

DECISION ANALYSIS

ASSURANCE OF EQUIVALENT PROTECTION TO PUBLIC HEALTH AND
ENVIRONMENT IN THE ABSENCE OF A COLORADO
RADIOACTIVE MATERIALS LICENSE

For

Valmont Butte Site
Valmont Butte Corporation
Boulder, Colorado

By

Colorado Department of Public Health and Environment
Hazardous Materials and Waste Management Division



Colorado Department
of Public Health
and Environment

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Table of Contents

I.	INTRODUCTION	1
II.	SITE HISTORY	1
	A. Location and Settings	1
	B. History and Current Status	2
	C. Reclamation	3
	D. Future Plans	3
III.	DEPARTMENT AUTHORITY FOR ACTION TO TERMINATE THE LICENSE	3
IV.	ASSURANCE OF EQUIVALENT PROTECTION TO PUBLIC HEALTH AND ENVIRONMENT IN THE ABSENCE OF A COLORADO RADIOACTIVE MATERIALS LICENSE	4
	A. Hendricks Mining Company, CRML 329-01	4
	B. Agreements and Declaration of Covenants	4
	C. EPA Ecology and Environment Field Investigation Team Drilling Activity at the Hendricks Mill Site, April 30, 1985	4
	D. Potential for Ground Water Contamination from Fluorspar Tailings	4
	E. Valmont Butte Corporation Environmental Report	5
	F. Surface Gamma Radiation Survey	5
	G. RESRAD Modeling of Residual Radioactive Material	6
V.	CONCLUSIONS	7
VI.	APPENDICES	8
	A. Selected References	9
	B. Figures	10
	Figure 1 - Site Map	11

I. INTRODUCTION

Past milling operations at the Valmont Butte site to produce acid grade fluorspar from ores, generated tailings with increased concentrations of naturally occurring radioactive material (NORM) as a waste material. The former owner of the Valmont Butte property, Allied Chemical Corporation, was issued a Colorado Radioactive Materials License (CRML) to segregate and store fluorspar tailings and contaminated soil on the premises. In 1977, the mill and property were sold to Tusco Corporation. The Allied license was terminated in April 1977, and Hendricks Mining Company, a lessee of Tusco, was granted a CRML to continue storage of the fluorspar tailings. The Hendricks operations produced additional tailings, but this material contained no increased concentrations of NORM. The Hendricks license expired in 1980 and was not renewed either by Hendricks or Tusco. In June 1994, Valmont Butte Corporation purchased the site from Tusco for possible resale or development. The Corporation requested that the Colorado Department of Public Health and Environment (Department) review all information related to the former Allied tailings pile and determine if a license for continued storage was necessary, and if not, what administrative action was needed to fully close out the Hendricks license. Valmont Butte Corporation developed a remediation plan and submitted a request to the Department to have the Hendricks license terminated.

The Valmont Butte remediation plan includes covering the contaminated tailings with clean fill and attaching covenants to the property, providing full disclosure of site conditions and prohibiting activities that might result in unacceptable exposure to the public. Under this plan, Valmont Butte Corporation proposes that the Hendricks license be officially terminated, and that covenants be attached to the property, which will provide assurance of equivalent protection of the public and the environment in the absence of a CRML.

It is the purpose of this decision analysis to document the effectiveness of the accomplished remediation and covenants in reducing and preventing potential exposure of the public to the tailings and contaminated soil stored on site, now and in the future, and to justify termination of the expired Hendricks CRML.

II. SITE HISTORY

A. Location and Settings

Location. The Valmont Butte site is located in Boulder County, Colorado, at 3000 North 63rd Street, about four miles east of the central Boulder business district. The site is bordered by Valmont Road on the north and 63rd Street to the west. To the north is located the small town of Valmont, with approximately 15-20 single family homes. Homes are also found along Valmont Road and along 63rd Street.

The site is approximately 105 acres, with the mill and associated buildings constituting approximately 8 acres and the covered impounded tailings, approximately 14 acres (see Site Map, Figure 1, Appendix B). The remaining 83 acres were not associated with the mill or its related operations.

The feature of concern at this site is a tailings disposal area of about 14 acres, which received, among other wastes, NORM, containing uranium and its radioactive decay products resulting from the fluorspar recovery operations at the mill, and contaminated soil containing above-background concentrations of radium-226 from the cleanup of an offsite radium processing facility in the city of Boulder.

The site is currently zoned "Existing General Industrial" which allows for a number of commercial uses on the property.

Environmental and Geologic Setting. The major geologic feature associated with the property is the Valmont dike, a volcanic dike running east-west on the north side of the site. The dike is approximately 100 feet above the surrounding countryside and is about a mile in length. The property is underlain by the Pierre Shale, a rock unit over 4000 feet thick in the area. The shale outcrops against the dike on the north side of the property. The shale is a tight impervious unit and contains no ground water.

The mill and disposal cell are sited immediately south of the igneous dike that forms the Valmont Butte. The site slopes moderately to gently to the south along the western one-third and gently to the east on the eastern two-thirds of the tract.

The mill sits on high ground to the northwest of the tailings impoundment on a slope supported by the Valmont Dike. The tailings impoundment is in a natural trough down slope and to the east of the mill, with an earthen dam across the eastern margin of the cell to effect isolation and containment of the tailings and contaminated soil.

B. History and Current Status

History. A 100 ton per day flotation mill was constructed on site in the 1940s by Allied Chemical Corporation to process fluoride ore from the Jamestown Mining District to produce acid grade fluorspar. The milling process consisted of crushing the rock to powder and mixing the powder with flotation reagents to liberate the fluorspar. Product collected from the flotation process was dried and shipped off site for sale. Tailings from the operation, amounting to about 40,000 cu. yd., were deposited into a 17-acre tailings pond in the center of the property. The Jamestown fluoride ore contained small amounts of NORM, which remained with the tailings when the ore was processed. Radium-226 concentration in the tailings was estimated, based on sample analysis, as 100 pCi/g, maximum and 54 pCi/g, average. Allied was issued a CRML from the State to segregate and store the NORM-containing tailings on site.

The Allied license was amended in 1971 to authorize acceptance of contaminated soil from a former radium processing mill site in Boulder, Colorado. Approximately 1500 cu. yd. of soil, with an estimated maximum concentration of 1000 pCi/g and an average concentration of 80 pCi/g was buried in the Allied tailings pile.

Allied continued its fluorspar operations through the early part of 1974, when the Jamestown mine was permanently closed.

In 1977, Tusco Corporation purchased the property from Allied. Hendricks Mining Company leased the mill and property from Tusco to mill gold and silver ores. Hendricks obtained a CRML from the State in 1977 to continue storage of the Allied fluorspar tailings, but was not licensed to process any additional NORM-containing material. During the period 1977-1985, Hendricks processed gold ores from the Caribou and Cross mines west of Nederland, Colorado, through the mill. Tailings from the gold and silver ore consisted mainly of silica sand with no significant amounts of NORM. These tailings were used to cover the Allied pond area and contaminated soils from Boulder with 2-4 ft of cover.

Hendricks continued gold-processing operations until 1985, when the mill was closed. The mill has been out of service since. The Hendricks radioactive material storage license expired in April 1980, and was not renewed either by Hendricks or the owner, Tusco. The Hendricks license was never officially terminated.

In June 1994, Valmont Butte Corporation purchased the site from Tusco as an investment for possible resale or development. Valmont Butte Corporation proposed to remediate the site by leaving the contaminated tailings in place, covering them with additional clean fill and attaching covenants to the property, providing full disclosure of site conditions and prohibiting activities that might disperse contaminants. Under this proposal, the Hendricks license would be officially terminated, and covenants on the property would provide assurance of equivalent protection of the public and the environment in the absence of a CRML.

C. Reclamation

The NORM-containing Allied impounded tailings (primary tailings pond) received the first cover consisting of 2-4 ft. of uncontaminated tailings from the Hendricks operation during 1977-1984. Upon completion of the Hendricks operation in 1985, Tosco placed a 1-2 ft. cap of clean fill dirt, from a hillside on the southern boundary of the property, over the tailings area, and reseeded the area with native vegetation. Since the purchase of the property in 1994, Valmont Butte Corporation has continued to add clean fill to the tailings so that at the present time, a total of approximately 8-14 ft. thick layer of inert material exists over the center of the tailings pile which diminishes to a 3-4 ft. thick layer at the outer edges of the tailings pile.

In addition, an approximate 1-2 ft. thick layer of tailings from the Allied operations and the Hendricks Operation, which was deposited in an overflow secondary tailings pond, is currently capped and stabilized by an approximately 2-4 ft. thick layer of inert clean fill.

On May 9, 1996, and June 20, 1996, inspectors from the Department visited the site to gather information regarding potential sources of radiation exposure at the site and to assess the potential for ground water contamination from the covered tailings. Surface gamma radiation exposure measurements were made by the inspectors over selected areas of the tailings, over the old tailings transfer ditch line, and building and equipment surfaces of the mill. Uncorrected surface soil readings, at scattered spots ranged from 40-100 $\mu\text{R/hr}$ (exposure rate in micro roentgens per hour) with most readings between 40-80 $\mu\text{R/hr}$. Background was measured at 20 $\mu\text{R/hr}$. Subsequently, cleanup measures were taken by the owners to excavate the soils where elevated readings were found, and to place and bury the contaminated material in the tailings pond area. In addition, clean fill was placed in the excavated areas. Additional information on surface gamma radiation surveys at the site and the potential for ground water contamination from the tailings is presented in Section III, following.

D. Future Plans

In June 1994, Valmont Butte Corporation purchased the Tusco property for possible resale or development. Possible future activities include selling all usable mill equipment, but there is no immediate plan to remove any of the existing buildings at the site.

III. DEPARTMENT AUTHORITY FOR ACTION TO TERMINATE THE LICENSE

Statutory authority to issue radioactive materials licenses, and the implicit authority to terminate such licenses, is found at *Colorado Revised Statutes* (C.R.S.) § 25-11-103 and 104. Regulatory authority to terminate licenses is found at the *Colorado Rules and Regulations Pertaining to Radiation Control* (6 CCR 1007-1, RH § 3.16.7). For the reasons described in Section IV of this report, the Department finds that Valmont Butte Corporation has met the applicable requirements necessary for license termination.

Moreover, 6 CCR 1007-1, RH § 1.51 authorizes the Department to grant exceptions from the requirements of these regulations as long as such exceptions are not contrary to law, and will not result in undue hazard to public health and safety or property. "

This exemption is compatible with the Nuclear Regulatory Commission (NRC) regulations, 10 C.F.R. 61.6, and the State of Colorado's radiation control program must be compatible with NRC's, 42 U.S.C. § 2021. NRC has interpreted the 'authorized by law' provision of its regulations to mean an exemption is authorized by law if it is not otherwise prohibited, 60 F.R. 6570-6573. The Department finds that the Agreement and Declaration of Covenants are not prohibited and, as described below, the Declaration of Covenants, along with site conditions described herein, are sufficiently equivalent to accomplish the purposes of a license. Termination of the license, therefore, will not present an undue hazard to the public health and safety or property and, to the extent necessary, the Department grants Valmont Butte Corporation an exception from the requirements of a license.

IV. ASSURANCE OF EQUIVALENT PROTECTION TO PUBLIC HEALTH AND ENVIRONMENT IN THE ABSENCE OF A COLORADO RADIOACTIVE MATERIALS LICENSE

The following documents have been reviewed by the Department as part of the analysis to determine the adequacy of the completed remediation and the covenants attached to the property, in protecting public health and environment in the absence of a radioactive materials storage license.

- A. Hendricks Mining Company, CRML 329-01. This radioactive materials license was issued to Hendricks Mining Company, April 4, 1977, for storage only of fluorspar mill tailings and contaminated soil. The license expired April 30, 1980. The license was not renewed and was not terminated.
- B. Agreements and Declaration of Covenants. The Valmont Butte Corporation and the Lincoln Trust Company, FBO William G. Smith, (collectively, landowners) and the State of Colorado (acting by and through the Department) have entered into an agreement and declaration of covenants as a legal document to be executed and delivered as an instrument for recording against the title to the property. In the agreement and declaration of covenants, the landowners covenant that no habitable structure will be constructed within the tailings ponds, that any structure constructed within the Valmont Butte Corporation property will be in compliance with current radon guidelines, that tailings ponds improvement, surface changes and permitted disturbances shall be subject to stated conditions and requirements, and improvements or alterations to, or removal of, existing ore mill building and improvements shall not commence without notifying the Department. The covenants are perpetual, run with the property, and are binding on the owners and their successors.
- C. EPA Ecology and Environment Field Investigation Team Drilling Activity at the Hendricks Mill Site, April 30, 1985. In February 1985, the EPA team drilled two boreholes at the site both upgradient and downgradient from the tailings pond. The purpose was to determine whether there was ground water contamination at the site as a result of leaching of tailings. The program was designed to identify the presence of ground water in the near surface material, and if ground water was present, to characterize the water quality. The downgradient bore was located within 200 feet of the toe of the tailings dam. Both boreholes extended 35 feet through the topsoil and overburden and 5 feet into the competent Pierre Shale. The team found no ground water and reasoned that there was no justifiable expectation of finding water at a greater depth. The absence of ground water provided evidence that the recharge to the basin was negligible and that evaporation from the ponds in existence at that time exceeded infiltration. EPA made a decision not to install monitoring wells at the site based on the fact that the formation was not saturated, and therefore, there was no apparent potential for contaminant movement via the ground water route.
- D. Potential for Ground Water Contamination from Fluorspar Tailings. Jeffrey L. Hynes, Colorado Geological Survey, evaluated the general and engineering geology of the Valmont Butte site and submitted a report to the Department June 8, 1999. The report concludes that the radioactive materials associated with the Valmont Butte site do not constitute a threat to ground water in the area and that maintenance of the surface cover and contouring at the site will effectively mitigate any potential for adverse surface water impacts.

The tailings impoundment, at the time of the report, was saturated due to the capture of surface runoff and incident precipitation. Additional fill and regrading was performed on the cell since this report, and with revegetation to promote evapotranspiration of the underlying material, should cause any perched water in the disposal cell to dry out over time. This would eliminate the hydraulic drive necessary to move any possible source of mobile tailings or leachate.

The report concludes that there are small amounts of contaminated material outside the footprint of the disposal cell material south of the Valmont Dike and in the proximity of the mill and railroad spur on the north side of the Valmont Dike. These areas and subsequent cleanup are discussed in more detail in a subsequent surface gamma radiation survey report (see Item F following).

- E. Valmont Butte Corporation Environmental Report. Tim Smith, Valmont Butte Corporation, submitted an Environmental Report (ER) on Valmont Butte site, to the Department, October 10, 1996. This was followed by a supplement to add information on the tailings material, November 8, 1996.

The ER characterizes the operational history of the mill facility and the tailings and projects future site activities (no mill use is foreseen). The report describes surrounding properties and landmarks, land use and population distribution. Included in the environmental characterization are a description of the geological features at the site, a statement on ecology, an analysis of the hydrology (both surface and ground water) and seismicity potential.

- F. Surface Gamma Radiation Survey. Paul Oliver, from the Grand Junction office of the Department, evaluated the effectiveness of site cleanup of surface contamination at Valmont Butte in a report of July 27, 1999, and supplement, August 2, 1999. On four occasions, two in 1998 and two in 1999, the Department conducted surface gamma surveys at the site. Surveys were made using a gamma scintillometer meter along lines of an established grid system that covered the site.

In all, 14 general areas were identified as requiring remedial action. Radioactive contamination was due to scattered wind blown tailings from previous Allied Chemical Corporation fluorspar milling operations. After each visit, recommendations for further cleanup were made to the current property owner, which were subsequently acted on.

Background surface gamma radiation one-half mile from the site was measured at 15-18 $\mu\text{R/hr}$. The criterion used for cleanup was a Department-approved gamma reading of 30 $\mu\text{R/hr}$ (uncorrected), about twice that of background. No statistical correlation was established between exposure rate in $\mu\text{R/hr}$ and radium-226 concentrations in soils at the site, but the 30 $\mu\text{R/hr}$ cleanup criterion established at other sites was consistent with soils containing 5 pCi/g radium-226.

Cleanup consisted of relocating the windblown tailings and placing them under cover in the tailings impoundment or in some cases, covering them in place with 2-ft. or more clean fill. Wind blown tailings in certain small localized areas could not be effectively relocated because of topographic restrictions. These dispersed tailings are not currently capped. No remediation was done in the locations due to the steepness of the area or isolation due to topography. These areas are located in the hillside south of the Primary and Secondary tailings ponds, the hillside along the Valmont Butte north of the Primary tailings pond, a drainage on the northwest side of the site below the Valmont Butte and Valmont Road, and an area north of the wood shop and over the slope where an old slurry line from mill operations previously existed. The Department has determined that the areas represent low potential for exposure or environmental impact.

The final Department survey verified that all identified areas of contamination had either been remediated or were approved by the Department for no further action.

- G. RESRAD Modeling of Residual Radioactive Material. A computer code, termed RESRAD (residual radiation), was used to calculate the radiation dose to an on-site resident (a maximally exposed individual or member of a critical population group) resulting from residual radioactivity at the Valmont Butte site. RESRAD was originally developed by Argonne National Laboratory in support of the DOE's effort to establish residual radioactive material guidelines, and has been widely used to derive cleanup criteria and to conduct dose calculations. The RESRAD code is a multiple pathway analysis code using input parameters, including hydrogeological, meteorological, geochemical, geometrical (size, area, depth), media (soil, concrete) and residual radioactive concentration. The value of the RESRAD modeling of Valmont Butte is in demonstrating that remediation efforts at the site have resulted in residual radiation and calculated dose levels that meet all applicable cleanup standards. Four RESRAD calculations were made as discussed in the following paragraphs. Details of the RESRAD computer code can be found in other publications.

The NRC decommissioning standard of 10 CFR 20.1403 was used as comparison for the Valmont Butte site cleanup. This standard requires reasonable assurance that the Total Effective Dose Equivalent (TEDE) from residual radioactivity distinguishable from background to the average member of a critical group will not exceed 25 mrem per year. According to this standard, evaluation of radon-222 and its short-lived progeny is not expected for comparison with the decommissioning standard.

RESRAD modeling considered four scenarios and calculated the potential total estimated dose in each scenario. These included both residential and industrial/commercial scenarios in the tailings pond area, and both residential and industrial/commercial scenarios in the windblown contaminated areas. The difference between the residential and industrial/commercial scenarios is in the pathways used for calculation and in the basic radiation dose standard applied. All pathways were used in the residential scenario (with the exception of radon). Specifically, the pathways used included external gamma, inhalation (without radon), plant ingestion, meat ingestion, milk ingestion, aquatic foods, drinking water and soil ingestion. Food ingestion pathways were excluded in the industrial/commercial scenario. Information on the site specific parameters used and a summary of calculated dose for each scenario are appended to this Decision Analysis. Texts with printouts from the modeling can be found in the reference: RESRAD Version 5.82 Modeling of Residual Radioactive Material, August 5, 1999.

Residential Scenario - Tailings Pond

Based on samples taken of the tailings when the fluorspar milling was in operation, the tailings contamination was assumed to be 50 pCi/g radium-226 in equilibrium with lead-210, thorium-230 uranium-234 and uranium-238 and their short half-life progeny. The area is 17 acres and the soil cover over the tailings is 2 meters (6.5 ft).

The results show a dose of 4.8×10^{-9} mrem/yr to a resident now and maximum dose of 0.0012 mrem/yr at 1000 years. This compares with a basic dose limit of 100 mrem/yr taken from the NRC 10 CFR 20.1403 decommissioning standard for restricted use. According to this standard, sites using site restrictions, such as institutional controls to meet the 25 mrem/yr standard should meet the 100 mrem/yr standard when it is postulated that these restrictions are not in place. The industrial/commercial zoning and the Agreement and Declaration of Covenants provide for restricted use of the Valmont Butte site. The residential scenario is modeled to estimate potential radiation dose to the public should the restrictions not be in place.

Industrial/Commercial Scenario - Tailings Pond

As with the residential scenario, the tailings contamination was assumed to be 50 pCi/g radium-226 in equilibrium with lead-210, thorium-230 uranium-234 and uranium-238 and their short half-life progeny. The area is 17 acres, and the soil cover over the tailings is 2 meters (6.5 ft).

The results show a dose of 2.6×10^{-2} mrem/yr to a resident now and maximum dose of 6.4×10^{-2} mrem/yr at 1000 years. This compares with a basic dose limit of 25 mrem/yr taken from the NRC 10 CFR 20.1403 decommissioning standard for restricted use. According to this standard, sites may use site restrictions, such as institutional controls, to meet the standard. The industrial/commercial zoning and the Agreement and Declaration of Covenants provide for restricted use of the Valmont Butte site.

Residential Scenario - Windblown Area

The soils concentration was based on analysis of radium-226 and uranium in a soil sample taken from a windblown area on site. Field survey meter readings at the location were 35-40 μ R/hr. Analysis (total less background) indicated a net concentration of 5.7 pCi/g radium-226, which was rounded up to 6 pCi/g. The net uranium concentration was 10.2 pCi/g, or about 5.1 pCi/g each for uranium-238 and uranium-234. These measured net concentrations were also rounded up to 6 pCi/g to estimate the isotopic concentrations for the windblown contamination. Lead-210, thorium-230, uranium-234 and uranium-238 and their short half-life progeny were all assumed to be in equilibrium. The windblown area is 18 acres, and the contaminated soil thickness was estimated at 15 cm or about 6 inches.

The results show a dose of 51 mrem/yr to a resident now, which is the annual maximum dose up to 200 years. In 200 years the contaminated layer is assumed to have eroded away. The same 100 mrem/yr basic radiation dose limit, taken from the NRC 10 CFR 20.1403 decommissioning standard for restricted use, applies. According to this standard, sites using site restrictions, such as institutional controls to meet the 25 mrem/yr standard, when it is postulated that these restrictions are not in place, should meet the 100 mrem/yr standard when the restrictions are in place. The industrial/commercial zoning and the Agreement and Declaration of Covenants provide for restricted use of the Valmont Butte site. The residential scenario is modeled to estimate potential radiation dose to the public should the restrictions not be in place.

Industrial/Commercial Scenario - Windblown Area

As with the residential scenario, the windblown soil contamination was assumed to be 6 pCi/g radium-226 in equilibrium with lead-210, thorium-230, uranium-234 and uranium-238 and their short half-life progeny. The windblown area is 18 acres and the contaminated soil thickness was estimated at 15 cm or about 6 inches.

The results show a dose of 20 mrem/yr to a resident now, which is the annual maximum dose up to 200 years. In 200 years the contaminated layer is assumed to have eroded away. This compares with a basic dose limit of 25 mrem/yr taken from the NRC 10 CFR 20.1403 decommissioning standard for restricted use. According to this standard, sites may use site restrictions, such as institutional controls, to meet the standard. The industrial/commercial zoning and the Agreement and Declaration of Covenants provide for restricted use of the Valmont Butte site.

V. CONCLUSIONS

The Environmental Report and Supplement, submitted by Valmont Butte Corporation, was reviewed by the Department and by Jeffrey L. Hynes, Colorado Geological Survey, with respect to the current geological, hydrological and geohydrological conditions at the site, and concluded that there are no off-site impacts to ground water or surface water from the cell containing radioactive soil and tailings.

A file review by Jeffrey L. Hynes, Colorado Geological Survey, of the potential for ground water contamination from the fluorspar tailings again concluded that the radioactive materials associated with the Valmont Butte site do not constitute a threat to ground water in the area, and that maintenance of surface cover and contouring at the site will effectively mitigate any potential for adverse water impacts.

The Department evaluated the effectiveness of site cleanup of radioactive soil and tailings by conducting verification surface gamma radiation surveys, and concluded that all identified areas of contamination had either been remediated or were approved for no further action.

RESRAD computer modeling of radiation dose to an on-site resident resulting from residual radioactivity at the Valmont Butte site, including both residential and industrial/commercial scenarios in the tailings pond and windblown contaminated areas, demonstrated that a resident would receive less than the NRC basic dose limit for restricted use when institutional controls are in place, of 25 mrem/yr. The industrial/commercial zoning and the Agreement and Declaration of Covenants provide for restricted use of the Valmont Butte site.

It is the determination of the Department that the Agreement and Declaration of Covenants, as an institutional control, together with the remedial actions performed at the site, are protective of public health and environment.

The covenants are perpetual, run with the property, and are binding on the owners and their successors. With these covenants and restrictions in place, the Department finds that equal protection of public health and safety or property is assured in the absence of a radioactive material license.

Therefore, the Colorado Radioactive Materials License, No. 329-01, issued to Hendricks Mining Company for storage only of fluorspar mill tailings and contaminated soil, should be terminated.

VII. APPENDICES

A. Selected References

B. Figures

Figure 1 - Site Map

APPENDIX A

Selected References

Agreement and Declaration of Covenants, between Valmont Butte Corporation, Lincoln Trust Company and the Colorado Department of Public Health and Environment, October 6, 1999.

Colorado Department of Natural Resources, memo from Jeffrey L. Hynes, Colorado Geological Survey, to Nancy M. Daugherty, CDPHE, on the review of the Valmont Butte Corporation, Environmental Report and Supplement on the Allied Chemical Mill, October 16, 1996.

Colorado Department of Natural Resources, memo from Jeffrey L. Hynes, Colorado Geological Survey, to Nancy M. Daugherty, CDPHE, on the potential for ground water contamination from residual fluorspar tailings and ore at the Valmont Butte Site, June 8, 1999.

Colorado Department of Public Health and Environment, Site Visits.

Site Visit - May 8, 1996

Report - May 9, 1996

Site Visit - June 20, 1996

Report - June 2, 1996

Colorado Department of Public Health and Environment, Technical Evaluation of Surface Gamma Radiation Survey, report by Paul Oliver, July 27, 1999, and Supplement Memo, August 2, 1999.

Colorado, *Rules and Regulation Pertaining to Radiation Control, 6 Colorado Code of Regulations 1007-1* (Regulations).

Colorado Radioactive Materials License No. 329-01, Hendricks Mining Company, issued April 4, 1977, expired April 30, 1980.

EPA, letter from David Schaller to Dick Gamewell, CDPHE, concerning the EPA Field Investigation Team drilling activities at the Hendricks Mill Site, April 30, 1985.

RESRAD Version 5.82 Modeling of Residual Radioactive Material, August 5, 1999.

Site Specific RESRAD Input Parameters and Summary Output for:

Residential Scenario - Tailings Pond

Industrial/Commercial Scenario - Tailings Pond

Residential Scenario - Windblown Area

Industrial/Commercial Scenario - Windblown Area

Valmont Butte Corporation, Environmental Report on the Allied Chemical Mill, October 10, 1996, and Supplement, November 8, 1996.

APPENDIX B

Figures

SITE MAP
VALMONT BUTTE CORPORATION SITE
BOULDER COUNTY, COLORADO

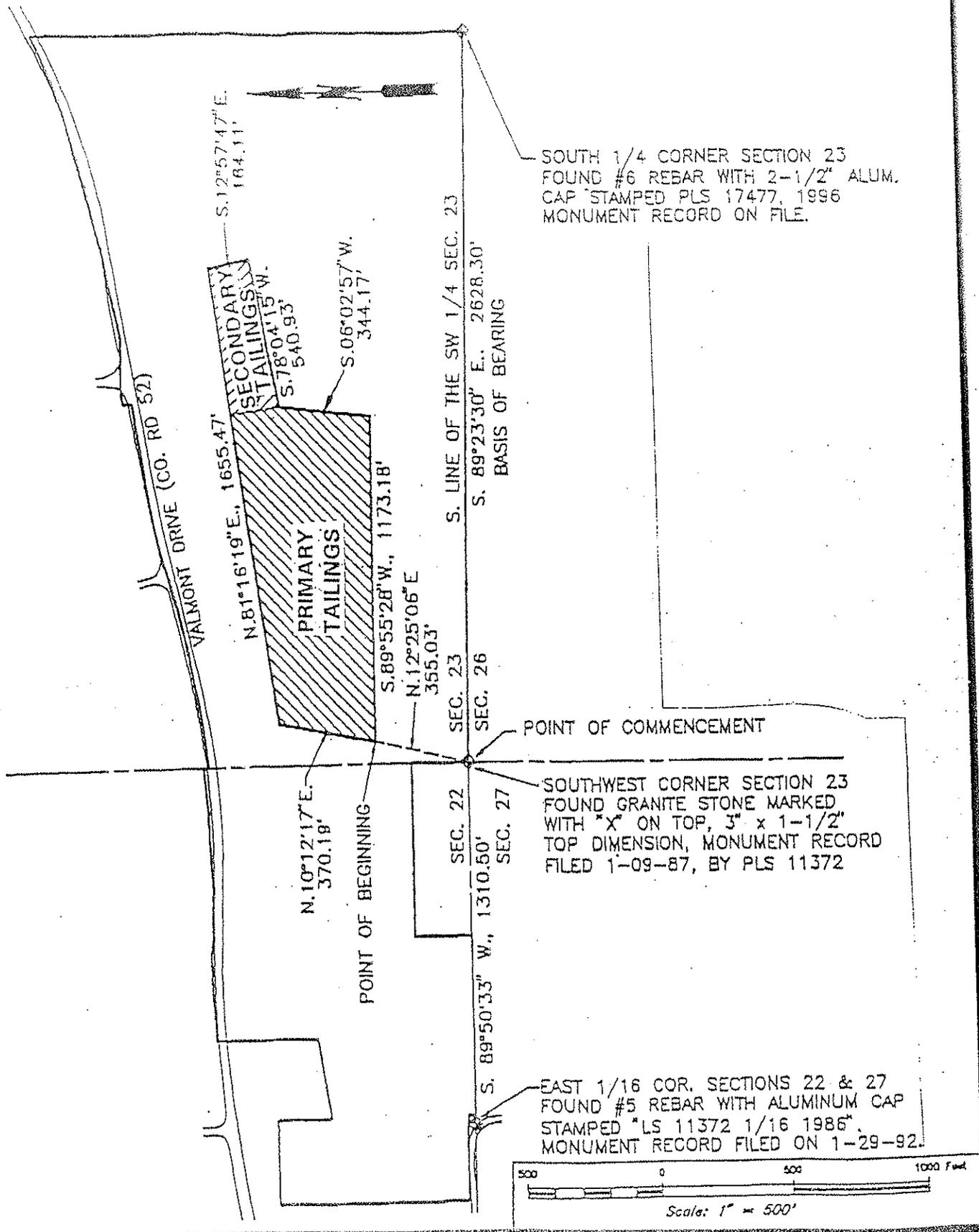


Figure 1