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OFFICE OF INSPECTION AND ENFORCEMENT
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Report: 81-01 Mill Appraisal Program

Docket: 40-3453

License: SUA-917

Licensee: Atlas Corporation
Atlas Minerals Division
Moab, Utah 84532

Appraisal at: Office and Mill Facilities in Moab, Utah

Appraisal Conducted: May 11-15, 1981

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Inspection Summary

Appraisal on May 11-15, 1981 (Report 40-3453/81-01)

Areas Appraised: Announced appraisal of health and safety programs including organization, management and training; internal exposure control; external exposure and contamination control; facilities and equipment; tailings management; and environmental monitoring. The appraisal involved 160 appraiser-hours on-site by one NRC Radiation Specialist, one member of the NRC Uranium Recovery Licensing Branch, and two NRC contract health physicists.

Results: Several significant weaknesses in the mill health and safety program were identified. These weaknesses are in the areas of organization and management (Section 1), internal exposure and contamination control (Sections 2 and 3), facilities and equipment (Section 4), and environmental monitoring (Section 6). Seven apparent violations were identified: Failure to post an airborne radioactivity area per 10 CFR 20.203(d)(2), (Section 2); failure to implement engineering controls per 10 CFR 20.103(b)(1), (Section 2); failure to investigate and correct contamination levels per License Condition 25(c), (Section 3); failure to properly instrument stack scrubber per License Condition 46, (Section 4); failure to maintain sprinkler system in operable condition per License Condition 34, (Section 4); failure to adequately survey airborne radioactivity in the mill and at the site boundary per 10 CFR 20.201(b), (Sections 2 and 6); and failure to perform stack sampling isokinetically per License Condition 39, (Section 6).

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## SUMMARY

The mill appraisal was conducted during the period May 11-15, 1981, to evaluate the adequacy and effectiveness of the mill health and safety program. At the time of the appraisal, the Atlas mill was operating; however, a planned maintenance shutdown did occur during the day of May 13, 1981. Team members toured various areas of the mill complex during each day on site.

The appraisal team consisted of one inspector from the NRC Region IV office, one NRC staff member from the Uranium Recovery Licensing Branch, and two contractor personnel from Battelle Pacific Northwest Laboratories. The appraisal effort included observation of work practices, interviews with personnel, independent measurements, and review of selected procedures and records. The scope of the appraisal included:

A. Organization, Management and Training

B. Internal Exposure Control

C. External Exposure and Contamination Control

D. Facilities and Equipment

E. Tailings Management

F. Environmental Monitoring

Weaknesses in the mill health and safety program were identified in several areas. Items the appraisal team considered significant weaknesses are as follows:

1. The radiation protection function is not fully effective in implementing the mill radiation safety program due to the combination of the function with the metallurgy function and deficiencies in the training and qualifications of its staff members.

2. Licensee programs for airborne radioactivity sampling, worker exposure determination, respiratory protection, contamination control and bioassay were found to be weak as a result of insufficient management commitment to program development, implementation, and enforcement which has resulted in inadequate sampling procedures and analysis techniques, incomplete assessment of worker exposure, and failure to institute process controls in order to maintain exposures ALARA.

3. The appraisers found that certain mill facilities and equipment were not designed or used in a manner that would reduce effluents to the environment or maintain exposure to workers ALARA.

4. The appraisers found that the rationale for the environmental monitoring program had not been fully developed. Thermoluminescent dosimeters for direct radiation measurements were improperly utilized, and specified surface ponds were not sampled. A program for data trend analyses and laboratory quality assurance, including laboratory intercomparisons, had not been established.

Additional weaknesses which are considered important but less significant than the above findings are identified within the report.

In addition to the weaknesses described above, seven violations of NRC requirements were identified as follows:

1. Contrary to 10 CFR 20.103(b)(1), process or other engineering controls were not implemented to limit concentrations of radioactive materials in air to levels below those which delimit an airborne radioactivity area.

2. Contrary to 10 CFR 20.201(b), adequate surveys were not made to evaluate worker exposure to airborne uranium in accordance with 10 CFR 20.103(a) and to evaluate radioactivity in effluents released to unrestricted areas in accordance with 10 CFR 20.106(a).

3. Contrary to 10 CFR 20.203(d)(2), an airborne radioactivity area was not posted.

4. Contrary to License Condition 25(c), contamination levels within the mill which exceeded assigned limits were not investigated or promptly corrected.

5. Contrary to License Condition 34, portions of the fire sprinkler system in the solvent extraction area of the mill were not maintained in a fully operable condition.

6. Contrary to License Condition 39, the yellowcake drying and packaging stack had not been sampled isokinetically.

7. Contrary to License Condition 46, operational checks of the yellowcake stack were not performed to assure that manufacturer's recommended ranges of operation were maintained and that instrumentation alarms were functional.

## 1.0 Organization, Management and Training

Documents Reviewed

Atlas Radiation Safety Procedures and Drafted Revisions

### 1.1 Organization and Management

#### 1.1.1 Program

The mill organization in place at the time of the appraisal is depicted by the chart in Figure 1. The metallurgy organization is further detailed in Figure 2. The Chief Metallurgist functions as the Radiation Safety Officer (RSO) and reports administratively to the General Mill Manager. The General Mill Manager reports directly to the President of Atlas Minerals located at the mill site. A regulatory affairs officer position reporting to the president is currently vacant and a candidate is being sought.

The mill operates twenty-four hours per day, seven days per week, and shuts down for one day every two weeks for maintenance purposes. The mill employees 225 salaried and hourly workers including 28 on the evening shift and 26 on the early morning shift. A union election was held on March 5, 1981, which favored representation by the Cement, Lime, and Gypsum Workers Union (AFL-CIO); however, the election has been challenged by management and has not yet been certified by the NLRB.

The Chief Metallurgist stated that approximately half of his efforts deal directly with radiation protection activities and that the Senior Metallurgist acts for him in his absence. The radiation protection organization also includes one Radiation Technician and three Assistant Radiation Technicians. There are no formal position descriptions for the RSO and his subordinates. Radiation protection functions on back shifts are assumed by the Shift Foremen. Daily maintenance planning meetings are attended by maintenance and operations

FIGURE 1

MILL ORGANIZATION

GENERAL MILL MANAGER

- Executive Secretary

- Chief Purchasing Agent
  - Mill Purchasing Agent
    - Chief Warehouseman

- Chief Metallurgist
  - Senior Metallurgist
    - Metallurgist

- Maintenance Manager
  - Maintenance Superintendent
    - Maintenance General Foreman
      - Maintenance Foremen (4)
    - Yard Foreman
  - Special Projects Engineer
    - Special Projects Foreman
  - Plant Engineer
    - Planning Foreman
      - Coordinator
  - Safety Engineer

- Mill Superintendent
  - Acid Circuit General Foreman
    - Shift Foremen (4)
    - Crusher Foreman
  - Alkaline Circuit General Foreman
    - Shift Foremen (4)
    - Labor Foreman

## FIGURE 2

## RADIATION PROTECTION ORGANIZATION

CHIEF METALLURGIST

- Senior Metallurgist
    - Metallurgist
    - Metallurgical Technician
    - Sample Prep Technician
- Analysts (2)
- Control Technicians (2)
- Assistant Control Technicians (5)
- Lab Laborer

- Radiation Technician
- Assistant Radiation Technicians (2)
- Metallurgy Clerk and Assistant Radiation Technician

representatives. The RSO is invited to attend as necessary, especially when maintenance or modification work is planned in the yellowcake hearth, scrubber, or packaging areas. A work authorization program enables the RSO or his designate to review proposed maintenance tasks and to prescribe use of radiation protection equipment and techniques as necessary.

Responsibility for the mill fire protection program is not centralized under one individual but is best identified with the Maintenance Manager. Responsibility for radiation safety training of new employees rests with the Safety Engineer.

### 1.1.2 Appraisal

The appraisal team unanimously agreed that the overriding radiation safety program inadequacy is the general ineffectiveness of the radiation protection function. This finding is supported by the program weaknesses described in the remainder of this report. There is no formalized, documented assignment of authority and responsibility, nor is there apparent sufficient management commitment in order to implement the radiation protection program. The combination of metallurgy and radiation protection functions in one component appears to result in reduced management emphasis on radiation protection and a potential conflict of interest with operational functions. This latter consideration is based primarily on the metallurgy component responsibility for ore lot and product assay. Licensee representatives advanced their belief that the RSO is better apprised, by virtue of his metallurgical duties, of operational activities requiring radiation safety evaluation. The appraisal team agrees with this conclusion but submits that the forfeiture of independence from operational functions is too high a cost for this feature.

The work authorization program appeared to function effectively; however, the forms were frequently not signed or dated by the approving individual. Thus the identity and affiliation of the individual prescribing radiation protection criteria for a job was often unclear.

### 1.1.3 Conclusions

Based upon the above findings, improvements in the following areas are required to achieve an acceptable progam:

1. The effectiveness and independence of the radiation protection function should be improved by separating metallurgy and radiation protection functions and by outlining a management commitment to fully implement the radiation safety program.

2. Formal position descriptions should be established for the RSO and his subordinates to facilitate a clear assignment of authority and responsibilities within the radiation protection component.

3. The radiation safety component should have full responsibility for the worker radiation safety training program or otherwise continually review the training program for effectiveness.

4. Responsibility for the mill fire protection program should be documented and clearly identified under a single individual.

The work authorization program although acceptable should provide for the clear identification of the approving individual.

## 1.2 ALARA Program and Management Audits

### 1.2.1 Program

The licensee has no identifiable program exclusively for the purpose of maintaining radiation exposure to workers and the general public as low as reasonably achievable (ALARA). There are two audit routines. The first consists of a review and sign off on data sheets generated by the radiation protection (RP) unit. The sheets are signed by the RP technician, the RSO, and the General Mill Manager. The second is the routine for daily documented mill inspections by the mill foremen as required by License Condition 25(b). The licensee has also contracted with a consultant to perform a special assessment of the RP function. The appraiser reviewed the consultants report of the assessment performed on October 16-17, 1980.

### 1.2.2 Appraisal

The licensee has no policy statement or any other documented guidance, procedures or information pertaining to ALARA. Although a standard suggestion box system exists, it was deemed unsuitable for the prompt reporting of equipment malfunctions, procedure violations, or ALARA suggestions. The program for management review of data sheets without distillation or commentary by the RSO appeared to have limited usefulness. The results of the mill foremen inspections are documented daily by means of a check mark beside a listing of each area within the mill. The marks indicate the absence of radiation protection problems. The appraiser noted that these daily reports for the last 18 months recorded only check marks and contained no comments specifying that radiation protection problems had been observed. The appraiser assessed this program to be unproductive and found no other audit procedure which would render an evaluation of RP effectiveness.

1.2.3 Conclusions

Based upon the above findings, improvements in the following areas are required to achieve an acceptable program:

1. The licensee should fully develop an ALARA program for milling activities. The Draft Regulatory Guide (Task OH 941-4) entitled "Information Relevant to Ensuring that Occupational Radiation Exposures at Uranium Mills Will Be As Low As Is Reasonably Achievable" should be reviewed for guidance.

2. The licensee should implement a management audit program which includes mill management evaluations of the RP unit effectiveness and RP unit evaluations of the radiation safety aspects of mill activities. The previously noted draft Regulatory Guide should be reviewed for guidance.

1.3 Procedures

1.3.1 Program

A manual of radiation protection procedures has been established. Also operating procedures have been established for routine operational activities within the mill. The RSO reviews operating procedures for proper consideration of radiation safety practices.

1.3.2 Appraisal

The RP procedures were found to be alarmingly brief. For example, the procedure for fluorometric analysis of uranium content in sample pellets describes the chemistry of the process in great detail; however, fluorometer use is described by "read pellets in fluorometer." Many RP operations such as contamination assessment and control, external dosimetry, and internal exposure assessment are not documented by procedure.

A formal system of document control has not been established for either RP procedures or standard operating procedures. Specifically, a formalized program for draft review is not described and procedures are not formally approved. Procedure distribution is not specified.

Weaknesses in RP procedures were identified by the consultant contracted to review the RP function during October 1980. Drafts of some procedures have been submitted to the licensee for review.

### 1.3.3 Conclusions

In order to achieve an acceptable program, RP procedures should be established which detail each RP program. A document control system for both RP and standard operating procedures should be established.

## 1.4 Personnel Qualification and Training

### 1.4.1 Program

Radiation protection training for new employees and subcontractors consists of two parts. Workers are initially given, by the personnel office, two pages of written material describing the nature of alpha, beta, and gamma radiation; the methods of protection from each type; and the regulatory limits for airborne radiation exposure. The written program for women also includes a copy of the statement on fetal exposure from Regulatory Guide 8.13. An extremely simple multiple-choice test follows which must be successfully passed before the individual may begin work. The second training program entails 24 hours of classroom training by the Safety Engineer. The instructor and course contents are approved by the Mine Safety and Health Administration (MSHA). Monthly Safety meetings with employees purportedly include radiation safety issues and serve as refresher training.

Qualifications of the RP staff were reviewed by the appraiser who determined that there are no established qualifications or training requirements for RP staff members. The RSO was found to be quite familiar with mill operations, having been employed by the licensee for many years. He has completed a ten-week health physics training course at Oak Ridge National Laboratories. The Radiation Technician has attended a one-week course offered by Eberline Instruments. A three-month radiation health and safety course was recently presented by the Utah State University Extension Service in Moab. This course was attended by the RSO, the Senior Metallurgist, and intermittently by the Radiation Technician.

### 1.4.2 Appraisal

Interviews of workers revealed limited knowledge of radiation safety. For example, one employee who had worked at the mill for many years cautioned the appraiser about the "highly radioactive vanadium" product. Most workers interviewed equated radiation protection with wearing a respirator.

The initial training course was found to deal primarily with the industrial safety aspects of the work, and the instructor was determined by the interview to lack the necessary qualifications and understanding of radiation protection principles to present radiation safety training. Specifically, the formal training does not include a complete discussion of topics such as biological effects of inhaled radionuclides, ALARA philosophy and lines of communication, and self-survey procedures. Although the training program has not been fully successful, licensee attempts at fulfilling 10 CFR 19.12 requirements were deemed adequate for compliance in this area.

Although the stated qualifications of RP staff members appeared sufficient to implement the RP program, many of the basic principles of radiation protection, particularly radiation surveying, are misunderstood by the RP staff. As will be more fully presented in the remainder of the report, the rationale for many programs and methods are not fully comprehended by the licensee. Examples of these problems are discussed in Sections 2.1.2.1 and 6.2.4. Although the level of expertise of the RSO or Radiation Technician did not appear to be a problem requiring immediate attention, in view of the significant findings in many appraisal areas, the appraisal team agreed that their level of expertise was not conducive to supporting a quality radiation protection program. The appraisers also expressed concern regarding the level of expertise available to address radiation safety matters on back shifts, especially in light of ongoing yellowcake drying and packaging during these hours. As indicated previously, Shift Foreman are responsible for this coverage, although they have received no training in excess of that offered any other employee assigned to mill operations. The RSO did state that his residence was within several miles of the mill and that he could and has responded to requests for assistance during back shifts. He also stated that RP staff members have on rare occasions assisted with special maintenance jobs during these shifts.

### 1.4.3 Conclusions

Based upon the above findings, improvements in the following areas are required to achieve an acceptable program:

1. A fully documented radiation safety training program should be established which provides thorough indoctrination of radiation protection principles to mill employees and subcontractors. The training should include as a minimum a thorough treatment of radiation theory, airborne and surface contamination hazards and control, regulatory limits, biological effects, survey methods, and ALARA policy. The program should otherwise be effective in assuring that workers understand the criteria outlined in 10 CFR 19.12. The program should include provisions for effective and periodic refresher training as well as initial training. Workers should be tested on their understanding of the material presented.

2. An ongoing training program should be established for the RP staff which includes special training in various aspects of applied radiation protection and control. The program should also include training in requirements of NRC regulations and licenses.

3. Corrective actions should be taken to assure that positions established for radiation training and back shift radiation safety coverage are assumed by individuals fully qualified to [illegible]te the prescribed functions.

## 2.0 Internal Exposure Control

### 2.1 Surveillance for Airborne Yellowcake, Ore Dust, and Radon

#### 2.1.1 Program

The licensee's air sampling program consists of sample collection, analysis, and exposure determination. The samples of primary interest are airborne yellowcake (YC), ore dust, radon, and radon daughters. Collection is accomplished utilizing portable air samplers and personnel lapel samplers. The portable air samplers are powered by 110 VAC and typically are set to draw 20 liters per minute. A 2.8 centimeter filter paper is used for particulate collection with a 30-minute sampling period. The lapel samplers utilize a rechargable battery pack capable of providing power to the air sample pump to draw 2.5 liters per minute. Particulates are collected on a 4.7 centimeter filter paper with sampling time dependent upon the specifics of each job. Typically portable air samplers are used for routine samples and lapels are utilized for non-routine maintenance jobs. In total there are 52 air sample locations at the facility varying in sample frequency from weekly to monthly to quarterly.

In addition to the samples taken for YC and ore dust, a particulate sample is collected to determine radon daughter concentrations at selected locations. This is done with a portable air sampler utilizing a 24 liter per minute flow rate with a 2.8 centimeter filter paper. Radon gas concentrations are measured by the use of a modified air sample pump and inflatable Mylar collection bag having a volume of two liters. A filter paper is used in series to prevent particulates from entering this collection device. The length of the sampling period is determined solely upon fully inflating the Mylar bag. Three hours after collection the sample bag contents are transferred to a scintillation (Lucas) chamber of 1.4 liters volume for analysis.

Analysis of air samples is accomplished entirely in the laboratory facilities on site. Sample results are available within two days of sampling. Fluorometric analysis for uranium is used to evaluate the particulate samples, both routine and non-routine, for YC and ore dust. The particulate samples drawn for radon daughter evaluations are performed utilizing a modified Kusnetz method. Radon gas collected by the Mylar bag method is analyzed with the use of the Lucas chamber and a photomultiplier detection system. The licensee uses radon daughter evaluations to determine working levels.

The determination of internal exposure due to airborne radioactivity is accomplished by the licensee utilizing airborne sample concentration data, time-keeping, and respiratory equipment protection factors. The Assistant Radiation Technician/Clerk maintains an updated record of hours worked by each worker in various locations in the mill. This is based on time studies performed in the past for selected job functions and on time cards for the rest of the workers. The clerk uses this data with the airborne concentration data to determine a weekly airborne exposure. When respiratory protection is utilized, the clerk adjusts the actual hours of work by dividing these hours by the protection factor to give the apparent hours exposured to the airborne concentration. The record sheet utilized for this function contains one individual's monthly data subdivided into daily hours worked at various locations and weekly airborne exposure totals. Once each quarter an exposure report is distributed with monthly exposure subtotals and the quarterly total. This report is generated solely for the radiation protection group and is not distributed to other groups of the licensee.

This report is based on the following:

- YC weekly exposure limit of $400 \times 10^{-11}$ uCi-hours/ml
- Ore dust area weekly guide of $200 \times 10^{-11}$ uCi-hours/ml
- Ore dust quarterly exposure limit of $2600 \times 10^{-11}$ uCi-hours/ml

Radon exposure is not included on this report nor is it tracked routinely; however, this information is provided if an individual requests it. All exposure data are generated by hand with a significant amount of data transfer from one form to another.

## 2.1.2 Appraisal

### 2.1.2.1 Sample Collection

The appraiser determined that the number and frequency of airborne samples taken routinely is adequate; however, the appraiser observed that after an airborne radioactivity area has been established, routine airborne sampling is not always routinely continued. In particular the grizzly pit area and the service area above the ore storage bins, both airborne radioactivity areas, are not a part of the routine sampling program. Personnel are allowed to enter these areas as long as respiratory protection is worn, the policy being that as long as such equipment is used, sampling is unnecessary. Lapel samplers are not usually issued and internal exposure determination is based on outdated general area sample data. Licensee policy does not consistently require the use of lapel samplers to enter any airborne radioactivity area.

The appraiser also observed that mill operational status was not always considered when taking routine air samples. Therefore, the data obtained to determine internal exposures may not always be representative of the working conditions. Also samplers are not always placed at a location to give a representative breathing zone sample. In particular the appraiser observed the Radiation Technician placing a portable air sampler on the third floor of the sample tower for a routine sample. The technician placed the sampler against a wall which was not representative of worker location or typical air flow paths. In the view of the appraiser the location selected represented stagnant air.

The appraiser observed that the collection of airborne samples is adequately documented. Records include date, time, volume, and location of airborne samples for portable, lapel, and radon sampling; however, the name of the technician performing the sample and the serial number of the sampler are not always documented.

The lapel sampler utilized by the licensee is calibrated monthly for flow rate. The flow rate value established during the calibration is utilized during the entire month without verification that it has not been changed. The flow rate control valve for the lapel samplers are readily accessible and easily changed accidently or by tampering.

The appraiser noted during tours of the mill that one known airborne radioactivity area, the crusher area, was not posted in accordance with 10 CFR 20.203(d)(2). This was identified as a violation. Other areas which were no longer airborne areas were posted with worn, rusted signs reading "Caution, Airborne Radioactivity Area." A discussion with the RSO revealed a general misunderstanding of area posting requirements. The RSO stated his conception that airborne radioactivity areas as defined in 10 CFR 20.203(d) were not required to be posted at the mill due to the exemption provided under License Condition 20. The appraiser explained that the license condition permitted posting of the mill entrance with a sign stating "Any area within this mill may contain radioactive material" as a substitute for the "Radioactive Materials" posting of each area or room on the project but that this exemption does not also include other required postings.

One radiation technician stated that when air sample results exceed maximum permissible concentration, he usually waits a day or a week before taking another sample as directed by the RSO. There is no attempt to correct the internal exposure credited to personnel working in these locations as long as the next sample results is an acceptable value.

The appraiser observed that the method of collection of radon gas is inadequate. The sample is collected in a Mylar bag and then transferred to a Lucas scintillation chamber. This transfer is performed by connecting the collection bag to one of the stopcocks of the Lucas chamber. Both stopcocks are then opened and the Mylar bag is compressed by hand to force the sample into the chamber. In performing this process there is no assurance that the final concentration in the chamber is representative of the concentration initially in the Mylar bag. A sample was collected by the appraiser by drawing a representative sample directly into the scintillation chamber without using the Mylar bag. This method detected airborne radon concentrations ten to fifteen times higher than the normal results obtained at the same location. The appraiser determined that if all licensee data were adjusted accordingly, radon values would still be well below regulatory limits.

The licensee was questioned regarding implementation of process and engineering controls to limit concentrations of radioactive materials in air. The licensee identified a number of actions that had been taken, but the appraisers expressed concern regarding the visible accumulations of ore dust in airborne radioactivity areas in the ore crushing, sampling, and storage areas. Dust several inches thick was observed on ledges, structural members, handrails, pipes, and machinery, which indicated that no attempt had been made to clean the area in quite some time. The licensee stated that walkways are cleaned routinely and that a house vacuum system is available to assist with this effort; however, water washdown is not routinely used for other areas due to concerns for electrical machinery. The appraisers, however, judged that some simple action, even shoveling or vacuuming, would greatly improve the dust conditions and that even water could be used routinely in many areas of the ore crushing, sampling, and storage facilities. The failure to institute engineering controls in these areas constituted a violation of 10 CFR 20.103(b)(1).

#### 2.1.2.2 Sample Analysis

The licensee was observed not to use formalized procedures for sample collection and analysis. The procedures were not dated or periodically reviewed. This coupled with the lack of an adequate health physics training program for radiation technicians raised doubts as to the adequacy of airborne sample data. As an example, the radon gas sampling procedure stated that the scintillation chamber should be placed on the photomultiplier tube and counted and that a background count should be performed on the chamber. However, the procedure did not indicate any of the steps to be taken for analysis such as counting time. Many procedures were not being followed, because the RSO had instituted new methods which have not been proceduralized. In addition, many health physics functions such as action levels and response to airborne data, were not represented by procedures.

In reviewing air sample assay data, the appraiser observed that when particulate air filters are utilized, the collection efficiency of the filter is not taken into consideration. The radiation technician stated that the filter is assumed to have 100% collection efficiency. The filters used by the licensee are typically in the range of 70-90% efficient for the desired flow rates based on IAEA Safety Series, Document No. 49 (1979), Table 1. Licensee documentation does not exist to verify that studies have been performed to ascertain a proper value for collection efficiency.

The appraiser determined that sample laboratory analysis is done entirely by the licensee. Inter-laboratory comparisions have not been done routinely except for river water analysis. Quality assurance checks have not been performed routinely to establish the reliability of airborne radioactivity data.

2.1.2.3 Exposure Determination

The appraiser reviewed exposure data for mill workers and determined that no worker had been exposed to levels in excess of regulatory limits. However, the accuracy of the data was questioned on the following basis:

(a) As previously indicated, the accuracy of air sample data used to derive exposure data is highly questionable.

(b) Time-keeping data used in conjunction with area air samples may contribute major errors to exposure calculations.

(c) Although protection factors to account for use of respiratory protection equipment is used in exposure calculations. some workers may not always be using such equipment as assumed.

Each of these factors are considered in detail below.

First, as indicated previously, the accuracy of air sample data is questionable for the following reasons:

(a) Samples may not be representative of concentrations in the actual breathing zone, due to samples being taken in areas of stagnant air.

(b) Mill operational status is not considered when samples are obtained.

(c) Certain areas are not routinely sampled.

(d) Steps are not taken to assure that lapel sampler flow rates are not changed during use.

(e) A laboratory intercomparison and quality assurance program has not been established.

(f) Sampling and analytical procedures have not been fully established.

(g) A collection efficiency factor is not considered for sample filters.

Second, time-keeping data used in conjunction with area air samples may contribute majors errors to exposure calculations, because such data, which consists of time studies and time card data submitted by the worker, may not accurately reflect area occupancy time.

The third factor relates to the application of protection factors to account for the use of respiratory protection equipment. Although such factors are always applied for work in "respirator required" areas, the appraisers noticed one worker on May 13, 1981, who was not wearing a respirator in one such area, the service area above the ore bins. Several workers who were interviewed stated that some individuals often do not wear respirators in such areas. Appraisers also noted that what cleanup was observed in ore dust areas was performed without respirators. This shoveling and sweeping resulted in visible dust resuspension about the worker without coincident air sampling or respirator use. In conclusion, the appraisal team expressed concern that some exposures may actually be fifty times those documented due to the possible inappropriate application of the protection factor of fifty for full-face respirators.

These deficiencies were determined to constitute a violation of 10 CFR 20.201(b).

In regard to the exposure data format, the exposure records clerk determines all airborne exposures by hand based on air sample assay data, time-keeping, and respiratory protection factors. This entails repetitive calculations with a significant amount of transfer of data from one form to another. The appraiser noted that the calculations/records format was not straightforward.

### 2.1.3 Conclusions

Based upon the above findings, improvements in the following areas are required to achieve an acceptable program:

1. Airborne radioactivity areas should be included in the routine air sampling program or, preferably, all individuals who enter such areas should use lapel air samplers.
2. Mill operational status should be considered when air sampling is performed, i.e., the particular area being sampled should be in full operational status at the time of sampling.
3. Area air samplers should always be placed at a location which yields a sample representative of the air inhaled by the worker.
4. Flowmeter valves on lapel air samplers should be modified to prevent changes in sample flow rate during use by the worker.
5. Airborne radioactivity areas should be properly and conspicuously posted. Areas which do not qualify as such areas should not be so posted.
6. The method of sampling radon gas concentrations should be modified to reflect a full and accurate assessment of airborne radon.
7. The licensee should implement a program to reduce accumulations in ore crushing, sampling, and storage areas.
8. An appropriate factor correcting for particulate air sample collection efficiency should be included in air sample analytical calculations.
9. A program for routine inter-laboratory comparisons should be established similar to those described in NRC Regulatory Guides 4.14 and 4.15.
10. Management audit of the program for time-keeping and exposure time reporting should be instituted to assure that such data are accurate.

11. Licensee management should assure that respirators are worn by individuals when required and that protection factors are applied only to exposure calculations when respirators are actually worn.

12. Record systems should be modified to afford the recording of sample serial number and technician name on sample records and to facilitate a more straightforward approach to exposure calculations.

## 2.2 Respiratory Protection

### 2.2.1 Program

A mill policy statement on respiratory protection was issued September 6, 1977. This document discusses the use of engineering controls to limit airborne exposures for routine operations. In addition, it describes the use of respiratory protection for non-routine operations. The training of personnel who administer the program and the training of personnel who use respiratory protection is also addressed.

The program elements of the licensee's respiratory protection program includes training, fitting, maintenance, cleaning, inspection, control, and issuance of respirators. Workers are required to have an annual physical examination which specifically evaluates ability to wear respirators. The respiratory protection training given to the workers consists of two types. The first is designed solely for the user and consists of initial and periodic retraining. It covers the following topics:

- -types of particulate contaminants
- -construction of respirators
- -reasons for using respirators
- -fitting
- -respirator malfunctions
- -emergency respirator use

This training is normally conducted by the RSO at periodic safety meetings for various groups at the mill. The second type of training is given by the RSO or Radiation Technician to the Assistant Radiation Technicians. It consists of the radiation protection responsibilities for maintenance, fitting, cleaning, inspection, control, and issuance of respirators. The training program for respirator users is formalized and documented; however, such has not been accomplished for the training program given to radiation protection personnel.

The fitting program utilized by the licensee consists of observing facial features and assuring a proper seal by using a negative pressure test. Each worker must enter a challenge atmosphere in a fit booth and perform a set of prescribed exercises. The challenge atmosphere is composed of isoamyl acetate at a concentration of 1000 parts per million. The worker is required to indicate if he can detect the isoamyl acetate (banana oil) thus giving a qualitative fit test. This test is performed every time a worker is issued a respirator.

The maintenance, cleaning, and inspection of respirators is performed by the radiation protection group. This consists of discarding used particulate cartridges, washing the respirators in a detergent solution, and then sanitizing them in a hypochlorite solution (50 ppm chlorine) for two minutes. The respirators are then air dryed with the exhalation valves, head straps, facial sealing surfaces, and lens pieces inspected for damage. At this point the technician surveys the total respirator to insure that the following conditions are met:

$<$ 0.2 mR/hr. beta-gamma
$<$ 100 dpm/100 $Cm^2$ smearable alpha
$<$ 1000 dpm/100 $Cm^2$ fixed alpha

Each respirator is then placed in a sealed plastic bag to be used at a later time.

The issuance of a respirator is contingent upon a successful fit. Once this has been determined, the workers name, the type of respirator, and the date are recorded in a log book in order to assure return of used respirators. When a respirator is returned, a check mark is placed next to the worker's name and the used cartridges are discarded. The respirator is placed in a drum to be cleaned.

The selection of respiratory equipment is based on the specifics of the job to be done and the results of airborne radioactivity samples. All equipment used has been approved in accordance with 30 CFR 11. The types of respirators and protection factors used by the licensee are:

Half-face (10)
Full-face (50)
Supplied air full-face (1000)

The airborne radioactivity areas of primary concern for wearing respiratory protection are:

-conveyer belt area underground near grizzly pit
-conveyer gallery above fine ore bins
-ball mill area when dust collectors are not running
-yellowcake packaging area

Limiting factors utilized by the licensee which would prohibit the use of respiratory protection are:

-facial hair
-eye glasses or contact lenses
-facial features
-other abnormalities as determined by the radiation protection staff

2.2.2 Appraisal

2.2.2.1 Policy Statment

The respiratory protection policy statement makes a strong commitment to the use of engineering controls as shown by the following statements from the document:

1. "Control of airborne radioactive materials shall be accomplished wherever possible by use of engineering controls."

2. "For routine operations, engineering controls will be developed and employed wherever practicable. Respirators will be used in routine operations only while engineering controls are being instituted and evaluated."

The respiratory training program also makes this commitment to engineering controls as shown by the following statement from its training guide:

"Proper selection, supervision, and training of personnel using respirators:

(c) Every reasonable effort is being made to reduce the need for respirators by decontamination, by hosing down the area with water, and cleaning to keep dust at a minimum."

However, as discussed in Section 2.1 of the report, washdown of ore dust areas is not being performed.

### 2.2.2.2 Program Elements

Training to radiation protection personnel on the fitting, cleaning, inspection, and issuance of respiratory protection equipment is administered by the RSO or the Radiation Technician. The Radiation Technician stated that he had performed this training exclusively over the last couple of years. The training consists of discussions with the Assistant Radiation Technicians on how to perform the necessary functions. As previously stated, the training is not based on any training documents or outlines. Also the performance of training is not documented and there is no requirement for retraining. The RSO stated that he gives training to respirator users on a routine basis at safety meetings. The appraiser observed that a training outline is used during this training. Documentation of this training exists for only one session which was given to the radiation protection staff members. Additionally, the training given to respirator users does not address the use of respiratory protection when cutting, welding, or grinding is performed on potentially contaminated surfaces.

Radiation protection personnel clean, sanitize, inspect, and radiologically survey respirators before issue. However, the only record of these functions is the "Respirator Inspection" form. Documentation on the form consists of the date, wipe test results, number of respirators beyond repair, number of respirators inspected, remarks, and a checklist of what parts were inspected or what functions were performed, such as

- rubber gasket
- inhalation and exhalation valve
- headband
- replaced filter
- cleaned and disinfected
- respirator body
- wipe test

The appraiser observed that there are no provisions for a form or tag to follow with each respirator indicating the inspector, date, and approval for use.

The issuance of respirators is performed by radiation protection personnel. The cleaned, inspected, bagged respirators are stored in a room next to the respirator fitting area. This room is locked at all times; however, many mill personnel have keys to this area since supplies other than radiation protection supplies are stored there. The radiation technician stated that more respirators end up in the used respirator container than are issued initially and that this primarily happens on the off shifts. Apparently respirators are being used without control by radiation protection personnel, and some personnel are not receiving respirator fits.

Although workers are examined annually by a physician to ascertain whether or not they are medically qualified to wear a respirator, the results of this exam are not communicated to the radiation protection organization. Thus, the issuing technician has no method of assuring that a worker is physically qualified to use the equipment.

The appraiser observed that when new respirators are procured from the warehouse stock, they are not inspected prior to use. Licensee policy is to accept these respirators, assuming since they are new that they will operate properly.

### 2.2.2.3 Selection of Equipment

The licensee utilizes filtered and supplied air respiratory protection based on the working conditions of the job. The supplied air system typically utilized consists of a full-face mask with one air inlet to which a flexible supplied air line is attached. The permanent supplied air lines run throughout the mill and are primarily used for high pressure service air. When supplied air respiratory protection is required, regulators/reducers are placed in series in the system. The appraiser observed that failure of the regulator/reducer would allow high pressure air to be impressed upon the respirator mask. In addition, the appraiser observed that the intakes for the high pressure air compressors are located inside the compressor building enabling introduction of fumes from other compressors located nearby. The appraiser also observed that the general area around the intakes is quite dusty. The Radiation Technician stated that contamination surveys are not performed at this location. A licensee representative stated that the air quality of the supplied air has never been analyzed to determine if it is Grade D or better.

### 2.2.3 Conclusions

Based upon the above findings, improvements in the following areas are required to achieve an acceptable program:

1. A training program should be established and documented for the radiation protection personnel who administer the respiratory protection program. The program should include provision for periodic refresher training.

2. Records of attendees at respirator user training sessions should be maintained.

3. The radiation protection function should assess the need for respiratory protection in airborne radioactivity areas during cutting, welding, and grinding operations on contaminated equipment.

4. A controlled area should be established for the storage of respiratory equipment with access available only to radiation protection personnel.

5. Each respirator which has been fully inspected and otherwise approved for use should be tagged in order to indicate the inspector's name and the date of the inspection.

6. The radiation protection representative issuing equipment should assure that each individual requesting use of a respirator has a current medical qualification to use such equipment.

7. New respirators should be inspected to the same standards as used respirators prior to being issued for use.

8. The licensee should take necessary precautions to assure that supplied-air system component failures will not introduce a high-pressure air stream into a respirator during use.

9. Air compressor intake ports should be located in areas free of fumes and contamination. Routine tests should be conducted to insure that air quality standards are maintained.

## 2.3 Bioassay

### 2.3.1 Program

#### 2.3.1.1 Urinalysis

The licensee has a urinalysis program established to monitor all workers in the uranium precipitation, solvent extraction, and yellowcake processing areas. In addition, all maintenance employees are monitored. No baseline values for a worker's urine uranium concentration has been established. No characterization of yellowcake solubility is performed. Workers are trained in the need for urinalysis during their initial three-day course and receive a review during refresher meetings.

The frequency of urine sampling is every two weeks on all of the employees mentioned above. Urine samples are collected when the employee returns to work after his two or three days off. If a sample is expected to have been contaminated, another sample is collected.

Urinalysis is performed on site by the Radiation Technician in the radiation laboratory, where environmental samples are also prepared and analyzed. Uranium fluorometry is used and two replicates per person are run along with two blanks and two standards. Approximately 25% of the urine specimens are spiked with either of two known prepared standards and processed with the routine specimens. Detection limits are no greater than 5 ug/l.

The licensee has only one action limit for urine uranium--15 ug/l. Any employee with a urine uranium concentration at this level or greater is resampled. If the results remain near or above this action limit a work restriction is enacted. This restriction remains in effect until the next urine sample, collected in one to two weeks or more, falls below 8 ug/l. At that time the worker may resume his normal duties in the mill.

Urinalysis results are obtained within a week of collection of the sample. The results are not posted but are kept in a file in the radiation safety office. An updated card is maintained on each employee and is available for review by the employee. Urinalysis results are compared with air sampling data only in cases when the action limit is approached or exceeded or when a high air concentration is determined.

#### 2.3.1.2 In-vivo Counting

Participants in the in-vivo program include operators and maintenance personnel who are involved in work in either the ore crushing, sampling, and grinding areas or the precipitation, solvent extraction, and yellowcake packaging areas. There are no baseline measurements made on new employees. Initial and refresher training are provided at the frequencies previously described for urinalysis.

In-vivo counting is performed annually on the workers listed above. The counting is performed by Helgeson Nuclear utilizing a mobile trailer. Two five inch diameter phoswich detectors are placed over the region of the lung while the worker is totally enclosed in the equivalent of three inches of virgin lead. The amount of natural uranium present is determined during a twenty minute count using the U-235, 186-KeV photopeak. The U-235 calibration is performed periodically using known sources distributed uniformly within a masonite lung phantom of variable thickness. This calibration is checked by counting the lung area of the phantom at the Y-12 Plant, Union Carbide Corporation, Oak Ridge National Laboratory. The minimum detectable activity is typically 30 to 60 ug for U-235 and 1 to 3 mg for natural uranium.

The licensee has set their action limit for in-vivo counting at 16 nCi. A review of the licensee's past data indicated that no results exceeded this action limit. The recounting of workers is determined by the vendor and may include showering to remove possible contamination.

In-vivo results are reported within one to three months of the vendor's visit to the mill. The employee's in-vivo data is maintained in each report and is not filed by individual employee. There is no routine mechanism present to correlate the in-vivo results with airborne concentrations.

### 2.3.2 Appraisal

#### 2.3.2.1 General

The licensee is tied by License Condition 12 to NRC Regulatory Guide 8.11. Additional requirements include the Staff Technical Position paper dated June 1978 and sent to all mill licensees stipulating action levels for urinalysis of 30 ug/l for four consecutive samples and 130 ug/l for one sample. The appraiser observed the urinalysis preparation and analysis area, reviewed both urinalysis and in-vivo data, and interviewed the RSO and the Radiation Technician who performs the urinalyses.

A review of the bioassay program revealed the lack of any written procedures. Absence of documentation in the following areas were particularly noticed:

1. Routine and special sampling program description including sample frequency, timeliness of analysis, analysis sensitivity, action levels, resampling requirements, and investigation of high results.

2. Training requirements for participants and for those administering the program

3. Correlation of results with air sampling data

4. ALARA review.

Also a quality assurance program has not been instituted to control either licensee urinalysis or vendor-supplied in-vivo counting services.

2.3.2.2 <u>Urinalysis</u>

The content of the licensee's urinalysis program appears to be that generally presented in NRC Draft Regulatory Guide 8.22, "Bioassay at Uranium Mills." The basic elements of the program, the collection frequency, and the sensitivity appear adequate. Each batch of specimens is not processed with at least two additional specimens obtained from persons who are known to have no lung or systemic uranium burden other than from natural background. Analyses of the specimens would permit the detection of uranium contamination in the laboratory or in the equipment or containers used.

The licensee's single action limit of 15 ug/l and the resampling and comparison with air samples is consistent with the current NRC position; however, in the cases reviewed where the limit was approached or exceeded, there was no documented investigation on file.

#### 2.3.2.3 In-vivo Counting

The licensee's action limit of 16 nCi uranium is at the upper limit of the range established in Regulatory Guide 8.22. Results of this level would indicate contamination confinement difficulties, that air sampling capabilities are unreliable, and that uranium activity in the lung is undesirably high. Review of data from recent years indicates that one worker exceeded the nine nCi limit in 1980 (11.2 $\pm$ 1.5) and another was possible (8.2 $\pm$ 1.9). Data from 1979 for all workers indicated practically no uranium in the lungs. Urinalysis data for the worker who exceed nine nCi showed values of 3.43, 8.65, and 1.4 ug/l uranium for the period of time when the in-vivo count was performed. The air sample data reviewed for the period in the worker's area did not indicate any abnormally high concentrations. Also none of the other worker's showed unduly elevated in-vivo counts.

### 2.3.3 Conclusions

Based upon the above findings, improvements in the following areas are required to achieve an acceptable program:

1. All new employees should submit urine samples for analysis prior to initial work in the mill in order that baselines may be established.

2. A laboratory quality assurance program should be established which includes frequent laboratory intercomparisons. Analysis of urine specimens from persons who are known to have no lung or systemic uranium burden above background should be performed with each batch.

3. Cases in which action limits are exceeded should be fully investigated, and a documented evaluation should be prepared.

4. The licensee should reduce the action limit for in-vivo results below 16 nCi. Draft Regulatory Guide 8.22 should be reviewed for guidance.

5. In-vivo results exceeding the action limit should be reported to the licensee by telephone.

# 3.0 External Exposure and Contamination Control

## 3.1 External Exposure Control

### 3.1.1 Program

The external exposure control program for the licensee consists of dosimetry and instrument surveys. The dosimetry utilized by the licensee is solely for whole body dose measurements and consists of thermoluminescent dosimeters (TLD's). Lithium fluoride TLD's are supplied and processed by a vendor on a monthly rotation. Licensee policy is to issue TLD's to each employee at least three months each year and to ball mill and packaging operators continuously. Three background badges are utilized each month. Two of them are located in the guard shack and one is southwest of the complex at Environmental Location No. 6. A total of 20 test and environmental TLD's and approximately 70 occupational exposure TLD's are processed each month.

A dosimetry report is generated each month by the vendor on an equivalent NRC-5 form. It contains environmental and occupational TLD results. Internal/External exposure history files for each worker are not utilized by the licensee. Typical exposures for workers as recorded by the vendor are 0 to 40 mRem gamma per month. Beta exposure is typically zero. Gamma dose rate surveys are performed quarterly utilizing portable GM survey instruments.

### 3.1.2 Appraisal

#### 3.1.2.1 Dosimetry

The appraiser observed that the TLD's utilized by the licensee were designed for detection of beta exposure in addition to gamma exposure. The vendor reports beta exposure to the licensee; however, typically this is reported as zero. The appraiser observed that the worker was not wearing the device properly in order to be sensitive to beta radiation. In many instances the device was worn with the beta window facing towards the body. Several workers stated that they had not been told how to wear the dosimeters.

Tours through the mill and discussions with radiation protection personnel and security personnel revealed that TLD's are not always worn when they should be. Often the TLD is left in the guard house on the TLD rack when entering the mill even though the security badge is picked up and worn.

Lastly, there is no program for quality assurance checks performed by the licensee on the vendor TLD's.

#### 3.1.2.2 Instrument Surveys

The gamma dose rate survey program was judged to be acceptable with two reservations. First, survey record sheets do not include the following information:

- -date and time of survey
- -instrument serial number
- -type of survey, i.e., general area or contact measurement
- -units of measurement
- -signature of surveyor

Also the sheets make use of site maps which do not clearly detail the location of the surveys. Second, beta rate surveys are performed only in eating areas and are not performed at each location where gamma surveys are made.

### 3.1.3 Conclusions

Based upon the above findings, the licensee program for external exposure control appears to be acceptable; however, the following improvements should be instituted:

1. The licensee should implement management controls to assure that dosimeters are worn when required. These controls should also insure that badges are worn so as to be sensitive to beta radiation. Proper use of dosimeters should be emphasized in worker training sessions.

2. The licensee should initiate a quality assurance program to test the validity of vendor reported data.

3. Instrument survey data should include all information specified in Section 3.1.2.2 of this report. Beta surveys should be performed at all in-plant locations where gamma measurements are made.

## 3.2 Contamination Control

### 3.2.1 Program

The contamination control program for the licensee consists of facility surveys and personnel contamination control. The facility surveys require performing dose rate beta, dose rate gamma, fixed alpha, smearable alpha and smearable beta-gamma measurements in 25 locations throughout the mill buildings. The locations are primarily eating areas, change rooms, control rooms, and offices. These surveys are conducted once every two weeks by the radiation technicians with the wipes being analyzed in laboratory counters.

The limits for contamination in these areas as referenced in License Condition 25(c) are as follows:

5,000 dpm/100 $Cm^2$ average fixed alpha
15,000 dpm/100 $Cm^2$ maximum fixed alpha
1,000 dpm/100 $Cm^2$ removable beta-gamma and alpha

Personnel contamination control at the licensee is accomplished by the use of protective clothing and showering. In addition, all personnel are required to either shower before leaving or perform a self survey at the guard house for alpha contamination. The personnel release limit is 1,000 dpm/100 $Cm^2$.

### 3.2.2 Appraisal

The appraiser noted that the biweekly contamination surveys were documented on a formal survey sheet. However, the date, time, and performer signature were not always noted on the form. In addition, the form does not provide for the documentation of the following:

- instrument serial number
- efficiency of laboratory counters
- exact location within an area where a wipe is taken, i.e., floor, wall, or table

The license condition requires that cleanup be initiated if limits are exceeded, that a study be performed to determine the cause of buildup, and that corrective measures be taken to prevent recurrence. The appraiser observed that this was not being done routinely. Documentation does not exist to indicate that studies had been performed to determine the causes of contamination buildup. As an example, the ball mill doghouse was found to have a fixed alpha contamination level of 19,230 dpm/100 $Cm^2$ on March 12, 1980.

The investigation findings for the problem by Radiation Protection were not available for review. As another example, the following fixed alpha data are from the acid filter area doghouse for the year of 1980:

| Date | dpm/100 $Cm^2$ |
|---|---|
| March 12 | 7,692 |
| March 26 | 15,384 |
| April 9 | 4,210 |
| April 23 | 5,263 |
| May 7 | 4,211 |
| May 21 | 4,736 |
| June 4 | 18,421 |
| June 18 | 631 |
| July 2 | 4,737 |
| July 17 | 26,315 |

The licensee stated that the doghouse was replaced near the end of the year; however, there is no indication that prompt action was taken earlier as suggested by the sample results in excess of the limit during March. This was viewed by the appraiser as a violation of License Condition 25(c) and also good health physics practices.

#### 3.2.3 Conclusions

Based on the above findings, improvements in the following areas are required to achieve an acceptable facility surveys program for contamination control:

1. Survey data sheets should include all particulars of the survey as previously indicated.

2. Licensee management should promptly respond to survey data indicating high contamination levels. Investigations and corrective actions should be thoroughly documented.

The licensee's program relative to personnel contamination control was judged to be adequate.

### 3.3 Survey Instrument and Laboratory Counter Suitability and Calibration

#### 3.3.1 Program/Appraisal

The licensee utilized both laboratory counters and portable survey instruments for program support. Two proportional counters and two MS-2 scalers with scintillation and GM detectors are used to count radon, radon daughter, and contamination samples. Portable GM and alpha survey instruments are utilized for routine dose rate surveys and for personnel contamination surveys. The appraiser noted that an adequate number of portable and laboratory instruments are available for radiation protection.

Portable survey instruments are sent to a vendor quarterly for calibration. The appraiser noted that the portable GM survey instruments are not source checked between calibrations; however, alpha portable survey instruments are source checked routinely with a traceable thorium-230 source.

The laboratory counters are calibrated by the licensee. This calibration consists of quarterly determination of alpha plateaus with a thorium-230 source and beta plateaus with a lead-210 source. If maintenance is performed on a counter during the quarter, a new plateau is determined. Licensee records indicate that an operating voltage is usually chosen on the low end of the plateau. In some cases there is even doubt as to the operating voltage; thus, operation on the plateau is not ascertained. The RSO stated that operation on the low end of the plateau was done to keep background counts low; however, data on one counter confirmed that the background count did not substantially change when an operating point in the middle of the plateau was chosen . The appraiser stated that an operating point in the middle of the plateau would be preferable. Also once the plateau has been plotted, there have been no further source checks on a periodic basis to confirm proper operation. The appraiser recommended that when the operating voltage is initially set, a count should be made with the source. Then on a periodic basis the source should be counted again to confirm that the counter is still working properly. The plateau records consisted of data recorded on a graphical format. The following deficiencies were observed in this documentation:

- -the chosen operating voltage was not always indicated
- -counter serial number was not recorded
- -units of measurement were not always indicated
- -calculations or remarks were not included
- -performer signatures were not recorded

### 3.3.2 Conclusions

Based on the above findings, the survey instrument and laboratory counter suitability and calibration program appears to be acceptable. The following recommendations should be considered for improvement of the program:

1. Operating voltages of laboratory counters should be set near the middle of the characteristic plateau. Also plateau determinations and operating voltage determinations should be fully documented.

2. Laboratory counters should be routinely source checked to assure that there have been no changes in operating characteristics.

## 3.4 Release of Equipment and Material to Unrestricted Areas

### 3.4.1 Program/Appraisal

Licensee policy requires that material leaving the mill complex be accompanied by an authorization signed by one of the mill superintendents or department heads. In addition, the Radiation Technician or RSO must also sign the authorization indicating contamination levels to be below the following limits:

1,000 dpm/100 $Cm^2$ removable beta-gamma or alpha
5,000 dpm/100 $Cm^2$ fixed beta-gamma or alpha
0.2 mRad/hr beta-gamma

The above information and approval signature were observed to be documented on a formalized record with all other pertinent specifics included. However, in the view of the appraiser there is doubt as to whether the proper management controls exist to insure that such surveys are always performed. As an example, on March 25, 1981, some equipment left the site with the following description:

"Two end bells, slip rings, for 250 HP AC motor"

The removal from the site was documented on Form AM-S-1. Discussions with the Radiation Technician and a review of records indicated approval from Radiation Protection had not been obtained. The signature block on the form had not been signed by Radiation Protection nor had the equipment been surveyed. The present system does not insure that all release forms are seen by Radiation Protection before the material leaves the site.

#### 3.4.2 Conclusions

Based on the above findings, this program was found to be acceptable, but stricter management controls should be implemented to assure that all equipment is surveyed prior to release to unrestricted areas.

## 4.0 Facilities and Equipment

### 4.1 Facility Adequacy and Process Controls

#### 4.1.1 Program

The radiation safety office and the radiation laboratory, used for the preparation and counting of in-plant air samples, urine bioassay samples, and certain environmental samples, are both located in the laboratory building, which also includes the metallurgy laboratories. Also located in this building are equipment and facilities in support of the respiratory protection program. Equipment repair and storage facilities and laundry facilities for the monitoring, washing and drying of coveralls are located in or near this building. Employee change rooms and showers are located in a building situated between the office building and the laboratory building. A first aid room is also located in the lab building. Training facilities are available in a conference room located in the office building.

In the mill, dust suppression methods are used at a number of points in the ore storage areas and the ore processing areas. The licensee currently has three major ore stockpile areas on site, two of these areas are near the grizzly and the third is located near the northeast site boundary. These stockpiles are inspected weekly by the Yard Boss to determine the effectiveness of dust controls methods which include self-crusting, natural dampness, and the use of a chemical binding agent. The weekly inspections are documented. Manually adjustable sprays are used in the grizzly pit, at drop points onto conveyor belts below the jaw crusher and the cone crusher discharge, and on the unloading port from No. 10 fine ore bin onto the outside pad. The ball mills operate on a 50% liquid basis and as such represent the end of ore dust producing activities.

Ore dust emission is also controlled by four bag filter dust collectors. Two of the collectors, No. 1 (north) and No. 2 (west), serve the points of dust emissions at the crushers and the transfer points between them. No. 3 collector services the fine ore storage feeders, and No. 4 serves the sample tower. The wet chemical process areas primarily utilize natural draft and powered ventilation systems. Certain operations such as leaching and solvent extraction are located outdoors. The uranium product dryer is a multiple hearth dryer that has a wet scrubber installed on the off-gas stack. A bag filter dust collector serves the engineered closed-system for yellowcake load-out to minimize dusting. Exhaust fans are also located on hoods in the radiation and metallurgy laboratories. A wet scrubber is connected to the metallurgy hood exhaust.

### 4.1.2 Appraisal

#### 4.1.2.1 Radiation Protection Services

The appraisers visited and reviewed the facilities used by the radiation safety staff in carrying out their various radiation protection functions. Since little guidance is available to determine the adequacy of these facilities, appraisal findings are based upon appraiser judgment and comparison with practices at other similar facilities.

The licensee appears to have adequate personnel decontamination areas and showers. Also, an alpha survey meter is located in the guard house for personnel contamination surveys, when leaving the mill restricted area. The radiation protection offices and associated procedures and records areas are small but adequate. The respiratory protection facilities, training areas, laundry and contamination monitoring area for coveralls, and equipment repair and storage areas are adequate for routine operations. The radiation laboratory is barely adequate. The space allocation for counting is small and has a high potential for contamination.

#### 4.1.2.2 Process Controls

The licensee's use of dust suppression methods in the front end of the mill circuit appeared marginal. The weekly inspections of the ore stock piles were reviewed and no chemical fixatives were found to have been used since September 1979. Since that time, natural moisture and self-crusting were reported as adequate to control dusting. The appraisers observed that these methods are not totally effective even in a moderate wind.

The drying and packaging of yellowcake is performed in an enclosure that is separated from other areas of the mill. This enclosure is maintained under a slight negative pressure. An air suction ring is located over the yellowcake drumming station. The air from the packaging enclosure passes through a bag filter dust collector which appears relatively effective in minimizing dusting, even though the area still requires the use of respirators.

The yellowcake scrubber recirculating pump and fan are interlocked with the yellowcake hearth. In the event of pump or fan failure, there is an automatic shutdown of the hearth and an audible alarm sounds in the yellowcake drying and packaging control room. The alarm is temperature activated rather than activated by water flow and air pressure differential as required by License Condition No. 46. Also, no daily checks of the alarm function are performed as required. These conditions were noted to be in violation of License Condition No. 46.

The bag filter dust collectors appear to be effective in the ore areas. However, the appraiser determined that the licensee is not making use of the manometers installed in order to monitor pressure differential across the bag filters thus enabling detection of a bag rupture. The licensee stated that bag rupture is detected only through a high dust collector stack sample or through visible dust emissions from a stack. Also, the appraiser observed that the fine ore bin dust collector release point is located almost directly below a doorway to the ball mill building. Thus if a bag filter does fail, ore dust may readily blow into this work area.

Throughout the week of the appraisal, team members observed that numerous powered ventilation fans were not operating in mill buildings. One of the fans was not supplied with a fan belt. A licensee representative stated that these ports are sealed during the winter, and this means of ventilation is not possible. The appraisers agreed, however, that due to the warm weather at the time of the appraisal, use of this equipment might have reduced airborne concentrations and thus contributed to ALARA.

The appraisal team voiced concerns relative to hoods in use in the laboratories. The hoods in use were not of commerical design and lacked aprons sufficient to control air flows and lips to control spills. Face air velocities were noticeably low and undoubtedly less than the industry standard rate of 125 cfm. Fumes and vapors were often noted escaping from the hoods into the lab work areas. The hoods contain numerous heating elements and lack internal washdown systems.

### 4.1.3 Conclusions

Based on the above findings, licensee facilities and equipment appear to be acceptable.

Based on the above findings, improvements in the following areas are required to achieve an acceptable program for process controls:

1. The licensee should take additional measures to assure the control of airborne dusts from ore pads.
2. The hearth/scrubber interlock alarm should be activated by changes in scrubber water flow and air pressure differential rather than by temperature. The audible alarm function associated with the interlock should be checked daily.
3. Dust collector manometer indications should be read and recorded daily in order to provide early detection of bag filter failure.
4. The exhaust port of the fine ore bin dust collector should be relocated to prevent effluent flow into the ball mill building.
5. All ventilation fans installed in mill buildings should be operated during warm weather in order to reduce airborne radioactivity levels.
6. Modifications to enhance safety during use of laboratory hoods should be made as outlined in this section.

## 4.2 Fire Protection and Emergency Response

### 4.2.1 Program/Appraisal

The fire protection program at the mill is dependent to a major extent on the nearby Moab volunteer fire department. As previously indicated, responsibility for the program is not centralized under a single individual; however, ultimate responsibility rests with the Maintenance Manager who is also responsible for all mill maintenance and engineering functions. The Safety Engineer has primary training responsibility. Fire team members are assigned from the mill operations functions.

An "Emergency Procedures" manual, which includes the responsibilities and authorities of certain key personnel, is given to each new employee. The manual does not clearly indicate the responsibility of each team member during a fire nor are equipment inspection procedures fully developed. An equipment inspection checklist exists, but it does not list each item of equipment separately. A warehouseman performs the inspection and completes the checklist weekly.

The fire response program is among the best planned and documented at the mill. However, two program areas are questionable. First, the procedure requires all personnel who are not team members to proceed to a fire armed with a fire extinguisher. The appraiser judged that this approach could result in undue confusion in certain instances. Second, the procedures do not call for use of respiratory protection during a fire. The appraiser noted that there are several "chemox" supplied air respirators on hand and that team members are trained in their use, but the respirators do not have NIOSH approvals. The procedures manual also has a short section devoted to tailings dam failure or other releases of material to the environs, but it is primarily a notification procedure and includes little in the way of response procedures.

The licensee was found to possess an adequate arsenal of fire-fighting equipment including a water supply and storage system, fire hose stations, and extinguishers. The licensee has ready for installation a diesel fire pump as backup to the electric pump installed on site. A new fire system had been installed in the boiler area, and installed fire systems protect most of the ore handling and processing equipment. The licensee has no routine program for alarm testing, flow testing, and foam quality tests, although he stated that the insurance underwriter does perform some of these.

The greatest identified fire hazard and program weakness is in the solvent extraction (SX) area. License Condition 34 requires that "the licensee shall insure that the automatic sprinkler system and the foam application system installed in the solvent extraction area are maintained in an operational condition to provide control over solvent fires in the storage tanks." Several sprinkler heads in the solvent extraction area were found heavily encrusted with mineral deposits. This condition was identified as violation of License Condition 34. Concrete walkways in the SX area were badly deteriorated which indicated that the large puddles of flammable process organics had covered them for a considerable period. The licensee stated that repairs are planned and the appraiser observed cleanup underway.

Provisions have been made to address job-related injuries. Emergency medical technicians and a local helicopter ambulance are available.

#### 4.2.2 Conclusions

Based on the above findings, the fire protection and emergency response program appears to be acceptable. The following recommendations should be considered for improvement of the program:

1. The fire system sprinkler heads in the SX area should be routinely cleaned in order to assure operational readiness.

2. Repairs to SX facilities should be completed to prevent leakage and resultant ponding of flammable process fluids.

3. Approved self-contained respirators should be procured for use during fires. Unapproved equipment should be removed from use. Procedures should be amended to require that such equipment be used under specified conditions.

### 4.3 Product Packaging and Transport

#### 4.3.1 Program/Appraisal

The appraiser did not observe barreled product being shipped during the period of the appraisal; however, the appraiser did review the finished product storage compound. Some of the filled drums were observed to be severly dented and distorted, apparently as a result of being clinched in the middle by a hydraulic device used in conjunction with a fork lift truck to transfer the drums to the compound. Several of the larger dents caused the top of the drums at one side to be visibly sloped. Also the lid retaining rings were secured by a 3/8" (estimated) bolt which the appraiser assessed was likely to fail, if the drum were to overturn in a highway accident, since drums contain an average weight of 800 pounds.

All drums in the compound were labeled with Department of Transportation (DOT) White I labels. The appraiser informed the licensee that 49 CFR 173.392(b) exempts use of such labeling, if shipments are made by exclusive use vehicle, which is the case for licensee shipments.

The appraiser determined that the licensee otherwise complied with DOT regulations in Title 49.

4.3.2 Conclusions

Based on the above findings, the licensee program for product packaging and transportation appears to be acceptable; however, the following improvements should be instituted:

1. A final inspection of product drums should be performed and documented prior to shipment to assure that drums are not deformed or distorted to such an extent that package strength is compromised.

2. Lid retaining rings should be secured with a 5/8" or larger bolt to better assure package integrity under accident conditions.

## 5.0 Tailings Management

### 5.1 Program

#### 5.1.1 Access Control

The mill and tailings impoundment are completely fenced and are posted with "Caution--Radioactive Material" signs every 275 feet. The integrity of the fence is checked by a roving security guard during the three shifts each day. There are two vehicle gates, the ore receiving gate near the scale house, and the gate at the guard house. Employees and visitors must pass through the guard house to reach the personnel access gate located adjacent to the office building.

#### 5.1.2 Tailings Containment

The tailings disposal impoundment is created by embankments on the north, east, and south sides and dikes on the remaining side. The exposed exterior portion of these embankments are covered with shale to reduce wind and water erosion. The embankment elevation is 4058 feet, and the operating level of the tailings pond is 4052 feet (both elevations in feet above mean sea level). The licensee is required to maintain at least six feet of freeboard between the embankment crest and the operating level of the pond. In addition, a minimum beach of 150 feet between the ponded liquid and the dam embankments is required.

The discharge of tailings into the impoundment is from a perimeter discharge line. The location of the ponded liquid within the impoundment is controlled by moving the position of the discharge point to the area where the liquid is closest to the embankment. Tailings liquid is recycled back to the mill from the decant point, located on a dike in the northeast portion of the pond. Recycling helps to control the pond elevation during normal operations.

Seepage through the embankment is collected at three locations. The largest drainfield, 750 feet long, and associated collection trenches, are located on the north side and drain into Sump No. 1. Another drainfield, located under the southwest embankment, is 150 feet long and drains to Sump No. 2, which also collects drainage from the shortest drainfield, 70 feet long, plus a collection trench located on the south side. Both of these sumps automatically pump the collected seepage back into the impoundment. The tailings discharge lines from the mill are routed up the outside of the northeast embankment. In the event of a break in the line from the mill or in the perimeter discharge line, the pumps can either be shut off or the flow diverted to the tailings sump, which flows to a lined collection pond near the SX facility. The tailings line is also emptied into the sump after pumping to the impoundment during winter months to prevent freezing of the discharge line. Continuing observation to detect breaks in the tailings line on the embankment slope is the responsibility of the SX operators.

The responsibility for the operation and maintenance of the tailings system, which includes the tailings lines, recycle lines, spigots, seepage collection system, and the tailings embankment, is assigned to the maintenance department as part of their normal duties. The maintenance personnel are also responsible for the inspection of the different components of the tailings containment system. There are three scheduled inspections during day shift on weekdays which are conducted by the Yard Boss. The Boiler Operators perform this function on weekends or holidays. During the other two shifts, the Boiler Operators perform the inspections ever four hours. These inspections are performed from a vehicle driven around the impoundment on the dike road and are documented at the end of each shift. The entire embankment is visually checked monthly on foot when the piezometer levels are determined. Moab Wash constitutes the diversion system which would help to protect the tailings embankment from the effects of the potential maximum flood. The Wash is visually checked as part of the day shift inspection.

### 5.1.3 Operational Control

The licensee minimizes the blowing and dusting of tailings from beaches in the tailings impoundment by three methods. The first method is by wetting the tailings as the tailings solution flows toward the pond from the perimeter discharge points. The second method utilizes sprays that are supplied with raffinate from the SX process. These sprays are used on all beaches except on the western side because of the presence of the highway and high-voltage electrical lines. This system has an automatic anemometer control to shut off the sprays in a high wind (Approximately 35 mph) to prevent the blowing of the spray beyond the embankments of the impoundment. The third method involves the use of a chemical fixative on all dried beaches and dike roads. It is applied at concentrations recommended by the U.S. Bureau of Mines and was initially checked on four test patches at the site.

The operational control of these systems is assigned to the maintenance component. The proper functioning and effectiveness of the control mechanisms are checked during the three day shift inspections discussed in the previous section. The spray systems also undergo separate inspection and routine maintenance twice a day. In addition, effectiveness of dusting controls are evaluated weekly during a more comprehensive documented inspection.

### 5.1.4 Tailings Embankment Modification

Modification of the tailings embankment, such as raising the elevation, is handled mostly by outside contractors. The constuction operations are coordinated with the ongoing tailings control program. Also, the contractor is supplied with sufficient water for construction purposes as well as for dust control during construction.

## 5.2 Appraisal

### 5.2.1 Access Control

The appraiser evaluated access control by interviewing the Yard Boss and reviewing copies of the "Tailings Pond Daily Check," which includes an item concerning the condition of the fence. In addition, it was observed that all access points were controlled and that the fence was in good condition and posted in accordance with 10 CFR 20.203. All aspects of access control were found by the appraiser to be acceptable.

### 5.2.2 Tailings Containment

The appraiser evaluated the tailings containment program by interviewing the Yard Boss, reviewing copies of the "Tailings Pond Daily Checks," checking as-built embankment drawings, and observing one of the day shift inspections as well as normal operations. This program is primarily assessed against the recommendations contained in NRC Regulatory Guide 3.11.1, Revision 1, "Operational Inspection and Surveillance of Embankment Retention Systems for Uranium Mill Tailings."

The appraiser found that the management responsibility for normal operations and maintenance of the tailings containment system has been assigned to the Yard Boss as part of his normal duties. Adequate resources, in terms of manpower, equipment, and materials, are dedicated to these activities.

The pond water level is regulated by recycling and spray evaporation during normal operations. There are no written contingency plans for flood events or other emergency conditions. It should be noted, however, that only rainfall into the impoundment and runoff from the inner sides of the embankments contribute to a rise in pond level.

Daily inspections of the tailings distribution and recycle systems, the seepage collection systems, and the tailings embankments are performed three times during the day shift and every four hours on the other two shifts. The inspections of the distribution and recycle system includes visual checks of the pipe couplings for slurry or recycle leakage and visual evaluation of erosion at the tailings discharge points. If there is an erosion problem, the spigotting point is moved to prevent backcutting toward the embankment. The tailings line is placed around the inside portion of the dike road around the impoundment. In the event of a rupture on the line, the slurry should flow into the impoundment due to a two-foot berm on the outer edge of the embankment's crest and a slight grade of the dike road toward the impoundment. Safety can be further ensured by detecting ruptures immediately so measures can be taken quickly. Alarm-triggering flowrate sensors have not been installed at nozzle outlets to detect ruptures, cloggings, or other slurry flow irregularities.

The inspections of the seepage collection systems include: (1) checks on erosion at the sump discharge into the pond and also conditions that might result in back-syphoning; (2) seepage rates which are qualitatively assessed. (Actual flow measurements are performed approximately every three months); (3) checks of drainage pipes, collection ditches, and sumps for plugging by sand, ice, or debris; and (4) checks that sump pumps are working.

The inspections of the embankment structure include the measurement of the water level using a calibrated digital meter and visual checks for cracking or slumping of the embankment. Moab Wash is visually checked for aggradation, erosion, or obstructions. The observations of the day shift inspections are noted on a form entitled "Tailings Pond Daily Checks." These forms contain checks on the conditions of the dikes, wind direction, evidence of blowing tailings, discharge lines in use, condition of recycle pump and recycle line, pond level, and the condition of the fence. Any significant erosion on the outer embankment is corrected promptly. The inspection checks during the other two shifts only document the general condition of the impoundment. While all of these checks are documented, none of the inspection procedures or criteria are specifically written down to minimize the possibility of overlooking any significant features. Furthermore, no correlation of pond level readings are made so that significant changes are noted.

The only other inspections performed are the monthly checks of the embankment piezometers. In the course of collecting these data from the piezometers, located at various levels on the embankment, a more complete embankment check is made. While the piezometer data are documented they are not correlated so that significant changes are noted. Also, there are no specific written procedures for the collection of piezometer data or the criteria for the embankment check.

### 5.2.3 Operational Controls for Mill Tailings

The appraiser evaluated the operational controls for mill tailings by interviewing the Yard Boss, reviewing copies of the weekly tailings control inspections and observing the operations and effectiveness of the control methods. The appraiser found that the responsiblity for operational control has been assigned to the Yard Boss as part of his normal duties. As mentioned earlier, both chemical fixatives and water are used for tailings dust control. Both methods are used except during the winter months when the tailings beaches are frozen. The weekly inspections appeared to be effective, since a number of problem areas were identified by documentation. The inspections provide evidence that the control methods are being used. However, there are no specific written operating procedures or criteria for evaluation of the effectiveness of the methods.

### 5.2.4 Tailings Embankment Modifications

The appraiser discussed past embankment modifications with the Yard Boss. The construction operations are coordinated with the ongoing tailings control program to assure tailings dust control. However, the mill's radiation safety staff do not provide radiation protection services to construction personnel during modification work.

## 5.3 Conclusions

Based on the above findings, the tailings management program appears to be acceptable. The following recommendations are made for improvements:

1. A monthly inspection of Moab Wash should be instituted. This inspection should be more comprehensive than the daily visual checks. During this inspection the diversion channel should be examined for channel bank erosion, bed aggradation or degradation and siltation, obstruction to flow, undesirable vegetation, condition of riprap, or any other unusual or inadequate operational condition.

2. A quarterly inspection should be instituted to include the following:

   (a) The top of the embankment and the downstream toe area should be examined and surveyed for any evidence of unusual localized or overall settlements or depressions.

(b) Embankment slopes should be examined and surveyed for irregularities in alignment and variance from originally constructed slopes, unusual changes from original crest alignment and elevation, evidence of movement at or beyond the toe, erosion, and surface cracks that indicate movement.

(c) The downstream face of embankment slopes and toes, and the downstream valley areas should be examined for evidence of existing or past seepage, springs, and wet or boggy areas.

(d) The maintenance of operating facilities and features (such as pumps and valves) that pertain to the safety of the retention system should be examined to determine the adequacy and quality of the maintenance procedures followed in maintaining the dam and facilities in safe operating condition.

(e) Procedures and criteria should be developed for unscheduled inspections following the occurrence of significant earthquakes, tornadoes, floods, intense local rainfalls, or other unusual events.

3. An annual technical evaluation should be made covering the topics contained in Section C.4 and 5 of Regulatory Guide 3.11.1, Revision 1. Inspections and evaluations should be planned and conducted under the direction of an experienced professional who is thoroughly familiar with the investigation, design, construction and operation of these type of facilities. This individual should ensure that all field inspectors are trained to be able to recognize and assess signs of possible distress or abnormality and to recommend appropriate mitigating measures.

## 6.0 Environmental Monitoring

### 6.1 Program

The licensee's environmental program is summarily described in Table 6.4 of the Final Environmental Statement (NUREG-0453) and includes requirements stipulated in License Condition 37 through 41. Since the program has been described in detail in these references and also in the licensee's environmental report accompanying the license renewal application, a detailed reiteration is not presented in this report.

The Radiation Safety Officer has been designated as the individual responsible for the development and implementation of the program.

## 6.2 Appraisal

### 6.2.1 Sampling Locations

Table 6.4 of the Final Environmental Statement (FES) describes in broad terms the program sampling locations, thus providing some latitude in the selection of specific locations. The appraiser noted that wind roses in the FES indicate winds to arise predominantly from the southeast, south, and southwest. This condition would suggest that ambient air and soils sampling should be performed at a point north of the mill complex at the site boundary. However, neither does the FES prescribe nor does the licensee perform sampling at this location. Boundary sample sites are located at Tex's Tour Center east of the site and at a point west of the complex and tailings pond, but neither is close enough to the mill source term to evaluate airborne concentrations at the north site boundary at a point closest to the stacks. The licensee was questioned regarding his method of ascertaining that airborne effluents released to unrestricted areas north of the complex annually average less than limits specified in Appendix B, Table II, of 10 CFR 20. Since the licensee indicated that no evaluation is performed, the appraisers identified this deficiency as a violation of 10 CFR 20.201(b), which requires that surveys shall be performed to verify compliance with paragraph 20.106(a).

The appraiser also noted several surface ponds south of the site that are not sampled. These include the plant water pond, the filter backwash pond, and a third pond downgradient from the other two. Also observed were process liquids from tank overflows running toward these ponds from the mill. One mill spokesman indicated that water from one of these ponds might be pumped for use in hand washing at mill restroom sinks. Also, the licensee stated that Moab Wash is not sampled at times when water flows along this course.

The licensee also described the site sanitary system and stated that annually sewage is pumped from the retention area to a truck and is transferred to the municipal sewage treatment plant in Moab. The appraiser was informed that shower drains discharge to the sewer system; however, sewer samples are never radiologically analyzed.

### 6.2.2 Stack Effluent Samples

The licensee performs sampling of effluent from dust collector stacks and from the yellowcake scrubber stack. None of these samples are performed isokinetically. For example, the probe used for scrubber stack sampling has a sharp right angle junction which collects the sample midway along the stack diameter. Since License Condition 39 specifies that sampling of this stack shall be conducted isokinetically, the appraisers identified this condition as a violation. The technician who performs the sampling also indicated that no action is taken to assure that the hearth is operating when the scrubber stack effluent is sampled.

There is one additional effluent release point, presently not sampled, that has a potential for signficant uranium release. This "recarb" stack includes a sprayer near its top which introduces process water bearing low concentrations of uranium. Boiler combustion gases are introduced at the bottom. A demister has recently been installed in this stack.

### 6.2.3 Ambient Air Samples

The continuous particulate air samplers used by the licensee are of commercial design and contain an electric sample pump, flow regulator, rotometer, and filter head. The complete assembly is mounted on a post at the permanent sample location and is enclosed in a metal box also supplied by the manufacturer. There are grates in the front and the back of the box and a fan at the back to draw air through the enclosure. The sample head assembly inside the box is located with its face within approximately 0.5 inch of the side of the box. The appraiser noted that impaction and venturi effects within the box would reduce the amount of particulate matter collected on the filter so as to yield a deceptively low result. The manufacturer of the device was contacted and stated that sampling was not meant to be performed with the enclosure in place over the sampling assembly; however, this is the arrangement used by the licensee. Also, sample changing procedures did not call for verifying sampler air flow by means of the rotometer prior to changing the filter.

Radon is sampled by collection of an air sample in a 47-liter bag. These samples are transferred to a Lucas chamber for counting. Because of the large volume of sample available, transfer problems which plagued in-plant radon sampling should be absent. The range of results obtained at the sample location at Arches National Park Headquarters compared favorably with the data obtained from samples at the same location by the Department of Radiological Health, University of Utah.

A meteorology tower is provided on site to continually monitor wind speed and direction at about plant stack height. The tower is also equipped with differential temperature sensors to monitor atmospheric stability. Only the wind speed and direction sensor is operable, and although charts are usually kept, the only data that are recorded in a usable form are wind speed and direction when samples are collected.

### 6.2.4 Direct Radiation

Direct radiation is monitored by two methods. The first is by instrument measurements performed quarterly around the boundary fence and tailings pond. The second method utilizes TLD's.

The TLD program was judged to be the more effective method due to the integrating capability of this measurement method. There were, however, a number of major weaknesses identified in the TLD program. The TLD's used are the same type of devices used for personnel monitoring. Devices specifically designed for environmental monitoring are not used. The TLD's are changed monthly rather than quarterly which results in a greater statistical error associated with the measurement. Also, the appraiser had difficulty understanding the rationale of TLD placement. Most were located in a predominantly upwind direction. Lastly, there has been no trend analysis of this data by the licensee.

### 6.2.5 Water Samples

Surface water samples are obtained from the Colorado River at one upstream point and five downstream points. The appraiser questioned the logic of the numerous downstream samples. One sample near the mill and a second downriver, at a point where complete mixing would be expected, would have seemed sufficient. Data are graphed, but sometimes axes were found to be mislabeled and points misplotted.

Groundwater is sampled from three wells located between the tailings pond and the river. The sampling procedure has been amended recently to require bailing two well volumes prior to sampling. The data are graphed and some trend analysis has been performed. A water sample is also obtained from a storage tank at Arches National Park Headquarters north of the mill. The appraiser questioned whether this truly could be considered a representative goundwater sample, since it was not obtained directly from the source.

### 6.2.6 Biota and Soil Samples

The licensee's program for vegetation and soil sampling was deemed adequate, although trend analyses have not been accomplished.

License Condition 41 requires the licensee to conduct a monitoring program to determine if small mammals on the mill site have experienced a buildup of arsenic in their edible tissues. If so, the impact on the local raptor population is to be predicted. According to the FES, the raptor of most concern is the prairie falcon which is known to be present in Arches National Park. To fulfill the requirement, the licensee has trapped mice on and off site. All reported results have been less than 0.03 mg arsenic per gram. The appraiser determined that the license condition has been fulfilled; however, the possible impact on the prairie falcon has not been properly evaluated, since the falcon feeds during the day and mice are primarily nocturnal. In any case, due to the high level of human activity on site, it is not considered likely that a day-feeding raptor could be receiving a significant portion of its food from the site.

### 6.2.7 Sample Analysis and Reporting

Except for vegetation samples and TLD's, all environmental samples are analyzed on site by the licensee. In most cases radioactive source standards are not traceable to the National Bureau of Standards, and in no case have samples been split with an EPA certified or other laboratory. The licensee is currently working to establish a laboratory quality assurance program as described in Regulatory Guide 4.15, "Quality Assurance for Radiological Monitoring Programs (Normal Operations) -- Effluent Streams and the Environment." Also data reports do not contain many of the sample conditions and data specified in Section 7 of Regulatory Guide 4.14, "Radiological Effluent and Environmental Monitoring at Uranium Mills."

### 6.2.8 Land Use Surveys

License Condition 40 requires the licensee to conduct annual land use surveys of the area within two miles of the mill. Two such reports have been submitted. The March 1981 report indicated that there were three permanent residents at Tex's Tour Center, a site adjacent to the mill and the nearest residence. The RSO stated that he did not know if there was a well on the property. A conversation with the desk clerk at the tour center revealed that there are seven full time residents and fifteen or more summer residents. There is no well.

## 6.3 Conclusions

Based on the above findings, improvements in the following areas are required to achieve an acceptable environmental monitoring program:

1. Ambient air and soil sampling should be performed at the site boundary north of the complex at a point where maximum airborne uranium concentrations would be expected.

2. Water sampling of site ponds, Moab Wash, and the site sewer retention area should be incorporated into the environmental program. Sampling rationale should be based on radioactivity analyses of initial samples.

3. Stack effluents should be sampled isokinetically and should be performed when the mill is in full operational status. The "recarb" stack effluent should be sampled for uranium and should be included on the routine sampling program if results so warrant.

4. Modifications to continuous particulate air samplers should be made to assure that sampling is representative of concentrations at the sample location.

5. The direct radiation measurement program utilizing TLD's should be re-evaluated in accordance with the comments noted in Section 6.2.4.

6. The licensee should assure that all environmental data is graphed or otherwise evaluated for trends.

7. The licensee should establish a laboratory quality assurance program in accordance with Regulatory Guide 4.15. Data should be recorded and reported in a manner similar to that described in Regulatory Guide 4.14.

# ANNEX A

## INDEPENDENT MEASUREMENTS

The appraisal team performed various independent measurements within the mill during the mill appraisal. Radiation dose rate measurements were made with a Xetex Model 304A survey meter. Dose rates were found to be typical of a mill environment ranging up to 2 mR/hr in the yellowcake product storage compound. Eight wipe surveys were performed in worker eating areas throughout the mill. The highest result was 2,562 dpm alpha/100 $Cm^2$ and 6,881 dpm beta-gamma/100 $Cm^2$ for a wipe sample of a desk top in the yellowcake packaging control room. Three air samples were taken and analysis is in progress.

# ANNEX B

## EXIT INTERVIEW

The appraisal team and the Region IV Technical Inspection Branch Chief met with licensee representatives (identified in Annex C) at the mill on May 15, 1981. The appraisal team leader summarized the scope and major findings of the appraisal. The findings were classified into three categories:

A. Significant appraisal findings are described in Appendix A of the transmittal letter forwarding this report and are based on conclusions listed in each subsection of the report. Written responses to these significant findings will be required to be submitted by the licensee. Actions taken on these findings will be reviewed during subsequent inspections.

B. Violations identified during the appraisal are described in Appendix B of the letter forwarding this report.

   Written responses to these items will be required to be submitted by the licensee. Actions taken on these items will be reviewed during subsequent inspections.

C. Findings of lesser significance but which are considered important by the appraisal team are discussed within the report. No written response to these findings will be required; however, progress and improvements in these areas will be reviewed in subsequent inspections.

## ANNEX C

## PERSONS CONTACTED

Atlas Minerals

*W. M. Jensen, General Mill Manager
*D. L. Edwards, Chief Metallurgist
*B. H. Flynn, Maintenance Manager
*R. E. McCormick, Mill Superintendent
*J. E. Panos, Administrative Manager
*J. Atwood, Senior Metallurgist
*R. Squires, Safety Engineer
*S. Shatley, Personnel Manager
J. Johnson, Radiation Technician
V. Hebel, Assistant Radiation Technician
D. Sargent, Assistant Radiation Technician
C. Pilling, Metallurgy Clerk and Assistant Radiation Technician
S. Pool, Warehouseman
S. Domenick, Alkaline Circuit General Foreman
L. Oliver, Acid Circuit General Foreman
R. Anderson, Yard Boss
J. Jackson, Electrical Foreman
J. Nelson, Instrument Lead Man
E. Hout, Assistant Control Technician
K. Flynn, Analyst
Various mill technicians and operators

Others

N. Savignac, Consultant
C. Peterson, Ranger, Arches National Park
S. Lopez, Ranger, Arches National Park
B. M. Johnson, Mine Safety and Health Administration
Desk Clerk, Tex's Tour Center

*Denotes those present at the exit interview on May 15, 1981.