 6.2-3 (Cont'd)
PHASE 2-COMPARISON OF ANNUAL DOSE COMMITMENTS WITH APPLICABLE RADIATION PROTECTION STANDARDS (ARIZONA STRIP ORE)

Location	Age Group	Organ	Estimated Dose (mrem/yr)	Applicable Limit (mrem/yr)	Fraction of Limit
Nearest Historical Resident (BHV-2)	Infant	Effective	6.59E-01	100	6.59E-03
		Bone	7.60E-01	-	-
		Avg. Lung	2.56E-01	-	-
		Bronchi	6.93E+00	-	-
	Child	Effective	5.45E-01	100	5.45E-03
		Bone	5.75E-01	-	-
		Avg. Lung	3.14E-01	-	-
		Bronchi	6.93E+00	-	-
	Teenage	Effective	5.62E-01	100	5.62E-03
		Bone	1.91E+00	-	-
		Avg. Lung	2.52E-01	-	-
		Bronchi	6.93E+00	-	-
	Adult	Effective	5.18E-01	100	5.18E-03
		Bone	8.76E-01	-	-
		Avg. Lung	1.84E-01	-	-
		Bronchi	6.93E+00	-	-
Nearest Actual Resident	Infant	Effective	1.95E+00	100	1.95E-02
		Bone	2.83E+00	-	-
		Avg. Lung	7.77E-01	-	-
		Bronchi	1.80E+01	-	-
	Child	Effective	1.49E+00	100	1.49E-02
		Bone	2.02E+00	-	-
		Avg. Lung	1.03E+00	-	-
		Bronchi	1.80E+01	-	-
	Teenage	Effective	1.55E+00	100	1.55E-02
		Bone	7.06E+00	-	-
		Avg. Lung	8.32E-01	-	-
		Bronchi	1.80E+01	-	-
	Adult	Effective	1.39E+00	100	1.39E-02
		Bone	3.13E+00	-	-
		Avg. Lung	5.84E-01	-	-
		Bronchi	1.80E+01	-	-

TABLE 6.2-3 (Cont'd)
PHASE 2-COMPARISON OF ANNUAL DOSE COMMITMENTS WITH APPLICABLE RADIATION PROTECTION STANDARDS (ARIZONA STRIP ORE)

Location	Age Group	Organ	Estimated Dose (mrem/yr)	Applicable Limit (mrem/yr)	Fraction of Limit
White Mesa Community	Infant	Effective	4.69E-01	100	4.69E-03
		Bone	3.49E-01	-	-
		Avg. Lung	1.55E-01	-	-
		Bronchi	5.75E+00	-	-
	Child	Effective	4.17E-01	100	4.17E-03
		Bone	2.52E-01	-	-
		Avg. Lung	1.45E-01	-	-
		Bronchi	5.75E+00	-	-
	Teenage	Effective	4.20E-01	100	4.20E-03
		Bone	6.85E-01	-	-
		Avg. Lung	1.15E-01	-	-
		Bronchi	5.75E+00	-	-
	Adult	Effective	4.05E-01	100	4.05E-03
		Bone	3.48E-01	-	-
		Avg. Lung	9.14E-02	-	-
		Bronchi	5.75E+00	-	-
Blanding	Infant	Effective	2.19E-01	100	2.19E-03
		Bone	2.20E-01	-	-
		Avg. Lung	7.98E-02	-	-
		Bronchi	2.40E+00	-	-
	Child	Effective	1.86E-01	100	1.86E-03
		Bone	1.64E-01	-	-
		Avg. Lung	9.22E-02	-	-
		Bronchi	2.40E+00	-	-
	Teenage	Effective	1.90E-01	100	1.90E-03
		Bone	5.15E-01	-	-
		Avg. Lung	7.49E-02	-	-
		Bronchi	2.40E+00	-	-
	Adult	Effective	1.79E-01	100	1.79E-03
		Bone	2.44E-01	-	-
		Avg. Lung	5.65E-02	-	-
		Bronchi	2.40E+00	-	-

From Table 6.2-3, the total annual effective dose commitments are at most 3.1% (effective dose for infant at BHV-1) of the R313-15-301(1)(a) limit of 100 mrem/yr (radon included) to an individual member of the public. Therefore, the predicted annual effective dose commitments comply with R313-15-101(1)(a).

In addition, Table 6.2-4 presents a summary of the annual dose commitments from the meat ingestion pathway for Grazing location 1 and 2. As before in the unlikely event that a receptor consumed beef from one of the grazing locations, the total dose would remain well below regulatory limits.

TABLE 6.2-4
PHASE 2-TOTAL ANNUAL DOSE COMMITMENTS FOR MEAT INGESTION PATHWAY (ARIZONA STRIP ORE) (mrem/yr)

Location	Age Group	Organ[b]		
		Effective[a]	Bone[a]	Avg. Lung[a]
Grazing Location 1	Infant	0.00E+00	0.00E+00	0.00E+00
	Child	2.73E-02	1.36E-01	1.24E-01
	Teenage	4.29E-02	7.10E-01	1.08E-01
	Adult	3.10E-02	3.83E-01	8.94E-02
Grazing Location 2	Infant	0.00E+00	0.00E+00	0.00E+00
	Child	1.71E-03	8.50E-03	7.18E-03
	Teenage	2.65E-03	4.48E-02	6.28E-03
	Adult	1.89E-03	2.35E-02	5.18E-03

Note:
a) Assumes cattle will graze at the particular Grazing location for 2 months of the year.

6.2.2 40 CFR 190 Regulatory Compliance

MILDOS-AREA calculated 40 CFR 190 doses (excludes radon). These doses are regulated by the 40 CFR 190 criterion of 25 mrem/yr to the whole body (excluding the dose due to radon) (EPA 2002) or to any organ of the body. The 40 CFR 190 doses are also used to demonstrate compliance with R313-15-101(4) (10 CFR 20.1101(d)). The licensee must demonstrate as an ALARA goal, that total effective dose equivalent to the individual member of the public likely to receive the highest total effective dose equivalent will not exceed 10 mrem/yr (absent of the radon dose).

Phase 1

Table 6.2-5 presents a summary of the 40 CFR 190 individual dose commitments for residential receptors for the age group of infant, child, teenage and adult for Phase 1.

TABLE 6.2-5
PHASE 1-COMPARISON OF 40 CFR 190 ANNUAL DOSE COMMITMENTS WITH APPLICABLE RADIATION PROTECTION STANDARDS (ARIZONA STRIP ORE)

Location	Age Group	Organ	Estimated Dose (mrem/yr)	Applicable Limit (mrem/yr)	Fraction of Limit
Nearest Potential Resident (BHV-1)	Infant	Effective	1.39E+00	25	5.55E-02
		Bone	4.76E+00	25	1.90E-01
		Avg. Lung	1.24E+00	25	4.95E-02
		Bronchi	2.48E-03	no limit given	-
	Child	Effective	5.92E-01	25	2.37E-02
		Bone	3.37E+00	25	1.35E-01
		Avg. Lung	1.69E+00	25	6.74E-02
		Bronchi	2.48E-03	no limit given	-
	Teenage	Effective	7.03E-01	25	2.81E-02
		Bone	1.22E+01	25	4.88E-01
		Avg. Lung	1.33E+00	25	5.31E-02
		Bronchi	2.48E-03	no limit given	-
	Adult	Effective	4.14E-01	25	1.66E-02
		Bone	5.32E+00	25	2.13E-01
		Avg. Lung	8.93E-01	25	3.57E-02
		Bronchi	2.48E-03	no limit given	-
Nearest Historical Resident (BHV-2)	Infant	Effective	2.06E-01	25	8.24E-03
		Bone	7.20E-01	25	2.88E-02
		Avg. Lung	2.18E-01	25	8.73E-03
		Bronchi	3.54E-04	no limit given	-
	Child	Effective	9.19E-02	25	3.68E-03
		Bone	5.32E-01	25	2.13E-02
		Avg. Lung	2.73E-01	25	1.09E-02
		Bronchi	3.54E-04	no limit given	-
	Teenage	Effective	1.09E-01	25	4.34E-03
		Bone	1.86E+00	25	7.44E-02
		Avg. Lung	2.11E-01	25	8.44E-03
		Bronchi	3.54E-04	no limit given	-
	Adult	Effective	6.49E-02	25	2.60E-03
		Bone	8.30E-01	25	3.32E-02
		Avg. Lung	1.43E-01	25	5.73E-03
		Bronchi	3.54E-04	no limit given	-

TABLE 6.2-5 (Cont'd)
PHASE 1-COMPARISON OF 40 CFR 190 ANNUAL DOSE COMMITMENTS WITH APPLICABLE RADIATION PROTECTION STANDARDS (ARIZONA STRIP ORE)

Location	Age Group	Organ	Estimated Dose (mrem/yr)	Applicable Limit (mrem/yr)	Fraction of Limit
Nearest Actual Resident	Infant	Effective	8.11E-01	25	3.24E-02
		Bone	2.79E+00	25	1.11E-01
		Avg. Lung	7.16E-01	25	2.86E-02
		Bronchi	1.44E-03	no limit given	-
	Child	Effective	3.44E-01	25	1.38E-02
		Bone	1.97E+00	25	7.88E-02
		Avg. Lung	9.78E-01	25	3.91E-02
		Bronchi	1.44E-03	no limit given	-
	Teenage	Effective	4.09E-01	25	1.64E-02
		Bone	7.09E+00	25	2.83E-01
		Avg. Lung	7.71E-01	25	3.08E-02
		Bronchi	1.44E-03	no limit given	-
	Adult	Effective	2.41E-01	25	9.64E-03
		Bone	3.09E+00	25	1.24E-01
		Avg. Lung	5.17E-01	25	2.07E-02
		Bronchi	1.44E-03	no limit given	-
White Mesa Community	Infant	Effective	8.58E-02	25	3.43E-03
		Bone	3.02E-01	25	1.21E-02
		Avg. Lung	1.16E-01	25	4.64E-03
		Bronchi	1.08E-04	no limit given	-
	Child	Effective	3.33E-02	25	1.33E-03
		Bone	1.99E-01	25	7.95E-03
		Avg. Lung	9.80E-02	25	3.92E-03
		Bronchi	1.08E-04	no limit given	-
	Teenage	Effective	3.51E-02	25	1.41E-03
		Bone	5.90E-01	25	2.36E-02
		Avg. Lung	6.92E-02	25	2.77E-03
		Bronchi	1.08E-04	no limit given	-
	Adult	Effective	2.21E-02	25	8.85E-04
		Bone	2.82E-01	25	1.13E-02
		Avg. Lung	4.87E-02	25	1.95E-03
		Bronchi	1.08E-04	no limit given	-

TABLE 6.2-5 (Cont'd)
PHASE 1-COMPARISON OF 40 CFR 190 ANNUAL DOSE COMMITMENTS WITH APPLICABLE RADIATION PROTECTION STANDARDS (ARIZONA STRIP ORE)

Location	Age Group	Organ	Estimated Dose (mrem/yr)	Applicable Limit (mrem/yr)	Fraction of Limit
Blanding	Infant	Effective	5.64E-02	25	2.26E-03
		Bone	1.96E-01	25	7.83E-03
		Avg. Lung	6.08E-02	25	2.43E-03
		Bronchi	8.89E-05	no limit given	-
	Child	Effective	2.35E-02	25	9.41E-04
		Bone	1.37E-01	25	5.48E-03
		Avg. Lung	6.86E-02	25	2.74E-03
		Bronchi	8.89E-05	no limit given	-
	Teenage	Effective	2.70E-02	25	1.08E-03
		Bone	4.62E-01	25	1.85E-02
		Avg. Lung	5.20E-02	25	2.08E-03
		Bronchi	8.89E-05	no limit given	-
	Adult	Effective	1.63E-02	25	6.50E-04
		Bone	2.08E-01	25	8.32E-03
		Avg. Lung	3.55E-02	25	1.42E-03
		Bronchi	8.89E-05	no limit given	-

From Table 6.5-2, the 40 CFR 190 annual dose commitments are at most 48.8% (dose to the bone for the teenage at BHV-1) of the 40 CFR 190 dose criterion of 25 mrem/yr. In addition, the 40 CFR 190 annual effective dose commitments demonstrate compliance with the R313-15-101(4) (10 CFR 20.1101(d)) ALARA goal of 10 mrem/yr to the individual member of the public likely to receive the highest total effective dose equivalent. The maximum total effective dose equivalent was 1.39 mrem/yr (infant at BHV-1), or 13.9% of the 10 mrem/yr goal.

In addition, Table 6.2-6 presents a summary of the 40 CFR 190 annual dose commitments from the meat ingestion pathway for Grazing location 1 and 2. As before in the unlikely event that someone was to consume beef from grazing area 1 or 2, the total dose would be small and well below regulatory limits.

TABLE 6.2-6
PHASE 1-40 CFR 190 ANNUAL DOSE COMMITMENTS FOR MEAT INGESTION PATHWAY (ARIZONA STRIP ORE) (mrem/yr)

Location	Age Group	Organ		
		Effective[a]	Bone[a]	Avg. Lung[a]
Grazing Location 1	Infant	0.00E+00	0.00E+00	0.00E+00
	Child	2.75E-02	1.37E-01	1.25E-01
	Teenage	4.33E-02	7.16E-01	1.09E-01
	Adult	3.13E-02	3.87E-01	9.03E-02
Grazing Location 2	Infant	0.00E+00	0.00E+00	0.00E+00
	Child	1.87E-03	9.27E-03	7.90E-03
	Teenage	2.88E-03	4.87E-02	6.92E-03
	Adult	2.06E-03	2.57E-02	5.71E-03

Note:
a) Assumes cattle will graze at the particular Grazing location for 2 months of the year.
b) Exclusive of radon.

The annual doses to the population estimated within 50 miles (80 km) of the site are provided in Table 6.2-7.

TABLE 6.2-7
PHASE 1-ANNUAL POPULATION DOSE COMMITMENTS WITHIN 50 MILES (80 km) OF THE MILL FOR ARIZONA STRIP ORE

Organ	ANNUAL POPULATION DOSE COMMITMENTS, PERSON-REM PER YEAR
	Mill Operations
Effective	3.08E-01
Bone	2.48E+00
Avg. Lung	3.28E-01
Bronchi	1.64E+01

The population dose arising from processing Arizona Strip ore during Phase 1 is estimated at 0.31 person-rem. This can be compared to the dose from natural background sources of radiation of about 360 mrem/yr as previously discussed.

The current population of San Juan County is about 14,400 people. Assuming everyone living in San Juan County receives an annual dose of (about) 360 mrem/yr, then the total dose due to natural background is approximately 5184 person-rem. The theoretical incremental dose of 0.31 person-rem is clearly inconsequential by comparison.

Phase 2

Table 6.2-8 presents a summary of the 40 CFR 190 individual dose commitments for residential receptors for the age group of infant, child, teenage and adult for Phase 2.

TABLE 6.2-8
PHASE 2-COMPARISON OF 40 CFR 190 ANNUAL DOSE COMMITMENTS WITH APPLICABLE RADIATION PROTECTION STANDARDS (ARIZONA STRIP ORE)

Location	Age Group	Organ	Estimated Dose (mrem/yr)	Applicable Limit (mrem/yr)	Fraction of Limit
Nearest Potential Resident (BHV-1)	Infant	Effective	1.38E+00	25	5.50E-02
		Bone	4.71E+00	25	1.88E-01
		Avg. Lung	1.21E+00	25	4.84E-02
		Bronchi	2.45E-03	no limit given	-
	Child	Effective	5.81E-01	25	2.32E-02
		Bone	3.31E+00	25	1.32E-01
		Avg. Lung	1.64E+00	25	6.58E-02
		Bronchi	2.45E-03	no limit given	-
	Teenage	Effective	6.89E-01	25	2.76E-02
		Bone	1.20E+01	25	4.79E-01
		Avg. Lung	1.29E+00	25	5.18E-02
		Bronchi	2.45E-03	no limit given	-
	Adult	Effective	4.05E-01	25	1.62E-02
		Bone	5.21E+00	25	2.08E-01
		Avg. Lung	8.71E-01	25	3.48E-02
		Bronchi	2.45E-03	no limit given	-

TABLE 6.2-8 (Cont'd)
PHASE 2-COMPARISON OF 40 CFR 190 ANNUAL DOSE COMMITMENTS WITH APPLICABLE RADIATION PROTECTION STANDARDS (ARIZONA STRIP ORE)

Location	Age Group	Organ	Estimated Dose (mrem/yr)	Applicable Limit (mrem/yr)	Fraction of Limit
Nearest Historical Resident (BHV-2)	Infant	Effective	2.05E-01	25	8.20E-03
		Bone	7.16E-01	25	2.86E-02
		Avg. Lung	2.16E-01	25	8.64E-03
		Bronchi	3.53E-04	no limit given	-
	Child	Effective	9.11E-02	25	3.64E-03
		Bone	5.27E-01	25	2.11E-02
		Avg. Lung	2.70E-01	25	1.08E-02
		Bronchi	3.53E-04	no limit given	-
	Teenage	Effective	1.07E-01	25	4.30E-03
		Bone	1.84E+00	25	7.38E-02
		Avg. Lung	2.09E-01	25	8.35E-03
		Bronchi	3.53E-04	no limit given	-
	Adult	Effective	6.42E-02	25	2.57E-03
		Bone	8.22E-01	25	3.29E-02
		Avg. Lung	1.42E-01	25	5.66E-03
		Bronchi	3.53E-04	no limit given	-
Nearest Actual Resident	Infant	Effective	8.04E-01	25	3.22E-02
		Bone	2.76E+00	25	1.10E-01
		Avg. Lung	7.02E-01	25	2.81E-02
		Bronchi	1.42E-03	not limited	-
	Child	Effective	3.39E-01	25	1.35E-02
		Bone	1.94E+00	25	7.74E-02
		Avg. Lung	9.57E-01	25	3.83E-02
		Bronchi	1.42E-03	not limited	-
	Teenage	Effective	4.02E-01	25	1.61E-02
		Bone	6.97E+00	25	2.79E-01
		Avg. Lung	7.54E-01	25	3.02E-02
		Bronchi	1.42E-03	not limited	-
	Adult	Effective	2.36E-01	25	9.46E-03
		Bone	3.03E+00	25	1.21E-01
		Avg. Lung	5.06E-01	25	2.02E-02
		Bronchi	1.42E-03	not limited	-

TABLE 6.2-8 (Cont'd)
PHASE 2-COMPARISON OF 40 CFR 190 ANNUAL DOSE COMMITMENTS WITH APPLICABLE RADIATION PROTECTION STANDARDS (ARIZONA STRIP ORE)

Location	Age Group	Organ	Estimated Dose (mrem/yr)	Applicable Limit (mrem/yr)	Fraction of Limit
White Mesa Community	Infant	Effective	8.53E-02	25	3.41E-03
		Bone	3.00E-01	25	1.20E-02
		Avg. Lung	1.15E-01	25	4.59E-03
		Bronchi	1.08E-04	not limited	-
	Child	Effective	3.30E-02	25	1.32E-03
		Bone	1.97E-01	25	7.87E-03
		Avg. Lung	9.68E-02	25	3.87E-03
		Bronchi	1.08E-04	not limited	-
	Teenage	Effective	3.48E-02	25	1.39E-03
		Bone	5.85E-01	25	2.34E-02
		Avg. Lung	6.83E-02	25	2.73E-03
		Bronchi	1.08E-04	not limited	-
	Adult	Effective	2.19E-02	25	8.75E-04
		Bone	2.79E-01	25	1.12E-02
		Avg. Lung	4.81E-02	25	1.92E-03
		Bronchi	1.08E-04	not limited	-
Blanding	Infant	Effective	5.64E-02	25	2.26E-03
		Bone	1.96E-01	25	7.82E-03
		Avg. Lung	6.07E-02	25	2.43E-03
		Bronchi	8.88E-05	not limited	-
	Child	Effective	2.35E-02	25	9.40E-04
		Bone	1.37E-01	25	5.47E-03
		Avg. Lung	6.84E-02	25	2.74E-03
		Bronchi	8.88E-05	not limited	-
	Teenage	Effective	2.70E-02	25	1.08E-03
		Bone	4.61E-01	25	1.85E-02
		Avg. Lung	5.19E-02	25	2.08E-03
		Bronchi	8.88E-05	not limited	-
	Adult	Effective	1.62E-02	25	6.49E-04
		Bone	2.08E-01	25	8.31E-03
		Avg. Lung	3.55E-02	25	1.42E-03
		Bronchi	8.88E-05	not limited	-

From Table 6.2-8, the 40 CFR 190 annual dose commitments are at most 48% (dose to the bone for the teenage at BHV-1) of the 40 CFR 190 dose criterion of 25 mrem/yr. In addition, the 40 CFR 190 annual effective dose commitments demonstrate compliance with the R313-15-101(4) (10 CFR 20.1101(d)) ALARA goal of 10 mrem/yr to the individual member of the public likely to receive the highest total effective dose equivalent. The maximum total effective dose equivalent was 1.38 mrem/yr (infant at BHV-1), or 13.8% of the 10 mrem/yr goal.

In addition, Table 6.2-9 presents a summary of the 40 CFR 190 annual dose commitments from the meat ingestion pathway for Grazing location 1 and 2. As before in the unlikely event that someone was to consume beef from grazing area 1 or 2, the total dose would be small and well below regulatory limits.

TABLE 6.2-9
PHASE 2-40 CFR 190 ANNUAL DOSE COMMITMENTS FOR MEAT INGESTION PATHWAY (ARIZONA STRIP ORE) (mrem/yr)

Location	Age Group	Organ		
		Effective[a]	Bone[a]	Avg. Lung[a]
Grazing Location 1	Infant	0.00E+00	0.00E+00	0.00E+00
	Child	2.73E-02	1.36E-01	1.24E-01
	Teenage	4.29E-02	7.10E-01	1.08E-01
	Adult	3.10E-02	3.83E-01	8.94E-02
Grazing Location 2	Infant	0.00E+00	0.00E+00	0.00E+00
	Child	1.71E-03	8.48E-03	7.14E-03
	Teenage	2.63E-03	4.46E-02	6.25E-03
	Adult	1.88E-03	2.35E-02	5.17E-03

Note:
a) Assumes cattle will graze at the particular Grazing location for 2 months of the year.
b) Exclusive of radon.

The annual doses to the population estimated within 50 miles (80 km) of the site are provided in Table 6.2-10.

TABLE 6.2-10
PHASE 2-ANNUAL POPULATION DOSE COMMITMENTS WITHIN 50 MILES (80 km) OF THE MILL FOR ARIZONA STRIP ORE

Organ	ANNUAL POPULATION DOSE COMMITMENTS, PERSON-REM PER YEAR
	Mill Operations
Effective	3.15E-01
Bone	2.55E+00
Avg. Lung	3.34E-01
Bronchi	1.65E+01

The population dose arising from processing Arizona Strip ore during Phase 2 is estimated at 0.32 person-rem. This can be compared to the dose from natural background sources of radiation in the Colorado Plateau of about 360 mrem/yr as previously discussed.

The current population of San Juan County is about 14,400 people. Assuming everyone living in San Juan County receives an annual dose of (about) 360 mrem/yr, then the total dose due to natural background is approximately 5184 person-rem. The theoretical incremental dose of 0.32 person-rem is clearly inconsequential by comparison.

7.0 KEY OBSERVATIONS

As described in Section 1.0, milling of conventional ore is scheduled for the Spring of 2008 when the milling of currently available alternate feed materials is completed (DUSA 2007a). The objective of this dose assessment was to extend the previous report (SENES 2007) to incorporate the dose from the proposed development of new tailings cell 4B, in support of a license amendment application for the construction and operation of that cell.

The NRC-approved MILDOS-AREA was used to estimate the dose commitments received by individuals and the general population within a 50 mile (80 km) radius of the site for the processing of Colorado Plateau or Arizona Strip ore separately. In each scenario, the doses arising from the emissions of dust and radon from the mill area and ore pads were assumed to be the same as in the previous 2007 report since the scenarios both involve the processing of Colorado Plateau and Arizona Strip ores. Therefore, MILDOS-AREA runs from the previous report were revised to exclude the tailings cells. The doses from the tailings cells were estimated in separate MILDOS-AREA runs and added to the dose from the mill area and ore pads. Table 7-1 provides a summary of the source terms included in Phases 1 and 2.

TABLE 7-1
SOURCE TERMS INCLUDED IN PHASES 1 AND 2

Source Term	Phase 1	Phase 2
Mill area	included	included
Ore Pads	included	included
Tailings Cell 2 with Interim Soil Cover	included	included
Tailings Cell 3	active	interim soil cover
Tailings Cell 4A	active	active
Tailings Cell 4B	excluded	active

The wind erosion and radon release rates from the tailings cells (active and with interim soil cover) were modelled by using a maximal worst case approach.

Each active tailings cell was modelled to have an active exposed (non-solution) tailings solids area of 10 acres (i.e., the maximum uncovered tailings solids area at any time allowed under NESHAPs Regulation 40 CFR 61.252(b), Subpart W) since it is not possible to predict the distribution of uncovered tailings between the active cells at any given time. As a result, the release rate of wind-eroded tailings dust was estimated at 10 acres at all times for each active cell. The total annual radon release rate was estimated by assuming a radon release rate of 20 pCi/m^2s (i.e., maximum radon-222 emissions to ambient air from an existing uranium mill pile) over the entire area of each cell consistent with NESHAPs.

The tailings cells (2 and 3) with interim soil cover were assumed to be the entire areas of each cell; however, only radon is released at a rate of 10 pCi/m^2s after the application of the soil cover.

The calculated total annual effective dose commitments (including radon) calculated using MILDOS-AREA were compared to the Utah Administrative Code R313-15-301(1)(a) requirement that the dose to individual members of the public shall not exceed 100 mrem/yr (radon included). For processing of Colorado Plateau ore, the maximum total annual effective dose commitments was calculated to be a maximum of 1.4 mrem/yr for an infant at the nearest potential resident, BHV-1 (Tables 6.1-1 and 6.1-3) (i.e., effective dose) and is about 1.4% of the R313-15-301(1)(a) limit of 100 mrem/yr (radon included) to an individual member of the public for Phases 1 and 2. For processing of Arizona Strip ore, the total annual effective dose commitments were calculated to be a maximum of 3.1 mrem/yr for an infant at the nearest potential resident, BHV-1 (Tables 6.2-1 and 6.2-3) (i.e., effective dose) and is about 3.1% of the 100 mrem/yr limit (radon included) to an individual member of the public for Phases 1 and 2. Overall, using conservative assumptions, the predicted annual effective dose commitments for Phases 1 and 2 comply with R313-15.

In addition, our MILDOS-AREA calculated 40 CFR 190 annual dose commitments (excluding radon) were compared to the 40 CFR 190 criterion, which is 25 mrem/yr to the whole body (excluding the dose due to radon) and 25 mrem/yr to any other organ to any member of the public (EPA 2002). The 40 CFR 190 doses were also used to demonstrate compliance with the ALARA goal set out in R313-15-101(4) (10 CFR 20.1101(d)) (i.e., the ALARA goal is to demonstrate that total effective dose equivalent to the individual member of the public likely to receive the highest total effective dose equivalent will not exceed 10 mrem/yr (absent of the radon dose)). For processing of Colorado Plateau ore, the 40 CFR 190 annual dose commitments were calculated to be a maximum of 4.8 mrem/yr for a teenager at the nearest potential resident, BHV-1 (Tables 6.1-5 and 6.1-8) (i.e., dose to the bone) and is about 19% of the 40 CFR 190 dose criterion of 25 mrem/yr, for Phases 1 and 2. Further, the 40 CFR 190 annual effective dose commitments demonstrate compliance with the R313-15-101(4) (10 CFR 20.1101(d)) ALARA goal of 10 mrem/yr to the individual member of the public likely to receive the highest total effective dose equivalent (the maximum total effective dose equivalent (radon excluded) during Phases 1 and 2 was 0.545 mrem/yr for an infant at BHV-1). For Arizona Strip ore, the 40 CFR 190 annual dose commitments were at most 12 mrem/yr for a teenage at the nearest potential resident, BHV-1 (Tables 6.2-5 and 6.2-8) (i.e., dose to the bone) and is about 49% of the 40 CFR 190 dose criterion of 25 mrem/yr for Phases 1 and 2. Further, the 40 CFR 190 annual effective dose commitments demonstrate compliance with the R313-15-101(4) (10 CFR 20.1101(d)) goal of 10 mrem/yr to the individual member of the public likely to receive the highest total effective dose equivalent (the maximum total effective dose equivalent (radon excluded) during Phases 1 and 2 was 1.39 mrem/yr for an infant at BHV-1). Overall, using conservative assumptions, ore processing in Phases 1 and 2 comply with the requirements of 40 CFR 190 and the ALARA goal set out in R313 -15-101(4).

8.0 REFERENCES

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APPENDIX A

HISTORY OF MILDOS

APPENDIX A HISTORY OF MILDOS

The MILDOS computer code was developed from the version IV for Argonne National Laboratory's (ANL's) Uranium Dispersion and Dosimetry (UDAD) computer program 1981. The MILDOS program was based on the models and assumptions from NRC Draft Regulatory Guide RH802-4 (Calculational Models for Estimating Radiation Doses to Man from Airborne Radioactive Material Resulting from Uranium Milling Operation) and portions of the UDAD document (Strenge and Bender 1981).

In 1989, ANL developed the MILDOS-AREA code by modifying the MILDOS code developed in 1981. The MILDOS-AREA code was designed for use on IBM or IBM compatible computers; the changes made were intended to enhance capabilities for calculating dose from large area-sources and updated dosimetry calculations. The major revision from the original MILDOS code is the treatment of atmospheric dispersion from area sources; MILDOS-AREA substituted a finite-element approach for the virtual-point source method (the algorithm used in the original MILDOS code) when specified by the user. The new approach subsequently led to a reduction in the number of sources from 20 to 10 in MILDOS-AREA due to the fact that a large area can be considered as a single source rather than two or more point sources.

The internal dosimetry calculations were also updated in MILDOS-AREA. In the original version of MILDOS, the dose to exposed individual is calculated for comparison with requirements of both 40 CFR 190 and 10 CFR 20 (R313-15). The calculations of ingestion DCFs were based on ICRP Publication 2 and 10A's ingestion models (ICRP 1966). The inhalation DCFs are calculated by the ANL computer program UDAD in accordance with Task Group on Lung Dynamics Lung Model (TGLM) of the International Commission on Radiological Protection (ICRP 1966, ICRP 1972). ICRP Publication 19 (ICRP 1972) gives dose commitments to adult members of the public at age 20 that are assumed to live another 50 years. DCFs are provided as a function of particle size and organ for the radionuclides U-238, U-234, Th-230, Ra-226, Pb-210, Po-210 and Bi-210. The inhalation dose factors incorporated into MILDOS-AREA are calculated using the dosimetric model from ICRP Publication 30 (ICRP 1979) (Yu 1992); the inhalation dose factors are provided for the age groups of infant, child, teenager and adult. However, these factors are fixed internally in the code, and are not part of the input options. The annual average air concentrations were computed to the maximum permissible concentrations (MPCs) in 10 CFR 20. The MPCs in 10 CFR 20 (incorporated by reference in R313-15) were revised in 1994 to incorporate the updated dosimetry to the 1CRP 1978 recommendations.

In 1997, the MILDOS-AREA code was updated to meet the requirements of the revised 10 CFR 20. The dose limit to the general public also changed; which led to a revised calculation

of the allowable concentrations (ALCs) for unrestricted areas, with MPC replaced with the term "effluent concentrations".

In 1998, ANL again updated the MILDOS-AREA code in an attempt to improve the "user friendliness" of the software. In the past, the user must develop an input file in an American Standard Code for Information Interchange (ASCII) file containing values that are required by the code. The code executes this file to produce the output. The latest version of MILDOS-AREA, has a graphical user interface (GUI) which provides an interface for the user to input each parameter needed for the calculations in the Windows operating system. The GUI allows the results of the MILDOS-AREA calculations to be viewed. The 1998 update was the last time ANL made changes to the MILDOS-AREA code. The most up-to-date version of MILDOS-AREA was used in this assessment.

MILDOS-AREA calculates the impacts based on annual average air concentrations of nuclides considered. The human pathways considered in MILDOS-AREA for individual and population impacts are: inhalation, external exposure from ground concentrations, external exposure from cloud immersion, ingestion of vegetables, ingestion of meat and ingestion of milk.

APPENDIX B

EMISSION CALCULATIONS

APPENDIX B EMISSION CALCULATIONS

Supplemental Information which describes the model and assumptions used to calculate the source emissions for the sources described in Section 4.0 are provided below.

B.1 CALCULATION OF ANNUAL DUST LOSS

The calculation of the annual dust loss from the ore pads and the tailings cells was required to calculate an emission factor. This dusting rate for the tailings impoundments is calculated according to the emission factor (E_w) equation from NRC Regulatory Guide 3.59 (NRC 1987). The equation of for the dusting rate is calculated as follows:

$$E_W = \frac{3.156 \times 10^7}{0.5} \times \sum_S R_S F_S \qquad (B.1)$$

where,

E_w= annual dust loss per unit area in g/m^2yr;
F_S= annual average frequency of occurrence of wind speed group S (dimensionless) obtained from the joint relative frequency distribution for the mill (provided by DUSA (Turk 2007b));
R_S= resuspension rate for the tailings pond at the average wind speed for wind group S, for particles ≤ 20 μm in diameter in g/m^2s;
3.156 x 10^7= number of seconds per year; and,
0.5= fraction of the total dust lost constituted by particle ≤ 20 μm in diameter.

TABLE B.1
PARAMETER VALUES FOR CALCULATION OF ANNUAL DUSTING RATE FOR EXPOSED TAILINGS

Wind Speed (kts)	Average Wind Speed	Resuspension Rate (R_S) (g/m^2s)[a]	Frequency of Occurrence, (F_S)[b]	R_S x F_S
0 to 3	1.5	0	0.165	0.00E+00
4 to 6	5.5	0	0.427	0.00E+00
7 to 10	10.0	3.92E-07	0.276	1.08E-07
11 to 16	15.5	9.68E-06	0.106	1.03E-06
17 to 21	21.5	5.71E-05	0.021	1.20E-06
21+	28.0	2.08E-04	0.005	1.04E-06
			$\sum_S$	3.37E-06

Notes:
a) Resuspension rate of a function of wind speed is computed by the MILDOS code.
b) Wind speed frequency obtained from joint frequency distribution data provided by DUSA (Turk 2007b).

Using equation B.1 and the parameters in Table B-1, the annual dust loss from the tailings cells is approximately 213 g/m^2yr. As mentioned in Section 4.2.1, the annual dust lost for ore pads is 10% of that of the tailings cells since the particulates on the ore pad are coarse material (1 to 6 inch) because the ore has not yet been ground; therefore the annual dust loss from the ore pad is 21.29 g/m^2yr.

B.2 EMISSION CALCULATIONS

The equations and assumptions used to calculate the radioactive particulate (U-238) and its daughters thorium (Th-230), radium (Ra-226) and lead (Pb-210)) and radon emission rates from the grizzly, grinding, ore pads, vanadium stack (exclusively for processing Colorado Plateau ore), yellowcake stacks (north and south yellowcake stacks) and the tailings cells were taken from NRC Regulatory Guide 3.59 (NRC 1987), NUREG-0706 (NRC 1980) and the EnecoTech analysis (EnecoTech 1991a and 1991b).

B.2.1 Wet Grinding

Radioactive Particulate Emission Rates

	Colorado Plateau Ore	Arizona Strip Ore
Process Rate (tpy)	730,000	730,000
Contaminant Concentration (pCi/g U-238)	700	1783
Process Emission Factor (lbs/ton)[a]	0.16	0.16
Activity Enrichment Ratio	2.5	2.5
Control Factor (%)[b]	99.90	99.90

Notes:

a) For moisture <8% (NRC 1987).

b) Particulate emission control from the wet grinding operations was assumed to be 99.9% (EnecoTech 1991a and 1999b)

The U-238 Emission Rate (S) is calculated as follows:

S= (Process Rate (tons/yr))*(Process Emission Factor (lbs/ton))* (453.6 g/lb)*(Contaminant Concentration (pCi/g))*(Activity Enrichment Ratio)* (1-Control Factor)*(10^{-12} Ci/pCi) (B.2-1)

Using equation B.2-1, the U-238 Emission Rate from wet grinding operations of Colorado Plateau ore is approximately 9.27E-05 Ci/yr. U-238 decay daughters (Th-230, Ra-226 and Pb-210) are assumed to be in secular equilibrium; therefore the decay daughters are also emitted at a rate of 9.27E-05 Ci/yr. Similarly, the U-238 Emission Rate from the wet grinding operations

of Arizona Strip ore is approximately 2.36E-04 Ci/yr and the decay daughters (Th-230, Ra-226 and Pb-210) are also emitted at a rate of 2.36E-04 Ci/yr.

Radon Emission Rates

	Colorado Plateau ore	**Arizona Strip ore**
Process Rate (tpy)	730,000	730,000
Contaminant Concentration (pCi/g Ra-226)	700	1783
Activity Factor(%)[a]	20	20

Note:

a) It was assumed that only 20% of the radon is available for release or emanation from the mineral grains in which it is produced (i.e. the emanating fraction or power is 0.20) (NRC 1980).

Radon Release (F):

F= (Process Rate (tons/yr))*(2000 lbs/ton)*(453.6 g/lb)*
(Contaminant Concentration pCi/g Ra-226)*(10^{-12} Ci/pCi)*(Activity Factor) (B.2-2)

Using equation B.2-2, the radon release from the wet grinding operations of Colorado Plateau ore is approximately 92.7 Ci/yr. Similarly, the radon release from the wet grinding operations of Arizona Strip ore is approximately 236 Ci/yr.

B.2.2 Ore Dump to Grizzly

Radioactive Particulate Emission Rates

	Colorado Plateau Ore	**Arizona Strip Ore**
Process Rate (tpy)	730,000	730,000
Contaminant Concentration (pCi/g U-238)	700	1783
Process Emission Factor (lbs/ton)[a]	0.16	0.16
Activity Enrichment Ratio	2.5	2.5
Control Factor (%)	99.90	99.90

Notes:

a) For moisture <8% (NRC 1987).

b) Grizzly Dump is enclosed on three sides. Trucks dump inside enclosure under negative pressure. The ID fans are ducted through a baghouse. Ore moisture content is 10 % (EnecoTech 1991a and 1999b).

The U-238 Emission Rate (S) is calculated as follows:

S= (Process Rate (tons/yr))*(Process Emission Factor (lbs/ton))*(453.6 g/lb)* (Contaminant Concentration (pCi/g))*(Activity Enrichment Ratio)*(1-Control Factor)* (10^{-12} Ci/pCi) (B.2-3)

Using equation B.2-3, the U-238 Emission Rate due to the trucks dumping Colorado Plateau ore on the grizzly is approximately 9.27E-05 Ci/yr. U-238 decay daughters (Th-230, Ra-226 and Pb-210) are assumed to be in secular equilibrium; therefore the decay daughters are also emitted at a rate of 9.27E-05 Ci/yr. Similarly, the U-238 Emission Rate due to the trucks dumping Arizona Strip ore on the grizzly is approximately 2.36E-04 Ci/yr and the decay daughters (Th-230, Ra-226 and Pb-210) are also emitted at a rate of 2.36E-04 Ci/yr.

Radon Emission Rates

No radon is released from the trucks dumping ore onto the grizzly.

B.2.3 Yellowcake Stacks

As mentioned in Section 4.1.3, the mill has two yellowcake dryers (north and south yellowcake stack dryers); therefore the total emissions were assumed to be divided equally between the two stacks (i.e., north and south yellowcake stacks).

Radioactive Particulate Emission Rates

	Colorado Plateau Ore	**Arizona Strip Ore**
Process Rate (tpy U_3O_8)	1716	4371
Contaminant Concentration (Ci/g of U-238)	3.33E-07	3.33E-07
Process Emission Factor (g U-238/g U_3O_8)	0.848	0.848
Emission Rate (lbs/ton)[a]	0.092	0.092

Note:

a) Based stack tests that showed an emission rate of 0.06 lbs/hr U_3O_8 per 1300 lbs/hr process rate which translates to 0.092 lb/ton including controls (EnecoTech 1991a and 1999b).

The U-238 Emission Rate (S) for one yellowcake stack is calculated as follows:

S= [(Process Rate (tons/yr U_3O_8))*(Emission Rate (lbs/ton))*(Process Emission Factor)* (453.6 g/lb)*(Contaminant Concentration (Ci/g))]/2 (B.2-4)

Based on field measurements, the decay daughters Th-230, Ra-226 and Pb-210 are processed along with yellowcake at 0.22%, 0.13% and 0.78%, respectively.

Using equation B.2-4, the U-238 Emission Rate from each yellowcake stack (north and south yellowcake stacks) is approximately 1.01E-02 Ci/yr for the processing of Colorado Plateau ore. The emission rate for the decay daughters Th-230, Ra-226 and Pb-210 is 2.22E-05, 1.31E-05 and 7.88E-05 Ci/yr, respectively from each yellowcake stack (north and south yellowcake stacks). Similarly, the U-238 Emission Rate from each yellowcake stack (north and south yellowcake stacks) is approximately 2.58E-02 Ci/yr for the processing of Arizona Strip ore. The emission rate for the decay daughters Th-230, Ra-226 and Pb-210 is 5.67E-05, 3.35E-05 and 2.01E-04 Ci/yr, respectively from each yellowcake stack (north and south yellowcake stacks).

Radon Emission Rates

There is no significant radon releases during this process.

B.2.4 Vanadium Stack

Radioactive Particulate Emission Rates

As mentioned in Section 4.1.4, the vanadium source was only used in the MILDOS-AREA model for Colorado Plateau ore. The product from the vanadium recovery contains less than 0.005% U_3O_8 (NRC 1980). Therefore, the emission rates of U-238 and its decay daughters from the vanadium stack were assumed to be 0.005% of the total emission rate from the yellowcake stacks (north and south yellowcake stacks).

Radioactive Particulate	Emission Rate (S) (Ci/yr)	
	Total from Yellowcake Stacks	Vanadium Stack[a]
U-238	2.02E-02	1.01E-06
Th-230	4.45E-05	2.22E-09
Ra-226	2.63E-05	1.31E-09
Pb-210	1.58E-04	7.88E-09

Note:

a) Total from yellowcake stacks (north and south yellowcake stacks)*0.005%.

Radon Emission Rates

There are no significant radon releases during this process.

B.2.5 Ore Pads

The ore pad storage operation has two different sources of emissions - namely unloading from the truck to the ore pad and wind emissions. For the wind emissions calculated, it was assumed that approximately 300,000 tons of ore are temporarily stockpiled with a height of 30 ft (9.1 m). and bulk density of ore of 120 lbs/ft^3 (1.47 tons/yd^3). Using these assumptions, the area of the ore pad is approximately 17,000 m^2.

Radioactive Particulate Emission Rates

Source Description: Truck Unloading

	Colorado Plateau Ore	**Arizona Strip Ore**
Process Rate (tpy)	730,000	730,000
Contaminant Concentration (pCi/g U-238)	700	1783
Process Emission Factor (lbs/yd^3)[a]	0.04	0.04
Activity Emission Ratio	2.5	2.5
Control Factor	None	None
Bulk Density of Ore (tons/yd^3)	1.47	1.47

Note:

a) Process emission factor for Truck end dump (NRC 1987).

The U-238 Emission Rate (S) is calculated as follows:

S= (Process Rate (tons/yr))*(1 yd^3/1.47 tons)* (Process Emission Factor (lbs/yd^3))*(453.6 g/lb)*(Contaminant Concentration (pCi/g))* (Activity Enrichment Ratio)*(10^{-12} Ci/pCi) (B.2-5)

Using equation B.2-5, the U-238 Emission Rate from truck unloading Colorado Plateau ore is approximately 1.58E-02 Ci/yr. U-238 decay daughters (Th-230, Ra-226 and Pb-210) were assumed to be in secular equilibrium; therefore the decay daughters are also emitted at a rate of 1.58E-02 Ci/yr. Similarly, the U-238 Emission Rate from truck unloading of Arizona Strip ore is approximately 4.02E-02 Ci/yr and the decay daughters (Th-230, Ra-226 and Pb-210) are also emitted at a rate of 4.02E-02 Ci/yr.

Source Description: Wind Erosion

	Colorado Plateau Ore	Arizona Strip Ore
Area (m^2)[a]	17000	17000
Contaminant Concentration (pCi/g U-238)	700	1783
Process Emission Factor, E_W (g/m^2yr)[b]	21.29	21.29
Activity Enrichment Ratio	2.5	2.5
Control Factor (%)[c]	50	50

Notes:

a) Calculated assuming a stockpile of 300,000 tons of ore with a height of 30 ft. and bulk ore density of 1.47 $tons/yd^3$.

b) The process emission factor for the ore pad was derived in Section B.1.

c) The control factor of 50% is based on the assumption that an active watering program will be in place during operations (EnecoTech 1991a and 1999b).

The U-238 Emission Rate (S) is calculated as follows:

S= (Process Emission Factor (g/m^2yr))*(Area (m^2))*(Contaminant Concentration (pCi/g))* (Activity Enrichment Ratio)*(1-Control Factor)*(10^{-12} Ci/pCi) (B.2-6)

Using equation B.2-6, the U-238 Emission Rate from trucks unloading Colorado Plateau ore is approximately 3.17E-04 Ci/yr. U-238 decay daughters (Th-230, Ra-226 and Pb-210) were assumed to be in secular equilibrium; therefore the decay daughters are also emitted at a rate of 3.17E-04 Ci/yr. Similarly, the U-238 Emission Rate from truck unloading of Arizona Strip ore is approximately 8.07E-04 Ci/yr and the decay daughters (Th-230, Ra-226 and Pb-210) are also emitted at a rate of 8.07E-04 Ci/yr.

The total radioactive particulate emission rates from the ore pad are obtained by adding the results of truck unloading and wind erosion and are as follows:

Radioactive Particulate	Emission Rate (S) (Ci/yr)	
	Colorado Plateau Ore	Arizona Strip Ore
U-238	1.61E-02	4.10E-02
Th-230	1.61E-02	4.10E-02
Ra-226	1.61E-02	4.10E-02
Pb-210	1.61E-02	4.10E-02

Radon Emission Rates

	Colorado Plateau ore	Arizona Strip ore
Area (m^2)	17000	17000
Contaminant Concentration (pCi/g Ra-226)	700	1783
Specific Radon Flux Factor (pCi Rn-222/m^2s)/(pCi/g Ra-226)	1	1

Radon Release (F):

F= (Specific Radon Flux Factor (pCi Rn-222/m^2s)/(pCi/g Ra-226))*(Contaminant Concentration (pCi/g Ra-226))*(Area (m^2))*(3.156x10^7 s/yr)*(10^{-12} Ci/pCi) (B.2-7)

Using equation B.2-7, the radon release from storage of Colorado Plateau ore is approximately 375 Ci/yr. Similarly, the radon release from storage of Arizona Strip ore is approximately 956 Ci/yr.

B.2-6 Tailings Cells

Factors used to Calculate Radioactive Particulate Emission Rates

	Colorado Plateau Ore		Arizona Strip Ore	
	Active		Active	
	Cell 3	Cell 4A/4B	Cell 3	Cell 4A/4B
Area (acres)	10	10	10	10
Contaminant Concentration (pCi/g U-238)[a]	42	42	107	107
Contaminant Concentration of all other isotopes (pCi/g)	700	700	1783	1783
Process Emission Factor, E_W (g/m^2yr)[b]	213	213	213	213
Activity Enrichment Ratio	2.5	2.5	2.5	2.5
Control Factor (%)[c]	70	70	70	70

Notes:

a) Assumes 94% recovery.

b) The process emission factor for the tailings cells was derived in Section B.1.

c) The control factor of 70% is based on the assumption that active watering programs as well as crusting agents are used to minimize the erosion of the tailings by wind (EnecoTech 1991a and 1991b).

The Emission Rate (S) for U-238 and its decay daughters were calculated as follows:

S= (Process Emission Factor (g/m^2yr))*(Area (acres))*(4047 m^2/acre)* (Contaminant Concentration (pCi/g)) *(Activity Enrichment Ratio)*(1-Control Factor)* (10^{-12} Ci/pCi) (B.2-8)

Using equation B.2-8, the U-238 Emission Rate from the active tailings cells 3, 4A and 4B from the processing of Colorado Plateau ore is approximately 2.71E-04 Ci/yr. The decay daughters (Th-230, Ra-226 and Pb-210) are emitted at a rate of 4.52E-03 Ci/yr.

Similarly, the U-238 Emission Rate from the active tailings cells 3, 4A and 4B from the processing of Arizona Strip ore is approximately 6.91E-04 Ci/yr. The decay daughters (Th-230, Ra-226 and Pb-210) are emitted at a rate of 1.15E-02 Ci/yr.

There is no dust released from tailings cells 2 and 3 with interim covers.

Factors Used to Calculate Radon Emission Rates

	Colorado Plateau/ Arizona Strip Ore			
	Interim Soil Cover		Active	
	Cell 2	Cell 3	Cell 3	Cell 4A/4B
Area (acres)	66.8	70	70	40
Contaminant Concentration (pCi/m^2s)	10	10	20	20

Radon Release (F):

F= (Contaminant Concentration (pCi/m^2s)*(Area (acres))*(4047 m^2/acre)*($3.156x10^7$ s/yr)* (10^{-12} Ci/pCi) (B.2-9)

Using equation B.2-9, the radon release from the active tailings cells 3, 4A and 4B are approximately 179 and 102 Ci/yr, respectively. The radon release for tailings cells 2 and 3 with interim cover are approximately 85.3 and 89.4 Ci/yr, respectively.

APPENDIX C

MILDOS-AREA RESULTS

APPENDIX C MILDOS-AREA RESULTS

This Appendix provides the dose estimates for MILDOS-AREA runs for the mill area (including the ore pads) and each tailings cell for the processing of Colorado Plateau or Arizona Strip ore. The total annual dose commitments and 40 CFR 190 annual dose commitments for Phases 1 and 2 are provided in Sections C.1 and C.2 for Colorado Plateau ore and Arizona Strip ore, respectively.

C.1 MILDOS-AREA RESULTS FOR COLORADO PLATEAU ORE

The MILDOS-AREA calculated total annual dose commitments (including radon) and 40 CFR 190 annual dose commitments for the mill area (including the ore pads) and each tailings cell for processing of Colorado Plateau ore are provided in Sections C.1.1 and C.1.2, respectively.

C.1.1 R313-15-301 (1)(a) Regulatory Compliance

TABLE C.1-1
ANNUAL DOSE COMMITMENTS
(COLORADO PLATEAU ORE)

Location	Age Group	Organ	Estimated Dose (mrem/yr)					
			Mill Area (including ore pads)	Interim Soil Cover		Active		
				Tailings Cell 2	Tailings Cell 3	Tailings Cell 3	Tailings Cell 4A	Tailings Cell 4B
Nearest Potential Resident (BHV-1)	Infant	Effective	1.11E+00	6.03E-02	5.84E-02	1.30E-01	6.88E-02	5.55E-02
		Bone	1.81E+00	2.57E-03	2.70E-03	6.09E-02	4.94E-02	3.74E-02
		Avg. Lung	4.66E-01	2.45E-03	2.55E-03	3.46E-02	2.77E-02	2.14E-02
		Bronchi	9.22E+00	9.67E-01	9.34E-01	1.87E+00	9.14E-01	7.44E-01
	Child	Effective	7.96E-01	6.03E-02	5.84E-02	1.29E-01	6.77E-02	5.46E-02
		Bone	1.24E+00	2.65E-03	2.79E-03	7.48E-02	6.06E-02	4.54E-02
		Avg. Lung	6.20E-01	2.56E-03	2.69E-03	4.86E-02	3.88E-02	2.92E-02
		Bronchi	9.22E+00	9.67E-01	9.34E-01	1.87E+00	9.14E-01	7.44E-01
	Teenage	Effective	8.34E-01	6.04E-02	5.85E-02	1.32E-01	7.05E-02	5.66E-02
		Bone	4.40E+00	3.28E-03	3.53E-03	2.42E-01	1.98E-01	1.46E-01
		Avg. Lung	4.94E-01	2.54E-03	2.66E-03	3.99E-02	3.15E-02	2.38E-02
		Bronchi	9.22E+00	9.67E-01	9.34E-01	1.87E+00	9.14E-01	7.44E-01
	Adult	Effective	7.30E-01	6.03E-02	5.84E-02	1.27E-01	6.59E-02	5.32E-02
		Bone	1.91E+00	2.85E-03	3.03E-03	1.20E-01	9.80E-02	7.29E-02
		Avg. Lung	3.43E-01	2.50E-03	2.61E-03	2.88E-02	2.25E-02	1.70E-02
		Bronchi	9.22E+00	9.67E-01	9.34E-01	1.87E+00	9.14E-01	7.44E-01

TABLE C.1-1 (Cont'd)
ANNUAL DOSE COMMITMENTS
(COLORADO PLATEAU ORE)

Location	Age Group	Organ	Estimated Dose (mrem/yr)					
			Mill Area (including ore pads)	Interim Soil Cover		Active		
				Tailings Cell 2	Tailings Cell 3	Tailings Cell 3	Tailings Cell 4A	Tailings Cell 4B
Nearest Historical Resident (BHV-2)	Infant	Effective	2.18E-01	2.14E-02	2.09E-02	4.54E-02	2.53E-02	2.42E-02
		Bone	2.69E-01	1.84E-03	1.90E-03	1.88E-02	1.55E-02	1.53E-02
		Avg. Lung	8.29E-02	1.61E-03	1.65E-03	1.17E-02	9.36E-03	9.18E-03
		Bronchi	2.20E+00	3.31E-01	3.22E-01	6.43E-01	3.39E-01	3.23E-01
	Child	Effective	1.75E-01	2.14E-02	2.08E-02	4.48E-02	2.49E-02	2.37E-02
		Bone	1.91E-01	1.97E-03	2.04E-03	2.20E-02	1.82E-02	1.80E-02
		Avg. Lung	1.01E-01	1.82E-03	1.87E-03	1.48E-02	1.19E-02	1.17E-02
		Bronchi	2.20E+00	3.31E-01	3.22E-01	6.43E-01	3.39E-01	3.23E-01
	Teenage	Effective	1.80E-01	2.14E-02	2.09E-02	4.57E-02	2.57E-02	2.44E-02
		Bone	6.40E-01	3.10E-03	3.28E-03	6.48E-02	5.52E-02	5.52E-02
		Avg. Lung	8.09E-02	1.78E-03	1.83E-03	1.23E-02	9.71E-03	9.60E-03
		Bronchi	2.20E+00	3.31E-01	3.22E-01	6.43E-01	3.39E-01	3.23E-01
	Adult	Effective	1.65E-01	2.14E-02	2.08E-02	4.43E-02	2.44E-02	2.33E-02
		Bone	2.89E-01	2.34E-03	2.45E-03	3.38E-02	2.84E-02	2.82E-02
		Avg. Lung	5.86E-02	1.70E-03	1.74E-03	9.44E-03	7.21E-03	7.10E-03
		Bronchi	2.20E+00	3.31E-01	3.22E-01	6.43E-01	3.39E-01	3.23E-01
Nearest Actual Resident	Infant	Effective	6.83E-01	4.54E-02	4.33E-02	9.67E-02	5.23E-02	4.57E-02
		Bone	1.05E+00	2.46E-03	2.54E-03	4.45E-02	3.61E-02	3.10E-02
		Avg. Lung	2.68E-01	2.30E-03	2.36E-03	2.59E-02	2.07E-02	1.79E-02
		Bronchi	5.98E+00	7.20E-01	6.84E-01	1.38E+00	6.95E-01	6.09E-01
	Child	Effective	5.03E-01	4.54E-02	4.33E-02	9.57E-02	5.14E-02	4.49E-02
		Bone	7.12E-01	2.55E-03	2.65E-03	5.38E-02	4.37E-02	3.74E-02
		Avg. Lung	3.56E-01	2.44E-03	2.53E-03	3.52E-02	2.81E-02	2.41E-02
		Bronchi	5.98E+00	7.20E-01	6.84E-01	1.38E+00	6.95E-01	6.09E-01
	Teenage	Effective	5.24E-01	4.54E-02	4.34E-02	9.81E-02	5.34E-02	4.66E-02
		Bone	2.52E+00	3.36E-03	3.58E-03	1.70E-01	1.40E-01	1.19E-01
		Avg. Lung	2.85E-01	2.41E-03	2.50E-03	2.90E-02	2.29E-02	1.96E-02
		Bronchi	5.98E+00	7.20E-01	6.84E-01	1.38E+00	6.95E-01	6.09E-01
	Adult	Effective	4.65E-01	4.54E-02	4.33E-02	9.41E-02	5.01E-02	4.38E-02
		Bone	1.10E+00	2.81E-03	2.95E-03	8.54E-02	6.99E-02	5.96E-02
		Avg. Lung	2.00E-01	2.36E-03	2.43E-03	2.13E-02	1.65E-02	1.41E-02
		Bronchi	5.98E+00	7.20E-01	6.84E-01	1.38E+00	6.95E-01	6.09E-01

TABLE C.1-1 (Cont'd)
ANNUAL DOSE COMMITMENTS
(COLORADO PLATEAU ORE)

Location	Age Group	Organ	Estimated Dose (mrem/yr)					
			Mill Area (including ore pads)	Interim Soil Cover		Active		
				Tailings Cell 2	Tailings Cell 3	Tailings Cell 3	Tailings Cell 4A	Tailings Cell 4B
White Mesa Community	Infant	Effective	1.40E-01	2.23E-02	2.48E-02	5.17E-02	3.15E-02	2.82E-02
		Bone	1.16E-01	2.81E-03	3.05E-03	1.44E-02	1.22E-02	1.08E-02
		Avg. Lung	4.60E-02	2.26E-03	2.47E-03	1.04E-02	8.61E-03	7.61E-03
		Bronchi	1.65E+00	3.36E-01	3.74E-01	7.48E-01	4.43E-01	3.97E-01
	Child	Effective	1.21E-01	2.23E-02	2.48E-02	5.11E-02	3.09E-02	2.77E-02
		Bone	7.67E-02	3.14E-03	3.38E-03	1.51E-02	1.27E-02	1.12E-02
		Avg. Lung	4.24E-02	2.76E-03	2.99E-03	1.09E-02	8.64E-03	7.69E-03
		Bronchi	1.65E+00	3.36E-01	3.74E-01	7.48E-01	4.43E-01	3.97E-01
	Teenage	Effective	1.21E-01	2.24E-02	2.49E-02	5.13E-02	3.10E-02	2.79E-02
		Bone	2.15E-01	5.93E-03	6.28E-03	3.51E-02	3.09E-02	2.72E-02
		Avg. Lung	3.35E-02	2.67E-03	2.90E-03	9.33E-03	7.10E-03	6.34E-03
		Bronchi	1.65E+00	3.36E-01	3.74E-01	7.48E-01	4.43E-01	3.97E-01
	Adult	Effective	1.17E-01	2.23E-02	2.48E-02	5.07E-02	3.05E-02	2.73E-02
		Bone	1.06E-01	4.04E-03	4.33E-03	2.08E-02	1.78E-02	1.57E-02
		Avg. Lung	2.66E-02	2.47E-03	2.69E-03	7.88E-03	5.77E-03	5.18E-03
		Bronchi	1.65E+00	3.36E-01	3.74E-01	7.48E-01	4.43E-01	3.97E-01
Blanding	Infant	Effective	6.98E-02	8.36E-03	8.50E-03	1.82E-02	1.05E-02	1.04E-02
		Bone	7.53E-02	1.17E-03	1.22E-03	7.12E-03	5.86E-03	5.93E-03
		Avg. Lung	2.45E-02	8.95E-04	9.22E-04	4.57E-03	3.64E-03	3.67E-03
		Bronchi	7.34E-01	1.25E-01	1.27E-01	2.53E-01	1.40E-01	1.38E-01
	Child	Effective	5.72E-02	8.34E-03	8.49E-03	1.79E-02	1.03E-02	1.02E-02
		Bone	5.16E-02	1.34E-03	1.39E-03	8.18E-03	6.75E-03	6.83E-03
		Avg. Lung	2.78E-02	1.15E-03	1.19E-03	5.69E-03	4.51E-03	4.55E-03
		Bronchi	7.34E-01	1.25E-01	1.27E-01	2.53E-01	1.40E-01	1.38E-01
	Teenage	Effective	5.84E-02	8.37E-03	8.52E-03	1.82E-02	1.06E-02	1.04E-02
		Bone	1.65E-01	2.74E-03	2.88E-03	2.28E-02	1.96E-02	1.99E-02
		Avg. Lung	2.26E-02	1.10E-03	1.14E-03	4.84E-03	3.74E-03	3.76E-03
		Bronchi	7.34E-01	1.25E-01	1.27E-01	2.53E-01	1.40E-01	1.38E-01
	Adult	Effective	5.46E-02	8.33E-03	8.47E-03	1.77E-02	1.01E-02	9.99E-03
		Bone	7.58E-02	1.79E-03	1.87E-03	1.23E-02	1.03E-02	1.05E-02
		Avg. Lung	1.70E-02	9.99E-04	1.03E-03	3.84E-03	2.86E-03	2.87E-03
		Bronchi	7.34E-01	1.25E-01	1.27E-01	2.53E-01	1.40E-01	1.38E-01

C.2.2 40 CFR 190 Regulatory Compliance

TABLE C.1-2
40 CFR 190 ANNUAL DOSE COMMITMENTS
(COLORADO PLATEAU ORE)

Location	Age Group	Organ	Estimated Dose (mrem/yr)					
			Mill Area (including ore pads)	Interim Soil Cover		Active		
				Tailings Cell 2	Tailings Cell 3	Tailings Cell 3	Tailings Cell 4A	Tailings Cell 4B
Nearest Potential Resident (BHV-1)	Infant	Effective	5.22E-01	0.00E+00	0.00E+00	1.24E-02	1.03E-02	7.72E-03
		Bone	1.76E+00	0.00E+00	0.00E+00	5.43E-02	4.54E-02	3.39E-02
		Avg. Lung	4.33E-01	0.00E+00	0.00E+00	2.83E-02	2.38E-02	1.80E-02
		Bronchi	9.30E-04	0.00E+00	0.00E+00	2.34E-05	1.93E-05	1.41E-05
	Child	Effective	2.12E-01	0.00E+00	0.00E+00	1.11E-02	9.23E-03	6.83E-03
		Bone	1.20E+00	0.00E+00	0.00E+00	6.80E-02	5.65E-02	4.18E-02
		Avg. Lung	5.85E-01	0.00E+00	0.00E+00	4.19E-02	3.48E-02	2.57E-02
		Bronchi	9.30E-04	0.00E+00	0.00E+00	2.34E-05	1.93E-05	1.41E-05
	Teenage	Effective	2.49E-01	0.00E+00	0.00E+00	1.46E-02	1.20E-02	8.86E-03
		Bone	4.37E+00	0.00E+00	0.00E+00	2.34E-01	1.93E-01	1.41E-01
		Avg. Lung	4.61E-01	0.00E+00	0.00E+00	3.33E-02	2.75E-02	2.03E-02
		Bronchi	9.30E-04	0.00E+00	0.00E+00	2.34E-05	1.93E-05	1.41E-05
	Adult	Effective	1.46E-01	0.00E+00	0.00E+00	8.99E-03	7.44E-03	5.49E-03
		Bone	1.88E+00	0.00E+00	0.00E+00	1.13E-01	9.35E-02	6.90E-02
		Avg. Lung	3.10E-01	0.00E+00	0.00E+00	2.24E-02	1.85E-02	1.36E-02
		Bronchi	9.30E-04	0.00E+00	0.00E+00	2.34E-05	1.93E-05	1.41E-05
Nearest Historical Resident (BHV-2)	Infant	Effective	7.43E-02	0.00E+00	0.00E+00	3.36E-03	2.99E-03	2.98E-03
		Bone	2.54E-01	0.00E+00	0.00E+00	1.47E-02	1.31E-02	1.30E-02
		Avg. Lung	7.02E-02	0.00E+00	0.00E+00	8.10E-03	7.28E-03	7.22E-03
		Bronchi	1.28E-04	0.00E+00	0.00E+00	5.68E-06	5.02E-06	5.04E-06
	Child	Effective	3.07E-02	0.00E+00	0.00E+00	2.86E-03	2.53E-03	2.53E-03
		Bone	1.76E-01	0.00E+00	0.00E+00	1.76E-02	1.56E-02	1.56E-02
		Avg. Lung	8.70E-02	0.00E+00	0.00E+00	1.07E-02	9.54E-03	9.53E-03
		Bronchi	1.28E-04	0.00E+00	0.00E+00	5.68E-06	5.02E-06	5.04E-06
	Teenage	Effective	3.58E-02	0.00E+00	0.00E+00	3.63E-03	3.22E-03	3.23E-03
		Bone	6.21E-01	0.00E+00	0.00E+00	5.79E-02	5.12E-02	5.14E-02
		Avg. Lung	6.73E-02	0.00E+00	0.00E+00	8.37E-03	7.42E-03	7.43E-03
		Bronchi	1.28E-04	0.00E+00	0.00E+00	5.68E-06	5.02E-06	5.04E-06
	Adult	Effective	2.12E-02	0.00E+00	0.00E+00	2.27E-03	2.01E-03	2.02E-03
		Bone	2.72E-01	0.00E+00	0.00E+00	2.85E-02	2.53E-02	2.53E-02
		Avg. Lung	4.55E-02	0.00E+00	0.00E+00	5.66E-03	5.01E-03	5.02E-03
		Bronchi	1.28E-04	0.00E+00	0.00E+00	5.68E-06	5.02E-06	5.04E-06

TABLE C.1-2 (Cont'd)
40 CFR 190 ANNUAL DOSE COMMITMENTS
(COLORADO PLATEAU ORE)

Location	Age Group	Organ	Estimated Dose (mrem/yr)					
			Mill Area (including ore pads)	Interim Soil Cover		Active		
				Tailings Cell 2	Tailings Cell 3	Tailings Cell 3	Tailings Cell 4A	Tailings Cell 4B
Nearest Actual Resident	Infant	Effective	3.01E-01	0.00E+00	0.00E+00	8.77E-03	7.42E-03	6.32E-03
		Bone	1.02E+00	0.00E+00	0.00E+00	3.85E-02	3.25E-02	2.77E-02
		Avg. Lung	2.43E-01	0.00E+00	0.00E+00	2.04E-02	1.74E-02	1.48E-02
		Bronchi	5.32E-04	0.00E+00	0.00E+00	1.61E-05	1.35E-05	1.14E-05
	Child	Effective	1.21E-01	0.00E+00	0.00E+00	7.79E-03	6.54E-03	5.55E-03
		Bone	6.85E-01	0.00E+00	0.00E+00	4.77E-02	4.01E-02	3.41E-02
		Avg. Lung	3.30E-01	0.00E+00	0.00E+00	2.93E-02	2.46E-02	2.09E-02
		Bronchi	5.32E-04	0.00E+00	0.00E+00	1.61E-05	1.35E-05	1.14E-05
	Teenage	Effective	1.42E-01	0.00E+00	0.00E+00	1.01E-02	8.46E-03	7.16E-03
		Bone	2.48E+00	0.00E+00	0.00E+00	1.62E-01	1.35E-01	1.14E-01
		Avg. Lung	2.59E-01	0.00E+00	0.00E+00	2.32E-02	1.94E-02	1.64E-02
		Bronchi	5.32E-04	0.00E+00	0.00E+00	1.61E-05	1.35E-05	1.14E-05
	Adult	Effective	8.31E-02	0.00E+00	0.00E+00	6.27E-03	5.26E-03	4.45E-03
		Bone	1.07E+00	0.00E+00	0.00E+00	7.88E-02	6.60E-02	5.60E-02
		Avg. Lung	1.74E-01	0.00E+00	0.00E+00	1.56E-02	1.31E-02	1.11E-02
		Bronchi	5.32E-04	0.00E+00	0.00E+00	1.61E-05	1.35E-05	1.14E-05
White Mesa Community	Infant	Effective	2.98E-02	0.00E+00	0.00E+00	1.90E-03	1.98E-03	1.72E-03
		Bone	1.02E-01	0.00E+00	0.00E+00	8.21E-03	8.59E-03	7.41E-03
		Avg. Lung	3.45E-02	0.00E+00	0.00E+00	5.38E-03	5.61E-03	4.85E-03
		Bronchi	3.85E-05	0.00E+00	0.00E+00	1.94E-06	2.05E-06	1.76E-06
	Child	Effective	1.04E-02	0.00E+00	0.00E+00	1.29E-03	1.36E-03	1.17E-03
		Bone	6.11E-02	0.00E+00	0.00E+00	8.25E-03	8.66E-03	7.45E-03
		Avg. Lung	2.86E-02	0.00E+00	0.00E+00	4.82E-03	5.07E-03	4.36E-03
		Bronchi	3.85E-05	0.00E+00	0.00E+00	1.94E-06	2.05E-06	1.76E-06
	Teenage	Effective	1.08E-02	0.00E+00	0.00E+00	1.46E-03	1.53E-03	1.32E-03
		Bone	1.85E-01	0.00E+00	0.00E+00	2.24E-02	2.36E-02	2.03E-02
		Avg. Lung	2.01E-02	0.00E+00	0.00E+00	3.45E-03	3.63E-03	3.12E-03
		Bronchi	3.85E-05	0.00E+00	0.00E+00	1.94E-06	2.05E-06	1.76E-06
	Adult	Effective	6.70E-03	0.00E+00	0.00E+00	9.71E-04	1.02E-03	8.78E-04
		Bone	8.57E-02	0.00E+00	0.00E+00	1.21E-02	1.27E-02	1.09E-02
		Avg. Lung	1.41E-02	0.00E+00	0.00E+00	2.42E-03	2.54E-03	2.18E-03
		Bronchi	3.85E-05	0.00E+00	0.00E+00	1.94E-06	2.05E-06	1.76E-06

TABLE C.1-2 (Cont'd)
40 CFR 190 ANNUAL DOSE COMMITMENTS
(COLORADO PLATEAU ORE)

Location	Age Group	Organ	Estimated Dose (mrem/yr)					
			Mill Area (including ore pads)	Interim Soil Cover		Active		
				Tailings Cell 2	Tailings Cell 3	Tailings Cell 3	Tailings Cell 4A	Tailings Cell 4B
Blanding	Infant	Effective	2.00E-02	0.00E+00	0.00E+00	1.05E-03	1.01E-03	1.03E-03
		Bone	6.79E-02	0.00E+00	0.00E+00	4.59E-03	4.42E-03	4.52E-03
		Avg. Lung	1.88E-02	0.00E+00	0.00E+00	2.63E-03	2.54E-03	2.58E-03
		Bronchi	3.17E-05	0.00E+00	0.00E+00	1.63E-06	1.56E-06	1.61E-06
	Child	Effective	7.55E-03	0.00E+00	0.00E+00	8.57E-04	8.23E-04	8.44E-04
		Bone	4.34E-02	0.00E+00	0.00E+00	5.31E-03	5.09E-03	5.23E-03
		Avg. Lung	2.06E-02	0.00E+00	0.00E+00	3.22E-03	3.09E-03	3.17E-03
		Bronchi	3.17E-05	0.00E+00	0.00E+00	1.63E-06	1.56E-06	1.61E-06
	Teenage	Effective	8.49E-03	0.00E+00	0.00E+00	1.07E-03	1.03E-03	1.05E-03
		Bone	1.48E-01	0.00E+00	0.00E+00	1.69E-02	1.62E-02	1.67E-02
		Avg. Lung	1.56E-02	0.00E+00	0.00E+00	2.47E-03	2.38E-03	2.44E-03
		Bronchi	3.17E-05	0.00E+00	0.00E+00	1.63E-06	1.56E-06	1.61E-06
	Adult	Effective	5.05E-03	0.00E+00	0.00E+00	6.77E-04	6.49E-04	6.67E-04
		Bone	6.50E-02	0.00E+00	0.00E+00	8.47E-03	8.13E-03	8.35E-03
		Avg. Lung	1.06E-02	0.00E+00	0.00E+00	1.68E-03	1.62E-03	1.66E-03
		Bronchi	3.17E-05	0.00E+00	0.00E+00	1.63E-06	1.56E-06	1.61E-06

C.2 MILDOS-AREA RESULTS FOR ARIZONA STRIP ORE

The MILDOS-AREA calculated total annual dose commitments (including radon) and 40 CFR 190 annual dose commitments for the mill area (including the ore pads) and each tailings cell for processing of Arizona Strip ore are provided in Sections C.2.1 and C.2.2, respectively.

C.2.1 R313-15-301 (1)(a) Regulatory Compliance

TABLE C.2-1
ANNUAL DOSE COMMITMENTS
(ARIZONA STRIP ORE)

Location	Age Group	Organ	Estimated Dose (mrem/yr)					
			Mill Area (including ore pads)	Interim Soil Cover		Active		
				Tailings Cell 2	Tailings Cell 3	Tailings Cell 3	Tailings Cell 4A	Tailings Cell 4B
Nearest Potential Resident (BHV-1)	Infant	Effective	2.82E+00	6.03E-02	5.84E-02	1.52E-01	8.64E-02	6.86E-02
		Bone	4.59E+00	2.57E-03	2.70E-03	1.47E-01	1.21E-01	9.11E-02
		Avg. Lung	1.19E+00	2.45E-03	2.55E-03	8.04E-02	6.62E-02	5.04E-02
		Bronchi	2.35E+01	9.67E-01	9.34E-01	1.87E+00	9.15E-01	7.45E-01
	Child	Effective	2.03E+00	6.03E-02	5.84E-02	1.48E-01	8.36E-02	6.63E-02
		Bone	3.15E+00	2.65E-03	2.79E-03	1.82E-01	1.50E-01	1.11E-01
		Avg. Lung	1.57E+00	2.56E-03	2.69E-03	1.16E-01	9.42E-02	7.02E-02
		Bronchi	2.35E+01	9.67E-01	9.34E-01	1.87E+00	9.15E-01	7.45E-01
	Teenage	Effective	2.12E+00	6.04E-02	5.85E-02	1.57E-01	9.07E-02	7.15E-02
		Bone	1.12E+01	3.28E-03	3.53E-03	6.05E-01	4.97E-01	3.67E-01
		Avg. Lung	1.26E+00	2.54E-03	2.66E-03	9.34E-02	7.57E-02	5.63E-02
		Bronchi	2.35E+01	9.67E-01	9.34E-01	1.87E+00	9.15E-01	7.45E-01
	Adult	Effective	1.86E+00	6.03E-02	5.84E-02	1.43E-01	7.90E-02	6.29E-02
		Bone	4.88E+00	2.85E-03	3.03E-03	2.97E-01	2.44E-01	1.81E-01
		Avg. Lung	8.74E-01	2.50E-03	2.61E-03	6.54E-02	5.27E-02	3.94E-02
		Bronchi	2.35E+01	9.67E-01	9.34E-01	1.87E+00	9.15E-01	7.45E-01

TABLE C.2-1 (Cont'd)
ANNUAL DOSE COMMITMENTS
(ARIZONA STRIP ORE)

Location	Age Group	Organ	Estimated Dose (mrem/yr)					
			Mill Area (including ore pads)	Interim Soil Cover		Active		
				Tailings Cell 2	Tailings Cell 3	Tailings Cell 3	Tailings Cell 4A	Tailings Cell 4B
Nearest Historical Resident (BHV-2)	Infant	Effective	5.57E-01	2.14E-02	2.09E-02	5.10E-02	3.04E-02	2.93E-02
		Bone	6.85E-01	1.84E-03	1.90E-03	4.19E-02	3.62E-02	3.59E-02
		Avg. Lung	2.11E-01	1.61E-03	1.65E-03	2.47E-02	2.10E-02	2.07E-02
		Bronchi	5.61E+00	3.31E-01	3.22E-01	6.44E-01	3.39E-01	3.23E-01
	Child	Effective	4.45E-01	2.14E-02	2.08E-02	4.98E-02	2.92E-02	2.81E-02
		Bone	4.85E-01	1.97E-03	2.04E-03	4.96E-02	4.28E-02	4.25E-02
		Avg. Lung	2.56E-01	1.82E-03	1.87E-03	3.18E-02	2.71E-02	2.69E-02
		Bronchi	5.61E+00	3.31E-01	3.22E-01	6.44E-01	3.39E-01	3.23E-01
	Teenage	Effective	4.59E-01	2.14E-02	2.09E-02	5.18E-02	3.10E-02	2.99E-02
		Bone	1.63E+00	3.10E-03	3.28E-03	1.54E-01	1.35E-01	1.35E-01
		Avg. Lung	2.05E-01	1.78E-03	1.83E-03	2.58E-02	2.16E-02	2.15E-02
		Bronchi	5.61E+00	3.31E-01	3.22E-01	6.44E-01	3.39E-01	3.23E-01
	Adult	Effective	4.21E-01	2.14E-02	2.08E-02	4.83E-02	2.79E-02	2.68E-02
		Bone	7.36E-01	2.34E-03	2.45E-03	7.84E-02	6.79E-02	6.78E-02
		Avg. Lung	1.49E-01	1.70E-03	1.74E-03	1.87E-02	1.54E-02	1.53E-02
		Bronchi	5.61E+00	3.31E-01	3.22E-01	6.44E-01	3.39E-01	3.23E-01
Nearest Actual Resident	Infant	Effective	1.74E+00	4.54E-02	4.33E-02	1.12E-01	6.49E-02	5.64E-02
		Bone	2.67E+00	2.46E-03	2.54E-03	1.05E-01	8.77E-02	7.48E-02
		Avg. Lung	6.82E-01	2.30E-03	2.36E-03	5.88E-02	4.87E-02	4.18E-02
		Bronchi	1.53E+01	7.20E-01	6.84E-01	1.38E+00	6.96E-01	6.10E-01
	Child	Effective	1.28E+00	4.54E-02	4.33E-02	1.09E-01	6.26E-02	5.44E-02
		Bone	1.81E+00	2.55E-03	2.65E-03	1.29E-01	1.07E-01	9.09E-02
		Avg. Lung	9.05E-01	2.44E-03	2.53E-03	8.18E-02	6.73E-02	5.73E-02
		Bronchi	1.53E+01	7.20E-01	6.84E-01	1.38E+00	6.96E-01	6.10E-01
	Teenage	Effective	1.34E+00	4.54E-02	4.34E-02	1.15E-01	6.77E-02	5.86E-02
		Bone	6.40E+00	3.36E-03	3.58E-03	4.21E-01	3.50E-01	2.97E-01
		Avg. Lung	7.27E-01	2.41E-03	2.50E-03	6.62E-02	5.40E-02	4.60E-02
		Bronchi	1.53E+01	7.20E-01	6.84E-01	1.38E+00	6.96E-01	6.10E-01
	Adult	Effective	1.19E+00	4.54E-02	4.33E-02	1.05E-01	5.94E-02	5.17E-02
		Bone	2.80E+00	2.81E-03	2.95E-03	2.08E-01	1.73E-01	1.47E-01
		Avg. Lung	5.09E-01	2.36E-03	2.43E-03	4.67E-02	3.78E-02	3.23E-02
		Bronchi	1.53E+01	7.20E-01	6.84E-01	1.38E+00	6.96E-01	6.10E-01

TABLE C.2-1 (Cont'd)
ANNUAL DOSE COMMITMENTS
(ARIZONA STRIP ORE)

Location	Age Group	Organ	Estimated Dose (mrem/yr)					
			Mill Area (including ore pads)	Interim Soil Cover		Active		
				Tailings Cell 2	Tailings Cell 3	Tailings Cell 3	Tailings Cell 4A	Tailings Cell 4B
White Mesa Community	Infant	Effective	3.56E-01	2.23E-02	2.48E-02	5.47E-02	3.47E-02	3.10E-02
		Bone	2.95E-01	2.81E-03	3.05E-03	2.73E-02	2.57E-02	2.24E-02
		Avg. Lung	1.17E-01	2.26E-03	2.47E-03	1.89E-02	1.74E-02	1.53E-02
		Bronchi	4.20E+00	3.36E-01	3.74E-01	7.48E-01	4.43E-01	3.97E-01
	Child	Effective	3.07E-01	2.23E-02	2.48E-02	5.32E-02	3.32E-02	2.96E-02
		Bone	1.96E-01	3.14E-03	3.38E-03	2.80E-02	2.63E-02	2.29E-02
		Avg. Lung	1.08E-01	2.76E-03	2.99E-03	1.85E-02	1.66E-02	1.46E-02
		Bronchi	4.20E+00	3.36E-01	3.74E-01	7.48E-01	4.43E-01	3.97E-01
	Teenage	Effective	3.09E-01	2.24E-02	2.49E-02	5.37E-02	3.36E-02	3.00E-02
		Bone	5.46E-01	5.93E-03	6.28E-03	6.98E-02	6.76E-02	5.87E-02
		Avg. Lung	8.54E-02	2.67E-03	2.90E-03	1.48E-02	1.29E-02	1.13E-02
		Bronchi	4.20E+00	3.36E-01	3.74E-01	7.48E-01	4.43E-01	3.97E-01
	Adult	Effective	2.97E-01	2.23E-02	2.48E-02	5.23E-02	3.22E-02	2.88E-02
		Bone	2.70E-01	4.04E-03	4.33E-03	3.96E-02	3.76E-02	3.27E-02
		Avg. Lung	6.77E-02	2.47E-03	2.69E-03	1.18E-02	9.87E-03	8.70E-03
		Bronchi	4.20E+00	3.36E-01	3.74E-01	7.48E-01	4.43E-01	3.97E-01
Blanding	Infant	Effective	1.78E-01	8.36E-03	8.50E-03	1.99E-02	1.22E-02	1.21E-02
		Bone	1.92E-01	1.17E-03	1.22E-03	1.43E-02	1.28E-02	1.30E-02
		Avg. Lung	6.25E-02	8.95E-04	9.22E-04	8.79E-03	7.70E-03	7.80E-03
		Bronchi	1.87E+00	1.25E-01	1.27E-01	2.53E-01	1.40E-01	1.38E-01
	Child	Effective	1.46E-01	8.34E-03	8.49E-03	1.94E-02	1.17E-02	1.16E-02
		Bone	1.31E-01	1.34E-03	1.39E-03	1.65E-02	1.48E-02	1.51E-02
		Avg. Lung	7.09E-02	1.15E-03	1.19E-03	1.08E-02	9.42E-03	9.59E-03
		Bronchi	1.87E+00	1.25E-01	1.27E-01	2.53E-01	1.40E-01	1.38E-01
	Teenage	Effective	1.49E-01	8.37E-03	8.52E-03	2.00E-02	1.23E-02	1.22E-02
		Bone	4.19E-01	2.74E-03	2.88E-03	4.92E-02	4.49E-02	4.60E-02
		Avg. Lung	5.74E-02	1.10E-03	1.14E-03	8.81E-03	7.54E-03	7.67E-03
		Bronchi	1.87E+00	1.25E-01	1.27E-01	2.53E-01	1.40E-01	1.38E-01
	Adult	Effective	1.40E-01	8.33E-03	8.47E-03	1.89E-02	1.13E-02	1.12E-02
		Bone	1.93E-01	1.79E-03	1.87E-03	2.56E-02	2.31E-02	2.35E-02
		Avg. Lung	4.34E-02	9.99E-04	1.03E-03	6.58E-03	5.48E-03	5.56E-03
		Bronchi	1.87E+00	1.25E-01	1.27E-01	2.53E-01	1.40E-01	1.38E-01

C.2.2 40 CFR 190 Regulatory Compliance

TABLE C.2-2
40 CFR 190 ANNUAL DOSE COMMITMENTS
(ARIZONA STRIP ORE)

Location	Age Group	Organ	Estimated Dose (mrem/yr)					
			Mill Area (including ore pads)	Interim Soil Cover		Active		
				Tailings Cell 2	Tailings Cell 3	Tailings Cell 3	Tailings Cell 4A	Tailings Cell 4B
Nearest Potential Resident (BHV-1)	Infant	Effective	1.33E+00	0.00E+00	0.00E+00	3.15E-02	2.63E-02	1.97E-02
		Bone	4.51E+00	0.00E+00	0.00E+00	1.38E-01	1.16E-01	8.63E-02
		Avg. Lung	1.10E+00	0.00E+00	0.00E+00	7.22E-02	6.07E-02	4.59E-02
		Bronchi	2.37E-03	0.00E+00	0.00E+00	5.96E-05	4.90E-05	3.59E-05
	Child	Effective	5.40E-01	0.00E+00	0.00E+00	2.84E-02	2.35E-02	1.74E-02
		Bone	3.06E+00	0.00E+00	0.00E+00	1.73E-01	1.44E-01	1.07E-01
		Avg. Lung	1.49E+00	0.00E+00	0.00E+00	1.07E-01	8.86E-02	6.55E-02
		Bronchi	2.37E-03	0.00E+00	0.00E+00	5.96E-05	4.90E-05	3.59E-05
	Teenage	Effective	6.36E-01	0.00E+00	0.00E+00	3.71E-02	3.07E-02	2.26E-02
		Bone	1.11E+01	0.00E+00	0.00E+00	5.95E-01	4.91E-01	3.61E-01
		Avg. Lung	1.17E+00	0.00E+00	0.00E+00	8.48E-02	7.01E-02	5.16E-02
		Bronchi	2.37E-03	0.00E+00	0.00E+00	5.96E-05	4.90E-05	3.59E-05
	Adult	Effective	3.72E-01	0.00E+00	0.00E+00	2.29E-02	1.89E-02	1.40E-02
		Bone	4.80E+00	0.00E+00	0.00E+00	2.88E-01	2.38E-01	1.76E-01
		Avg. Lung	7.89E-01	0.00E+00	0.00E+00	5.70E-02	4.72E-02	3.48E-02
		Bronchi	2.37E-03	0.00E+00	0.00E+00	5.96E-05	4.90E-05	3.59E-05
Nearest Historical Resident (BHV-2)	Infant	Effective	1.90E-01	0.00E+00	0.00E+00	8.54E-03	7.63E-03	7.59E-03
		Bone	6.49E-01	0.00E+00	0.00E+00	3.74E-02	3.34E-02	3.33E-02
		Avg. Lung	1.79E-01	0.00E+00	0.00E+00	2.07E-02	1.86E-02	1.84E-02
		Bronchi	3.27E-04	0.00E+00	0.00E+00	1.45E-05	1.28E-05	1.28E-05
	Child	Effective	7.82E-02	0.00E+00	0.00E+00	7.27E-03	6.46E-03	6.46E-03
		Bone	4.48E-01	0.00E+00	0.00E+00	4.48E-02	3.98E-02	3.98E-02
		Avg. Lung	2.21E-01	0.00E+00	0.00E+00	2.73E-02	2.42E-02	2.43E-02
		Bronchi	3.27E-04	0.00E+00	0.00E+00	1.45E-05	1.28E-05	1.28E-05
	Teenage	Effective	9.11E-02	0.00E+00	0.00E+00	9.26E-03	8.21E-03	8.22E-03
		Bone	1.58E+00	0.00E+00	0.00E+00	1.47E-01	1.30E-01	1.31E-01
		Avg. Lung	1.71E-01	0.00E+00	0.00E+00	2.13E-02	1.89E-02	1.90E-02
		Bronchi	3.27E-04	0.00E+00	0.00E+00	1.45E-05	1.28E-05	1.28E-05
	Adult	Effective	5.39E-02	0.00E+00	0.00E+00	5.80E-03	5.15E-03	5.14E-03
		Bone	6.93E-01	0.00E+00	0.00E+00	7.27E-02	6.45E-02	6.45E-02
		Avg. Lung	1.16E-01	0.00E+00	0.00E+00	1.44E-02	1.28E-02	1.28E-02
		Bronchi	3.27E-04	0.00E+00	0.00E+00	1.45E-05	1.28E-05	1.28E-05

TABLE C.2-2 (Cont'd)
40 CFR 190 ANNUAL DOSE COMMITMENTS
(ARIZONA STRIP ORE)

Location	Age Group	Organ	Estimated Dose (mrem/yr)					
			Mill Area (including ore pads)	Interim Soil Cover		Active		
				Tailings Cell 2	Tailings Cell 3	Tailings Cell 3	Tailings Cell 4A	Tailings Cell 4B
Nearest Actual Resident	Infant	Effective	7.69E-01	0.00E+00	0.00E+00	2.23E-02	1.89E-02	1.61E-02
		Bone	2.60E+00	0.00E+00	0.00E+00	9.79E-02	8.29E-02	7.06E-02
		Avg. Lung	6.19E-01	0.00E+00	0.00E+00	5.19E-02	4.43E-02	3.79E-02
		Bronchi	1.36E-03	0.00E+00	0.00E+00	4.11E-05	3.43E-05	2.90E-05
	Child	Effective	3.08E-01	0.00E+00	0.00E+00	1.98E-02	1.67E-02	1.41E-02
		Bone	1.75E+00	0.00E+00	0.00E+00	1.21E-01	1.02E-01	8.66E-02
		Avg. Lung	8.41E-01	0.00E+00	0.00E+00	7.47E-02	6.27E-02	5.32E-02
		Bronchi	1.36E-03	0.00E+00	0.00E+00	4.11E-05	3.43E-05	2.90E-05
	Teenage	Effective	3.62E-01	0.00E+00	0.00E+00	2.57E-02	2.16E-02	1.83E-02
		Bone	6.33E+00	0.00E+00	0.00E+00	4.13E-01	3.44E-01	2.91E-01
		Avg. Lung	6.63E-01	0.00E+00	0.00E+00	5.90E-02	4.94E-02	4.19E-02
		Bronchi	1.36E-03	0.00E+00	0.00E+00	4.11E-05	3.43E-05	2.90E-05
	Adult	Effective	2.12E-01	0.00E+00	0.00E+00	1.60E-02	1.34E-02	1.13E-02
		Bone	2.72E+00	0.00E+00	0.00E+00	2.01E-01	1.68E-01	1.42E-01
		Avg. Lung	4.44E-01	0.00E+00	0.00E+00	3.97E-02	3.32E-02	2.82E-02
		Bronchi	1.36E-03	0.00E+00	0.00E+00	4.11E-05	3.43E-05	2.90E-05
White Mesa Community	Infant	Effective	7.59E-02	0.00E+00	0.00E+00	4.83E-03	5.06E-03	4.36E-03
		Bone	2.59E-01	0.00E+00	0.00E+00	2.09E-02	2.19E-02	1.89E-02
		Avg. Lung	8.79E-02	0.00E+00	0.00E+00	1.37E-02	1.44E-02	1.24E-02
		Bronchi	9.81E-05	0.00E+00	0.00E+00	4.94E-06	5.23E-06	4.48E-06
	Child	Effective	2.66E-02	0.00E+00	0.00E+00	3.29E-03	3.45E-03	2.96E-03
		Bone	1.56E-01	0.00E+00	0.00E+00	2.10E-02	2.21E-02	1.90E-02
		Avg. Lung	7.28E-02	0.00E+00	0.00E+00	1.23E-02	1.29E-02	1.11E-02
		Bronchi	9.81E-05	0.00E+00	0.00E+00	4.94E-06	5.23E-06	4.48E-06
	Teenage	Effective	2.75E-02	0.00E+00	0.00E+00	3.71E-03	3.91E-03	3.36E-03
		Bone	4.73E-01	0.00E+00	0.00E+00	5.70E-02	6.00E-02	5.16E-02
		Avg. Lung	5.11E-02	0.00E+00	0.00E+00	8.78E-03	9.24E-03	7.95E-03
		Bronchi	9.81E-05	0.00E+00	0.00E+00	4.94E-06	5.23E-06	4.48E-06
	Adult	Effective	1.70E-02	0.00E+00	0.00E+00	2.47E-03	2.60E-03	2.24E-03
		Bone	2.19E-01	0.00E+00	0.00E+00	3.07E-02	3.23E-02	2.79E-02
		Avg. Lung	3.60E-02	0.00E+00	0.00E+00	6.15E-03	6.47E-03	5.56E-03
		Bronchi	9.81E-05	0.00E+00	0.00E+00	4.94E-06	5.23E-06	4.48E-06

TABLE C.2-2 (Cont'd)
40 CFR 190 ANNUAL DOSE COMMITMENTS
(ARIZONA STRIP ORE)

Location	Age Group	Organ	Estimated Dose (mrem/yr)					
			Mill Area (including ore pads)	Interim Soil Cover		Active		
				Tailings Cell 2	Tailings Cell 3	Tailings Cell 3	Tailings Cell 4A	Tailings Cell 4B
Blanding	Infant	Effective	5.12E-02	0.00E+00	0.00E+00	2.68E-03	2.57E-03	2.63E-03
		Bone	1.73E-01	0.00E+00	0.00E+00	1.17E-02	1.12E-02	1.15E-02
		Avg. Lung	4.77E-02	0.00E+00	0.00E+00	6.71E-03	6.45E-03	6.58E-03
		Bronchi	8.07E-05	0.00E+00	0.00E+00	4.16E-06	3.99E-06	4.11E-06
	Child	Effective	1.93E-02	0.00E+00	0.00E+00	2.19E-03	2.10E-03	2.15E-03
		Bone	1.10E-01	0.00E+00	0.00E+00	1.35E-02	1.30E-02	1.33E-02
		Avg. Lung	5.25E-02	0.00E+00	0.00E+00	8.21E-03	7.87E-03	8.07E-03
		Bronchi	8.07E-05	0.00E+00	0.00E+00	4.16E-06	3.99E-06	4.11E-06
	Teenage	Effective	2.17E-02	0.00E+00	0.00E+00	2.73E-03	2.61E-03	2.69E-03
		Bone	3.77E-01	0.00E+00	0.00E+00	4.32E-02	4.14E-02	4.25E-02
		Avg. Lung	3.97E-02	0.00E+00	0.00E+00	6.31E-03	6.04E-03	6.21E-03
		Bronchi	8.07E-05	0.00E+00	0.00E+00	4.16E-06	3.99E-06	4.11E-06
	Adult	Effective	1.29E-02	0.00E+00	0.00E+00	1.72E-03	1.66E-03	1.70E-03
		Bone	1.66E-01	0.00E+00	0.00E+00	2.16E-02	2.07E-02	2.13E-02
		Avg. Lung	2.71E-02	0.00E+00	0.00E+00	4.29E-03	4.11E-03	4.23E-03
		Bronchi	8.07E-05	0.00E+00	0.00E+00	4.16E-06	3.99E-06	4.11E-06