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Corporate Manager
Reclamation

ENVIRONMENTAL, HEALTH, SAFETY
AND GOVERNMENT AFFAIRS

December 11, 2001

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U.S. Nuclear Regulatory Commission
Fuel Cycle Licensing Branch, NMSS
Mail Stop T-8A33
Two White Flint North
11545 Rockville Pike
Rockville, MD 20852

Attn: Mr. Melvyn N. Leach, Branch Chief

Re: Docket No. 40-8903
License No. SUA-1471
2001 Annual ALARA Audit

Dear Mr. Leach:

Homestake Mining Company of California (HMC) is pleased to submit, as per license condition 32C of License SUA-1471, the 2001 Annual ALARA Audit Report.

The audit was conducted on December 5, and the report finalized on December 11. Activities at the site during this report period have been limited to normal operation of the ground-water restoration program and routine maintenance of top of the large tailings pile.

If you have any additional questions regarding this report, please contact me at the Grants site, 505-287-4456. Thank you.

Sincerely,

Enclosure

Cc: Mr. Ken Hooks, NRC Project Manager
Mr. Blair Spitzberg, NRC Arlington, TX
Mr. Harold F. Barnes, HMC SF0 w/o report
Mr. Dean Williams, HMC SF0 w/report

HOMESTAKE MINING COMPANY
P.O. BOX 98 · GRANTS, NM 87020-0011

NMSSOIPublic

Annual ALARA Audit

December 5, 2001

**Grants Operations
Homestake Mining Company
P. O. Box 98
Grants, New Mexico 87020**

Prepared by:

**Kenneth R. Baker, Ph. D.
Environmental Restoration Group, Inc.
12809 Arroyo de Vista NE
Albuquerque, NM 87111**

1.0 Introduction

On December 5, 2000, Kenneth R. Baker, consultant to Homestake Mining Company (HMC), conducted the 2001 Annual ALARA Audit for the Grants Uranium Mill site. The audit was conducted in accordance with the United States Nuclear Regulatory Commission (NRC) Regulatory Guide 8.31, "Information Relevant to Ensuring That Occupational Exposure At Uranium Mills Will Be As Low As Reasonably Achievable."

The following topics were covered in the audit:

- Follow up on prior ALARA audit
- ALARA policy
- Radiation exposures
- Bioassay results
- Self audits
- ALARA planning activities
- Worker training
- Radiation safety meetings
- Radiation surveys
- Overexposures
- Health physics staff
- Procedures, Data Collection, and Management

All mill buildings have been removed and the off-pile tailings cleanup was completed in 1995. The side slopes of the main tailings pile and the mill yard area have a permanent radon barrier and an erosion protection cover. An interim cover is being maintained on the top of the large tailings pile and that portion of the small tailings pile that is not covered by the evaporation pond.

Activities at the site during 2001 include the operation of a reverse osmosis (RO) unit that supports the groundwater restoration program, dewatering the large tailings pile, some additional well drilling, and maintaining the groundwater restoration system. The groundwater restoration consists of the pumping the groundwater collection wells, operating the evaporation ponds, injecting clean water into the contaminated aquifer, and operating the RO plant. The RO treatment capacity is currently being expanded and will be completed in early 2002.

The primary potential radiation exposure results from maintaining the pumps, valves, and piping associated with the tailings dewatering and groundwater collection systems.

2. Discussion

The audit process involved scoping the audit, gathering relevant information, review of information, interviewing appropriate personnel, and writing the report. The reviews are briefly summarized below.

2.1 Follow-up on Previous Audit Recommendations

The last ALARA audit was conducted on June 26, 2000, 1999. No recommendations were made.

2.2 ALARA Policy

The corporate ALARA policy statement is included in Standard Operating Procedure HP-6. This policy has been implemented as evidenced by the incorporation of ALARA in discussions in worker training and radiation work permits.

2.3 Radiation Exposures

2.3.1 External Exposures

Dosimetry data for the fourth quarter 2000 and first three quarters 2001 were reviewed. A total of 23 badges were issued during the period. The maximum quarterly dose equivalent was reported as 22 mrem. The maximum year-to-date dose equivalent for the CY 2001 was reported as 39 mrem. Homestake changed dosimetry vendors in late 2000. The results from the new badges indicate higher precision than the Eberline badges that were previously use. Thus, more positive results were reported compared to previous periods. No lost badges were reported. Annual exposure reports for CY2000 were sent to all employees on February 22, 2000.

These low exposures reflect the effort that management and the workers have expended in maintaining exposures ALARA as well as the low radiation work environment.

2.3.2 Internal Exposures from Long-Lived Particulate Sources

HMC does not routinely require airborne particulate monitoring since there are no exposed tailings. Invasive activities normally involve the use of water to suppress any dust that may be generated. HMC has a "spot check program" where the most exposed individual working under an RWP will be monitored for a day, normally one per month. Occasionally, a personal air sampler will be placed on the most exposed individual. There were three RWPs issued in 2001 but no air samples were taken.

A review of the records for 1998-2000 indicates that eight air samples were taken for work done within the controlled areas on top of the pile. The average gross alpha concentration for the samples is $6.5E-13$ $\mu\text{Ci/ml}$ with a range of $0-1.34E-12$ $\mu\text{Ci/ml}$. Using the DAC for uranium of $2E-11$ $\mu\text{Ci/ml}$, the average and maximum concentrations represent 3 percent and 7 percent of the DAC. This data suggests that the intake of radionuclides would be 3 percent of an ALI for full-time workers. This is considered conservative since the DAC for Ra-226 is $3E-10$ $\mu\text{Ci/ml}$ and may better represent tailings than uranium. Also since these workers work only a fraction of the year, the percent of the ALI would be reduced further, probably by a factor of 2 or more. The NRC requires

that a worker be monitored for internal exposure (10 CFR Part 20, §20.1502(b)) if it is likely that the worker will receive 10 percent of the applicable ALI. This auditor believes that it is highly unlikely that these workers (drillers) in the controlled area receive ten percent of the ALI in a year, probably on the order of one percent of the ALI.

Spot check data exists for a worker who spends approximately 50 percent of his time on top of the tailings pile doing routine maintenance outside the controlled area. Data for 1998-2000 show that 8 air samples were taken during this period with an average and maximum gross alpha concentration of $3.5E-13$ $\mu\text{Ci}/\text{ml}$ and $1.34E-12$ $\mu\text{Ci}/\text{ml}$. This represents 2 percent and 7 percent of the DAC. Since he worked approximately 50 percent of the time on the pile, the data would indicate that his annual intake was approximately 1 percent of the ALI.

Recommendation: While the existing data suggest that workers are exposed to very low levels of airborne particulate, periodic air samples should be taken to document the gross alpha air concentrations in controlled areas while working on top of the pile.

2.3.2 Internal Exposure from Radon

The radon concentrations on the site perimeter near the tailings pile indicate near-background levels. However, the RO building presents a source of concern for radon exposure. Worker occupancy is normally limited to one hour per day, seven days per week unless construction work is underway in which the building is occupied during the daytime for approximately 40 hours per week. Three workers share the responsibility of routine plant operations.

A track-etch detector is placed in the RO building and changed out every six months. The average radon concentrations in the building for 2000 and the first six months of 2001 were measured to be 23 pCi/l and 47 pCi/l, respectively. Grab sample WL measurements were made during the daytime on June 10, 1999 and October 5, 1999 with the results being 0.002 WL and 0.012 WL, respectively. Another WL measurement of 0.1 WL was made on May 19, 2000 in the building while doors were closed and the unit operating. HMC took action to require that upon entering the building in the morning, the doors are opened to provide ventilation and the ventilation fan operated for at least 10 minutes prior to entering. No measurements have been made during the daytime to assess the effectiveness of the procedure.

The DAC for Rn-222 with daughters present is 30 pCi/l (ALI = 100 μCi). If one assumes that an employee works in the building for one hour per day for one-third of the days of the year ($365/3=122$ hours) in an environment equal to the average radon concentration of 47 pCi/l ($4.7E-8$ $\mu\text{Ci}/\text{ml}$), the radon intake is equal to $4.7E-8 \mu\text{Ci}/\text{ml} * 122 \text{ h/year} * 60 \text{ min/h} * 2E4 \text{ ml/min} = 6.9 \mu\text{Ci}/\text{y}$, where $2E4$ ml/min is the breathing rate. This intake is seven percent of the ALI for radon and would not require monitoring under 10 CFR Part 20, §20.1502(b), providing this was his/her only source for internal exposure. This is considered a very conservative assessment in that the radon concentration at the time of exposure should be a small fraction of the average concentration. Data to document this assumption is needed.

Recommendation: Since no recent monitoring data exist on the indoor radon concentrations during working hours, radon concentration or working level measurements should be made on a regular frequency.

2.4 Bioassay Results

Procedures call for a semi-annual routine urine-sampling schedule for employees. This was done in January 2001 and May 2001. Contractor employees were sampled at the beginning and end of short-term projects. In addition, some HMC employees were sampled more frequently if they were involved in field activities.

Bioassay results are reflective of the uptake of radionuclides in the body. HMC's urine-sampling program was reviewed. Since January 2001, 45 routine samples and 8 spiked samples were analyzed. The vendor laboratory is required to have a lower limit of detection (LLD) of 5 $\mu\text{g/l}$ for uranium. Any measured value of 15 $\mu\text{g/l}$ must be investigated and appropriate mitigation measures taken. Persons with urine samples exceeding 35 $\mu\text{g/l}$ must be placed on work restrictions to limit further intakes of uranium. No workers submitted samples that measured above the LLD. The spiked samples were within the 30 percent tolerance limit.

The results for the bioassay program support the conclusion that the worker uptake of uranium is very low and probably insignificant. These results are also consistent with the perimeter air sample data.

2.5 Self Audits

The RPA requires that the technicians (Venable/Vigil) prepare a monthly ALARA report. The report consists of radiation protection data reflective of the operations as well as an accounting of the major activities for the month. Any problems encountered are also presented. After reviewing several of the reports, the auditor concluded that the reports provide the RPA with adequate detail to assure that exposures are being maintained ALARA. The RPA indicated that he reads and reviews the data presented in the reports. The RPA had initialed the reports, indicating that he or his designee had reviewed them.

2.6 ALARA Planning Activities

HMC conducts all invasive work (involving tailings) under a radiation work permit (RWP). The three RWPs issued in 2001 were evaluated and determined to be appropriate. Requirements in the RWP are explained to the workers in morning meetings. When contract laborers are used, spot checks are conducted to assure that the requirements are appropriate and being followed. These spot checks include frisking working personnel and equipment to determine the levels of contamination, performing exposure rate measurements in the work area, and possibly taking air samples. Monthly safety meetings are held where radiation protection problems are addressed. Since the levels of exposure have been demonstrated to be low, the ALARA planning activities are adequate.

Investigations of radiation exposures in the new RO building were made during pre-operations, startup, and continuing operations. The Radiation Protection Administrator

(RPA) was initially concerned about the potential for elevated radon working levels (WL) within the building and possibly buildup of scale in components, which could produce elevated direct radiation exposure. No evidence of scale buildup has been witnessed to date. However radon levels are elevated. The RPA revealed further plans to install a ventilation fan above the water overflow trench that will hopefully reduce the radon concentrations. The likely source of the radon is the water in the overflow trench that runs through the RO building.

Another ALARA activity is associated with assuring that adequate clean cover exists on top of the large tailings pile to control the tailings and also reduce gamma exposure rates to workers. For CY2000, the pile has been divided into 12 segments where a radiation survey was done at a rate of one segment per month. Additional clean cover was applied to areas exhibiting an exposure rate of greater than 15 $\mu\text{R/h}$ above background. In CY2001, approximately 50 percent of the cover was surveyed and additional cover material added as required. This work will continue in CY2002.

2.7 Worker Training

All radiation workers receive formal classroom radiation safety training. Workers must pass a written examination. Annual refresher training is required and generally is a repeat of the course material given initially. Kenneth Baker conducted the last annual training on December 6, 2001. The Radiation Protection Administrator (RPA) or Adrian Venable normally gives the contractor training. Use of videotapes developed for HMC by a consultant is incorporated into the contractor employee training.

2.8 Radiation Surveys

A review of the instrument maintenance and calibration records was made. All instruments in use had been calibrated. A calibration schedule is prepared for use in tracking calibrations. The records were found in good order.

Radiation surveys are conducted on all personnel and equipment leaving the radiation control area. This has been defined as the boundary of areas where invasive work is being done. Work area radiation levels are reported in the RWPs and the spot checks reports.

Clean area surveys are no longer required per license condition. While no surveys were conducted in CY2001, plans are to continue these surveys periodically. Prior years data show that the contamination is at near background levels.

A review of the release surveys was done. Procedures are being followed and all released items were within the release limits.

2.9 Health Physics Staff

The current health physics staff consists of:

Roy Cellan, Radiation Protection Administrator
Adrian Venable, Senior Health Physics Technician

Joe Vigil, Site Supervisor and Senior Environmental Technician

A review of the education and experience of the staff indicated that all meet or exceed the requirements of NRC Regulatory Guide 8.31 for working in uranium mills.

2.10 Overexposures

No personnel were overexposed to date during this audit period.

2.11 Procedures, Data Collection, and Management

The RPA reviewed all procedures in May 2001. A license condition requires this to be done at least annually. No procedures are currently under revision or preparation.

The staff data specialist, Mrs. Joyce Gleadle, maintains a schedule of required tasks which is used by the RPA in assuring that all scheduled work is completed. This is supplemented by an additional detailed plan for the groundwater restoration program, where well sampling frequencies and required analyses are listed for each well. There is evidence that management is using the schedule to prepare individual assignments. Sign-offs by technicians and the Site Supervisor are noted after completion of tasks.

3.0 Recommendations

The radiation protection program is effective in reducing exposures to as low as reasonably achievable. The staff is continuing to take additional measures to assure that the ALARA policy is implemented. This auditor, however, recommends that periodic air particulate samples be taken in areas requiring RWPs and periodic radon concentration or working level measurements be made in the RO building during occupancy periods. Existing data indicate that the exposures are very low but a greater effort is needed to document, on a regular basis, that these low exposures continue to exist.