- **Impact 3.3.3.7-3:**There would be a low potential for impacts to ground water quality due to drainage from tailings impoundments and WRDFs under the Slower, Longer Project Alternative.

  Significance of the Impact: The impact is not considered significant. Based on the conclusions from the analysis, no additional mitigation is proposed.

3.3.3.7.3 Pit Lake Water Quality Impacts

Under the Slower, Longer Project Alternative pit lake water quality impacts would be indistinguishable from the Proposed Action.

- **Impact 3.3.3.7-4:** There would be a low potential for impacts to ground water quality due to the formation of a ground water sink in the open pit under the Slower, Longer Project Alternative.

  Significance of the Impact: The impact is not considered significant. Based on the conclusions from the analysis, no additional mitigation is proposed.

3.4 Geology and Mineral Resources

3.4.1 Regulatory Framework

The U.S. Congress established the right to access and develop mineral resources on open lands administered by the Federal Government under the 1872 General Mining Law. This law has been amended many times since its passage; however, the underlying right to access and develop minerals has remained in the General Mining Law. Limitations on the development of minerals under the General Mining Law have been established by the U.S. Congress in their passage of the various environmental laws (i.e., CWA, Clean Air Act [CAA], Endangered Species Act [ESA], etc.). The BLM has been charged by the U.S. Congress with the management of activities on public lands under the General Mining Law. The BLM implements this management through regulations at 43 CFR 3809.

The U.S. Congress has passed two laws that establish the policy for the development of mineral resources in the U.S. These acts are the MMPA and the Materials and Minerals Policy Research and Development Act of 1980. Congress declared that the national mineral policy is "...to foster and encourage private enterprise in (1) the development of economically sound and stable domestic mining, minerals, metal and mineral reclamation industries, (2) the orderly and economic development of domestic resources, reserves, and reclamation of metals and minerals to help assure satisfaction of industrial, security, and environmental needs ...". The 1980 Act reiterates these statements from the 1970 act.

The NDWR has safety requirements for water impoundment facilities of a size that are covered under the regulations at NAC 535.010 through 535.420. These regulations address how impoundments are designed, constructed, operated, and inspected.

Construction of mine facilities is regulated by standards of the Uniform Building Code (UBC). Eureka County currently uses the 2003 version of the International Building Code. The seismic zone designation throughout Eureka County is zone 3 on a scale ranging from 1 (indicating less damage expected) to 4 (indicating the most damage expected). Seismic activity in the vicinity of the Project Area is discussed under Section 3.4.2.4.10. Eureka County does not have specific regulations for building construction.

3.4.2 Affected Environment

3.4.2.1 Study Methods

The geology in the Project Area has been studied in detail by numerous geologic investigators. A comprehensive map of Eureka County was compiled in 1967 and is included in Geology and Mineral Resources of Eureka County, Nevada (Roberts et al.1967). The geology in the area has recently been researched and the structural setting reinterpreted (Crafford 2007) as part of the process of compiling a new geologic map for the entire State of Nevada. Crafford (2007) has described the various geologic units in context of sedimentary rocks and assemblages. Local, in depth studies of the Project Area have been ongoing since the deposit at Mount Hope was discovered. Current studies by EML geologists concur with the descriptions formulated by geologists formerly working at the Project. The following section describes the geology of the Project Area and the Mount Hope deposit. The geologic information in this section is summarized primarily from the paper written by Westra and Riedell (1996) and published in the Geological Society of Nevada's 1996 Geology and Ore Deposits of the American Cordillera, Symposium Proceedings. Crafford's (2007) interpretations have been noted where appropriate.

3.4.2.2 Existing Conditions

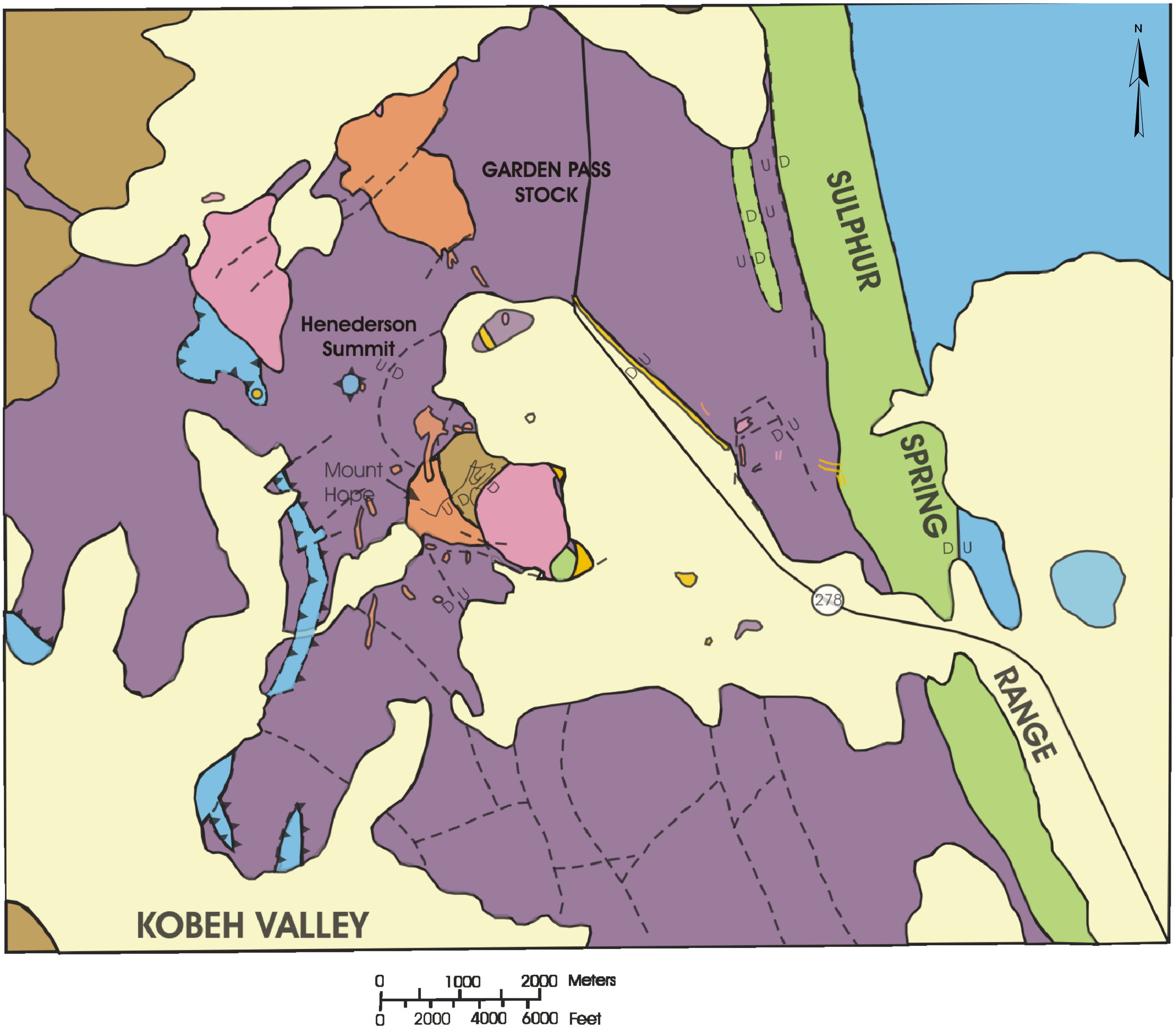
The Project is located in the central Great Basin section of the Basin and Range Physiographic Province. Block faulting in the area has resulted in generally north south trending topography. Structural deformation has resulted in a series of valleys separated by mountain ranges.

3.4.2.3 Regional Geology

Mount Hope is situated near the leading edge of the Roberts Mountains thrust. East vergent thrusting placed a basinal sedimentary and volcanic ("Western") assemblage on top of coeval, predominantly shelf sequence carbonate rocks ("Eastern" assemblage) during the Devonian-Mississippian Antler orogeny (process of mountain building). Western assemblage mudstones, cherts, sandy limestones, sandstones, and conglomerates of the Ordovician Vinini Formation underlie most of the Project Area. Figures 3.4.1, 3.4.2, and 3.4.3 show the geology and stratigraphy of the area.

Eastern assemblage shelf sequence rocks, including the Silurian Lone Mountain Dolomite and Devonian Nevada Formation, are exposed along the eastern side of the Sulphur Spring Range. Several fault bounded exposures of dolomite and limestone of the Nevada and Devils Gate Formations lie west of Mount Hope. These have been interpreted as windows through the Roberts Mountains thrust; fault slices of lower plate material caught up in the upper plate; tectonic slides structurally interlayered with and overlying the Vinini Formation, emplaced during early Cretaceous (?)[1] gravity sliding; or lower plate blocks rotated and juxtaposed against Vinini Formation rocks by Oligocene or younger extensional faults. Previous mapping and

[1] The use of "(?)" is a standard practices when stating uncertain geologic ages.



QUATERNARY

Alluvium

TERTIARY

Basalt flows

Dacite porphyry

Quartz porphyry

Rhyolite ash flow tuffs and vent breccias

PERMIAN

Garden Valley Formation - limestone, sandstone, conglomerate, shale

ORDOVICIAN TO DEVONIAN

Miogeosynclinal Carbonates and Clastics - Includes Eureka Quartzite, Lone Mountain and Nevada Dolomites, and Devils Gate Limestone

ORDOVICIAN

Vinini Formation - chert, siltstone, shale, limestone, quartzite

SYMBOLS

Contact

U/D Normal fault, showing displacement

Thrust fault

SOURCE: Westra and Riedell (1996) published in the Geological Society of Nevada's 1996 Geology and Ore Deposits of the American Cordillera

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Mount Lewis Field Office
50 Bastian Road
Battle Mountain, Nevada 89820

DESIGN: EMLLC	DRAWN: GSL	REVIEWED: RFD
CHECKED: -	APPROVED: RFD	DATE: 05/02/2011
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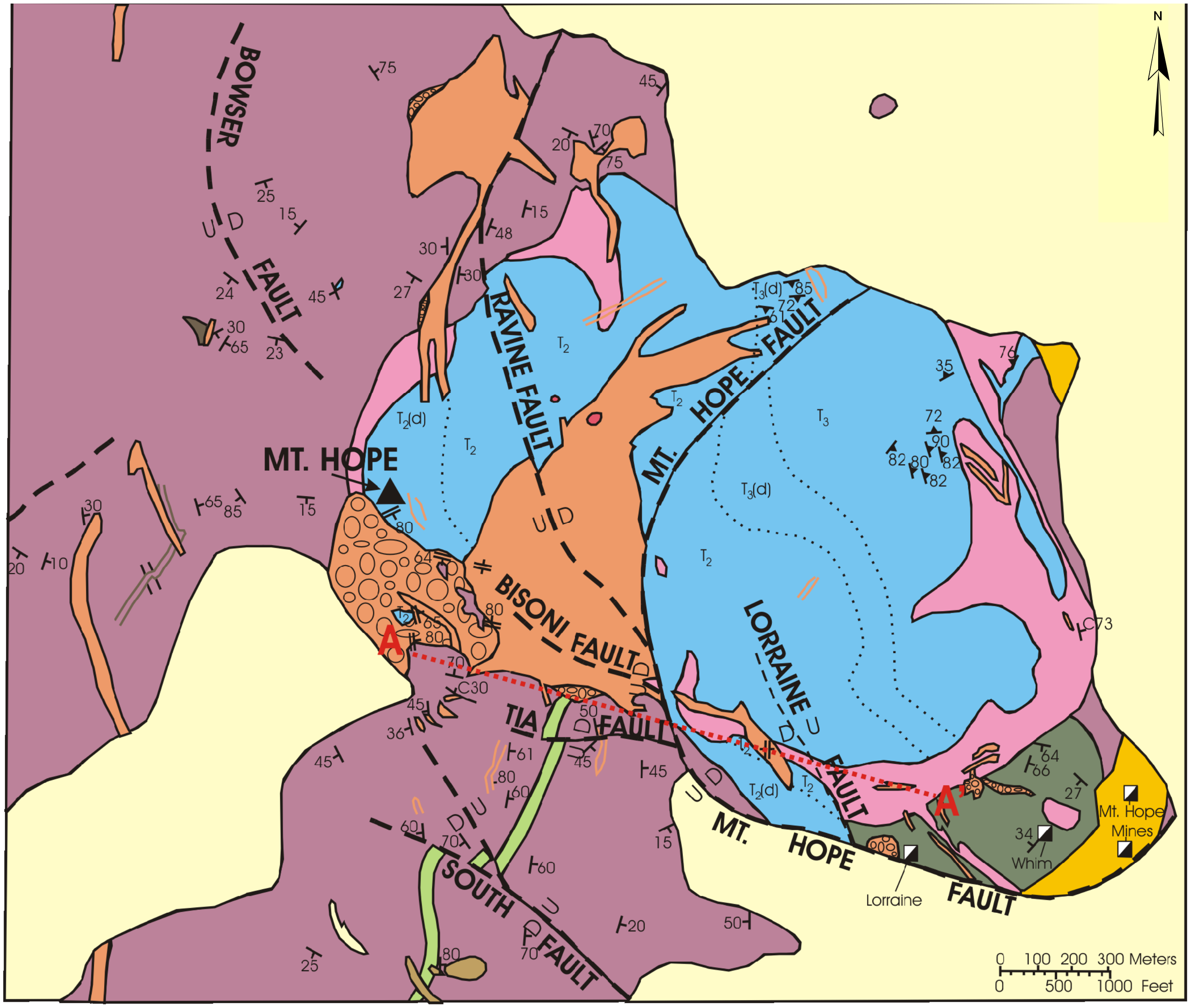
BUREAU OF LAND MANAGEMENT

MOUNT HOPE PROJECT

DRAWING TITLE:

General Geology of the Mount Hope Area, Nevada

Figure 3.4.1



A-A' indicates line of cross section in Figure 3.4.3.

QUATERNARY
- Alluvium

TERTIARY
- Dacite porphyry
- Quartz porphyry breccia (age uncertain)
- Quartz porphyry
- Quartz porphyry border phase
- Rhyolite vent breccia
- Quartz-eye tuff (age uncertain)
- T_3, T_3(d), T_2, T_2(d), T_1 — Mt. Hope Tuff - cooling units designated T_1, T_2, and T_3 from oldest to youngest. Density welded zones indicated by (d). T, undivided Mt. Hope Tuff
- Biotite quartz monzonite porphyry (age uncertain)

PERMIAN
- Garden Valley Formation

ORDOVICIAN

Vinini Formation
- Chert, argillite, quartzite, minor limestone
- Limestone, with subordinate clastic sediments

SYMBOLS
- C30 — Contact: mapped, approximate, inferred, showing dip
- Contact between cooling and welding unit in tuff
- U/D — Normal fault, showing displacement
- 65 — Strike and dip of beds
- 30 — Strike and dip of eutaxitic foliation
- 80 — Strike and dip of sheeted quartz vein sheet
- Mine workings

SOURCE: Westra and Riedell (1996) published in the Geological Society of Nevada's 1996 Geology and Ore Deposits of the American Cordillera

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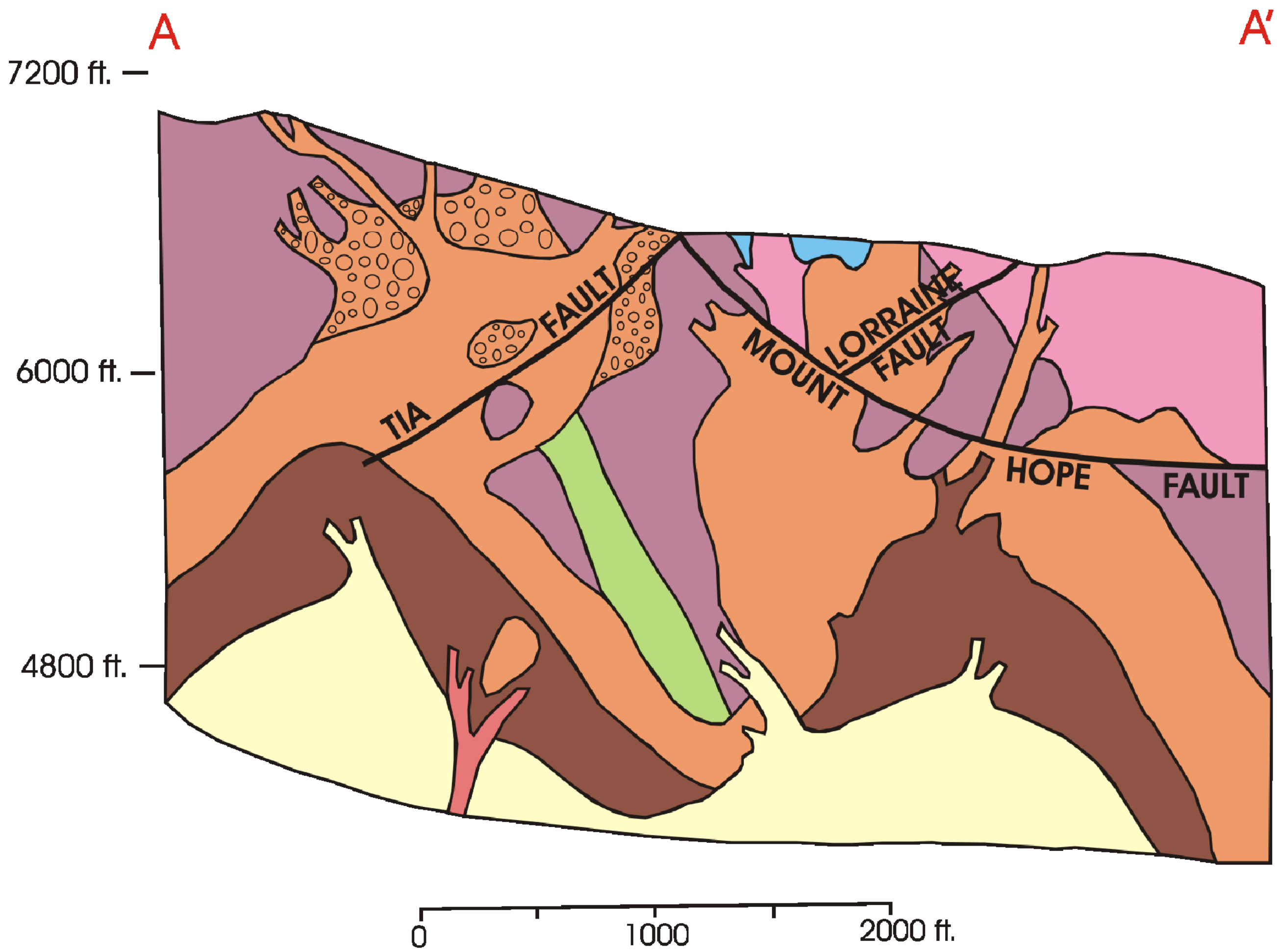
BUREAU OF LAND MANAGEMENT

MOUNT HOPE PROJECT

DRAWING TITLE:

Geologic Map of the Mount Hope Area

Figure 3.4.2



TERTIARY

- Fine-grained granite
- Coarse-grained quartz porphyry
- Apilitic quartz porphyry
- Quartz porphyries
- Quartz porphyry border phase
- Rhyolite vent breccia
- Mount Hope Tuff

ORDOVICIAN

VININI FORMATION

- Chert, argillite, quartzite, minor limestone
- Limestone, with subordinate clastic sediments

SOURCE: Westra and Riedell (1996) published in the Geological Society of Nevada's 1996 Geology and Ore Deposits of the American Cordillera

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BUREAU OF LAND MANAGEMENT

MOUNT HOPE PROJECT

DRAWING TITLE:

Geologic Cross Section

Figure 3.4.3

drilling indicate that the carbonate blocks both overlie and are interleaved within the Vinini Formation, and are in turn overlain by tuffs related to the Mount Hope igneous complex. Crafford (2007) has reinterpreted and recategorized early mapped units into assemblages such as Slope Assemblage, Basin Assemblage, and others. These assemblages formed under varying circumstances and then were involved in complex structural events, which destroyed the original stratigraphic sequence making it very difficult to determine or interpret underlying and overlying strata and the age of those strata. This is a key component to the discussion of paleontology in Section 3.5.

During the Antler orogeny, an elongate foreland basin formed at the toe of the allochthon. This basin was filled with a post-orogenic coarse clastic “Overlap” assemblage representing detritus eroded off the Antler highlands. In the Mount Hope area, the Overlap assemblage is represented by Permian limestone, conglomerate, and shale of the Garden Valley Formation, exposed in the Sulphur Spring Range and at the southeastern contact of the Mount Hope igneous complex. Intermittent orogenic movement during the late Paleozoic and Mesozoic resulted in folding and thrust faulting of the Overlap assemblage and underlying formations.

The leading edge of the Roberts Mountains thrust is not exposed in the Mount Hope area; however, the distribution of Western and Eastern assemblage rocks indicates that the trace of the thrust is concealed beneath the Garden Valley Formation in the Sulphur Spring Range or is faulted out by the structure bounding the range to the east. Drilling in the vicinity of the Mount Hope complex, to a depth of 2,888 feet, has failed to intercept lower plate carbonate rocks.

During the Eocene and Oligocene, extensive andesitic and rhyolitic magmatism occurred within a broad east northeast trending belt that extended from central Nevada to north central Utah. Felsic magmas crystallized as small hypabyssal plugs at Mount Hope and Garden Pass and as rhyolitic ash flows at Mount Hope and in the Henderson Summit area. Unconsolidated to poorly consolidated late Tertiary and Quaternary gravel, sand, and silt fill valleys formed by Basin and Range block faulting.

3.4.2.4 Geology of the Mount Hope Area

3.4.2.4.1 Paleozoic Sedimentary Rocks

Crafford (2007) divides the rock units in the Project Area into two separate assemblages: 1) the Slope assemblage that contains Ordovician through Lower Mississippian rocks; and 2) units in the Basin assemblage that include Upper Cambrian through Devonian rocks.

The Devonian-Ordovician Vinini Formation is widely exposed south and west of the Mount Hope igneous complex. Thin to medium bedded shale, siltstone, chert, and conglomerate predominate; quartzite and sandy limestone are also present. One thin but persistent sandy limestone unit divides the section into a lower sequence of dominantly argillaceous rocks, cropping out to the west, and a chert and quartzite rich upper unit to the east. The limestone bed dips and thickens eastwardly and may correlate with skarn present in the deep subsurface.

Along the southeast side of the Mount Hope complex, the basal limestone unit of the Permian Garden Valley Formation has been preserved in a small asymmetrical syncline. It overlies Vinini Formation in an unconformable or possibly thrust contact.

3.4.2.4.2 Garden Pass Quartz Porphyry

The Garden Pass stock is located 2.5 miles north of Mount Hope and consists largely of unaltered rhyolitic quartz porphyry, similar to the main phase quartz porphyry of the Mount Hope complex.

3.4.2.4.3 The Mount Hope Igneous Complex

The Mount Hope Igneous Complex consists of rhyolitic and subordinate rhyodacitic to dacitic intrusive and extrusive phases and thus represents a subvolcanic erosion level of a mid-Tertiary eruptive center. Welded rhyolite tuffs are distinguished by the presence of shard structures and variable amounts of coarse pumice. These rocks probably formed from localized ash flows erupted from the complex. Rhyolite vent breccias are rich in lithic fragments but lack pumice and glass shards, and form steeply dipping ring dikes along the margins of the complex. Quartz porphyries occur both as autoliths in and as dikes cross cutting the rhyolite tuffs and vent breccias and must, therefore, predate and postdate the latter rock types.

Rhyolite tuffs: The most extensive ash flow unit, the informally named variably welded Mount Hope tuff, is characterized by 25 to 40 percent small angular phenocrysts, Vinini siltstone, and pumice in a devitrified groundmass of fine crystalline quartz and K-feldspar (potassium feldspar). The texture of the tuffs contrasts with that of porphyries and pumice fragments due to the fracturing of crystals during ash flow eruption and dissipation of fine ash out of the top of the eruptive cloud, resulting in the higher phenocryst content in the tuffs.

Rhyolite vent breccias: The southeastern and northwestern contacts of the Mount Hope complex are marked by ring dikes of rhyolite vent breccia that cut all units of Mount Hope tuff. The breccias have broken crystals similar to those in the Mount Hope tuff, but contain fewer phenocrysts, larger and more abundant lithic fragments, and neither shards nor pumice. Angular fragments of early quartz porphyry and Vinini siltstone, quartzite, and hornfels are included.

Quartz porphyries: Intrusive rhyolitic quartz porphyries contain subhedral to euhedral (or rarely broken) quartz, K-feldspar, and plagioclase phenocrysts in groundmasses of allotriomorphic granular texture and varying grain size. Early quartz porphyry, presently known only from autoliths in rhyolite tuffs and vent breccias, is the only known quartz porphyry phase that predates these units. Autoliths of early quartz porphyry are most common in rhyolite vent breccia along the eastern and southeastern edges of the complex, suggesting that a mass of early quartz porphyry may occur in the subsurface in this area. No reliable macroscopic or petrographic criteria distinguish this rock type from the quartz porphyries that postdate the eruptive episode.

A minimum of four post-eruptive quartz porphyry phases together constitute an irregular intrusive mass that cuts both Mount Hope tuff and rhyolite vent breccia. From margin to core, the quartz porphyry phases become successively younger and have progressively coarser groundmasses. The discontinuous rind of the porphyry pluton, exposed primarily along the southwestern contact zone, consists of a chilled border phase. An extremely fine grained groundmass, common broken phenocrysts, and numerous xenoliths of Vinini hornfels distinguish this unit from the later porphyries. Main phase quartz porphyry, the most widespread intrusive phase at the surface, forms an irregular stock of somewhat variable texture and numerous dikes cutting the Vinini Formation.

With increasing depth, the quartz porphyry grades into or is cut by aplitic quartz porphyry characterized by distinctly coarser aplitic groundmass. Only rarely do dikes of aplitic quartz porphyry intrude overlying quartz porphyry. The core of the igneous complex consists of a heterogeneous mass of granite porphyries and coarse grained quartz porphyries. A contact breccia, with fragments of quartz porphyries and Vinini hornfels and skarn, locally separates the granite porphyry with a quartz K-feldspar oligoclase groundmass of grains. The finer grained groundmass of the coarse grained quartz porphyry in the core of the stock may be the result of pressure quenching during brecciation of the granite border zone.

Other related intrusive units are volumetrically insignificant. Fine grained granite or aplite forms rare dikes cutting all quartz porphyry phases. Small hydrothermal quartz porphyry breccias with matrices of silicified rock flour have been mapped northeast and south southeast of the summit of Mount Hope.

Intermediate rocks: Dikes of rhyodacitic to dacitic composition crop out north, east and west of the Mount Hope Complex. It is uncertain whether these rocks represent more mafic products of the Mount Hope magma chamber or different magmas altogether. Rare dikes of biotite quartz monzonite porphyry cut Vinini Formation west of the complex and are cut in turn by dikes of quartz porphyry. Dacite porphyry occurs as dikes on the lower slopes north and east of Mount Hope and shows no crosscutting relationships with the rhyolitic units of the complex; however, this porphyry is affected by hydrothermal alteration.

Age of the Mount Hope Complex: Radiometric age dates range from 26 to 49 million years ago (Ma) and are markedly discordant for individual units. Wide spans in potassium argon and fission track dates have been reported from other porphyry Mo deposits but are now considered suspect due to probable resetting at lower temperatures. Current interpretation of these data, with consideration given to differences in the quality of samples is that the age of all the rhyolitic units is about 38 Ma based on clustering of ages in the 36 to 40 Ma range. Dacite porphyries exhibit peripheral alteration and mineralization consistent with their spatial position in the system but yield anomalously younger 30 to 33 Ma ages. Based on geologic relationships, it is inferred that the dacite porphyry is approximately the same age as the rhyolitic rocks.

3.4.2.4.4 Structural Development During the Emplacement of Mount Hope Igneous Complex

The thickness and distribution of the Mount Hope tuff in the subsurface and the highly variable and locally steep dips of eutaxitic foliation suggest that ash flow eruptions were accomplished by cauldron subsidence. The actual cauldron bounding structures have not been observed either in outcrop or drill core because they were largely to completely filled with rhyolite vent breccia. Subsidence is inferred, however, because the ring dikes of rhyolite vent breccia juxtapose outcropping Paleozoic sedimentary rocks on their outer sides against substantial thicknesses of Mount Hope tuff overlying downdropped Paleozoic rocks on their inner sides. Map patterns of rhyolite vent breccia suggest two cauldrons formed.

The western cauldron, approximately 3,300 feet in diameter, is outlined by the partial ring dike northwest and north northeast of the summit of Mount Hope. This ring fracture system juxtaposes a 1,000-foot thick section of the lower cooling unit of the Mount Hope tuff against Vinini Formation. The restricted distribution of this cooling unit indicates that eruption and accumulation were almost entirely confined to this small western cauldron.

The ring dike of rhyolite vent breccia that borders the complex on the eastern side was emplaced along a structure that juxtaposed the middle and upper cooling units against Paleozoic rocks to the east and south. The ring dike partially outlines a cauldron approximately 900 feet across, comprising the eastern half of the complex. Both middle and upper tuff units ponded in, and probably erupted from, this eastern cauldron. At least 1,150 feet of subsidence is inferred. The outflow facies of the middle cooling unit has been preserved in the Henderson Summit area and in widely scattered small erosional remnants. The Bowser fault, northwest of Mount Hope, forms a broad semi-circular structure that may define a yet larger subsidence area.

3.4.2.4.5 Postmineral Structures

Several fault zones can be traced between drill holes in the subsurface. Offsets in zones of alteration and mineralization indicate that significant postmineral normal movement took place along these structures. Locally strong pyrite and molybdenite mineralization within these zones may provide evidence for some premineral history. Two sets of faults occur: 1) high angle structures trending west northwest and 2) moderate to high angle ring shaped structures that truncate the earlier set.

The west northwest trending Bisoni and Tia faults cut the southwestern edge of the complex and adjacent Vinini Formation. The faults dip 60 to 70° in a northerly direction. The Mount Hope fault terminates these structures to the east. Offsets of Mo zones along these faults suggest postmineral movement of less than 330 feet.

The Mount Hope fault has been well defined by drilling and is a listric fault with easterly dips of 55° at the surface and 30 to 35° at depth. In plain view, the fault is spoon shaped, opening to the northeast, which suggests that displacement was in a north 65° east direction. Normal movement estimated at 650 to 800 feet placed argillic alteration on top of better grade Mo mineralization in the footwall.

The Lorraine fault appears to dip southwesterly at a moderate angle. It is restricted to the hanging wall of, and may be an antithetic normal fault related to, the Mount Hope Fault. The listric Ravine fault only occurs in the footwall of the Mount Hope fault. The Ravine fault is nearly vertical at the surface, but flattens with increasing depth to a moderate easterly dip.

Map patterns suggest that cooling units of the Mount Hope tuff dip gently northeast, although attitudes of compaction foliation are far less regular. Miocene basalts exposed in the Roberts Mountains also dip gently east suggesting that Basin and Range block faulting tilted the Mount Hope area between ten and 20° east following mineralization.

3.4.2.4.6 Alteration and Minor Element Distribution

Hydrothermal alteration and mineralization affect nearly all of the Mount Hope complex and a wide area of adjacent sedimentary rocks. Patterns of alteration and metal zoning are well developed. Mapping and petrographic study allow correlation of alteration effects in igneous rocks with those in the Vinini Formation. Regardless of host, such effects are classified into weak argillic propylitic, argillic, potassic phyllic, potassic, high silica, and biotite alteration zones, arranged from periphery to core of the hydrothermal system.

Weak Argillic Propylitic Alteration: Weak argillic and propylitic assemblages characterize the outermost zone of the Mount Hope hydrothermal system. In quartz porphyry, plagioclase is partly replaced by kaolinite and sericite. The more calcium rich dacite porphyry commonly exhibits propylitic assemblages, with aggregates of epidote, carbonates, and clays replacing plagioclase. Thermal metamorphism of Vinini argillites extends up to 2,000 feet from the contact with the Mount Hope complex and produced hornfels with blocky fracturing but no megascopic mineral changes. Local structurally controlled argillized zones, with carbonates, chlorite, and sulfides, extend outward into unaltered Vinini siltstones and shales.

Argillic Alteration: Argillic assemblages are widespread and especially well developed in Mount Hope tuff and rhyolite vent breccia in the hanging wall of the Mount Hope fault. Montmorillonite, kaolinite, mixed layer illite/montmorillonite, and minor calcite and sericite/illite completely replace plagioclase. K-feldspar is fresh to weakly "dusted" by clays and sericite. Vinini hornfels within the argillic zone contains quartz, sericite and disseminated pyrite. Closer to the center of the hydrothermal system, but still within the argillic zone, hydrothermal or contact metamorphic biotite imparts a distinctive chocolate brown color to the hornfels. Minor amounts of pyrite or pyrrhotite are present. Limestone of the Garden Valley Formation formed marble with isolated pods and lenses of skarn containing garnet, pyroxene, tremolite, epidote, fluorite, and retrograde clays, carbonates, chlorite, and biotite. Silicate veins are rare to absent in most rock types, although sparse hairline quartz veinlets cut more competent rocks such as the densely welded tuffs. Disseminated grains and thin veinlets of pyrite increase with depth. Discontinuous veinlets containing sphalerite, pyrrhotite, or rarely galena are also common.

Low Mo (less than 20 parts per million [ppm]) and fluorine (F) (less than 500 ppm) values characterize the argillic zone. Highly anomalous Pb, Zn, Ag, and Mn form distinct haloes largely within the argillic zone, above and peripheral to molybdenite ore. In cross section, anomalous Pb and Ag values occur above and outside a strongly developed Zn and Mn halo. The historic Mount Hope mine exploited the high grade Zn-rich mineralization formed where this halo intersected reactive limestones of the Garden Valley Formation. Intense orbicular alteration and the highest total sulfide concentrations generally overlap with strong Zn mineralization. Cu and Sn values increase with depth in the argillic zone, but commonly peak in the underlying potassic phyllic zone.

Potassic Phyllic Alteration: Early potassic alteration with overprinted sericite forms a discontinuous zone between the potassic core and the peripheral argillic zone. This region, termed the potassic phyllic zone, is best developed in quartz porphyries and Vinini hornfels along the southern and southwestern sides of the complex. Throughout the exposed potassic phyllic zone, quartz veinlets commonly occur in near vertical sheeted sets that appear to form radial and annular patterns centered on the exposed potassic core. The potassic phyllic zone averages only one to two weight percent sulfides, mostly pyrite and molybdenite, with pyrrhotite also present in Vinini hornfels.

A rapid increase in Mo content takes place within the potassic phyllic zone. No more than 500 to 650 feet separate the 0.01 percent and the 0.1 percent Mo contours in most drill holes. Chalcopyrite bearing veinlets are also common in this zone and, where exposed to weathering, may give rise to a zone of weak chalcocite enrichment. Tin (Sn) is commonly found in high concentrations. The highest F values straddle the transition between potassic phyllic and underlying potassic alteration, directly above the Mo ore zone. Fluorite occurs in veinlets and in xenomorphic aggregates replacing the porphyry groundmass and some K-feldspar phenocrysts.

No topaz has yet been recognized. F is preferentially concentrated in sedimentary rocks of the Vinini Formation, and a very strong surface F anomaly occurs along the contact with the main quartz porphyry phase.

Potassic Alteration: A zone of potassic alteration represents the exposed core of the hydrothermal system and widens considerably with depth, extending easterly in the footwall of the Mount Hope fault. Potassic altered quartz porphyries consist largely of quartz, K-feldspar, and minor fluorite, and show a striking enrichment in potassium. Hydrothermal K-feldspar replaces plagioclase and floods in the groundmass. Green to yellow sericite and kaolinite, in turn, replace relict and some K-feldspathized plagioclase. Fluorite locally replaces groundmass grains and K-feldspar phenocrysts. Recrystallization of argillite formed brown hornfels containing quartz, biotite, K-feldspar, plagioclase, and minor sericite. Calcareous sedimentary rocks formed skarns containing garnet, diopside, and retrograde actinolite, hornblende, chlorite, and biotite. Some quartz veins in the calcareous rocks have envelopes of hydrothermal K-feldspar which postdate formation of the garnet skarn.

A well developed stockwork of quartz ± fluorite ± K-feldspar ± molybdenite veinlets cuts quartz porphyries and Vinini hornfels and is largely confined to the potassic zone. Vein density ranges from four to 30 volume percent of the rock. In the Vinini Formation, K-feldspar is more common in veinlets, and haloes of dark brown biotite or pale tan grey K-feldspar surround the quartz veins. Parallel vein walls, dilation of earlier structures, and offsets of earlier by later veins all indicate that open fracture filling was the dominant mechanism of vein formation. The potassic zone averages less than one percent pyrite plus molybdenite, and outcrops contain only sparse limonites.

Potassic alteration is approximately coextensive with the surface Mo anomaly and with ore grade Mo mineralization at depth. Anomalous tungsten concentrations commonly occur within the deeper part of the potassic zone. The highest tungsten values occur in biotite and calc-silicate hornfels of the Vinini Formation with scheelite being the dominant tungsten (W) mineral.

High Silica Alteration: A gradual increase in barren granular hydrothermal silica with depth marks the transition into zones of high silica alteration. In igneous rocks, high silica zones contain in excess of 30 volume percent hydrothermal quartz in veins and irregular replacements. Locally, massive silica has obliterated all igneous textures. In addition to quartz, these high silica zones contain minor carbonates, chlorite, and pyrite, but fluorite is conspicuously absent. Quartz produced by silica flooding is coarser grained than quartz occurring in stockwork veins. Petrographic study suggests that silica flooding began with suturing of strained quartz phenocrysts, forming mosaics that grew outward and coalesced into patches of granular silica. In Vinini hornfels, vein quartz increases only slightly in the high silica zone, but veinlets are less regular and nebulous patches of silica flooding are more common than in the overlying potassic zone.

Patches of silica flooding consistently appear to cut quartz molybdenite ± fluorite veinlets in drill core, in some instances assimilating remnants of mineralized fractures as “ghost” molybdenite. Such relationships suggest that silicic alteration formed somewhat later than the bulk of molybdenite mineralization.

A slight increase in pyrite content accompanies the transition from potassic to high silica alteration. Magnetite, absent from higher levels of the system, averages up to 0.5 weight percent in veinlets with quartz, biotite, chlorite, and pyrite. Traces of arsenopyrite and hematite have been noted, and Pb and Zn are locally anomalous. A significant increase in sericite, kaolinite, and calcite after relict feldspars occurs 160 to 330 feet below the top of the high silica zone and overlaps into the underlying biotite zone.

Biotite Alteration: A zone characterized by magmatic and hydrothermal biotite occurs in the subsurface in granite porphyry and coarse grained quartz porphyry. Aggregates of hydrothermal biotite with retrograde chlorite and sericite occupy magmatic biotite sites. Primary biotite and oligoclase become more abundant with increasing depth. Widely spaced high angle quartz calcite veins are common. A thin zone of low-grade Mo and W mineralization generally occurs near the top of the biotite zone.

3.4.2.4.7 Nature and Habit of Molybdenite Mineralization

Molybdenite mineralization at Mount Hope occurs in a stockwork of fractures and veinlets. Disseminated molybdenite, although present, is very rare. The bulk of mineralization occurs in four types of veinlets: 1) quartz molybdenite veinlets (comprising 75 percent of ore) range from 0.1 to five millimeters (mm) in thickness and generally contain molybdenite crystals averaging one mm in the longest dimension; 2) coarse quartz molybdenite veins (ten percent of ore) are five to 20 mm thick and are lined with rich clusters of molybdenite crystals averaging 0.08 mm across. Such veins are most common in Vinini Formation; 3) blue quartz veins (ten percent of ore) are three to ten mm thick and bluish gray in color, imparted by sparse grains of molybdenite averaging 0.05 mm across. These veins are most common in the deeper part of the system; and 4) molybdenite "paint" (five percent of ore) refers to thin films of molybdenite, commonly smeared and slickensided, on fractures devoid of quartz.

3.4.2.4.8 Vein Paragenesis

The age relations between various vein types at Mount Hope are complex. Detailed core logging and petrographic studies suggest the following generalized sequence: 1) early barren quartz ± K-feldspar ± fluorite veins; 2) quartz fluorite molybdenite ± K-feldspar veins; 3) quartz molybdenite ± fluorite veins; 4) blue quartz veins; 5) granular silica associated with the formation of high silica zones; 6) quartz sericite pyrite ± chlorite ± fluorite veinlets (shallow); quartz pyrite ± magnetite ± biotite ± chlorite veinlets (deep); 7) molybdenite "paint" on fractures; and 8) late fractures lined with pyrite, clay or carbonate. Pervasive early potassic alteration affected all quartz porphyries, hornfels of the Vinini Formation, and possibly Mount Hope tuff. Related vein types 1 and 2 cut potassic altered porphyries and Vinini Formation but are rare in the tuffs. Molybdenite bearing quartz veins, types 2 through 4, formed during the transition from potassic to high silica alteration. These veins appear to become thicker and leaner in molybdenite with time and increasing depth, and culminate in the patches of barren granular quartz comprising the high silica assemblage. Weakly developed phyllic alteration, represented by vein type 6, cut potassic and high silica alteration. Argillic alteration may by superimposed on potassic altered Mount Hope tuff and extends well beyond the earlier potassic zone.

3.4.2.4.9 Local Geologic Structures

Three Quaternary age faults have been mapped within ten miles of the Project Area. There is a discontinuous and vaguely defined group of faults that extend southeast from approximately four miles west of Mount Hope to three miles northwest of Mount Whistler, on the southeastern flank of the Roberts Mountains. These are short faults where bedrock is found against Quaternary pediment slope deposits (Lidke 2000). There is evidence along the zone for at least one faulting event that is no older than early Pleistocene in age.

Another group of faults strikes north and is located in the Garden Valley area immediately north of the Project Area. These faults trend north and appear to down drop Quaternary deposits of the Garden Valley against Paleozoic and Tertiary bedrock of the Roberts Mountains and Sulphur Springs Range, which border the western and eastern flank of the valley, respectively (Lidke 2000). There is evidence for Quaternary movement along these faults, but no estimates of offset amounts for these faults have been reported.

Approximately ten miles southwest of Mount Hope is a northwest striking fault that follows the southwestern flank of the Roberts Mountains. It is a major range front fault that appears to extend farther southeast as a prominent scarp on pediment slope deposits of the northern part of the Kobeh Valley (Lidke 2000). Along the southwestern flank of the Roberts Mountains, the fault has a down to the southwest stratigraphic offset that juxtaposes Paleozoic bedrock against Quaternary pediment slope deposits (Lidke 2000). Evidence of latest movement is Holocene in age.

None of these faults have been studied in detail and very little is known about their nature, character and movement history, and there is no record of recent movement along these faults.

3.4.2.4.10 Seismicity

Although the Project is in a seismically active region of the country, it is not located within Nevada's major seismic belts. A search of the UNR Seismological Laboratory database revealed that from 1872 to 2008, there have been 364 recorded earthquakes greater than 3.0 within 100 miles of the site; 40 recorded earthquakes greater than 3.0 within 50 miles of the site, and zero recorded earthquakes greater than 3.0 within ten miles of the Project Area. Most of the earthquake activity in the last 156 years has been 100 miles west of the Project Area.

Table 3.4-1 indicates that 89 percent of the earthquakes within 100 miles of the site and 98 percent of the earthquakes within 50 miles of the site have been below 5.0 in magnitude. The highest magnitude earthquakes were 7.2 and 7.8 and were located approximately 100 miles southwest and 90 miles northwest, respectively. The highest magnitude earthquake (5.5) closest to the Project Area, was recorded on April 2, 1875, approximately 26 miles to the southeast. There have been no earthquakes recorded with a magnitude greater than 3.5 within ten miles of the proposed site since record keeping began in 1852.

Table 3.4-1: Seismic Events (>3.0) Recorded Near the Project Area Between 1872 and 2008

Local Magnitude	Number within 100 Miles	Number within 50 Miles	Number within 10 miles
>7.0	2	0	0
6.0 - 6.9	3	0	0
5.0 - 5.9	36	1	0
4.0 - 4.9	207	19	0
3.0 - 3.9	116	20	0

Assessment of the seismic hazards at Mount Hope was conducted using seismic models available from the U.S. Geological Survey (USGS). One assessment tool models the occurrence of a seismic event within a 30 mile radius of the site within the next 50 years. Another calculates the peak acceleration caused by a seismic event in the next 50 years.

The USGS model indicated that the probability of a magnitude 5.0 quake occurring within 30 miles of the site in the next 50 years is between 0.4 and 0.5. The probability of a magnitude 6.0 quake occurring within 30 miles of the site in the next 50 years is between 0.10 and 0.15. The probability of an earthquake greater than a 7.0 occurring within 30 miles of the site in the next 50 years is between 0.005 and 0.01. The probability of an earthquake greater than 8.0 occurring within 30 miles of the area in the next 50 years is essentially zero.

In order to evaluate the force on a building during an earthquake, peak acceleration can be calculated for an area. During an earthquake ground acceleration varies with time. Peak acceleration can be calculated with a two percent and ten percent probability of exceedance in 50 years. An exceedance of two percent was used because it is the most conservative amount. The analysis was completed so that there is a two percent chance that the ground acceleration would be exceeded in a 50 year time period. For the Project, the percentage is calculated between 20 and 30 percent. A percentage of 20 to 30 percent calculated for the Project Area indicates that if there is an earthquake within the next 50 years, then it would result in negligible damage to buildings of good design and construction.

3.4.2.4.11 Mineral Resources

The Mount Hope deposit is a classic Mo porphyry, similar in type to the Climax deposit in Colorado. This type of deposit has well zoned molybdenite mineralization where many intersecting small veins of molybdenite form a stockwork in an altered quartz monzonite porphyry. Similar to other porphyry-type ore deposits, the ore is low-grade but the ore body is very large. EML is focused on the economic Mo mineralization in the deposit; however, based on drilling results and the presence of other mineralization in the district such as W, Ag, gold (Au), Pb, Zn, and Cu that are present in the pit walls adjacent to and distal from the open pit, EML would evaluate these additional mineral resources in the future (IMC 2005). The Mount Hope deposit contains a nearly 1.0 billion ton molybdenite ore body that would produce approximately 1.1 billion pounds of recoverable Mo during its 44-year lifetime. Up to 2.708 billion tons of ore and waste rock would be excavated from the open pit with an ore to waste ratio of 1:1.6. A single open pit would result from the phased mining. The ultimate pit depth would be approximately 2,600 feet below ground surface at an elevation of approximately 4,700 feet amsl.

Exxon in 1988, in one of their last diamond drill holes, encountered significant widths of good grade Zn mineralization. The drill hole encountered two zones: one zone from 128 to 272 feet in depth, 144 feet assayed 9.1 percent Zn; and one zone from 423 to 472 feed in depth, 49 feet assayed 9.3 percent Zn. Recent analyses determined that the mineralization represents a skarn zone between sediments and quartz porphyry. The mineralization in this hole is approximately 300 feet north and generally along trend of the Zn mineralization in the original Mount Hope underground Zn mine. As long as a mile of strike length remains open and unexplored. The zone is outside the limits of the planned Mo open pit. The original underground workings developed a high-grade Zn zone; however, there was no follow up to determine the full extent of the deposit after the Mo deposit was discovered in 1978.

3.4.3 Environmental Consequences and Mitigation Measures

Major issues related to geology and minerals include the following: a) geologic hazards created or magnified by Project development; b) failure of, or damage to, critical facilities caused by seismically induced ground shaking; and c) exclusion of future mineral resource availability caused by the placement of facilities (tailings or waste rock storage areas, etc.).

3.4.3.1 Significance Criteria

Adverse impacts to geology and minerals would be significant if the proposed action or alternatives resulted in any of the following:

- Impacts to the facility site or design caused by geologic hazards, including landslides and catastrophic slope failures or ground subsidence;
- Structural damage or failure of a facility caused by seismic loading from earthquakes; or
- Restriction on the current or future extraction of known mineral resources.

3.4.3.2 Assessment Methodology

Impacts of the Proposed Action and Project Alternatives were assessed based on review of reports prepared in support of the Project, review of the Project baseline characterization reports (SRK 2006), review of the Plan for the Project (EML 2006), and review of the Proposed Action. The significance of the impacts was evaluated based on the significance criteria listed above. Stability analysis of the Project waste rock dumps was analyzed in the Waste Rock Disposal and Low Grade Ore Storage Facilities Design Report (SWC 2008a). Stability analyses for the Project storage and tailings facilities are included in the South and North Tailings Storage Facilities Located in Kobeh Valley Design Report (SWC 2008b).

Waste Rock Disposal Facilities

Slope stability analyses for the WRDFs were conducted in support of the permitting level design. These analyses required the selection of strength parameters from the geotechnical work performed to date and from experience on projects similar to the Project. The slope stability analyses examined the stability of the proposed WRDFs and the LGO Stockpile under both static and seismic loading conditions.

Slope stability analyses were completed for five cross sections developed from ultimate facility configurations under the Proposed Action. Detailed information can be found in SWC's reports (2008a and 2008b), which can be viewed during normal office hours at the MLFO. For this study, all stability analyses were conducted using SLIDE V5.0 (RocScience 2007), which analyzes the stability of slopes using the limit equilibrium method. The limit equilibrium method of analysis used to find the critical circular and wedge type failure surfaces was the Spencer Method. The Spencer Method satisfies both moment and force equilibrium. The program automatically iterates through a variety of potential failure surfaces, calculates the safety factor for static and pseudostatic conditions for each surface according to Spencer's Method, and selects the surface with the minimum factor of safety commonly referred to as the critical failure surface. Specific input requirements of the SLIDE program include geometric profiles, material properties (moist unit weight, saturated unit weight, effective cohesion, and effective friction angle) and a phreatic surface profile.

Stability analyses were conducted under both static and seismic loading conditions. An earthquake event having a 1,100-year return period with a four percent probability of exceedance occurring during the 45-year operation life is considered appropriate for design of the waste rock facilities at Mount Hope. Peak horizontal ground accelerations (PHGA) were determined to be 0.15 gravity (g) and 0.23g for firm rock (Sb) and soil (Sc) respectively. For slope stability analyses, a design horizontal ground acceleration equal to two thirds of the PHGA is considered conservative for deep rotational failures (Hynes and Franklin 1984); therefore, a value of 0.15g was conservatively selected for analyzing WRDFs and the LGO Stockpile both on firm rock and soil. The complete hazard analysis is described in detail in SWC (2008b).

Strength parameters were established based on laboratory testing to date and SWC's experience with similar projects. The waste rock materials contained within all three facilities were considered to be predominantly comprised of competent, relatively durable rock based on comparatively shallow overburden depths of soil overlying bedrock within the ultimate pit limit. Results of the slope stability analyses performed on the waste rock facilities and LGO Stockpile are presented in Table 3.4-2.

Stability analyses were completed for the South TSF at the ultimate crest elevation of 6,710 feet and at the mid-life crest elevation of 6,525 feet under both static and seismic loading conditions. Since the TSF is sited in a somewhat remote area, the tailings embankment was classified as a "large dam significant hazard" in accordance with Nevada Dam Safety Guidelines. Under this classification, a dam is considered a significant hazard if its failure carries a low potential for loss of life but could cause an appreciable economic loss.

Table 3.4-2: Summary of Stability Analyses Results for the Waste Rock Disposal Facilities and the Low-Grade Ore Stockpile

Location	Section	Static Factor of Safety (Circular/Wedge)	Pseudostatic Factor of Safety (Circular/Wedge)
Non-PAG WRDF	1	2.0/2.0	1.3/1.3
	2	2.0/2.0	1.3/1.3
PAG WRDF	3	2.0/2.0	1.3/1.4
	4	2.0/2.1	1.4/1.4
Low-Grade Ore Stockpile	5	1.7/1.7	1.2/1.2

<u>Tailings Storage Facilities</u>

Similar to the WRDF analyses, the TSFs were analyzed using SLIDE V5.0 (RocScience 2007) using the Spencer Method. Static analyses were conducted with no applied horizontal forces, while pseudostatic analyses modeled design seismic conditions by incorporating a constant horizontal force. The embankment section selected for analysis is composed of foundation soil, cycloned sand, slimes, rockfill (toe drain), starter dam material, and smooth and textured LLDPE geomembrane liner. The material properties used for the slope stability analysis were established based on the geotechnical investigation and laboratory testing performed to date, from work completed on other projects similar in nature, area specific experience, and published data from previous studies. The nonlinear shear strength envelope was determined from Shear Interface Testing (SWC 2008b).

The distribution of head and predicted phreatic level within the facility were modeled using a finite element method seepage model embedded within the SLIDE V5.0 program. The facility cross section was modeled under steady state conditions with the probable maximum flood pond level. The phreatic surface model is considered a worst case scenario where the underdrain system is not functional, and the operating pool is at the permitted maximum freeboard level. The modeled phreatic surface is considered to be conservative because it is anticipated that the underdrain system would function as designed and the cycloned sand embankment would remain unsaturated. In addition, the supernatant reclaim pond would be maintained a considerable distance from the crest of the TSF; however, at a minimum, the reclaim pond should be maintained 1,500 feet from the TSF crest during extreme flood conditions. The TSF cross section was modeled as having a uniform conductivity in all directions (isotropic) for all material types. The hydraulic conductivities for the materials overlying the geomembrane liner were selected from laboratory data and experience with similar material on other projects. Hydraulic conductivities used in the finite element model are summarized in SWC (2008b). Results of the stability analyses for the cross sections under consideration are shown in Table 3.4-3.

Table 3.4-3: Results of Slope Stability Analyses for the Tailings Storage Facilities

Section	Type of Failure Modeled	Static Factor of Safety
Ultimate TSF	Circular	2.2
	Block	1.5
18-year (mid-life) TSF	Circular	2.0
	Block	1.5

3.4.3.3 Proposed Action

3.4.3.3.1 Mineral Resources

Direct impacts of the Proposed Action on geologic and mineral resources would result in excavation of up to 2.7 billion tons of ore and waste rock from the open pit with an ore to waste ratio of 1:1.6. This equates to 1.0 billion tons of ore that would be processed. A total of 1.1 billion pounds of Mo would be shipped off site and the remainder of the material would be sent to the two tailings facilities. A total of 1.7 billion tons of waste rock would be stored in WRDFs immediately adjacent to the open pit.

The placement of the WRDFs immediately adjacent to the open pit could limit the future development of mineral resources located in the pit walls adjacent to the open pit, should those potential mineral resources be amenable to development through open pit mining methods; however, there is not sufficient reasonably available geologic and resource information to more definitively address this potential impact.

■ **Impact 3.4.3.3-1:** Implementation of the Proposed Action would result in resource extraction and production of 1.1 billion pounds of Mo.

Significance of the Impact: This is not considered a potentially significant impact to geology and minerals. However, the impact is economically significant. Based on the conclusions from the analysis, no additional mitigation is proposed.

- **Impact 3.4.3.3-2:** Implementation of the Proposed Action would result in the extraction of waste rock that would be placed adjacent to the open pit and limit the future development of the identified Zn mineralization located to the north of the open pit.

  Significance of the Impact: This is not considered a potentially significant impact to geology and minerals, because a known Zn mineralization has not been sufficiently defined and potentially could be developed using underground mining techniques. Based on the conclusions from the analysis, no additional mitigation is proposed.

3.4.3.3.2 Geological Hazards

The USGS model indicated that the probability of a magnitude 5.0 quake occurring within 30 miles of the site in the next 50 years is between 0.4 and 0.5. The probability of a magnitude 6.0 quake occurring within 30 miles of the site in the next 50 years is between 0.10 and 0.15. The probability of an earthquake greater than a 7.0 occurring within 30 miles of the site in the next 50 years is between 0.005 and 0.01. The probability of an earthquake greater than 8.0 occurring within 30 miles of the area in the next 50 years is essentially zero.

Seismic events could result in slope failures or structural damage to mine facilities due to an earthquake event having an 1,100 year return period with a four percent probability of exceedance during the operational life of the Project. Based on the results from SWC's analyses (2008a), which indicate a safety factor of 1.7 to 2.0, the WRDFs and Low-Grade Ore Stockpile are stable for all conditions analyzed.

For a water impoundment facility, which is the standard to which the embankment is designed, the desired minimum static factor of safety required by the NDWR is typically 1.4 for static conditions. Based on the results from SWC's analyses of the TSFs (2008b), the proposed facility is stable under static loading conditions since the computed values (1.5 to 2.2) exceed the prescriptive factors of safety; therefore, there would be no impacts associated with geologic hazards.

3.4.3.3.3 Residual Impacts

The potential residual impacts to geology and mineral resources from the Proposed Action are an irreversible and irretrievable commitment of mineral resources through the removal of 1.1 billion pounds of Mo from the mined materials.

3.4.3.4 <u>No Action Alternative</u>

3.4.3.4.1 Mineral Resources

As a result of the No Action Alternative, none of the impacts to the mineral resources generated by the Proposed Action or any other alternative would occur; therefore, implementation of the No Action Alternative would restrict the development of a known mineral resource and not allow the removal of 1.1 billion pounds of Mo from the materials that would have been mined.

- **Impact 3.4.3.4-1:** A known mineral resource with 1.1 billion pounds of recoverable Mo would not be developed due to implementation of the No Action Alternative.

  Significance of the Impact: This impact is considered significant; however, no mitigation measures appear feasible.

3.4.3.4.2 Geological Hazards

The No Action Alternative would result in no impacts from geologic hazards associated with the Proposed Action. Impacts associated with normal earth dynamics (i.e., earthquakes) could occur but could not be predicted.

3.4.3.4.3 Residual Impacts

Under the No Action Alternative, residual adverse impacts to mineral resources would not occur because the known mineral resource would not be developed; however, this impact is not irreversible or irretrievable.

3.4.3.5 <u>Partial Backfill Alternative</u>

3.4.3.5.1 Mineral Resources

Implementation of the Partial Backfill Alternative would result in potential impacts that are similar to those outlined under the Proposed Action.

Direct impacts of the Partial Backfill Alternative on geologic and mineral resources would result in excavation of up to 2.7 billion tons of ore and waste rock from the open pit with an ore to waste ratio of 1:1.6. This equates to 1.0 billion tons of ore that would be processed. A total of 1.1 billion pounds of Mo would be shipped off site, and the remainder of the material would be sent to the two tailings facilities. A total of 1.7 billion tons of waste rock would be stored in WRDFs immediately adjacent to the open pit, and then there would be the placement of 1.24 billion tons of this mined waste rock back into the open pit.

The placement of a majority of the waste rock back into the open pit, as well as the placement of the remaining WRDF immediately adjacent to the open pit could limit the future development of mineral resources located in the pit walls adjacent to the open pit should those mineral resources be amenable to development through open pit mining methods. This alternative would have impacts similar to the impacts of the Proposed Action. In addition, the placement of the waste rock back into the open pit would limit the future development of a mineral resource (see Section 3.4.2.4.11) that would be amenable to development through underground mining methods; however, there is not sufficient reasonably available geologic and resource information to more definitively address this potential impact.

- **Impact 3.4.3.5-1:** Implementation of the Partial Backfill Alternative would result in resource extraction and production of 1.1 billion pounds of Mo.

  Significance of the Impact: This is not considered a potentially significant impact to geology and minerals. However, the impact is economically significant. Based on the conclusions from the analysis, no additional mitigation is proposed.

- **Impact 3.4.3.5-2:** Implementation of the Partial Backfill Alternative would result in the extraction of waste rock that would be placed adjacent to the open pit and then replaced within the open pit, thus limiting the future development of the identified Zn mineralization located to the north of the open pit to a degree that is greater than under the Proposed Action.

  Significance of the Impact: This is not considered a potentially significant impact to geology and minerals, because a known Zn mineralization has not been sufficiently defined and potentially could be developed using underground mining techniques. Based on the conclusions from the analysis, no additional mitigation is proposed.

3.4.3.5.2 Geological Hazards

The potential geological hazards impacts from the Partial Backfill Alternative would be the same as those discussed under the Proposed Action.

3.4.3.5.3 Residual Impacts

The potential residual impacts to geology and mineral resources from the Partial Backfill Alternative are an irreversible and irretrievable commitment of mineral resources through the removal of 1.1 billion pounds of Mo from the mined materials.

3.4.3.6 Off-Site Transfer of Ore Concentrate for Processing Alternative

3.4.3.6.1 Mineral Resources

The potential impacts to geology and mineral resources from the Off-Site Transfer of Ore Concentrate for Processing Alternative are an irreversible and irretrievable commitment of mineral resources through the removal of 1.1 billion pounds of Mo from the mined materials.

- **Impact 3.4.3.6-1:** Implementation of the Proposed Action would result in resource extraction and production of 1.1 billion pounds of Mo.

  Significance of the Impact: This is not considered a potentially significant impact to geology and minerals. However, the impact is economically significant. Based on the conclusions from the analysis, no additional mitigation is proposed.

- **Impact 3.4.3.6-2:** Implementation of the Proposed Action would result in the extraction of waste rock that would be placed adjacent to the open pit and limit the future development of the identified Zn mineralization located to the north of the open pit.

  Significance of the Impact: This is not considered a potentially significant impact to geology and minerals, because a known Zn mineralization has not been sufficiently defined and potentially could be developed using underground mining techniques. Based on the conclusions from the analysis, no additional mitigation is proposed.

3.4.3.6.2 Geological Hazards

The potential geological hazards impacts from the Off-Site Transfer of Ore Concentrate for Processing Alternative would be the same as those discussed under the Proposed Action.

3.4.3.6.3 Residual Impacts

The potential residual impacts to geology and mineral resources from the Off-Site Transfer of Ore Concentrate for Processing Alternative are an irreversible and irretrievable commitment of mineral resources through the removal of 1.1 billion pounds of Mo for the mined materials.

3.4.3.7 Slower, Longer Project Alternative

3.4.3.7.1 Mineral Resources

Impacts to mineral resources from the Slower, Longer Project Alternative are expected to be similar to impacts from the Proposed Action; however, impacts from the Slower, Longer Project Alternative would occur over a period approximately twice as long in duration compared to the Proposed Action.

- **Impact 3.4.3.7-1:** Implementation of the Slower, Longer Project Alternative would result in resource extraction and production of 1.1 billion pounds of Mo.

  Significance of the Impact: This is not considered a potentially significant impact to geology and minerals. However, the impact is economically significant. Based on the conclusions from the analysis, no additional mitigation is proposed.

- **Impact 3.4.3.7-2:** Implementation of the Slower, Longer Project Alternative would result in the extraction of waste rock that would be placed adjacent to the open pit and limit the future development of the identified Zn mineralization located to the north of the open pit.

  Significance of the Impact: This is not considered a potentially significant impact to geology and minerals, because a known Zn mineralization has not been sufficiently defined and potentially could be developed using underground mining techniques. Based on the conclusions from the analysis, no additional mitigation is proposed.

3.4.3.7.2 Geological Hazards

The potential geological hazards impacts from the Slower, Longer Project Alternative would be the same as those discussed under the Proposed Action.

3.4.3.7.3 Residual Impacts

The potential residual impacts to geology and mineral resources from the Slower, Longer Project Alternative are an irreversible and irretrievable commitment of mineral resources through the removal of 1.1 billion pounds of Mo for the mined materials.

3.5 Paleontology

3.5.1 Regulatory Framework

On March 30, 2009, Paleontological Resource Protection Act (PRPA) became law when President Barack Obama signed the Omnibus Public Land Management Act (OPLMA) of 2009, Public Law 111-011. Public Law 111-011, Title VI, Subtitle D on Paleontological Resources Preservation (123 Stat. 1172; 16 United States Code [U.S.C.] 470aaa) requires the Secretaries of the Interior and Agriculture to manage and protect paleontological resources on federal land using scientific principles and expertise. The OPLMA-PRP includes specific provisions addressing management of these resources by the BLM, National Park Service (NPS), Bureau of Reclamation, U.S. Fish and Wildlife Service (USFWS), and U.S. Forest Service (USFS).

The BLM manages paleontological resources under a number of federal laws including: FLPMA Sections 310 and 302(b), which directs the BLM to manage public lands to protect the quality of scientific and other values; 43 CFR 8365.1-5, which prohibits the willful disturbance, removal, and destruction of scientific resources or natural objects; 43 CFR 3622, which regulates the amount of petrified wood that can be collected for personal noncommercial purposes without a permit; and 43 CFR 3809.420 (b)(8), which stipulates that a mining operator "shall not knowingly disturb, alter, injure, or destroy any scientifically important paleontological remains or any historical or archaeological site, structure, building or object on Federal lands."

IM No. 2008-009, effective October 15, 2007, defines the BLM classification system for paleontological resources on public lands. The classification system is based on the potential for the occurrence of significant paleontological resources in a geologic unit and the associated risk for impacts to the resource based on federal management actions. This classification system for paleontological resources is intended to provide a more uniform tool to assess potential occurrences of paleontological resources and evaluate possible impacts. The system uses geologic units as base data, which are more readily available to all users, and is intended to be applied in broad approach for planning efforts, and as an intermediate step in evaluating specific projects.

The descriptions for the classes used in the Potential Fossil Yield Classification (PFYC) system are intended to serve as guidelines rather than strict definitions. Knowledge of the geology and the paleontological potential for individual units or preservational conditions should be considered when determining the appropriate class assignment.

In addition, IM No. 2009-011, effective October 10, 2008, provides guidelines for assessing potential impacts to paleontological resources in order to determine mitigation steps for federal actions on public lands under the FLPMA and the NEPA. These guidelines also apply where a federal action impacts split estate lands. This IM provides for field survey and monitoring procedures to help minimize impacts to paleontological resources from federal actions in cases where it is determined that significant paleontological resources would be adversely affected by a federal action.

These two IMs, along with the PFYC system, provide guidance for the assessment of potential impacts to paleontological resources, field survey and monitoring procedures, and recommended mitigation measures that protect paleontological resources impacted by federal actions.

It is the policy of the BLM that potential impacts from federal actions on public lands, including land tenure adjustments, be identified and assessed, and proper mitigation actions be implemented when necessary to protect scientifically significant paleontological resources. This policy also applies to federal actions impacting split estate lands and is subject to the right of landowners to preclude evaluation and mitigation of paleontological resources on their land. The removal of a significant paleontological resource from public lands requires a Paleontological Resources Use permit for collection. Significant paleontological resources collected from public lands are federal property and must be deposited in an approved repository. Paleontological resources collected from split estate lands are the property of the surface estate owner, and their disposition would be in accordance with the surface agreement between the landowner and the permittee.

Surface disturbing activities may cause direct adverse impacts to paleontological resources through the damage or destruction of fossils or loss of valuable scientific information by the disturbance of the stratigraphic context in which fossils are found. Indirect adverse impacts may be created by increased accessibility to important paleontological resources, leading to looting or vandalism. Land tenure adjustments may result in the loss of significant paleontological resources to the public if paleontological resources pass from public ownership. Generally, the Project proponent is responsible for the cost of implementing mitigation measures, including the costs of investigation, salvage, and curation of paleontological resources.

3.5.2 Affected Environment

3.5.2.1 Study Methods

The Assessment of Potential Impacts to Paleontological Resources (IM No. 2008-009) was reviewed using the PFYC system, based on current geologic mapping, to determine if impacts to paleontological resources would occur. Based on scoping of the Proposed Action in regard to paleontological resources, if initial scoping identifies the possibility for adversely affecting paleontological resources, further analysis is necessary. Guidance indicates that if there would be no impact or potential impact based on the action, or the fossil resource may be impacted but is too deep to be recovered (e.g., deep well bore passing through a fossil formation) the Project file must be documented and no additional assessment is necessary.

3.5.2.2 Existing Conditions

The open pit, WRDFs, processing facilities, and a portion of the TSFs would be located in, on, or adjacent to the Mount Hope igneous complex, which consists of rhyolitic intrusive and extrusive rocks, and thus represents a subvolcanic erosion level of a mid-Tertiary eruptive center (see Section 3.4). The western cauldron, approximately 3,300 feet in diameter, is outlined by the partial ring dike northwest and north northeast of the summit of Mount Hope and juxtaposes a 1,000-foot thick section of the lower cooling unit of the Mount Hope tuff against Vinini Formation. There would be no fossils in the rhyolitic rocks because fossils do not occur in volcanic intrusive or extrusive rocks. The extensive and complicated faulting that has occurred would also preclude stratigraphic accuracy if fossils were encountered. These units would be considered as Class 1 - Very Low.

The Devonian-Ordovician Vinini Formation is widely exposed south and west of the Mount Hope igneous complex. Thin to medium bedded shale, siltstone, chert, and conglomerate predominate; quartzite and sandy limestone are also present. One thin but persistent sandy limestone unit divides the section into a lower sequence of dominantly argillaceous rocks, cropping out to the west, and a chert and quartzite rich upper unit to the east. The limestone bed dips and thickens easterly and may correlate with skarn present in the deep subsurface. Along the southeast side of the Mount Hope complex, the basal limestone unit of the Permian Garden Valley Formation has been preserved in a small asymmetrical syncline and overlies Vinini Formation in unconformable or possibly thrust contact. Hydrothermal alteration and mineralization affect nearly all of the Mount Hope complex and a wide area of adjacent Paleozoic sedimentary rocks. Drilling to a depth of 2,888 feet in the vicinity of the Mount Hope complex has failed to intercept lower plate carbonate rocks, which could potentially contain fossils. Patterns of alteration and metal zoning are well developed and nearly all of the original textures in both the volcanic and sedimentary rocks have been destroyed. Mapping and petrographic study allow correlation of alteration effects in igneous rocks with those in the Vinini Formation which have been metamorphosed. Any fossil presence would have been destroyed in this process. These units would be considered as Class 1 - Very Low.

The TSF constructed south of Mount Hope would be constructed in soils that overlie lacustrine and basin fill sediments. Exploration drilling southwest of Mount Hope has identified thick sequences of lacustrine deposits adjacent to the mountain front. Data from deep oil and gas exploration wells indicate that Tertiary and early Quaternary basin fill deposits are fine grained and contain considerable amounts of clay. The thickness of Tertiary deposits ranges from tens of feet to thousands of feet. Quaternary sediments in the Project Area are typically coarse grained fluvial sediments derived from the adjacent mountain blocks, fine and coarse grained alluvial fan deposits, and fine grained playa deposits. The potential exists for fossils to occur within the lacustrine lake beds; however, these fossils would be buried to an unknown depth. There is also the possibility that vertebrate fossils could be found in lake bed and spring related sediments or paleo-channel material such as the mammoth tusk that was found in Crescent Valley near the Cortez mine (BLM 2008a). Sporadic and unremarkable mammoth remains are known from many locations in Quaternary lake bed and spring related sediments throughout Nevada (BLM 1996a). These units would be considered as Class 2 - Low and 3b - Unknown.

No paleontological resources of critical scientific or educational value are known to occur within the Project Area. The nearest important fossil locality is located in the Roberts Mountains region where significant vertebrate microfossils have been recovered from the same base strata that the Mount Hope igneous complex possibly intruded. Turner and Murphy (1988) report the discovery of Siluro-Devonian vertebrate microfossils within the Roberts Mountains and Burrow (2003) describes the remains of an upper Silurian acanthodian, *Poracanthodes punctatus*, which extends the known geographic range of the taxon outside of the circum-Arctic.

Paleontological resources have been discovered in the Roberts Mountains, especially Vinini Creek, Pete Hanson Creek, and Cottonwood Canyon, and are significant for their invertebrate fossil resources because they have yielded numerous new species. Johnson (1962) reports a previously unrecorded species of brachiopod, leading to the designation of a new Middle Devonian zone from rocks in the Roberts Mountains. Ausich (1978) reports a new species of *Pisocrinus* from the Roberts Mountains which expanded the known range for this type of Silurian crinoid. Stone and Berdan (1984), based on investigations of the Late Silurian strata of the Roberts Mountains, identified three new genera and 18 new species of ostracodes. Finney et al. (2007) state, "A continuous trench exposure within the uppermost type Vinini Formation at Vinini Creek, Roberts Mountains, Nevada, provides an unparalleled opportunity to examine the fate of graptolites, prominent Paleozoic zooplankton, during most of the Hirnantian mass extinction event".

3.5.3 Environmental Consequences and Mitigation Measures

3.5.3.1 Significance Criteria

The Proposed Action or an alternative would have a significant effect on the environment if there were sensitive paleontological resources within the Project Area that would be affected by the Project's activities.

3.5.3.2 Assessment Methodology

Impacts of the Proposed Action and Project Alternatives were assessed based on review of geologic maps and reports that have been completed in the Project Area. The significance of the impacts was evaluated based on the significance criteria listed above and through analysis based on IM Nos. 2008-009 and 2009-011.

3.5.3.3 Proposed Action

Project components associated with the open pit, WRDFs, and the processing facilities would be located in an area of geologic units that are identified as Class 1. Thus these components would have essentially no potential to impact significant paleontological resources. The TSFs and the water production field would be located in areas with Tertiary lacustrine and Quaternary basin fill sediments that could contain paleontological resources of critical scientific or educational value, and these geologic units are identified as either Class 2 or 3b. BLM review of paleontological resources found no known vertebrate or invertebrate fossils in the Project Area.

Since fossils are usually buried, their locations cannot be confirmed unless excavation occurs in those geologic units. The TSFs would be constructed on the lower portion of the soil horizons in those areas and thus would not excavate those underlying geologic units. Activities within the water production area would also occur within the soil horizons or as drilling through the geologic units. These types of activities would have no impacts to these geologic units with questionable importance for paleontological resources; therefore, the Proposed Action would not impact paleontological resources of critical scientific or educational value.

3.5.3.4 No Action Alternative

As a result of the No Action Alternative, there would be no impacts to paleontological resources since the permitted activities consist of drilling and soil excavations, which would not affect the underlying geologic formations.

3.5.3.5 Partial Backfill Alternative

Project components associated with the open pit, WRDFs, and the processing facilities under this alternative would be located in an area of geologic units that are identified as Class 1. Thus these components would have essentially no potential to impact significant paleontological resources. The TSFs and the water production field would be located in areas with Tertiary lacustrine and Quaternary basin fill sediments that could contain paleontological resources of critical scientific or educational value, and these geologic units are identified as either Class 2 or 3b. BLM review of paleontological resources found no known vertebrate or invertebrate fossils in the Project Area.

Since fossils are usually buried, their locations cannot be confirmed unless excavation occurs in those geologic units. The TSFs would be constructed on the lower portion of the soil horizons in those areas and thus would not excavate those underlying geologic units. Activities within the water production area would also occur within the soil horizons or as drilling through the geologic units. These types of activities would have no impacts to these geologic units with questionable importance for paleontological resources; therefore, the Partial Backfill Alternative would not impact paleontological resources of critical scientific or educational value.

3.5.3.6 Off-Site Transfer of Ore Concentrate for Processing Alternative

Project components associated with the open pit, WRDFs, and the processing facilities under this alternative would be located in an area of geologic units that are identified as Class 1. Thus these components would have essentially no potential to impact significant paleontological resources. The TSFs and the water production field would be located in areas with Tertiary lacustrine and Quaternary basin fill sediments that could contain paleontological resources of critical scientific or educational value, and these geologic units are identified as either Class 2 or 3b. BLM review of paleontological resources found no known vertebrate or invertebrate fossils in the Project Area.

Since fossils are usually buried, their locations cannot be confirmed unless excavation occurs in those geologic units. The TSFs would be constructed on the lower portion of the soil horizons in those areas and thus would not excavate those underlying geologic units. Activities within the water production area would also occur within the soil horizons or as drilling through the geologic units. These types of activities would have no impacts to these geologic units with questionable importance for paleontological resources; therefore, the Off-Site Transfer of Ore Concentrate for Processing Alternative would not impact paleontological resources of critical scientific or educational value.

3.5.3.7 Slower, Longer Project Alternative

Project components associated with the open pit, WRDFs, and the processing facilities would be located in an area of geologic units that are identified as Class 1. Thus these components would have essentially no potential to impact significant paleontological resources. The TSFs and the water production field would be located in areas with Tertiary lacustrine and Quaternary basin-fill sediments that could contain paleontological resources of critical scientific or educational value, and these geologic units are identified as either Class 2 or 3b. BLM review of paleontological resources found no known vertebrate or invertebrate fossils in the Project Area.

Since fossils are usually buried, their locations cannot be confirmed unless excavation occurs in those geologic units. The TSFs would be constructed on the lower portion of the soil horizons in those areas and thus would not excavate those underlying geologic units. Activities within the water production area would also occur within the soil horizons or as drilling through the geologic units. These types of activities would have no impact to these geologic units with questionable importance for paleontological resources; therefore, the Slower, Longer Project Alternative would not impact paleontological resources of critical scientific or educational value.

3.6 Air and Atmospheric Values

3.6.1 Regulatory Framework

Ambient air quality and the emission of air pollutants are regulated under both federal and state laws and regulations. Regulations potentially applicable to the Proposed Action and alternatives include the following: National Ambient Air Quality Standards (NAAQS); Nevada State Ambient Air Quality Standards (NSAAQS); Prevention of Significant Deterioration (PSD); New Source Performance Standards (NSPS); Federal Operating Permit Program (Title V); and State of Nevada air quality regulations (NAC 445B). The federal and state AAQS are presented in Table 3.6-1.

3.6.1.1 Federal Clean Air Act

The Federal CAA, and the subsequent CAA Amendments of 1990 (CAAA), require the EPA to identify NAAQS to protect the public health and welfare. The CAA and the CAAA establish NAAQS for seven pollutants, known as "criteria" pollutants because the ambient standards set for these pollutants satisfy "criteria" specified in the CAA. The criteria pollutants regulated by the CAA and their currently applicable NAAQS set by the EPA are listed in Table 3.6-1. The list of criteria pollutants is amended by the EPA as needed to protect public health and welfare. The most recent revisions include amendments to standards for the following pollutants (dates represent publication in the FR): particulate matter less than 2.5 micrometers in aerodynamic diameter ($PM_{2.5}$) and particulate matter less than ten micrometers in aerodynamic diameter (PM_{10}) (October 2006), ozone (O_3) (March 2008), Pb (November 2008), nitrogen dioxide (NO_2) (February 2010), and SO_2 (June 2010). The EPA recently proposed to update the 8-hour O_3 standard (see 75 FR 2938-3052) from 0.075 ppm to somewhere between 0.060-0.070 ppm; a proposed standard is expected later in 2011. These revised limits will not be enforceable within the State of Nevada until the Nevada State Implementation Plan (SIP) is amended by the BAPC and formally approved by the EPA. The current NAAQS are listed in Table 3.6-1.

3.6.1.2 Nevada State Ambient Air Quality Standards

NAC 445B.22097 includes ambient air quality standards for the State of Nevada (Table 3.6-1). The NSAAQS are generally identical to the NAAQS, with the exception of the following: (a) the 8-hour O_3 standard revised by the EPA in 2008, (b) an additional state standard for carbon monoxide (CO) in areas with an elevation in excess of 5,000 feet amsl; (c) the recently promulgated 1-hour NAAQS standards for NO_2 and SO_2, (d) the state standard for PM_{10} (Annual Arithmetic Mean) where the comparable NAAQS standard was revoked by the EPA in 2006; (e) the 24-hour and annual NAAQS standards for $PM_{2.5}$ promulgated by EPA in 2006; and (f) for some pollutants, the determination of when a violation of a state standard or federal standard occurs.

3.6.1.3 Attainment and Nonattainment Areas

Pursuant to the CAA, the EPA has developed classifications for distinct geographic regions known as air quality management areas. Under these classifications, for each federal criteria pollutant, each air basin (or portion of an air quality management area (AQMA) [or "planning area"]) is classified as "in attainment" if the AQMA has "attained" compliance with (i.e., not exceeded) the adopted NAAQS for that pollutant; is classified as "non-attainment" if the levels of ambient air pollution exceed the NAAQS for that pollutant; or is classified as "maintenance" if the monitored pollutants have fallen from non-attainment levels to attainment levels. AQMAs for which sufficient ambient monitoring data are not available are designated as "attainment-unclassifiable" for those particular pollutants until actual monitoring data support formal "attainment" or "non-attainment" classification.

Table 3.6-1: Federal and State Ambient Air Quality Standards for Criteria Pollutants

Criteria Pollutant	Averaging Period	Nevada Standards	Federal Standards	
		Concentration[a]	Primary[a]	Secondary[a]
Ozone (O_3)	1-Hour[b]	0.12 ppm (235 µg/m^3)	--	Same as Primary Standards
	8-Hour[b]	---	0.75 ppm (150 µg/m^3)	
Carbon Monoxide (CO)	8-Hour (<5,000')[c]	9 ppm (10.5 mg/m^3)	9 ppm (10 mg/m^3)	---
	8-Hour (≥5,000')[c]	6 ppm (7 mg/m^3)	9 ppm (10 mg/m^3)	
	1-Hour[c]	35 ppm (40.5 mg/m^3)	35 ppm (40 mg/m^3)	
Nitrogen Dioxide (NO_2)	Annual (Arithmetic Average)	53 ppb (100 µg/m^3)	53 ppb (100 µg/m^3)	Same as Primary Standards
	1-Hour[d]	---	100 ppb (188 µg/m^3)	---
Sulfur Dioxide (SO_2)	1-Hour[f]	75 ppb (196 µg/m^3)	196 µg/m^3 (75 ppb)	---
	Annual (Arithmetic Average)	30 ppb (80 µg/m^3)	80 µg/m^3 (30 ppb)	---
	24-Hour[c]	140 ppb (365 µg/m^3)	365 µg/m^3 (140 ppb)	---
	3-Hour[c]	500 ppb (1,300 µg/m^3)	---	1,300 µg/m^3 (500 ppb)
Particulate Matter (PM_{10})	24-Hour[c]	150 µg/m^3	---	Same as Primary Standards
	24-Hour[e] (Based on Averaged Exceedances over Three Years	---	150 µg/m^3	
	Annual Arithmetic Mean	50 µg/m^3	---	
Particulate Matter ($PM_{2.5}$)	24-Hour (Based on the 98th Percentile Averaged over Three Years)	---	35 µg/m^3	Same as Primary Standard
	Annual Arithmetic Mean Averaged Over Three Years	---	15.0 µg/m^3	
Lead (Pb)	Rolling Three-Month Average	---	0.15 µg/m^3	Same as Primary Standards
	Calendar Quarter	1.5 µg/m^3	1.5 µg/m^3	

a Equivalent units given in parentheses are based upon a reference temperature of 25°C and a reference pressure of 760 mm mercury. Measurements of air quality are corrected to a reference temperature of 25°C and a reference pressure of 760 mm mercury (1,013.2 millibar); units of measure for the standards are ppm by volume, parts per billion (ppb - 1 part in 1,000,000,000) by volume, milligrams per cubic meter of air (mg/m^3), and micrograms per cubic meter of air (µg/m^3).

b To attain the 8-hour NAAQS standard, the three-year average of the fourth highest daily maximum 8-hour average O_3 concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm (effective May 27, 2008). The EPA revoked the 1-hour standard in all areas, although some areas have continuing obligations under that standard ("anti-backsliding"). The 1-hour standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is less than or equal to 1.

[c] A violation of the federal standard occurs on the second exceedance during a calendar year; a violation of the State of Nevada standard occurs on the first exceedance during a calendar year.
[d] The 1-hour nitrogen dioxide standard is attained when the three-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area does not exceed 100 ppb (effective January 22, 2010).
[e] Not to be exceeded more than once per year on average over three years.
[f] To attain this standard, the three-year average of the 99th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 75 ppb. Final rule signed June 2, 2010.

In addition to the designations relative to attainment of conformance with the NAAQS, the CAA requires the EPA to place each planning area within the U.S. into one of three classes, which are designed to limit the deterioration of air quality when it is "better than" the NAAQS. "Class I" is the most restrictive air quality category and was created by Congress to prevent further deterioration of air quality in National Parks and Wilderness Areas of a given size which were in existence prior to 1977, or those additional areas that have since been designated Class I under federal regulations (40 CFR 52.21). All remaining areas outside of the designated Class I boundaries were designated Class II planning areas, which allow a relatively greater deterioration of air quality once the Minor Source Baseline Date has been set. No Class III areas have been designated. Regardless of the class of the planning area, the air quality cannot exceed the NAAQS. The nearest Class I planning area to the Project, the Jarbidge Wilderness Area, is located approximately 130 miles northeast of the Project Area. There are no Class I airsheds within 60 miles (approximately100 kilometers) of the Project Area.

3.6.1.4 Prevention of Significant Deterioration

Federal PSD applicability regulations limit the maximum allowable increase in ambient particulate matter in a Class I planning area, resulting from a major or minor stationary source to four $\mu g/m^3$ (annual geometric mean) and eight $\mu g/m^3$ (24-hour average). For Class II Planning areas the maximum allowable increase is 17 $\mu g/m^3$ (annual geometric mean) and 30 $\mu g/m^3$ (24-hour average). Increases in other criteria pollutants are similarly limited. Specific types of facilities that emit, or have the potential to emit, 100 tpy or more of PM_{10} or other criteria air pollutants, or any facility that emits, or has the potential to emit, 250 tpy or more of PM_{10} or other criteria air pollutants, is considered a major stationary source.

Most fugitive emissions are not counted as part of the calculation of emissions for PSD. Major stationary sources are required to notify federal land managers of Class I planning areas within 100 kilometers of the major stationary source. There are no Class I planning areas within 100 kilometers of the Project Area. As stated above, the nearest Class I planning area to the Project Area is the Jarbidge Wilderness Area. The Project air pollutant emission sources under the Proposed Action and alternatives emission sources are minor stationary sources that are not subject to PSD regulatory requirements.

3.6.1.5 New Source Performance Standards

NSPSs were established by the CAA. The standards, which are for new or modified stationary sources, require the sources to achieve the best available control technology. The NSPS apply to specific types of processes which, in the case of the Proposed Action include certain units used to process metallic minerals. The requirements applicable to these existing units are found in 40 CFR Part 60, Subpart LL (Standards of Performance for Metallic Mineral Processing Plants).

3.6.1.6 Federal Operating Permit Program

As part of the CAA and its subsequent amendments, a facility wide permitting program was established for larger sources of pollution. This program, known as the Title V program, requires that these “major sources” of air pollutants submit a Title V permit application. To be classified as a “major source”, a facility must emit more than 100 tpy of any regulated pollutant, ten tpy of any single hazardous air pollutant (HAP), or 25 tpy or more of any combination of HAPs, from applicable sources.

3.6.1.7 Nevada Air Quality Operating Permit

The CAA delegates primary responsibility for air pollution control to state governments, which in turn often delegate this responsibility to local or regional organizations. The SIP was originally the mechanism by which a state set emission limits and allocated pollution control responsibility to meet the NAAQS. The function of a SIP broadened after passage of the 1990 CAAA and now includes the implementation of specific technology based emission standards, permitting of sources, collection of fees, coordination of air quality planning, and PSD of air quality within regional planning areas and statewide. Section 176 of the CAA, as amended, requires that federal agencies must not engage in, approve, or support in any way any action that does not conform to a SIP for the purpose of attaining ambient air quality standards.

The BAPC is the agency in the State of Nevada that has been delegated the responsibility for implementing a SIP (excluding Washoe and Clark Counties, which have their own SIPs). Included in a SIP are the State of Nevada air quality permit programs (NAC 445B.001 through 445B.3485, inclusive) and the NSAAQS (see Table 3.6-1). In addition to establishing the NSAAQS, the BAPC is responsible for permit and enforcement activities throughout the State of Nevada (except in Clark and Washoe Counties).

The Proposed Action and alternatives are located in Eureka County, Nevada. The applicable permitting authority for the county is the BAPC. Before any construction of a potential source of air pollution can occur, an air quality operating permit application must be submitted to the BAPC in order to obtain an Air Quality Operating Permit.

3.6.1.8 Nevada Mercury Control Program

The BAPC is the agency in the State of Nevada delegated the responsibility for regulating the Nevada Mercury Control Program (NMCP). The NMCP program became effective in May 2006 with the purpose of achieving mercury reduction by utilizing mercury control technology through implementation of Nevada Maximum Achievable Control Technology (NvMACT). The NMCP is only applicable to control mercury emissions from operations at precious metals mining facilities. The Proposed Action and reasonable alternatives are not subject to the NMCP program because none of them would be a precious metal mining facility.

3.6.1.9 Climate Change

The BLM has developed draft guidance in the form of an IM 2008-171 for the incorporation of climate change into NEPA documents. At present, there is no regulatory program that requires reductions in greenhouse gas (GHG). However, in response to a Supreme Court decision interpreting the CAA, the EPA has published an advance notice of proposed rulemaking seeking public comment on whether GHG emissions should be regulated under the CAA, and if so, by what methods. Congress is also debating legislation that would impose regulatory controls or incentives for reducing GHG emissions.

3.6.2 Affected Environment

3.6.2.1 Study Methods

The existing meteorological and air quality conditions in the air quality study area were obtained from the sources discussed in the following sections. Limited meteorological and no air quality data have been collected at the Project. Baseline air quality and meteorological conditions representative of the Project Area were assessed using data from the nearby monitoring stations of north central Nevada. In the air dispersion model, meteorological data from the Mercury-Desert Rock Station was utilized. Meteorological data from the Ely, Nevada, airport (WBO-262631), located 80 miles southeast of the Project, was utilized for climate characterization (Figure 3.6.1). The Desert Rock site was used because the BAPC provided the meteorological data as being the most representative for the Project Area. The Ely Monitoring Station measures ambient temperature, wind speed, wind direction, and precipitation, at an elevation of approximately 6,260 feet amsl.

The majority of the Project permitable point source emissions would be located in the Diamond Valley AQMA, which includes the area bounded by the crest of the Sulphur Springs Range, Whistler Mountain, and the Mountain Boy Range on the west and north and the crest of the Diamond Mountains to the east. Fugitive emissions associated with vehicles, vehicle travel, mining, blasting, and material handling would occur in the Diamond Valley AQMA, as well as the Kobeh Valley AQMA. The Kobeh Valley AQMA includes an area bounded on the north by the Roberts Mountains, on the west by the Simpson Park Range, and on the east by Whistler Ridge. The southern boundary is topographically indistinct.

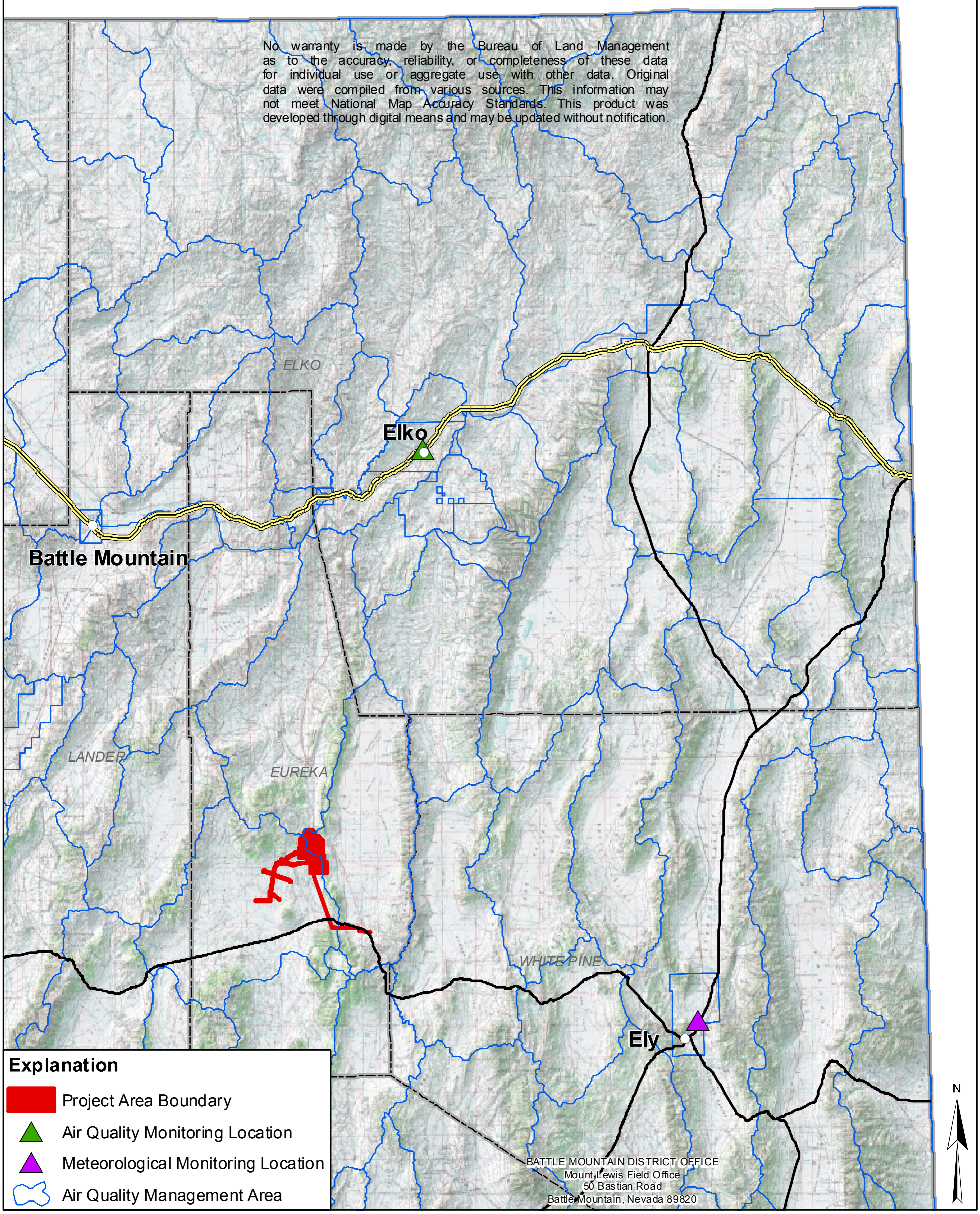
3.6.2.2 Existing Conditions

The Project is not included in any of the source categories listed in the Federal PSD Regulations, and the PSD applicable emissions from the Project are below the 250 tpy PSD threshold. Therefore, the Project is not in a PSD triggered planning area, increment is not being consumed, and the Project is not subject to PSD regulation.

3.6.2.2.1 Climate and Meteorology

The Project Area is a high desert environment characterized by arid to semiarid conditions, with bright sunshine, low annual precipitation, and large daily ranges in temperatures. The climate is controlled primarily by the rugged and varied topography to the west, in particular the Sierra Nevada Mountain Range. Prevailing westerly winds move warm moist Pacific air over the western slopes of the Sierra Nevada where the air cools, condensation takes place, and most of the moisture falls as precipitation. As the air descends the eastern slope, compressional warming takes place resulting in minimal rainfall.

Climate information from the Ely airport is representative of the high desert environment. Based on the data collected from the Ely station over the period 1897 through 2006, the average temperature was 44.7°F, with temperatures ranging from 101°F to minus 30°F. Annual



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BUREAU OF LAND MANAGEMENT

MOUNT HOPE PROJECT

DRAWING TITLE:

Elko and Ely, Nevada, Monitoring Sites

Figure 3.6.1

precipitation in the area during the same period ranged from zero to 5.52 inches. The mixture of dry desert and mountainous terrain sufficiently dries the air systems that move through the region.

A key component of accessing meteorological effects on an airshed is through atmospheric dispersion. Dispersion is influenced by several parameters, including wind speed, temperature inversions (mixing heights), and atmospheric stability. Prevailing winds in 2007 at the Ely Station were typically from the southwest, with average annual wind speeds at 6.9 miles per hour (mph). Month-to-month variations were small, with average wind speeds ranging from 4.4 to 8.4 mph. These wind speeds tend to promote atmospheric mixing and generally transport locally generated air emissions away from the area. Beneficial air movement that vents an airshed is defined as an "unstable" atmospheric condition.

In "stable" atmospheric conditions, inversions would restrict vertical movement of the air in the lower atmosphere. Atmospheric pollutants are prevented from mixing with the air above the inversion layer. The resulting lower mixing heights produce higher pollutant concentrations since the volume of air with which the pollutants can mix is limited. In cold night/hot day weather patterns, mixing heights can be quite high in the afternoon versus low mixing heights at night and in the early morning due to nighttime cooling.

Mixing heights in the Project Area are estimated to be highest during the afternoon of summer months at 5,900 feet (annual average), which is conducive for good air dispersion. In the late afternoon, unstable atmospheric conditions that vent and disperse the air are favorable. Adequate mixing of air is needed during summer months when temperatures are higher and pollutants are more reactive on a local scale. During the winter months the opposite occurs. Mixing heights are much lower, approximately 250 feet (annual average), resulting in poor air dispersion. Cooler temperatures, however, effectively slow pollutant reactivity.

3.6.2.2.2 Air Quality

Air quality in the Project Area is governed by both factors of pollutant emissions and meteorological conditions. As discussed above, wind speeds, mixing heights, and stability all affect the circulation and dilution of emissions in the area.

The Project Area is located within an AQMA that is currently in "attainment-unclassifiable" for all pollutants having an air quality standard (40 CFR 81.329). No NO_2, SO_2, or Pb non-attainment areas are located within the State of Nevada. Washoe County, Nevada (within which the city of Reno is located) is the PM_{10}, CO, and O_3 non-attainment area located closest to the Project Area, although it is located more than 100 miles to the west.

At present, the BAPC does not conduct ambient air quality monitoring in the vicinity of the Project. The closest station is located in Elko, Nevada, which is approximately 75 miles northeast (Figure 3.6.1). The site is a State and Local Air Monitoring Site (SLAMS) for continuous monitoring of PM_{10} only. The latest Bureau of Air Quality Planning (BAQP) Trend Report for 2003 reported the highest 24-hour ambient PM_{10} concentration to be 163 $\mu g/m^3$. The mean concentration measured for a 24-hour period for PM_{10} during 2003 was only 20 $\mu g/m^3$ (Table 3.6-2) (http://ndep.nv.gov/baqp/ monitoring/trend/report).

Table 3.6-2: Ambient PM_{10} Monitoring Data from the Elko Site

Year	24-Hour Average PM_{10} Concentration ($\mu g/m^3$)		
	1st High	2nd High	Arithmetic Mean
1992	39	37	21
1993	79	66	29
1994	87	59	31
1995	75	74	36
1996	119	107	32
1997	52	49	25
1998	103	65	22
1999	115	93	29
2000	98	91	28
2001	119	84	29
2002	151	145	23
2003	163	111	20
Average	100.0	81.8	27.1

3.6.2.2.3 Climate Change

Ongoing scientific research has identified the potential impacts of anthropogenic (man-made) GHG emissions and changes in biological carbon sequestration due to land management activities on global climate. Through complex interactions on a regional and global scale, these GHG emissions and net losses of biological carbon sinks cause a net warming effect of the atmosphere, primarily by decreasing the amount of heat energy radiated by the earth back into space. Although GHG levels have varied for millennia, recent industrialization and burning of fossil carbon sources have caused carbon dioxide equivalent (CO_2(e)) concentrations to increase dramatically, and are likely to contribute to overall global climatic changes. The Intergovernmental Panel on Climate Change (IPCC) in 2007 concluded that “warming of the climate system is unequivocal” and “most of the observed increase in globally average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations" (IPCC 2007a).

Global mean surface temperatures have increased nearly 1.8˚F from 1890 to 2006. Models indicate that average temperature changes are likely to be greater in the Northern Hemisphere. Northern latitudes (above 24˚N) have exhibited temperature increases of nearly 2.1 ˚F since 1900, with nearly a 1.8˚F increase since 1970 alone. Without additional meteorological monitoring systems, it is difficult to determine the spatial and temporal variability and change of climatic conditions, but increasing concentrations of GHGs are likely to accelerate the rate of climate change.

In 2001, the IPCC indicated that by the year 2100, global average surface temperatures would increase 2.5 to 10.4˚F above 1990 levels. The National Academy of Sciences has confirmed these findings, but also has indicated there are uncertainties regarding how climate change may affect different regions. Computer model predictions indicate that increases in temperature would not be equally distributed, but are likely to be accentuated at higher latitudes. Warming during the winter months is expected to be greater than during the summer, and increases in daily minimum temperatures is more likely than increases in daily maximum temperatures. Increases in temperatures would increase water vapor in the atmosphere, and reduce soil moisture, increasing generalized drought conditions, while at the same time enhancing heavy storm events. Although large-scale spatial shifts in precipitation distribution may occur, these changes are more uncertain and difficult to predict. “As with any field of scientific study, there are uncertainties associated with the science of climate change. This does not imply that scientists do not have confidence in many aspects of climate change science. Some aspects of the science are known with virtual certainty, because they are based on well-known physical laws and documents trends" (EPA 2008a).

Several activities contribute to the phenomena of climate change, including emissions of GHGs (especially CO_2 and methane) from fossil fuel development, large wildfires and activities using combustion engines; changes to the natural carbon cycle; and changes to radiative forces and reflectivity (albedo). It is important to note that GHGs would have a sustained climatic impact over different temporal scales. For example, recent emissions of CO_2 can influence climate for 100 years.

It may be difficult to discern whether global climate change is already affecting resources, let alone the area of the Proposed Action. In most cases there is more information about potential or projected effects of global climate change on resources. It is important to note that projected changes are likely to occur over several decades to a century. Therefore, many of the projected changes associated with climate change may not be measurably discernible within the reasonably foreseeable future.

3.6.3 Environmental Consequences and Mitigation Measures

The Project would require an Air Quality Operating Permit from the BAPC. The main impact related to air quality would be the result of increased pollutant concentrations. The Project would increase emissions of regulated pollutants from PSD applicable sources and sources applicable to the NSPS regulations. The Project would not result in emissions of any regulated pollutant from PSD applicable sources above 250 tpy, subjecting the Project to PSD regulations or Title V application requirements.

3.6.3.1 Significance Criteria

The Proposed Action would have a significant effect on the environment if any of the following would occur:

- Violate any regulatory requirement of the BAPC;
- Violate any state or federal ambient air quality standard;
- Contribute substantially to an existing or projected air quality violation; or
- Expose sensitive receptors to substantial pollutant concentrations.

3.6.3.2 Assessment Methodology

In order to evaluate the impacts of the Project, an assessment of the significance of the impacts was made based on the significance criteria listed above. The air quality analyses quantified the emissions of the applicable criteria pollutants from the mining and processing of ore from the Project.

An air dispersion modeling analysis was utilized to characterize the Project. The air pollution sources at the Project that were modeled in the air dispersion modeling analysis include the following source categories:

- Process emission points (material handling, crushing, conveying, leaching, drying, roasting, etc.);
- Auxiliary sources (emergency generators, etc.); and
- Fugitive emission sources (drilling, blasting, loading, unloading, hauling, wind erosion, mobile machinery tailpipes, etc.).

Air emission estimates were calculated based on the maximum material throughput for each applicable time period, using EPA approved AP-42 emission factors for the Project and information provided by EML. Table 3.6-3 shows the emissions, in tpy, that were used in the NEPA model.

Table 3.6-3: Modeled Emission Rates for the NEPA Model

Model and Source Category	Annual Emissions (tons/year)					
	PM_{10}	$PM_{2.5}$	NO_2	SO_2	CO	VOC[1]
NEPA - Point and Process Fugitive Sources	96.8	85.5	63.3	98.0	8.5	49.2
NEPA - Fugitive and Tailpipe Sources	963.4	161.4	1,906.3	87.7	1,702.0	263.0
NEPA – Total	1,060.2	246.9	1,969.6	185.7	1,710.5	312.2

[1](VOC) volatile organic compound.

3.6.3.2.1 Model Selection and Options

The most recent version (09292) of the AERMOD modeling system was used for the air quality impact analyses. AERMOD was run using regulatory default options (Air Sciences Inc. 2010a; EML 2008b).

AERMOD requires the input of particle size distribution parameters (mandatory) for sources characterized as OPENPIT in a model run. These parameters include the particle size category (PARTDIAM) and the associated mass fractions (MASSFRAX) and densities (PARTDENS). The parameters were developed from the particle size (less than ten microns) multipliers provided in AP-42, Section 13.2.4 (Aggregate Handling and Storage Piles). In addition to the pit, these particle distribution parameters are also associated with the other fugitive emission locations characterized as VOLUME sources for PM_{10} and $PM_{2.5}$ modeling (Air Sciences Inc. 2010a).

The effects of building induced downwash were incorporated into the air quality modeling analyses. Building downwash parameters were calculated using the most recent version of the Building Profile Input Program (BPIP) with Plume Rise Model Enhancement (PRIME) algorithm (BPIP-PRIME version 04274) and the August 28, 2008, version of the buildings layout (Air Sciences Inc. 2010a).

3.6.3.2.2 Receptors

The following receptor data were utilized in the modeling analyses. The nested Cartesian receptor grids, centered on the facility, utilized to access ground level impacts from the Project facility emissions are as follows:

- Near field receptors at 100-meter spacing, out to 2,500 meters;
- Intermediate field receptors at 250-meter spacing, out to 5,000 meters; and
- Far field receptors at 500-meter spacing, out to 10,000 meters.

Receptors placed at a 25-meter spacing along the facility public exclusion boundary line are also included in the models. Receptors within the facility public exclusion boundary were not modeled.

A group of sensitive receptors has been evaluated in the air dispersion modeling analysis. This group includes receptors placed at nearby ranches, permanent dwellings, designated campgrounds, and the Town of Eureka. These sensitive receptors are provided in the Table 3.6-4.

In addition, 100 receptors each along the boundaries of the Jarbidge Wilderness Area (a designated federal Class I area) and the Great Basin National Park that were closest to the Project Area were also modeled.

All the receptors are processed with the AERMOD Terrain preprocessor (AERMAP, version 06341) to generate receptor terrain elevations and hill height values using the 30-meter resolution USGS 7.5-minute Digital Elevation Model (DEM) Files (Air Sciences, Inc. 2010a). The modeled sources, fenceline, and receptor grid locations are shown in Figure 3.6.2.

Table 3.6-4: Sensitive Receptors and Universal Transverse Mercator Coordinates

Receptor	Universal Transverse Mercator (UTM) Coordinates	
	Easting (meters [m])	Northing (m)
Eureka County High School	588,204	4,374,062
Eureka Elementary School	589,341	4,373,756
Eureka County Medical Clinic	589,358	4,374.008
Alpha Ranch	568,465	4,428,941
Roberts Creek Ranch	560,933	4,400,378
Tonkin Reservoir	550,030	4,418,098

3.6.3.2.3 Meteorological Data

Five years (from 1988 to 1992) of hourly meteorological data processed with surface and upper air parameters collected at the Mercury Desert Rock Airport (WBAN station #03169) were utilized. This AERMOD ready data set was recommended for the analysis and was provided by the BAPC. A wind frequency distribution of the meteorological data is illustrated on Figure 3.6.3.

3.6.3.2.4 Modeled Pollutants and Assumptions

The air quality impact analyses include modeling for the following air pollutants and averaging periods. These data are presented in Table 3.6-5.

Table 3.6-5: Air Pollutants and Applicable Averaging Times for the Air Quality Modeling

Pollutant	Averaging Time[a]
PM_{10}	24-Hour
	Annual
$PM_{2.5}$	24-Hour
	Annual
Pb	Quarterly
CO	1-Hour
	8-Hour
NO_2	1-Hour
	Annual
SO_2	1-Hour
	3-Hour
	24-Hour
	Annual

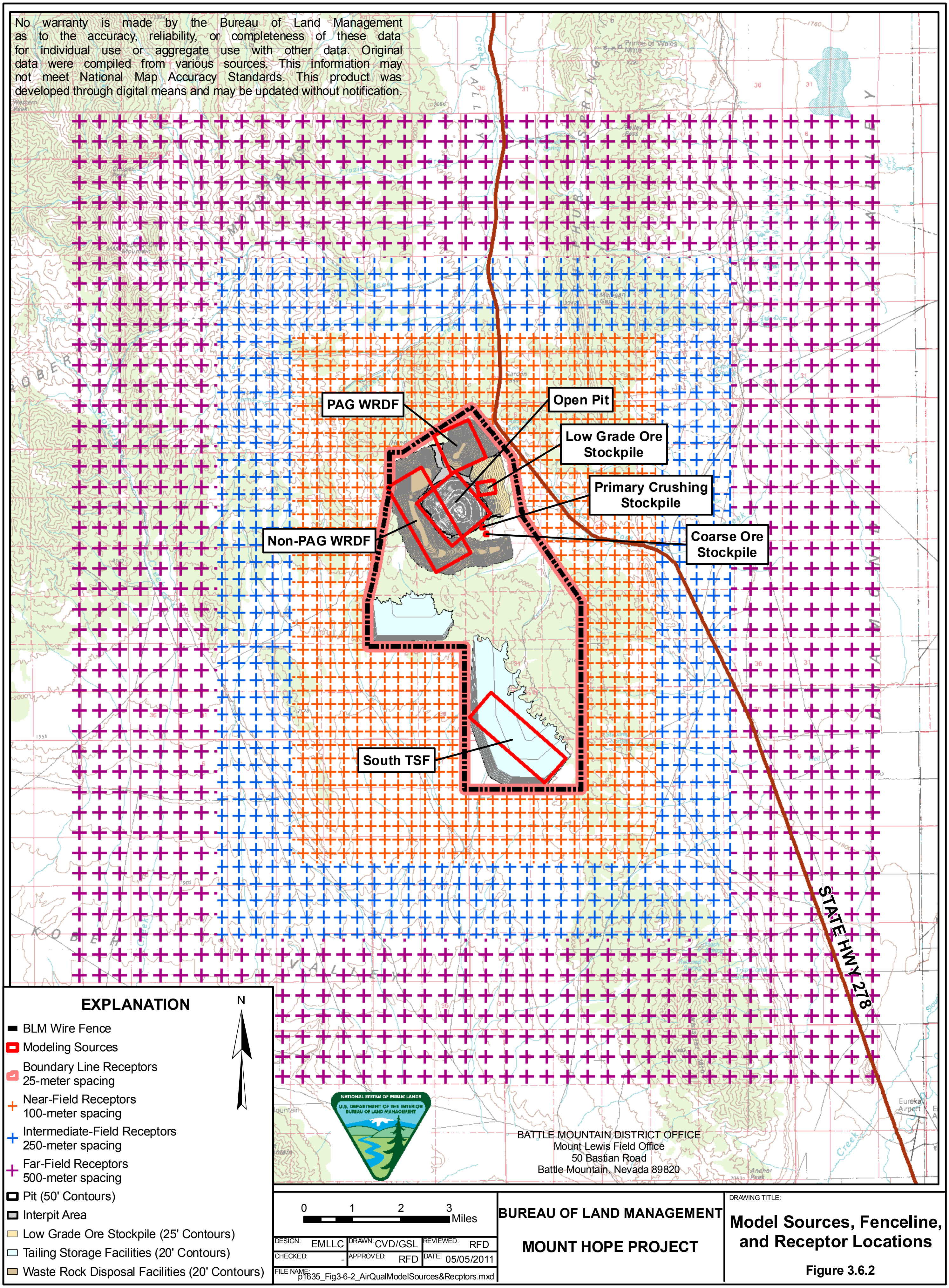
[a] All concentrations are applicable at any point of public access.

In addition to the above pollutants, O_3 impacts were also evaluated using the Scheffe model. This method is a screening lookup table approach that uses the maximum potential annual VOC emission rate and the ratio of the VOC to NO_2 emissions to conservatively determine the maximum incremental O_3 impacts (Air Sciences Inc. 2010a).

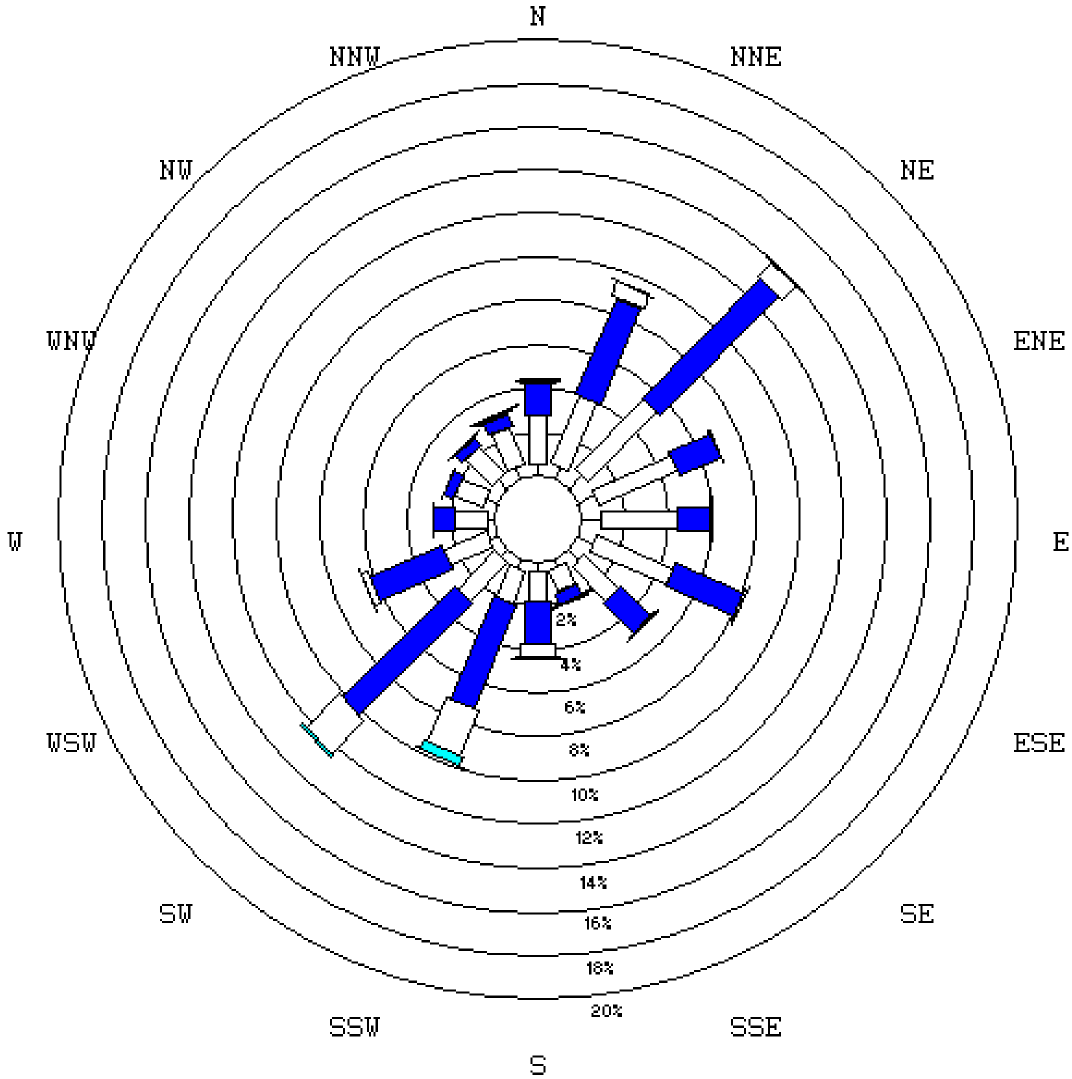
Pb emissions were calculated by multiplying the Pb constituent with PM emissions, which are calculated based on PM_{10}/PM ratio of 0.35. The modeled Pb emissions were based on hourly emission rates from point sources and annual emission rates for the fugitive sources (Air Sciences Inc. 2010a).

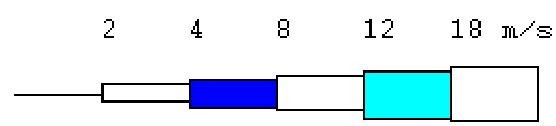
The maximum design rates are used to estimate the emissions from stacks and process fugitive sources, and the fugitive emissions are based on the mine year production rates (Air Sciences Inc. 2010a).

In the NEPA modeling analysis, a smaller and coarser screening receptor grid was developed in order to conduct the analysis efficiently and without generating and analyzing cumbersome data. The screening grid consists of 25-meter spaced boundary line receptors, 100-meter spaced receptors out to a distance of two and a half kilometers, and 250-meter spaced receptors out to five kilometers, for a total of 8,052 receptors. This screening grid was modeled for the 32 years of active mining using the Mercury Desert Rock meteorological data. The results of the screening model showed that the highest impacts were driven by either of the two WRDFs or the LGO Stockpile. Based upon these findings, the mine production years representing the highest



No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.
PAG WRDF
Open Pit
Low Grade Ore Stockpile
Primary Crushing Stockpile
Coarse Ore Stockpile
Non-PAG WRDF
South TSF
STATE HWY 278
EXPLANATION
N
BLM Wire Fence
Modeling Sources
Boundary Line Receptors 25-meter spacing
Near-Field Receptors 100-meter spacing
Intermediate-Field Receptors 250-meter spacing
Far-Field Receptors 500-meter spacing
Pit (50' Contours)
Interpit Area
Low Grade Ore Stockpile (25' Contours)
Tailing Storage Facilities (20' Contours)
Waste Rock Disposal Facilities (20' Contours)
0 1 2 3 Miles
BATTLE MOUNTAIN DISTRICT OFFICE
Mount Lewis Field Office
50 Bastian Road
Battle Mountain, Nevada 89820
BUREAU OF LAND MANAGEMENT
MOUNT HOPE PROJECT
DRAWING TITLE:
Model Sources, Fenceline, and Receptor Locations
Figure 3.6.2
DESIGN: EMLLC
DRAWN: CVD/GSL
REVIEWED: RFD
CHECKED: -
APPROVED: RFD
DATE: 05/05/2011
FILE NAME: p1635_Fig3-6-2_AirQualModelSources&Recptors.mxd





1988-1992 Wind Frequency Distribution
Mercury Desert Rock Airport (WBAN 03160)

Calm hours = 2509 Missing hours =0
Number of non-calm/missing hours = 41339

BATTLE MOUNTAIN DISTRICT OFFICE
Mount Lewis Field Office
50 Bastian Road
Battle Mountain, Nevada 89820

DESIGN: EMLLC	DRAWN: CVD	REVIEWED: RFD
CHECKED: -	APPROVED: RFD	DATE: 05/09/2011
FILE NAME: p1635_Fig3-6-3_MercuryDesertRockAirportWindRose.mxd		

BUREAU OF LAND MANAGEMENT

MOUNT HOPE PROJECT

DRAWING TITLE:

Mercury Desert Rock Airport Wind Frequency Distribution

Figure 3.6.3

emissions in the Non-PAG WRDF, PAG WRDF, and the LGO Stockpile, along with all the other sources, were selected for each pollutant and modeled with five years of meteorological data (Air Sciences Inc. 2010a).

The mine production years chosen for the NEPA modeling and the selection criteria are presented in Table 3.6-6. The sensitive receptors along the Jarbidge Wilderness Area and the Great Basin National Park were modeled separately from the boundary and grid receptors. The highest emissions for mine production Years 6 and 24 for all pollutants, was modeled with the five meteorological data sets.

3.6.3.2.5 Applicable Air Quality Standards

The background concentrations are added to the modeled impact to estimate the total pollutant concentrations, which were compared with the NAAQS for compliance demonstrations. The NAAQS are presented in Table 3.6-1.

3.6.3.2.6 Background Concentrations

To assess the impact of the Project on the ambient air quality, it was necessary to account for existing, or background, levels for each pollutant. No monitoring has been performed within the Project Area for ambient concentrations of $PM_{2.5}$, CO, NO_2, O_3, or SO_2, nor does the BAPC specify background concentrations for these pollutants. However, background values are necessary for the purpose of comparing modeled results to the NAAQS and NSAAQS. Most monitoring is undertaken in locations with relatively high population density where high pollutant levels might be expected. It is difficult to find monitoring data from locations as remote as the Project Area.

Table 3.6-6: Modeled Mine Production Years and Selection Criteria

Pollutant	Mine Production Year	Selection Criteria
All	Year 24	Highest cumulative and individual emissions for all pollutants
	Year 6	Year of highest impact in screen model runs
CO	Year 1	Highest emissions in PAG
	Year 27	Highest emissions in Non-PAG
	Year 16	Highest emissions in LGO Stockpile
NO_2	Year 24	Highest emissions in PAG
	Year 27	Highest emissions in Non-PAG
	Year 16	Highest emissions in LGO Stockpile
PM_{10}, $PM_{2.5}$, and Pb	Year 1	Highest emissions in PAG
	Year 20	Highest emissions in Non-PAG
	Year 16	Highest emissions in LGO Stockpile
SO_2	Year 1	Highest emissions in PAG
	Year 27	Highest emissions in Non-PAG
	Year 32	Highest emissions in LGO stockpile

The PM_{10} background concentrations are the default Nevada values recommended by the BAPC for unmonitored rural areas like the Project Area. For the $PM_{2.5}$ background, monitoring aerosol data from Great Basin National Park were used. For the O_3 background, monitoring data from the Lehman Caves National Monument station located within the Great Basin National Park were used. Background concentrations from the remaining pollutants are adopted from other EPA/NDEP monitoring stations in the vicinity. Although there are no monitoring stations near the Mount Hope site, the EPA/NDEP do maintain stations that measure CO, NO_2, and SO_2 that are within or just outside relatively high populated or urban areas. The measurements at these stations are conservatively high for use as background concentrations for the Project Area. Upon review of the various monitoring stations in Nevada, the pollutant measurements from Boulder City (CO and SO_2) and Jean (NO_2) monitoring stations were selected as background concentrations for this analysis. These stations are the farthest distance from their respective nearest urban areas and thus considered to be conservatively representative for the Project modeling analysis. Boulder City is located 21 minutes southeast of Las Vegas, and Jean is located 30 miles southwest of Las Vegas (Air Sciences Inc. 2010a).

Not all monitoring sites monitor all of the criteria pollutants. Table 3.6-7 lists the pollutant, time frame, monitor location, years of data reviewed, and assumed background value based on the first high value from the years reviewed.

Table 3.6-7: Background Values for Criteria Pollutants

Pollutant	Averaging Period	Monitor Location	Year	Background Concentration (µg/m³)	Reference
PM_{10}	24-Hour	NV Rural Area Default	--	10.2	BAPC
	Annual	NV Rural Area Default	--	9.0	BAPC
$PM_{2.5}$	24-Hour	Great Basin NP	2005-2007	7.0	EPA Air Data*
	Annual	Great Basin NP	2005-2007	2.4	BAPC
CO	1-Hour	Boulder City, Clark Co., NV	1999-2003	1,716	EPA Air Data*
	8-Hour	Boulder City, Clark Co., NV	1999-2003	1,602	EPA Air Data*
NO_2	1-Hour	Jean, Clark Co., NV	2004-2006	27	EPA Air Data*
	Annual	Jean, Clark Co., NV	1998-2006	13.2	EPA Air Data*
SO_2	1-Hour	Boulder City, Clark CO., NV	2001-2003	18.6	EPA Air Data*
	3-Hour	Boulder City, Clark Co., NV	2001-2003	49.7	EPA Air Data*
	24-Hour	Boulder City, Clark Co., NV	2001-2003	13.1	EPA Air Data*
	Annual	Boulder City, Clark Co., NV	2001-2003	2.6	EPA Air Data*
Pb	Quarterly	--	--	0.00	BAPC
O_3	1-Hour	Lehman Caves, NM White Pine Co., NV	1996-2006	179.6	EPA Air Data*

* http:///www.epa.gov/air/data/index.html

3.6.3.3 Proposed Action

The Proposed Action consists of many activities and actions, each of which may have the potential to emit air pollutants. NAC 445B.187 defines "stationary source" as "...any building, structure, facility, or installation, including temporary sources which emits or may emit any regulated air pollutant that is regulated under ... NAC445B.001 to NAC445B.3485." NAC 445B.059 further defines "emission unit" as, "... a part of a stationary source that emits or has the potential to emit any regulated air pollutant." A comprehensive list of the sources of air pollutant emissions, resulting either directly from the Proposed Action or from indirectly related facilities used to process ore from the Proposed Action are presented in Table 3.6-8.

Table 3.6-8: List of Sources Analyzed for the Mount Hope Project

Emission Unit Description	Pollutants*
Primary Crusher Dump Pocket	PM_{10}, $PM_{2.5}$, Pb, HAPs
Primary Crusher & Apron Feeder Discharge	PM_{10}, $PM_{2.5}$, Pb, HAPs
Transfer to Coarse Ore Conveyor	PM_{10}, $PM_{2.5}$, Pb, HAPs
Transfer to Course Ore Stockpile	PM_{10}, HAPs
Reclaim Apron Feeder Transfer	PM_{10}, HAPs
Conveyor Transfer to SAG Mill	PM_{10}, HAPs
Pebble Crusher and Discharge	PM_{10}, HAPs
Sodium Metasilicate Silo Loading	PM_{10}, HAPs
Sodium Metasilicate Silo Unloading	PM_{10}, HAPs
Boiler for Dryer	CO, NO_2, PM_{10}, $PM_{2.5}$, Pb, SO_2, VOC, HAPs
Concentrate Dryer	CO, NO_2, PM_{10}, $PM_{2.5}$, Pb, SO_2, VOC, HAPs
Concentrate Transfer to Roasters via Conveyors, Bins, and Bucket Elevators	PM_{10}, $PM_{2.5}$, Pb, HAPs
Concentrate Roasters (1 and 2)	CO, NO_2, PM_{10}, $PM_{2.5}$, Pb, SO_2, VOC, HAPs
Primary and Secondary Screening	PM_{10}, $PM_{2.5}$, Pb, HAPs
TMO/ Rock Breaker- Roaster Building	PM_{10}, $PM_{2.5}$, Pb, HAPs
TMO Transfer to Packaging via Conveyors, Bins, and Bucket Elevators	PM_{10}, $PM_{2.5}$, Pb, HAPs
Lime Silo 1 Loading	PM_{10}, $PM_{2.5}$, HAPs
Lime Silo 1 Discharge	PM_{10}, $PM_{2.5}$, HAPs
Lime Silo 2 Loading	PM_{10}, $PM_{2.5}$, HAPs
Lime Silo 2 Discharge	PM_{10}, $PM_{2.5}$, HAPs
FeMo Plant- Batch Reactor	PM_{10}, $PM_{2.5}$, Pb, HAPs
FeMo Mixer	PM_{10}, $PM_{2.5}$, Pb, HAPs
FeMo Jaw Crusher	PM_{10}, $PM_{2.5}$, Pb, HAPs
FeMo Transfer to Packaging via Conveyors, Bins, and Bucket Elevators	PM_{10}, $PM_{2.5}$, Pb, HAPs
TMO Transfers, Handling, and Packaging	PM_{10}, $PM_{2.5}$, Pb, HAPs
FeMo Transfers, Handling, and Packaging	PM_{10}, $PM_{2.5}$, Pb, HAPs
Emergency Generator – Portable	CO, NO_2, PM_{10}, $PM_{2.5}$, SO_2, VOC, HAPs
Emergency Generator - Truck Shop	CO, NO_2, PM_{10}, $PM_{2.5}$, SO_2, VOC, HAPs

Emission Unit Description	Pollutants*
Emergency Generator - Mill Building	CO, NO_2, PM_{10}, $PM_{2.5}$, SO_2, VOC, HAPs
Emergency Generator - Tailings Pump House	CO, NO_2, PM_{10}, $PM_{2.5}$, SO_2, VOC, HAPs
Boiler - Mill Maintenance - General Heating	CO, NO_2, PM_{10}, $PM_{2.5}$, SO_2, VOC, HAPs
Boiler - Mine Maintenance - General Heating	CO, NO_2, PM_{10}, $PM_{2.5}$, SO_2, VOC, HAPs
Boiler - Filter/Packaging - General Heating	CO, NO_2, PM_{10}, $PM_{2.5}$, SO_2, VOC, HAPs
Boiler - FeMo Plant - General Heating	CO, NO_2, PM_{10}, $PM_{2.5}$, SO_2, VOC, HAPs
100,000 Gallon #2 Fuel Oil Tank	VOC, HAPs
Diesel Storage Tank	VOC, HAPs
Diesel Storage Tank	VOC, HAPs
Diesel Storage Tank	VOC, HAPs
Boiler - Mill Maintenance - Office Heating	CO, NO_2, PM_{10}, $PM_{2.5}$, SO_2, VOC, HAPs
Boiler - Mill Maintenance - Shower Boiler	CO, NO_2, PM_{10}, $PM_{2.5}$, SO_2, VOC, HAPs
Boiler - Mine Maintenance - Office Heating	CO, NO_2, PM_{10}, $PM_{2.5}$, SO_2, VOC, HAPs
Boiler - Mine Maintenance - Shower Boiler	CO, NO_2, PM_{10}, $PM_{2.5}$, SO_2, VOC, HAPs
Boiler - Truck Wash - General Heating	CO, NO_2, PM_{10}, $PM_{2.5}$, SO_2, VOC, HAPs
Boiler - Truck Wash - Wash Steamer	CO, NO_2, PM_{10}, $PM_{2.5}$, SO_2, VOC, HAPs
Boiler - Administration	CO, NO_2, PM_{10}, $PM_{2.5}$, SO_2, VOC, HAPs
Boiler - Administration	CO, NO_2, PM_{10}, $PM_{2.5}$, SO_2, VOC, HAPs
Boiler - Laboratory - General Heating	CO, NO_2, PM_{10}, $PM_{2.5}$, SO_2, VOC, HAPs
Boiler - Laboratory - Water Heater	CO, NO_2, PM_{10}, $PM_{2.5}$, SO_2, VOC, HAPs
Boiler - Health and Safety - General Heating	CO, NO_2, PM_{10}, $PM_{2.5}$, SO_2, VOC, HAPs
Boiler - Health and Safety - Water Heater	CO, NO_2, PM_{10}, $PM_{2.5}$, SO_2, VOC, HAPs
Boiler - Truck Shop - General Heating	CO, NO_2, PM_{10}, $PM_{2.5}$, SO_2, VOC, HAPs
Antifreeze Storage Tank	VOC, HAPs
Used Antifreeze Storage Tank	VOC, HAPs
Used Oil Storage Tank	VOC, HAPs
Truck Maintenance Fluid Storage Tank	VOC, HAPs
ATF Storage Tank	VOC, HAPs
Engine Oil Storage Tank	VOC, HAPs
Gear Oil Storage Tank	VOC, HAPs
Hydraulic Fluid Storage Tank	VOC, HAPs
Engine Oil Storage Tank	VOC, HAPs
Used Antifreeze Storage Tank	VOC, HAPs
Used Oil Storage Tank	VOC, HAPs
Gasoline Storage Tank	VOC, HAPs
Highway Diesel Storage Tank	VOC, HAPs
Fuel Oil #2/ MIBC Blend Storage Tank	VOC, HAPs
MIBC Storage Tank	VOC, HAPs
Pine Oil Storage Tank	VOC, HAPs
Fuel Oil #2 Storage Tank	VOC, HAPs
Fuel Oil Storage Tank	VOC, HAPs

Emission Unit Description	Pollutants*
Hydrochloric Acid Storage Tank	VOC, HAPs
Drilling	PM_{10}, $PM_{2.5}$, Pb, HAPs
Blasting	CO, NO_2, PM_{10}, $PM_{2.5}$, Pb, SO_2, HAPs
HG Ore - In-Pit Loading	PM_{10}, $PM_{2.5}$, Pb, HAPs
HG Ore - Stockpile Unloading	PM_{10}, $PM_{2.5}$, Pb, HAPs
HG Ore - Stockpile Loading	PM_{10}, $PM_{2.5}$, Pb, HAPs
LGO In-Pit Loading	PM_{10}, $PM_{2.5}$, Pb, HAPs
LGO Stockpile Unloading	PM_{10}, $PM_{2.5}$, Pb, HAPs
Waste - In-Pit Loading	PM_{10}, $PM_{2.5}$, Pb, HAPs
Waste - PAG Unloading	PM_{10}, $PM_{2.5}$, Pb, HAPs
Waste – Non-PAG Unloading	PM_{10}, $PM_{2.5}$, Pb, HAPs
LGO Stockpile Loading	HAPs
Wind Erosion - PC Stockpile	PM_{10}, $PM_{2.5}$, Pb, HAPs
Wind Erosion - LG Stockpile	PM_{10}, $PM_{2.5}$, Pb, HAPs
Wind Erosion - PAG	PM_{10}, $PM_{2.5}$, Pb, HAPs
Wind Erosion – Non-PAG	PM_{10}, $PM_{2.5}$, Pb, HAPs
Wind Erosion - Course HG Stockpile	PM_{10}, $PM_{2.5}$, Pb, HAPs
Wind Erosion - Pit to PC Haul Road	PM_{10}, $PM_{2.5}$, Pb, HAPs
Wind Erosion - Pit to Low-Grade Ore Stockpile Haul Road	PM_{10}, $PM_{2.5}$, Pb, HAPs
Wind Erosion - Pit to PAG Haul Road	PM_{10}, $PM_{2.5}$, Pb, HAPs
Wind Erosion - Pit to Non-PAG Haul Road	PM_{10}, $PM_{2.5}$, Pb, HAPs
Wind Erosion - Tailings Storage Facility	PM_{10}, $PM_{2.5}$, Pb, HAPs
Haul - HG Ore to PC & Stockpile	PM_{10}, $PM_{2.5}$, Pb, HAPs
Haul - LG Ore to Stockpile	PM_{10}, $PM_{2.5}$, Pb, HAPs
Haul - Waste to PAG	PM_{10}, $PM_{2.5}$, Pb, HAPs
Haul - Waste to Non-PAG	PM_{10}, $PM_{2.5}$, Pb, HAPs
Haul - LG Stockpile to PC	PM_{10}, $PM_{2.5}$, Pb, HAPs
Tailpipe – Loaders	CO, NO_2, PM_{10}, $PM_{2.5}$, SO_2, VOC, HAPs
Tailpipe - Haul Trucks	CO, NO_2, PM_{10}, $PM_{2.5}$, SO_2, VOC, HAPs
Tailpipe – Dozers	CO, NO_2, PM_{10}, $PM_{2.5}$, SO_2, VOC, HAPs
Tailpipe – Graders	CO, NO_2, PM_{10}, $PM_{2.5}$, SO_2, VOC, HAPs
Tailpipe - Water Trucks	CO, NO_2, PM_{10}, $PM_{2.5}$, SO_2, VOC, HAPs
Tailpipe – Excavators	CO, NO_2, PM_{10}, $PM_{2.5}$, SO_2, VOC, HAPs
Tailpipe - Blasthole Drills	CO, NO_2, PM_{10}, $PM_{2.5}$, SO_2, VOC, HAPs
Tailpipe - Hydraulic Shovel	CO, NO_2, PM_{10}, $PM_{2.5}$, SO_2, VOC, HAPs
Paved Road Travel - Commuter Buses	PM_{10}, $PM_{2.5}$, HAPs
Tailpipe - Commuter Buses	CO, NO_2, PM_{10}, $PM_{2.5}$, SO_2, VOC, HAPs

* - Hazardous air pollutant (HAP) emissions could occur from any or all sources

3.6.3.3.1 PM_{10}, $PM_{2.5}$, and Pb Emissions and Modeled Concentrations

PM_{10} emissions are generated by almost all sources in Table 3.6-8. The major sources of PM_{10} and $PM_{2.5}$ emissions include resuspension of unpaved road dust from haul trucks, wind erosion of the WRDFs and the ore storage stockpiles, as well as processing material using crushers, screens, and conveyors, and emissions from blasting operations. Emission controls such as watersprays help minimize emissions from the material process equipment (i.e., crushers, screens, conveyors, etc.) (AirSciences Inc. 2010a; 2011a; 2011b).

The PM_{10}/$PM_{2.5}$ emissions from the bus transportation of the employees on public roads to and from the Project Area would total 2.86 tpy (AirSciences Inc. 2011c). These emissions would be from engine exhaust, tire and brake wear, and fugitive dust generated from bus travel on paved roads. These emissions would have an incremental impact on the air quality in the vicinity of the transportation route.

The potential for indirect fugitive dust emissions from the ground water production exists as a result of the Proposed Action. As discussed under Section 3.2, the ground water pumping in Kobeh Valley would results in the lowering of the table in Kobeh Valley. As discussed in Section 3.9, a phreatophytic vegetation community exists in Kobeh Valley where the current water table is near the ground surface. Should the water table be lowered a sufficient distance, the current vegetation community in this area may shift to another community, have a lower population density (less individual plants per given area), or there may be an area without any vegetation. Should this occur and there are sufficient activities in that area to keep the soil surface from crusting, then the wind would result in the creation of wind-blown fugitive dust. These emissions would have an incremental impact on the air quality in the vicinity of the Kobeh Valley.

The maximum modeled ambient PM_{10} concentration in the NEPA modeling analysis, including background concentrations, for modeled years of highest impact (Years 1, 6, 16, 20, and 24) at any point of public access are 95.4 $\mu g/m^3$ per 24-hour time period with 1991 meteorological data, and 20.8 $\mu g/m^3$, annual arithmetic average with 1988 meteorological data (Table 3.6-9). The maximum modeled ambient $PM_{2.5}$ concentration in the NEPA modeling analysis, including background concentrations, for modeled years of highest impact (Years 1, 6, 16, 20, and 24) at any point of public access are 21.7 $\mu g/m^3$ per 24-hour time period with 1991 meteorological data, and 4.5 $\mu g/m^3$, annual arithmetic average with 1988 meteorological data (Table 3.6-9). The modeled high concentration for Pb is substantially below the NSAAQS and NAAQS standards.

Table 3.6-9: Highest Modeled Air Pollutant Concentrations from the Proposed Action at Receptor Points Accessible to the Public

Pollutant	Averaging Time	Met. Data Year	Highest Modeled Receptor Point			Lowest Applicable Ambient Standard ($\mu g/m^3$)
			Receptor Location[1]		Dispersion Modeling Results ($\mu g/m^3$)[2]	
			UTM Easting (m)	UTM Northing (m)		
PM_{10}	24-Hour	1991	569,638	4,407,545	93.4	150
	Annual	1988	569,680	4,407,572	20.7	50
$PM_{2.5}$	24-Hour	1991	569,638	4,407,545	24.9	35

Pollutant	Averaging Time	Met. Data Year	Highest Modeled Receptor Point			Lowest Applicable Ambient Standard ($\mu g/m^3$)
			Receptor Location[1]		Dispersion Modeling Results ($\mu g/m^3$)[2]	
			UTM Easting (m)	UTM Northing (m)		
	Annual	1988	569,680	4,407,572	4.4	15
SO_2	1-Hour	1990	567,905	4,405,317	121.4	196
	3-Hour	1991	571,620	4,407,068	156.3	1,300
	24-Hour	1991	567,700	4,405,600	29.3	365
	Annual	1992	572,386	4,404,696	4.3	80
CO	1-Hour	1991	567,824	4,405,251	4,224.6	40,000
	8-Hour (< 5,000')	1991	571,588	4,407,107	2,011.9	10,000
	8-Hour (≥ 5,000')	1991	571,588	4,407,107	2,011.9	6,667
Pb	1-Month	1989	569,742	4,407,613	0.009	0.15
NO_2	1-Hour	1991	573,700	4,402,800	170.8	188
	Annual	1991	567,745	4,404,835	26.3	100

[1] All coordinates in UTM projection, North American Datum 1983.
[2] Background values, as listed in Table 3.6-7 are included.

The modeled high concentration receptor locations for the NEPA modeling analysis is shown in Figure 3.6.4.

- **Impact 3.6.3.3-1:** Emissions of PM_{10}, $PM_{2.5}$, and Pb would be generated by numerous processes as a result of the Proposed Action, including the resuspension of road dust, wind erosion of exposed dirt surfaces, and activities related to the processing of ore materials. These activities are inherent to the mining process and would be ongoing throughout the life of the Proposed Action. The modeled PM_{10}, $PM_{2.5}$, and Pb concentrations show levels below the NSAAQS and NAAQS, even with the addition of the background values.

- **Significance of the Impact:** This impact is not considered significant. Based on the conclusions from the analysis, no additional mitigation is proposed.

3.6.3.3.2 Combustion Emissions and Modeled Concentrations

Combustion of diesel in the haul trucks and mobile equipment, such as loaders, dozers, etc., the combustion of propane in processing units such as the boilers, and the combustion of fuel oil or diesel in units such as the roaster, can produce elevated ambient levels of CO, NO_2, SO_2, PM_{10}, $PM_{2.5}$, and O_3 (from VOC emissions). In most cases, combustion emissions are generally uncontrolled for the emissions units. Despite the lack of tailpipe emissions control technology for combustion sources throughout the Project Area, the maximum modeled CO, NO_2, and SO_2 concentrations from the modeling analysis is well below either the NSAAQS or the NAAQS. The modeled results, including background concentrations, for each pollutant for each applicable averaging time are shown in Table 3.6-9.

The CO, NO_2, SO_2, and VOC emissions from the bus transportation of the employees on public roads, to and from the Project Area total 2.32, 4.97, 0.01, and 0.25 tpy (Air Sciences Inc 2011c). These emissions would be from engine exhaust. These emissions would have an incremental impact on the air quality in the vicinity of the transportation route.

- **Impact 3.6.3.3-2:** Combustion emissions of CO, NO_2, SO_2, PM_{10}, $PM_{2.5}$, and VOC would be generated by numerous processes as a result of the Proposed Action, including combustion emissions from diesel engines and burning propane, fuel oil, or diesel in various process equipment. The modeled CO, NO_2, SO_2, PM_{10}, $PM_{2.5}$, and VOC show levels below the NSAAQS and NAAQS.

- **Significance of the Impact:** This impact is not considered significant. Based on the conclusions from the analysis, no additional mitigation is proposed.

3.6.3.3.3 HAPs Emissions

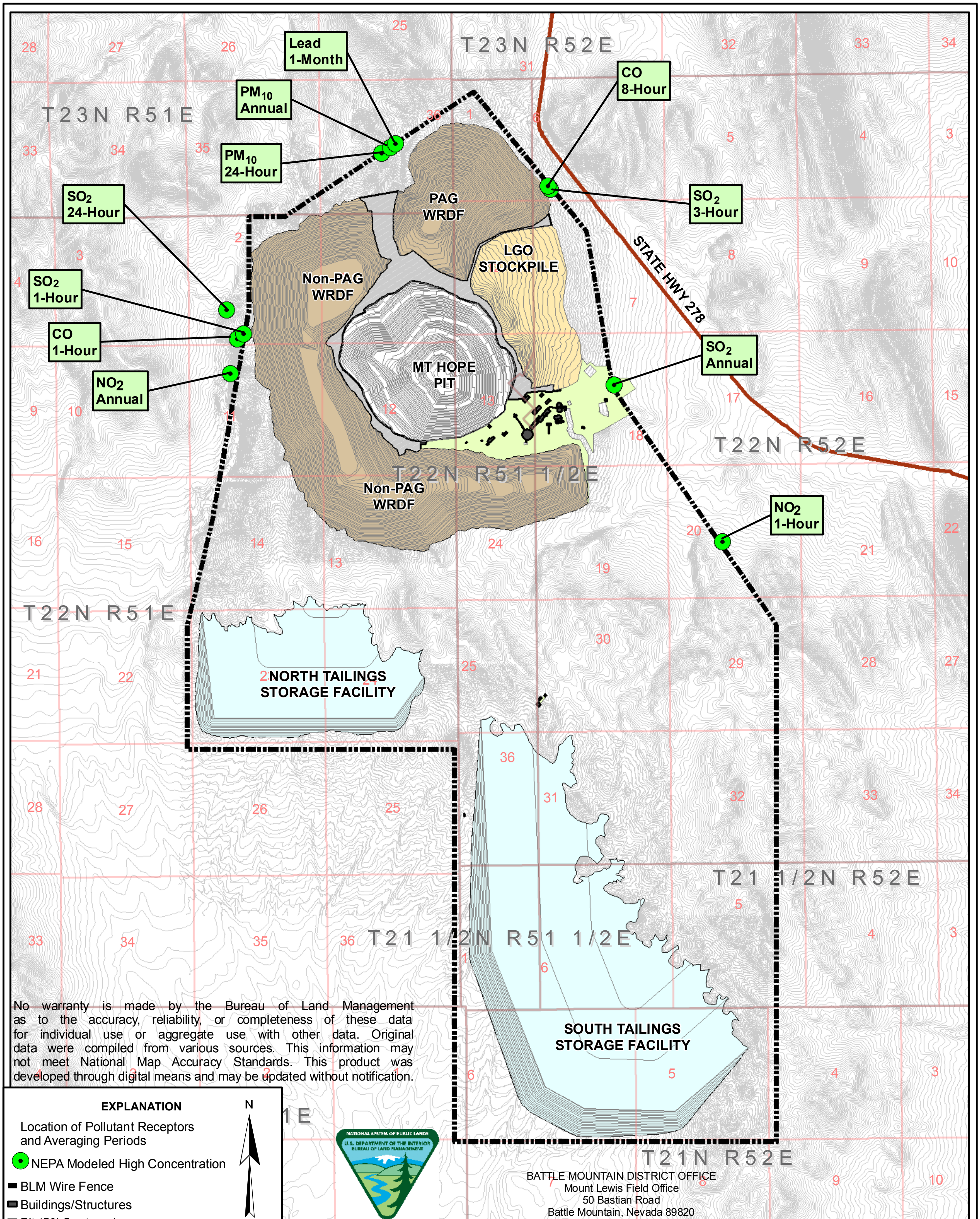
HAPs emissions from the Proposed Action would result from the handling of earthen materials, the combustion of the hydrocarbon fuels, and the handling and use of various chemicals. A summary of the total HAPs emissions that would be emitted from the Proposed Action is presented in Table 3.6-10 (Air Sciences Inc. 2010b). The facility-wide HAPs emissions would be 5.66 tpy and Mn would be the highest emitted single HAP at 1.15 tpy. These estimated emissions include both fugitive and process sources. EPA thresholds for any single HAP, or for all HAPs combined, are ten and 25 tpy, respectively. With the exception of Pb, there are no ambient air quality standards for HAPs and these emissions would have an incremental impact on the air quality in the vicinity of the Project Area. Pb is a criteria pollutant, as mentioned previously in the text.

3.6.3.3.4 Sensitive Receptors Effects

Dispersion modeling was also performed to determine the impacts on the "sensitive" receptors listed in Section 3.6.3.2.2 for the NEPA analysis. The highest 24-hour PM_{10} impact from the Proposed Action on the defined sensitive receptors was found to be 6.686 $\mu g/m^3$ at the Roberts Creek Ranch. The highest annual PM_{10} impact from the Proposed Action on the defined sensitive receptors was found to be 1.091 $\mu g/m^3$, also at the Roberts Creek Ranch (Table 3.6-11).

The NEPA modeling analysis was also performed to determine the impacts of the gaseous pollutants from the Proposed Action on the defined sensitive receptors, including the Jarbidge Wilderness, for each applicable averaging time shown in Table 3.6-11. In all instances, the concentrations are a small fraction of the ambient standards, and in the case of the Jarbidge Wilderness, much less than the PSD Class I increments.

The highest 24-hour and annual PM_{10} concentrations modeled from the Proposed Action emissions at the Jarbidge Wilderness Area are 0.351 $\mu g/m^3$ and 0.008 $\mu g/m^3$, respectively. Although the Project is not subject to limitations by the PSD Class I increments (8 $\mu g/m^3$ and 4 g/m^3, 24-hour and annual averaging times, respectively), the ambient concentration increases modeled from Proposed Action emissions values are far below these PSD Class I increments and the EPA's modeling significance level of 1 $\mu g/m^3$.



0 2,000 4,000 6,000 Feet

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BUREAU OF LAND MANAGEMENT

MOUNT HOPE PROJECT

DRAWING TITLE:

Modeled Highest Pollutant Concentrations for the Proposed Action

Figure 3.6.4

Table 3.6-10: HAPs Emissions for the Mount Hope Project

HAPs	Facility Total (tpy)	Fugitive Sources (tpy)	Process Sources (tpy)
Formaldehyde	0.126	0.108	0.018
Benzene	1.066	1.063	0.003
Acetaldehyde	0.035	0.035	0.0003
Naphthalene	0.179	0.178	0.001
Xylenes	0.264	0.264	--
1,3-Butadiene	0.00001	--	0.00001
Acrolein	0.011	0.011	0.00005
Toluene	0.387	0.385	0.002
Hexane	0.415	--	0.415
Phosphorus as P2O5	1.080	0.989	0.091
Xylenes	0.001	--	0.001
Lead	0.270	0.245	0.025
Manganese	1.156	1.128	0.028
Mercury	0.001	0.000	0.0002
Nickel	0.033	0.032	0.001
Antimony	0.011	0.011	--
Arsenic	0.165	0.125	0.041
Beryllium	0.008	0.008	0.000
Cadmium	0.035	0.035	0.000
Chromium	0.166	0.158	0.007
Cobalt	0.009	0.009	--
Hydrochloric Acid	0.241	--	0.241
Selenium	0.004	0.003	0.001
Total HAPs	**5.66**	**4.79**	**0.88**

Table 3.6-11: Highest Modeled Air Pollutant Concentration Impacts from the Proposed Action at the Defined Sensitive Receptors

Pollutant	Averaging Time	Met Year	Receptor Location		Dispersion Modeling Results ($\mu g/m^3$)	Lowest Applicable Ambient Standard ($\mu g/m^3$)
			UTM Easting (m)	UTM Northing (m)		
Jarbidge Wilderness Area						
$PM_{2.5}$	24-Hour	1991	618,652	608,076	0.098	35
	Annual	1991	618,652	608,076	.002	15
PM_{10}	24-Hour	1991	628,553	4,608,074	0.351	4
	Annual	1991	628,652	4,608,076	0.008	8
CO	1-Hour	1991	628,228	4,608,450	25.833	40,000
	8-Hour (< 5,000')	1990	628,652	4,608,076	3.815	10,000
	8-Hour (≥ 5,000')	1990	628,652	4,608,076	3.815	6,670
Pb	1-Month	1991	628,353	4,608,070	0.000	1.5
NO_2	1-Hour	1990	632,947	4,608,167	1.325	188
	Annual	1991	628,453	4,608,072	0.010	2.5

Pollutant	Averaging Time	Met Year	Receptor Location		Dispersion Modeling Results (μg/m³)	Lowest Applicable Ambient Standard (μg/m³)
			UTM Easting (m)	UTM Northing (m)		
SO_2	1-Hour	1989	632,947	4,608,167	0.640	196
	3-Hour	1991	628,322	4,608,165	0.494	25
	24-Hour	1991	628,652	4,608,076	0.076	5
	Annual	1991	628,652	4,608,076	0.001	2
Great Basin National Park						
$PM_{2.5}$	24-Hour	1988	728,953	4,320,711	0.062	35
	Annual	1991	732,016	4,327,170	0.001	15
PM_{10}	24-Hour	1992	730,368	4,325,913	0.186	150
	Annual	1991	732,016	4,327,170	0.007	50
CO	1-Hour	1988	728,953	4,320,711	14.405	40,000
	8-Hour (< 5,000')	1988	728,953	4,320,711	1.806	10,000
	8-Hour (≥ 5,000')	1988	728,953	4,320,711	1.806	6,670
Pb	1-Month	1988	732,016	4,327,170	0.000	1.5
NO_2	1-Hour	1991	732,016	4,327,170	1.060	188
	Annual	1991	732,016	4,327,170	0.009	100
SO_2	1-Hour	1992	730,405	4,324,245	0.299	196
	3-Hour	1988	728,953	4,320,711	0.261	1,300
	24-Hour	1988	728,953	4,320,711	0.042	365
	Annual	1991	732,016	4,327,170	0.001	80
Eureka County High School						
$PM_{2.5}$	24-Hour	1992	588,204	4,374,063	0.349	35
	Annual	1990	588,204	4,374,063	0.018	15
PM_{10}	24-Hour	1992	588,204	4,374,063	1.287	150
	Annual	1990	588,204	4,374,063	0.073	50
CO	1-Hour	1992	588,204	4,374,063	75.613	40,000
	8-Hour (< 5,000')	1992	588,204	4,374,063	9.485	10,000
	8-Hour (≥ 5,000')	1990	588,204	4,374,063	9.485	6,670
Pb	1-Month	1990	588,204	4,374,063	0.000	1.5
NO_2	1-Hour	1990	588,204	4,374,063	18.338	188
	Annual	1990	588,204	4,374,063	0.091	100

Pollutant	Averaging Time	Met Year	Receptor Location		Dispersion Modeling Results (μg/m³)	Lowest Applicable Ambient Standard (μg/m³)
			UTM Easting (m)	UTM Northing (m)		
SO_2	1-Hour	1990	588,204	4,374,063	2.847	196
	3-Hour	1992	588,204	4,374,063	1.360	1,300
	24-Hour	1992	588,204	4,374,063	0.216	365
	Annual	1990	588,204	4,374,063	0.010	80
Eureka Elementary School						
$PM_{2.5}$	24-Hour	1990	589,341	4,373,756	0.295	35
	Annual	1990	589,341	4,373,756	0.017	15
PM_{10}	24-Hour	1990	589,341	4,373,756	1.343	150
	Annual	1990	589,341	4,373,756	0.075	50
CO	1-Hour	1991	589,341	4,373,756	68.838	40,000
	8-Hour (< 5,000')	1988	589,341	4,373,756	9.378	10,000
	8-Hour (≥ 5,000')	1988	589,341	4,373,756	9.378	6,670
Pb	1-Month	1991	589,341	4,373,756	0.000	1.5
NO_2	1-Hour	1990	589,341	4,373,756	18.819	188
	Annual	1990	589,341	4,373,756	0.098	100
SO_2	1-Hour	1990	589,341	4,373,756	3.022	196
	3-Hour	1988	589,341	4,373,756	1.315	1,300
	24-Hour	1992	589,341	4,373,756	0.174	365
	Annual	1990	589,341	4,373,756	0.010	80
Eureka County Medical Clinic						
$PM_{2.5}$	24-Hour	1988	589,358	4,374,009	0.299	35
	Annual	1990	589,358	4,374,009	0.018	15
PM_{10}	24-Hour	1991	589,358	4,374,009	1.399	150
	Annual	1990	589,358	4,374,009	0.076	50
CO	1-Hour	1991	589,358	4,374,009	73.130	40,000
	8-Hour (< 5,000')	1988	589,358	4,374,009	10.150	10,000
	8-Hour (≥ 5,000')	1988	589,358	4,374,009	10.150	6,670
Pb	1-Month	1991	589,358	4,374,009	0.000	1.5
NO_2	1-Hour	1990	589,358	4,374,009	20.697	188
	Annual	1990	589,358	4,374,009	0.101	100

Pollutant	Averaging Time	Met Year	Receptor Location		Dispersion Modeling Results (µg/m³)	Lowest Applicable Ambient Standard (µg/m³)
			UTM Easting (m)	UTM Northing (m)		
SO_2	1-Hour	1988	589,358	4,374,009	3.192	196
	3-Hour	1988	589,358	437,009	1.384	1,300
	24-Hour	1991	589,358	437,009	0.182	365
	Annual	1990	589,358	437,009	0.011	80
Alpha Ranch						
$PM_{2.5}$	24-Hour	1989	568,465	4,428,941	0.699	35
	Annual	1991	568,465	4,428,941	0.023	15
PM_{10}	24-Hour	1988	568,465	4,428,941	2.763	150
	Annual	1991	568,465	4,428,941	0.110	50
CO	1-Hour	1989	568,465	4,428,941	173.068	40,000
	8-Hour (< 5,000')	1989	568,465	4,428,941	51.529	10,000
	8-Hour (≥ 5,000')	1989	568,465	4,428,941	51.529	6,670
Pb	1-Month	1989	568,465	4,428,941	0.000	1.5
NO_2	1-Hour	1992	568,465	4,428,941	23.035	188
	Annual	1991	568,465	4,428,941	0.148	100
SO_2	1-Hour	1991	568,465	4,428,941	3.790	196
	3-Hour	1989	568,465	4,428,941	3.227	1,300
	24-Hour	1989	568,465	4,428,941	0.445	365
	Annual	1991	568,465	4,428,941	0.013	80
Roberts Creek Ranch						
$PM_{2.5}$	24-Hour	1989	560,933	4,400,379	1.829	35
	Annual	1991	560,933	4,400,379	0.225	15
PM_{10}	24-Hour	1991	560,933	4,400,379	6.686	150
	Annual	1991	560,933	4,400,388	1.091	50
CO	1-Hour	1990	560,933	4,400,379	173.931	40,000
	8-Hour (< 5,000')	1991	560,933	4,400,379	51.529	10,000
	8-Hour (≥ 5,000')	1991	560,933	4,400,379	51.529	6,670
Pb	1-Month	1990	560,933	4,400,379	0.001	1.5
NO_2	1-Hour	1988	560,933	4,400,379	46,245	188
	Annual	1991	560,933	4,400,379	1.416	100

Pollutant	Averaging Time	Met Year	Receptor Location		Dispersion Modeling Results (μg/m³)	Lowest Applicable Ambient Standard (μg/m³)
			UTM Easting (m)	UTM Northing (m)		
SO_2	1-Hour	1990	560,933	4,400,379	5.798	196
	3-Hour	1991	560,933	4,400,379	3.951	1,300
	24-Hour	1991	560,933	4,400,379	0.942	365
	Annual	1991	560,933	4,400,379	0.112	80
Tonkin Reservoir						
$PM_{2.5}$	24-Hour	1989	550,030	4,418,098	0.834	35
	Annual	1988	550,030	4,418,098	0.053	15
PM_{10}	24-Hour	1989	550,030	4,418,098	3.142	150
	Annual	1988	550,030	4,418,098	0.236	50
CO	1-Hour	1989	550,030	4,419,098	114.115	40,000
	8-Hour (< 5,000')	1992	550,030	4,419,098	18.251	10,000
	8-Hour (≥ 5,000')	1992	550,030	4,419,098	18.251	6,670
Pb	1-Month	1989	550,030	4,419,098	0.000	1.5
NO_2	1-Hour	1989	550,030	4,419,098	38.482	188
	Annual	1988	550,030	4,419,098	0.316	100
SO_2	1-Hour	1989	550,030	4,419,098	4.838	196
	3-Hour	1992	550,030	4,419,098	2.750	1,300
	24-Hour	1989	550,030	4,419,098	0.443	365
	Annual	1988	550,030	4,419,098	0.031	80

- **Impact 3.6.3.3-3:** The modeled PM_{10}, $PM_{2.5}$, Pb, CO, NO_2, SO_2, and O_3 from the Proposed Action emissions show a very small increase in these pollutants at the sensitive receptors.

- **Significance of the Impact:** This impact is not considered significant. Based on the conclusions from the analysis, no additional mitigation is proposed.

3.6.3.3.5 Climate Change Effects

The estimated fuel and electrical power consumption for the Proposed Action is provided in Table 3.6-12. In accordance with Nevada law, a portion of the electrical power consumed by EML would continue to come from renewable energy sources, increasing from 11 percent in 2009 to 15 percent in 2013 and thereafter (Nevada State Legislature 2008).

Recent publications in the scientific literature suggest there is a direct correlation between global warming and emissions of GHG (IPCC 2007b). Other recent publications in the scientific literature suggest the correlation is not evident (Singer and Avery 2008; Spencer 2008;

Soloman 2008). GHGs include CO_2, methane, NO_X, and O_3. GHGs also include water vapor, although a dominant GHG it is generally not considered in GHG calculations. Although many of these gases occur naturally in the atmosphere, man-made sources substantially have increased the emissions of GHGs over the past several decades. Of the man-made GHGs, the greatest contribution currently comes from CO_2 emissions.

Table 3.6-12: Proposed Action and Alternatives Fuel and Power Consumption and Greenhouse Gas Emissions

Energy Source	Years	Alternatives				
		Proposed Action	Partial Backfill	Off-Site Transfer of Ore Concentrate for Processing	Slower, Longer Project Alternative[5]	No Action
Diesel Fuel Consumption (gallons per year)	1 - 32	10,000,000	10,000,000	10,000,000	5,000,000	11,000
	33 - 44	1,157,750	9,697,750	1,157,750	578,875	0
	45 - 48.4[1]	0	8,540,000	0	0	0
Propane Consumption (gallons per year)	1 - 32	1,218,100	1,218,100	505,100	609,050	0
	33 - 44	618,200	618,200	256,400	309,100	0
	45 - 48.4[1]	0	0	0	0	0
Electricity Consumption (megawatt-hours per year)	1 - 32	454,500	454,500	441,600	227,250	0
	33 - 44	444,200[2]	444,200[2]	437,800[3]	222,100	0
	45 - 48.4	17,520	17,520	17,520	8,760	0
Greenhouse Gas Emissions[4] (tons CO_2 per year)	1 - 32	604,251	604,251	586,069	302,125.5	124
	33 - 44	489,581	586,125	480,510	244,790.5	0
	45 - 48.4[1]	18,641	115,186	18,641	9,320.5	0

Source: EML 2009b.
1 - From year 32 to year 49 it would take approximately 16.4 years to complete the partial backfilling of the open pit under the Partial Backfill Alternative.
2 - Power requirements for the mill roaster, wells, and tailings (no electric shovels or drills are required for remining of the LGO Stockpile and waste rock dumps.
3 - Power requirements for the mill, concentrate leaching and drying, wells, and tailings (excludes to roaster)
4 - Emissions based on EPA AP-42 (EPA 2009) and Department of Energy (DOE) (DOE 2000) data.
5 - Although the lower mining and processing rates are inherently less fuel efficient, on a production unit basis, the precise energy consumption amounts cannot be determined without redesigning the mining fleet and processing facility. Therefore, for the purposes of this analysis, it is assumed that the Slower, Longer Project Alternative would consume half the energy for twice the duration relative to the Proposed Action.

GHG emissions associated with the proposed Project primarily would be associated with the consumption of energy for mining and ore processing over the 44-year mine life. Operations that would contribute to GHG emissions would include the following:

- Fuel consumption (vehicles and machinery)
- Electricity consumption (machinery, milling, heap leach water circulation, ground water pumping and dewatering)
- Diesel fuel combustion during the roasting of the ore concentrate (diesel is used as a flotation agent and may be carried through the process)

The current national annual emissions of GHGs are approximately eight billion tons (EPA 2008b). Under the Proposed Action, the Project would emit up to approximately 604 thousand tons per year of GHGs, or approximately 0.00755 percent of the national annual emissions.

Existing climate prediction models for the prediction of climate change are global in nature; therefore, they are not at the appropriate scale to estimate potential impacts of climate change on the Proposed Action and the associated environment.

3.6.3.3.6 Residual Effects

The residual effects of the Proposed Action include point source and fugitive PM_{10}, $PM_{2.5}$, and Pb emissions from vehicular traffic, blasting, and material handling and processing operations. Other impacts include combustion emissions of PM_{10}, $PM_{2.5}$, CO, NO_2, SO_2, and VOC generated by numerous processes as a result of the Proposed Action, including combustion emissions from diesel engines, and burning propane, fuel oil, or diesel in various process equipment. These effects would cease once the Project ceases and there are no irreversible or irretrievable effects for the Proposed Action on air resources.

3.6.3.4 No Action Alternative

Under the No Action Alternative, air quality impacts associated with the Project would not occur. EMI would not be authorized to develop the Project and mine the ore body as described in the Proposed Action. However, the currently authorized exploration in the Project Area could continue, which would result in fugitive dust emissions and combustion emissions.

3.6.3.4.1 PM_{10}, $PM_{2.5}$, and Pb Emissions and Modeled Concentrations

The major sources of PM_{10}, $PM_{2.5}$, and Pb emissions from the No Action Alternative include resuspension of unpaved road dust from trucks and emissions from drill operations. Emission controls such as road watering would help minimize these emissions.

- **Impact 3.6.3.4-1:** Emissions of PM_{10}, $PM_{2.5}$, and Pb would be generated by the No Action Alternative in an amount substantially less than under the Proposed Action. The modeled PM_{10}, $PM_{2.5}$, and Pb concentrations under the Proposed Action support the conclusion that these concentrations under the No Action Alternative would be below the NSAAQS and NAAQS, even with the addition of the background values.

- **Significance of the Impact:** This impact is not considered significant. Based on the conclusions from the analysis, no additional mitigation is proposed.

3.6.3.4.2 Combustion Emissions

Combustion of diesel in the trucks and drilling rigs can produce elevated ambient levels of CO, NO_2, SO_2, PM_{10}, $PM_{2.5}$, and O_3. The amount of these emissions under the No Action Alternative would be substantially less than under the Proposed Action. Despite the lack of tailpipe emissions control technology for combustion sources throughout the Project Area, the maximum modeled CO, NO_2, SO_2, PM_{10}, $PM_{2.5}$, and O_3 concentrations from both models for the Proposed Action would be well below either the NSAAQS or the NAAQS, and, therefore, the concentrations under the No Action alternative would also be less than the NSAAQS and the NAAQS.

- **Impact 3.6.3.4-2:** Combustion emissions of CO, NO_2, SO_2, PM_{10}, $PM_{2.5}$, and VOC would be generated by the No Action Alternative in amounts that would be substantially less than under the Proposed Action. The modeled CO, NO_2, SO_2, PM_{10}, $PM_{2.5}$, and O_3 concentrations under the Proposed Action support the conclusion that these concentrations under the No Action Alternative would be below the NSAAQS and NAAQS, even with the addition of the background values.

- **Significance of the Impact:** This impact is not considered significant. Based on the conclusions from the analysis, no additional mitigation is proposed.

3.6.3.4.3 HAPs Emissions

The major sources of HAPs emissions from the No Action Alternative include resuspension of unpaved road dust, which contain HAP metals, from trucks and combustion emissions from drill operations. Emission controls such as road watering would help minimize these emissions.

3.6.3.4.4 Sensitive Receptors Effects

Dispersion modeling for the Proposed Action was also performed to determine the impacts on the "sensitive" receptors listed in Section 3.6.3.2.2 for the NEPA analysis. The highest 24-hour PM_{10} impact from the Proposed Action on the defined sensitive receptors was found to be 6.686 $\mu g/m^3$ at the Roberts Creek Ranch. The highest annual PM_{10} impact from the Proposed Action on the defined sensitive receptors was found to be 1.091 $\mu g/m^3$, also at the Roberts Creek Ranch; therefore, any potential impacts from the No Action Alternative would be less than those identified for the Proposed Action.

The NEPA modeling analysis was also performed for the Proposed Action to determine the impacts of the gaseous pollutants from the Proposed Action on the defined sensitive receptors, including the Jarbidge Wilderness. In all instances, the concentrations are a small fraction of the ambient standards, and in the case of the Jarbidge Wilderness, much less than the PSD Class I increments; therefore, any potential impacts from the No Action Alternative would be less than those identified for the Proposed Action.

- **Impact 3.6.3.4-3:** The emissions of PM_{10}, $PM_{2.5}$, Pb, CO, NO_2, SO_2, and O_3 from the No Action Alternative emissions may show a very small increase in these pollutants at the sensitive receptors and any potential impacts would be less than those under the Proposed Action.

- **Significance of the Impact:** This impact is not considered significant. Based on the conclusions from the analysis, no additional mitigation is proposed.

3.6.3.4.5 Climate Change Effects

The estimated fuel and electrical power consumption for the No Action Alternative is provided in Table 3.6-11. GHG emissions associated with the No Action Alternative primarily would be associated with the consumption of fuel (vehicles and machinery). The current national annual emissions of GHGs are approximately eight billion tons (EPA 2008b). Under the No Action Alternative, the Project would emit up to approximately 124 tons per year of GHGs, or approximately 0.000001 percent of the national annual emissions.

Existing climate prediction models for the prediction of climate change are global in nature; therefore, they are not at the appropriate scale to estimate potential impacts of climate change on the No Action Alternative and the associated environment.

3.6.3.4.6 Residual Effects

The residual effects of the No Action Alternative include point source and fugitive PM_{10}, $PM_{2.5}$, and Pb emissions from vehicular traffic and drilling operations. Other impacts include combustion emissions of PM_{10}, CO, NO_2, SO_2, PM_{10}, $PM_{2.5}$, and VOC generated by vehicles and drill rigs as a result of the No Action Alternative, including combustion emissions from diesel and gasoline engines. These effects would cease once the activities under the No Action Alternative ceases and there are no irreversible or irretrievable effect for the No Action Alternative on air resources. The potential impacts would be adverse, but not irreversible.

3.6.3.5 Partial Backfill Alternative

The Partial Backfill Alternative would be the same as the Proposed Action, except that at the end of the mining in the open pit, the open pit would be partially backfilled to eliminate the potential for a pit lake. Backfilling would begin in Year 32 with an approximately 17-year time frame to complete the partial backfill process. The backfilling would be completed using 1.3 billion tons of Non-PAG waste rock from the Non-PAG WRDF. Emissions related to the backfilling process would be essentially the same as those from the mining process. A quantitative analysis was not completed because the modeling analysis for the Proposed Action, which looked at time periods from one hour to annual, sufficiently encompasses the potential impacts of the Partial Backfill Alternative. The air quality impacts would occur over a longer period of time as compared to the Proposed Action.

3.6.3.5.1 PM_{10}, $PM_{2.5}$, and Pb Emissions

Activities under the Partial Backfill Alternative would be the same as under the Proposed Action through the completion of the mining operation. Therefore, the analysis of the potential air quality impacts for the Proposed Action appropriately characterize the potential air quality impacts for the Partial Backfill Alternative. In Year 32 of the mine life, backfilling would begin under the Partial Backfill Alternative, and approximately 1.3 billion tons of waste rock deposited at the Non-PAG WDRF would be transferred to the open pit to complete the partial backfilling of the waste rock mined under this alternative. The emissions associated with this activity are fugitive dust and combustion emissions associated with the loader transport and dumping of the waste rock. These emissions are a subset of the type and location of emissions evaluated for the placement of the waste rock under the analysis for the Proposed Action. Since the Proposed Action did not result in an identified exceedance of the NAAQS, activities under this portion of the Partial Backfill Alternative are also not expected to result in an exceedance of the NAAQS.

The $PM_{10}/PM_{2.5}$ emissions from the bus transportation of the employees on public roads to and from the Project Area would be similar to those of the Proposed Action, on an annual basis. However, the emissions would occur over a longer time period, due to the backfilling of the open pit. These emissions would have an incremental impact on the air quality in the vicinity of the transportation route.

The potential for indirect fugitive dust emissions from the ground water production in Kobeh Valley would be essentially the same as under the Proposed Action. These emissions would have an incremental impact on the air quality in the vicinity of the Kobeh Valley.

- **Impact 3.6.3.5-1:** The emissions of PM_{10}, $PM_{2.5}$, and Pb would be generated by numerous processes as a result of the Partial Backfill Alternative, including the resuspension of road dust, wind erosion of exposed dirt surfaces, and activities related to the processing of ore materials. These activities are inherent to the mining process and would be ongoing throughout the life of the Partial Backfill Alternative. Since this alternative is essentially the same as the Proposed Action, just longer in duration, the PM_{10}, $PM_{2.5}$, and Pb concentrations would be below the NSAAQS and NAAQS, even with the addition of the background values.

- **Significance of the Impact:** This impact is not considered significant. Based on the conclusions from the analysis, no additional mitigation is proposed.

3.6.3.5.2 Combustion Emissions

Combustion of diesel in the haul trucks and mobile equipment, such as loaders, dozers, etc., the combustion of propane in processing units such as boilers, and the combustion of fuel oil or diesel in units such as the roaster, can produce elevated ambient levels of CO, NO_2, SO_2, PM_{10}, $PM_{2.5}$, and O_3 (from VOC emissions). In most cases, combustion emissions are generally uncontrolled for the emissions units. Despite the lack of tailpipe emissions control technology for combustion sources throughout the Project Area, the maximum modeled CO, NO_2, SO_2, PM_{10}, $PM_{2.5}$, and O_3 concentrations from both models are well below either the NSAAQS or the NAAQS. The modeled results, including background concentrations, for each pollutant for each applicable averaging time are shown in Table 3.6-9.

The CO, NO_2, SO_2, and VOC emissions from the bus transportation of the employees on public roads would be similar to those of the Proposed Action, on an annual basis. However, the emissions would occur over a longer time period, due to the backfilling of the open pit. These emissions would be from engine exhaust. These emissions would have an incremental impact on the air quality in the vicinity of the transportation route.

- **Impact 3.6.3.5-2:** Combustion emissions of CO, NO_2, SO_2, PM_{10}, $PM_{2.5}$, and VOC would be generated by numerous processes as a result of the Partial Backfill Alternative, including combustion emissions from diesel engines and burning propane, fuel oil, or diesel in various process equipment. These emissions would be essentially the same as under the Proposed Action, except longer in duration. Therefore, the CO, NO_2, SO_2, PM_{10}, $PM_{2.5}$, and O_3 concentrations would be below the NSAAQS and NAAQS.

- **Significance of the Impact:** This impact is not considered significant. Based on the conclusions from the analysis, no additional mitigation is proposed.

3.6.3.5.3 HAPs Emissions

HAPs emission rates from this alternative would be essentially the same as under the Proposed Action, on an annual basis. These emissions would result from the handling of earthen materials, the combustion of the hydrocarbon fuels, and the handling and use of various chemicals.

However, the emissions would occur over a longer time period, due to the backfilling of the open pit. With the exception of Pb, there are no ambient air quality standards for HAPs and these emissions would have an incremental impact on the air quality in the vicinity of the Project Area. Pb is a criteria pollutant, as mentioned previously in the text.

3.6.3.5.4 Sensitive Receptors Impacts

Since the Partial Backfill Alternative is essentially the same as the Proposed Action, just longer in duration, the dispersion modeling that was performed for the Proposed Action to determine the impacts on the "sensitive" receptors listed in Section 3.6.3.2.2 is also representative of the Partial Backfill Alternative.

This same NEPA modeling analysis for the Proposed Action was performed to determine the impacts of the gaseous pollutants from the Project on the defined sensitive receptors, including the Jarbidge Wilderness, for each applicable averaging time shown in Table 3.6-10, and is representative of the Partial Backfill Alternative. In all instances, the concentrations are a small fraction of the ambient standards and, in the case of the Jarbidge Wilderness, are much less than the PSD Class I increments.

- **Impact 3.6.3.5-3:** The PM_{10}, $PM_{2.5}$, Pb, CO, NO_2, SO_2, and O_3 concentrations from the Partial Backfill Alternative would show a very small increase in these pollutants at the sensitive receptors.

- **Significance of the Impact:** This impact is not considered significant. Based on the conclusions from the analysis, no additional mitigation is proposed.

3.6.3.5.5 Climate Change Effects

The estimated fuel and electrical power consumption for the Partial Backfill Alternative is provided in Table 3.6-11. GHG emissions associated with the Partial Backfill Alternative primarily would be associated with the consumption of fuel (vehicles and machinery) and electricity. The current national annual emissions of GHGs are approximately eight billion tons (EPA 2008b). Under the Partial Backfill Alternative, the Project would emit up to approximately 604 thousand tons per year of GHGs, or approximately 0.00755 percent of the national annual emissions.

Existing climate prediction models for the prediction of climate change are global in nature; therefore, they are not at the appropriate scale to estimate potential impacts of climate change on the Partial Backfill Alternative and the associated environment.

3.6.3.5.6 Residual Effects

The residual adverse impacts of the Partial Backfill Alternative include fugitive PM_{10}, $PM_{2.5}$, and Pb emissions from vehicular traffic, blasting, and material handling and processing operations. Other impacts include combustion emissions of PM_{10}, $PM_{2.5}$, CO, NO_2, SO_2, and VOC generated by numerous processes as a result of the Partial Backfill Alternative, including combustion emissions from diesel engines and burning propane, fuel oil, or coal in various process equipment. These impacts would be adverse, but not irreversible.

3.6.3.6 Off-Site Transfer of Ore Concentrate for Processing Alternative

Activities under the Off-Site Transfer of Ore Concentrate for Processing Alternative would be the same as the Proposed Action; however the ore processing facility would include only the milling operations of the molybdenum sulfide concentrate. The technical grade Mo oxide and FeMo portions of the processing facility would not be constructed. In addition, the leaching of the concentrate would likely not be done on site and the Mo sulfide would be shipped off site for processing. A quantitative analysis was not completed because the analysis for the Proposed Action sufficiently encompasses the potential impacts of the Off-Site Transfer of Ore Concentrate for Processing Alternative.

3.6.3.6.1 PM_{10}, $PM_{2.5}$, and Pb Emissions

Activities under the Off-Site Transfer of Ore Concentrate for Processing Alternative would be the same as under the Proposed Action through the completion of the mining and milling operations, less the roaster and FeMo operations. The off-site transfer of the ore concentrate would still result in air quality impacts, but the roaster and FeMo operation impacts would occur at a different site. Therefore, the emissions in the Project Area under this alternative would be reduced as compared to the Proposed Action. The roaster and FeMo operations emissions are a substantial portion of the "NEPA – Point and Process Fugitive Sources" emissions outlined in Table 3.6-3. Since the Proposed Action would not result in an identified exceedance of the NAAQS, activities under this portion of the Off-Site Transfer of Ore Concentrate for Processing Alternative would also not be expected to result in an exceedance of the NAAQS.

The PM_{10}/$PM_{2.5}$ emissions from the bus transportation of the employees on public roads to and from the Project Area would be similar, but perhaps slightly less, to those of the Proposed Action, on an annual basis, due to fewer employees. These emissions would have an incremental impact on the air quality in the vicinity of the transportation route.

The potential for indirect fugitive dust emission from the ground water production in Kobeh Valley would be essentially the same as under the Proposed Action. These emissions would have an incremental impact on the air quality in the vicinity of the Kobeh Valley.

- **Impact 3.6.3.6-1:** Emissions of PM_{10}, $PM_{2.5}$, and Pb would be generated by numerous processes as a result of the Off-Site Transfer of Ore Concentrate for Processing Alternative, including the resuspension of road dust, wind erosion of exposed dirt surfaces, and activities related to the processing of ore materials. These activities are inherent to the mining process and would be ongoing throughout the life of the Project. The PM_{10}, $PM_{2.5}$, and Pb concentrations would be below the NSAAQS and NAAQS, even with the addition of the background values.

- **Significance of the Impact:** This impact is not considered significant. Based on the conclusions from the analysis, no additional mitigation is proposed.

3.6.3.6.2 Combustion Emissions

Activities under the Off-Site Transfer of Ore Concentrate for Processing Alternative would be the same as under the Proposed Action through the completion of the mining operation less the roasting and FeMo operations. The off-site transfer of the ore concentrate would still result in air quality impacts for roasting and FeMo operations, but these impacts would occur at a different site. Therefore, the emissions in the Project Area would be reduced and would be accounted for at the undetermined alternative processing location. These emissions are a subset of the type and location of emissions evaluated for the Proposed Action. Since the Proposed Action would not result in an identified exceedance of the NAAQS, activities under this portion of the Off-Site Transfer of Ore Concentrate for Processing Alternative would also not be expected to result in an exceedance of the NAAQS.

Combustion of diesel in the haul trucks and mobile equipment, such as loaders, dozers, etc., the haul of concentrate to an off-site processing facility, and the combustion of propane in processing units such as the boilers, can produce elevated ambient levels of CO, NO_2, SO_2, PM_{10}, $PM_{2.5}$, and O_3. In most cases, combustion emissions are generally uncontrolled for the emissions units. Despite the lack of tailpipe emissions control technology for combustion sources throughout the Project Area, the maximum CO, NO_2, SO_2, PM_{10}, $PM_{2.5}$, and O_3 concentrations would be below either the NSAAQS or the NAAQS. These emissions would be greater than under the Proposed Action, due to the off-site transfer of ore concentrate. However, there would be a corresponding reduction in emissions due to the elimination in the roaster process under this alternative. The emissions from the off-site transfer of ore concentrate have not been quantified because the potential location for the transfer is not reasonably known.

The CO, NO_2, SO_2, and VOC emissions from the bus transportation of the employees on public roads would be similar, but perhaps slightly less, to those of the Proposed Action, on an annual basis, due to fewer employees. These emissions would be from engine exhaust. These emissions would have an incremental impact on the air quality in the vicinity of the transportation route.

- **Impact 3.6.3.6-2:** Combustion emissions of CO, NO_2, SO_2, PM_{10}, $PM_{2.5}$, and VOC would be generated by numerous processes as a result of the Off-Site Transfer of Ore Concentrate for Processing Alternative, including combustion emissions from diesel engines, and burning propane, fuel oil, or diesel in various process equipment. The CO, NO_2, SO_2, PM_{10}, $PM_{2.5}$, and O_3 concentrations would be below the NSAAQS and NAAQS.

- **Significance of the Impact:** This impact is not considered significant. Based on the conclusions from the analysis, no additional mitigation is proposed.

3.6.3.6.3 HAPs Emissions

HAPs emission rates from this alternative would be less than under the Proposed Action, on an annual basis because the roasting of the ore would not occur. These emissions would result from the handling of earthen materials, the combustion of the hydrocarbon fuels, and the handling and use of various chemicals. With the exception of Pb, there are no ambient air quality standards for HAPs and these emissions would have an incremental impact on the air quality in the vicinity of the Project Area. Pb is a criteria pollutant, as mentioned previously in the text.

3.6.3.6.4 Sensitive Receptors Impacts

Since the Off-Site Transfer of Ore Concentrate for Processing Alternative is essentially the same as the Proposed Action, just with lower emissions at the Project site only, the dispersion modeling that was performed for the Proposed Action to determine the impacts on the "sensitive" receptors listed in Section 3.6.3.2.2 is representative of the Off-Site Transfer of Ore Concentrate for Processing Alternative.

This same NEPA modeling analysis for the Proposed Action was performed to determine the impacts of the gaseous pollutants from the Project on the defined sensitive receptors, including the Jarbidge Wilderness, for each applicable averaging time shown in Table 3.6-10 and is representative of the Off-Site Transfer of Ore Concentrate for Processing Alternative. In all instances, the concentrations are a small fraction of the ambient standards, and in the case of the Jarbidge Wilderness, are much less than the PSD Class I increments.

- **Impact 3.6.3.6-3:** The PM_{10}, $PM_{2.5}$, Pb, CO, NO_2, SO_2, and VOC concentrations from the Off-Site Transfer of Ore Concentrate for Processing Alternative would show a very small increase in these pollutants at the sensitive receptors.

- **Significance of the Impact:** This impact is not considered significant. Based on the conclusions from the analysis, no additional mitigation is proposed.

3.6.3.6.5 Climate Change Effects

The estimated fuel and electrical power consumption for the Off-Site Transfer of Ore Concentrate for Processing Alternative is provided in Table 3.6-11. GHG emissions associated with the Off-Site Transfer of Ore Concentrate for Processing Alternative primarily would be associated with the consumption of fuel (vehicles and machinery) and electricity. The current national annual emissions of GHGs are approximately eight billion tons (EPA 2008b). Under the Off-Site Transfer of Ore Concentrate for Processing Alternative, the Project would emit up to approximately 586,069 tons per year of GHGs, or approximately 0.0073 percent of the national annual emissions. These emissions would be greater than under the Proposed Action, due to the off-site transfer of ore concentrate. However, there would be a corresponding reduction in emissions due to the elimination in the roaster process under this alternative. The emissions from the off-site transfer of ore concentrate have not been quantified because the potential location for the transfer is not reasonably known.

Existing climate prediction models for the prediction of climate change are global in nature; therefore, they are not at the appropriate scale to estimate potential impacts of climate change from the Off-Site Transfer of Ore Concentrate for Processing Alternative and the associated environment.

3.6.3.6.6 Residual Effects

The residual adverse impacts of the Off-Site Transfer of Ore Concentrate for Processing Alternative include fugitive PM_{10} and Pb emissions from vehicular traffic, blasting, and material handling on-site. Other impacts include combustion emissions of PM_{10}, $PM_{2.5}$, CO, NO_2, SO_2, and VOC generated by numerous processes as a result of the Off-Site Transfer of Ore Concentrate for Processing Alternative, including mostly combustion emissions from loading and hauling. These impacts would be adverse, but not irreversible.

3.6.3.7 Slower, Longer Project Alternative

Under the Slower, Longer Project Alternative, the Project would operate at approximately one-half the production rate as described in the Proposed Action, which would result in a project that would last approximately twice as long as the Proposed Action. Under this half-production rate alternative, the currently planned 96,000,000 st/y mining rate would be reduced to 48,000,000 st/y and the mill throughput would be reduced from 60,500 st/d of ore to 30,250 st/d.

The air dispersion model for the Project includes the parameters for the optimal design capacity of the equipment specified under the Proposed Action. The Proposed Action includes specific equipment for mining and milling and the operation of this equipment for 24 hours per day seven days per week at optimized throughput rates. Under the Slower, Longer Project Alternative, the mining and milling operation rates would be less than the Proposed Action. Therefore, the equipment that has been designed for the mining and milling under the Proposed Action could not be used and different equipment would need to be purchased.

A half-production Project has not been designed; however, for the sake of comparison, there are several facets of a half-production rate project that could be anticipated. Mining and processing equipment would be smaller, as would ancillary facilities (powerline supply and well field for example). The decreased size (and quantity) of mining and processing facilities and equipment would have decreased operational capacity, resulting in decreased emissions per time period (for example, per day, month or year). However, even though production would be half of the Proposed Action, it is expected that the emission reduction compared to the Proposed Action would be less than half (on a per-day or per-year basis). As a result, the Slower, Longer Project Alternative would create more emissions per ton processed than the Proposed Action. The smaller equipment that would be purchased may produce fewer emission (per day or year) than the larger equipment in the Proposed Action; however, work vehicles and smaller equipment types often tend to be less efficient and may therefore emit more per gallon or unit of energy output than larger models. Therefore, over the life of the Project under this alternative the total emissions would be greater than under the Proposed Action. Further, cutting the production in half does not cut the workforce traveling to the site in half (see Section 3.17.3 for further discussion). Rather, it is estimated that this Alternative would reduce the workforce by 30 percent compared to the Proposed Action. As a result, emissions from employee and contractor transportation to and from the Project Area would be decreased but not in proportion to the reduced production rate. Reagent consumption would be the same on a per-unit (of production) basis, but the smaller consumption rate would decrease storage requirements and material shipments.

3.6.3.7.1 PM_{10}, $PM_{2.5}$, and Pb Emissions

Since the Proposed Action did not result in an identified exceedance of the NAAQS, activities under the Slower, Longer Project Alternative would be smaller in magnitude and would therefore also not be expected to result in an exceedance of the NAAQS.

- **Impact 3.6.3.7-1:** The emissions of PM_{10}, $PM_{2.5}$, and Pb would be generated by essentially identical processes as discussed under the Proposed Action. However, the concentrations of these pollutants would be lower than modeled for the Proposed Action due to the halved production rate and decreased operating thresholds of smaller equipment and facilities. The resulting concentrations of PM_{10}, $PM_{2.5}$,, and Pb would be lower than the Proposed Action which are below the NSAAQS and NAAQS.

- **Significance of the Impact:** This impact is not considered significant. Based on the conclusions from the analysis, no additional mitigation is proposed.

3.6.3.7.2 Combustion Emissions

The CO, NO_2, SO_2, and VOC emissions (and resulting O_3 formed by NO_x and VOC emissions) from the bus transportation of the employees on public roads would be similar to those of the Proposed Action, on an annual basis. However, the emissions would occur over a longer time period, due to the mine life being extended to approximately 88 years. These emissions would be from engine exhaust. These emissions would have an incremental impact on the air quality in the vicinity of the transportation route.

- **Impact 3.6.3.7-2:** Combustion emissions of CO, NO_2, SO_2, PM_{10}, $PM_{2.5}$, and VOC (and resultant O_3 concentrations) would be generated by numerous processes as a result of the Slower, Longer Project Alternative, including combustion emissions from diesel engines and burning propane, fuel oil, or diesel in various process equipment. These emissions would be lower than the Proposed Action when examined on a daily, monthly or annual basis (according to the exposure time period the air quality standards are associated with). Therefore, the CO, NO_2, SO_2, PM_{10}, $PM_{2.5}$, and O_3 concentrations would be below the NSAAQS and NAAQS.

- **Significance of the Impact:** This impact is not considered significant. Based on the conclusions from the analysis, no additional mitigation is proposed.

3.6.3.7.3 HAPs Emissions

HAPs emission rates from this alternative would be lower than as described under the Proposed Action. These emissions would result from the handling of earthen materials, the combustion of the hydrocarbon fuels, and the handling and use of various chemicals. However, the emissions per time period would be reduced and would occur over a longer time period. Although regulated by the EPA, with the exception of Pb, there are no ambient air quality standards for HAPs and these emissions would have a more dispersed incremental impact on the air quality in the vicinity of the Project Area than under the Proposed Action.

3.6.3.7.4 Sensitive Receptors Impacts

Since the Slower, Longer Project Alternative is essentially the same as the Proposed Action, just decreased operational rates and longer in duration, the dispersion modeling that was performed for the Proposed Action to determine the impacts on the "sensitive" receptors listed in Section 3.6.3.2.2 is a conservative representation of the Slower, Longer Project Alternative.

- **Impact 3.6.3.7-3:** The PM_{10}, $PM_{2.5}$, Pb, CO, NO_2, SO_2, and O_3 concentrations from the Slower, Longer Project Alternative would show a decrease in these pollutants at the sensitive receptors.

- **Significance of the Impact:** This impact is not considered significant. Based on the conclusions from the analysis, no additional mitigation is proposed.

3.6.3.7.5 Climate Change Effects

Power consumption and greenhouse gas emissions have not been calculated for the Slower, Longer Project Alternative. However, the usage of these energy sources and GHG emissions have been calculated for the Proposed Action, which is provided in Table 3.6-12. GHG emissions associated with the Slower, Longer Project Alternative would be similar, and possibly slightly greater than those under the Proposed Action over the life of the Project. However, hourly or daily emission rates would be lower due to the decreased scale of operations, although the duration would be doubled.

Existing climate prediction models for the prediction of climate change are global in nature; therefore, they are not at the appropriate scale to estimate potential impacts of climate change on the Slower, Longer Project Alternative and the associated environment.

3.6.3.7.6 Residual Effects

The residual adverse impacts of the Slower, Longer Project Alternative include fugitive PM_{10}, $PM_{2.5}$, and Pb emissions from vehicular traffic, blasting, and material handling and processing operations. Other impacts include combustion emissions of PM_{10}, $PM_{2.5}$,CO, NO_2, SO_2, and VOC (and resulting O_3 formation) generated by numerous processes as a result of the Slower, Longer Project Alternative, including combustion emissions from diesel engines and burning propane, fuel oil, or coal in various process equipment. These impacts would be less than under the Proposed Action.

3.7 <u>Visual Resources</u>

3.7.1 Regulatory Framework

Scenic quality is a measure of the visual appeal of a parcel of land. Section 102(a)(8) of FLPMA placed an emphasis on the protection of the quality of scenic resources on public lands. Section 101(b) of the NEPA of 1969 required that measures be taken to ensure that aesthetically pleasing surroundings be retained for all Americans.

To ensure that these objectives are met, the BLM devised the VRM System. The VRM system provides a means to identify visual values, establish objectives for managing these values, and provide information to evaluate the visual effects of proposed projects. The inventory of visual values combines evaluations of scenic quality, sensitivity levels, and distance zones to establish visual resource inventory classes, which are "informational in nature and provide the basis for considering visual values in the land use planning process. They do not establish management direction and should not be used as a basis for constraining or limiting surface disturbing activities" (BLM 1986b).

VRM classes are typically assigned to public land units through the use of the visual resource inventory classes in the BLM's land use planning process. One of four VRM classes is assigned to each unit of public lands. The specific objectives of each VRM class are presented in Table 3.7-1.