1. Atlas Minerals
Division of Atlas Corporation
P. O. Box 486
Moab, Utah 84532

2. March 2 and 3, 1970

3. Reinspection (4)

4. 10 CFR 20 and 40

5. License No. SUA-917 (Docket 40-3453)

6. This unannounced inspection included a review of records related to the procurement, processing and storage of source material, interviews with those responsible for the administrative and radiological protection aspects of the licensee's program, examination of procedures employed by the licensee, tours of the mill circuit, tailings area, and related sampling locations, and a summary discussion of the inspection findings with licensee management.

The following item of noncompliance was apparent:

10 CFR 20.201(b), "Surveys"

in that, adequate surveys were not conducted in order to show compliance w th 10 CFR 20.103(a), "Exposure of individuals to concentrations of radioactive material in restricted areas," during non-routine replacement of the yellow cake dryer during the period April 14, 1969 to May 16, 1969. (See para. 3P)

7. September 23 and 24, 1968

8. No

Initials	Herman J. Paas, Jr. Inspector	2/18/70 Date
Initials	Reviewer	2/18/70 Date

Inspection History

9. Reinspection (3) of the subject license was conducted on September 23 and 24, 1968. Three items of noncompliance noted during this inspection were transmitted to the licensee on Form AEC-592 dated October 9, 1968, which described these items as follows:

> " a. During the period December, 1967, through July, 1968, the sample tower operator was exposed to concentrations of airborne natural uranium in excess of the concentrations listed in 10 CFR 20, Appendix B, contrary to the requirements of 10 CFR 20.103(a), 'Exposure of individuals to the concentrations of radioactive material in restricted areas.' (Item corrected, see par. 34, 35 & 36)
>
> " b. The exposure referenced in item a above was not reported, in writing, to the individual receiving the exposure nor to the AEC, contrary to the requirements of 10 CFR 20.405(a)(and (b), 'Reports of overexposures and excessive concentrations.' (Item corrected, see para. 10)
>
> " c. Contrary to 10 CFR 20.201, 'Surveys,' by failure to conduct time studies and correctly time-weight the available information, surveys which were conducted were not adequate to show compliance with 10 CFR 20.103(a), 'Exposure of individuals to concentrations of radioactive materials in restricted areas,' for the following:
>
> > " 1. the crushing plant during the period January, 1968, through September, 1968; (Item corrected, see par. 33)
> >
> > " 2. the packaging area during the year 1968; and, (Item corrected, see para. 33)
> >
> > " 3. the ball mill area during December, 1967." (Item corrected, see para. 33)

10. During reinspection (4), it was noted that the licensee had implemented the corrective actions described in his reply to AEC-592 in correspondence dated November 1, 1968. The current status of these items of noncompliance is further described in the related paragraphs, as referenced in the previous paragraph.

11. It should be noted that during the interval during the conduct of reinspection (3), the licensee was involved in two incidents requiring investigation. A fire in the solvent extraction area of the uranium mill, which occurred on December 25, 1968, was investigated on December 26, 1968, and the findings of this investigation were summarized in a Compliance Investigation Report dated February 11, 1969. A break in the tailings distribution pipe, which occurred on November 23, 1968, was investigated by CO:IV on November 26, 1968, and the findings of this investigation were summarized in a Compliance Investigation Report dated January 3, 1969. No items of noncompliance were noted in either of these investigations.

Current Inspection

12. An unannounced reinspection (4) of this license was conducted on March 2 and 3, 1970. Mr. Dennis Daley of the State of Utah Department of Health accompanied the inspector throughout the inspection. In addition to including inspections of all items listed in

paragraph 6 of this report, the inspection included a review of all measurements that were taken in relation to the two incidents which were the subjects of investigations conducted on November 26, 1968, and December 26, 1968. It should be noted that many of the evaluations regarding these two incidents were not completed at the time the original investigations were conducted.

13. Personnel contacted during the course of this inspection included:

Mr. William P. Badger, Chief Metallurgist
Mr. Waynard Jensen, General Superintendent
Mr. Gary Boyer, Process Metallurgist
Mr. Dick Unger, Administrative Coordinator

Messrs. Badger and Boyer were the principal interviewees and Mr. Boyer accompanied the inspector throughout the entire inspection. It should be noted that Mr. Paul Bethurum, Manager for the Utah Operations of the Atlas Minerals Division, was not in residence at the mill site during the period of inspection.

Organization

14. The in-residence management team is currently composed of the individuals described in the previous paragraph. Mr. Bethurum, as manager of the operation at Moab, reports to Mr. Roy F. Hollis, President of Atlas Minerals, who is located at the licensee's corporate office at 910 Security Life Building, Denver, Colorado.

15. Changes in the licensee's organization during the period covered by this inspection included the replacement of Mr. R. McCormick, Special Projects Engineer, by Mr. Gary Boyer, who assumed all duties formerly handled by Mr. McCormick. Mr. Dick Unger, who formerly was associated with other milling activities of this licensee, was assigned to the Moab mill in the position of Administrative Coordinator. This is a new position in the licensee's structure and the duties incorporate liaison functions that the licensee conducts with the Atomic Energy Commission in respect to license administration and Grand Junction relationships.

Responsibility

16. Mr. Badger stated that the responsibility for administering the licensee's program and conducting it in a manner acceptable to established health and safety criteria is a joint effort among several personnel under his supervision and as a result of their efforts, he is summarily responsible for the overall program. Badger stated that he reports to Mr. Bethurum in this respect. He stated that Mr. Boyer is responsible for the collection of all samples and the subsequent analysis of them. He stated that the results of these measurements are jointly evaluated by Boyer, Unger, and himself (Badger). Badger stated that all programs and sampling results are reviewed by him and Unger and that

they jointly recommend or implement any decision regarding unusual findings.

Operations

17. Employment records revealed that the licensee employs approximately 100 people in the overall Moab milling operations. Approximately 50 of these employees are directly engaged in the milling process wherein their duties involve nominal potential for exposure.

18. Following a review of records that represent the period July 1, 1969, through the date of the inspection, Mr. Badger stated that the mill has been processing between 1,000 and 1100 tons of uranium-bearing ore per day. He stated that this ore contains between 0.23 and 0.24% U_3O_8 by weight and that the current process allows approximately 95.66% of the U_3O_8 to be recovered.

19. It should be noted that milling operations were continuous from the date of the previous inspection (September 24, 1968) to December 25, 1968, on which date a fire destroyed the solvent extraction circuit. Milling operations were again resumed on July 1, 1969, and were conducted on a 24-hour continuous basis through the date of this inspection. Mr. Badger stated, and the records later verified, that all employees engaged in milling operations work a 42-hour work week.

Ore Procurement

20. Badger stated that approximately 66% of raw ore processed through the mill comes from properties owned by Atlas Minerals. The remaining 33% of all ore processed originates from properties that are not owned by Atlas and the subsequent processing of this ore is performed on a custom-milling basis.

Sales

21. Records exhibited by the licensee showed that some of the Atlas ores and nearly all of the custom-milled ores processed result in the sale of U_3O_8 to the AEC. Some Atlas ores result in sales to Boston Edison through Allied Chemical and, commencing in February, 1970, Atlas started supplying some U_3O_8 to West Germany sources. The records indicated that through Fiscal 1970, approximately 180,000 pounds of U_3O_8 were sold to the AEC from Atlas-processed material and approximately 45,000 pounds of U_3O_8 were sold to the AEC from the processing of custom-milled ores. The licensee possesses a contract for providing 700,000 pounds of U_3O_8 to Boston Edison and another contract for one million pounds to West Germany customers. Over 600,000 pounds of the latter commitment have already been shipped. Badger stated that the current program related to sales is projected for a 1-1/2-year operation and that, at the present time, the on-site inventory of U_3O_8 is

negligible.

Process Changes

22. Discussions with Badger, Jensen, and Boyer indicated that, except for the shutdown related to the December, 1968, fire, there were no significant changes in the circuit or process. It should be noted that the acid circuit was not rebuilt after the December, 1968, fire, and all operations conducted the startup on July 1, 1969, involved use of the alkaline circuit. It was also noted that the licensee added an oxide storage tank to the old ammonia precipitation process and now incorporates the use of hydrogen pyroxide in the precipitation step.

LIQUID EFFLUENT CONTROL PROGRAM

Description

23. Process tailings continue to be discharged to the large tailings pond which currently contains an estimated 10 million tons of tailings. The licensee controls the liquid level of the pond by means of a vertical pipe which, via adjustment of the height of the pipe, allows the pond to discharge surface liquids to an overflow collection pond where the overflow effluent is treated with barium chloride as it flows to another adjacent small settling pond. This treated liquid is released on a non-continuous basis to the Colorado River through a calibrated weir from which a continuous sample, proportional to the amount of liquids released, is collected. The licensee evaluates the concentration of contaminants in the effluent at locations representing the feed solution to the barium chloride addition pond, the effluent discharged to the Colorado River following barium chloride addition, and samples the Colorado River on a monthly basis at one location above the point of effluent addition and at five locations downstream from the point of this addition. All analyses are conducted on a monthly basis and either represent samples that are collected on a proportionate basis in the effluent discharge system or on a grab sample basis for the locations sampled in the Colorado River. Analyses of these samples are performed for Ra-226, Th-230, and natural uranium.

Activity Measured in Effluent Discharged to Colorado River

24. Records maintained by the licensee showed that during periods when liquid tailings are allowed to be decanted from the main tailings pond, the licensee treats the feed solution with barium chloride at the rate of 1 ml of barium chloride for every two gallons of tailings discharge. Samples of this effluent are collected as feed solution prior to the barium chloride treatment and as effluent discharge, which represents the barium chloride treated tailings prior to the release to the Colorado River. These samples are collected proportionately on a monthly basis and are analyzed for Ra-226, Th-230, and natural uranium.

The results of these measurements were reviewed and it was noted that the liquid effluents discharged to the Colorado River did not contain concentrations of Ra-226 or Th-230 above the applicable MPC's of 3×10^{-8} uc/ml and 2×10^{-6} uc/ml at any time. The following table summarizes these data on a quarterly basis:

Effect of Barium Chloride Addition

	Ra, 226, 10^{-8} uc/ml		Th-230, 10^{-6} uc/ml	
Period	Feed Solution	Effluent Discharge	Feed Solution	Effluent Discharge
4th Qtr., 1968	2.46	Nil	0.151	0.112
1st Qtr., 1969	No discharge *			
2nd Qtr., 1969	No discharge *			
3rd Qtr., 1969	1.76	0.08	0.010	0.009

* No ore was processed during the period December 25, 1968, to July 1, 1969, due to a rebuilding program resulting from fire in solvent extraction circuit on December, 25, 1968.

Colorado River and Effluent Discharge Flow Rates

25. The concentrations of radioactive contaminants in the effluent discharged to the Colorado River, as tabulated in the previous table, were observed to be further diluted by a factor in excess of 10^3 by the flow rate of the Colorado River. Records maintained by the licensee showed that the River flowed at a rate of the order of 1.5×10^6 to 2.3×10^6 gallons per minute, whereas the effluent discharge rate ranged from 400 to 1100 gallons per minute. It should be noted that the rate of flow for the effluent represents an average over a one month period. The following values extracted from the licensee's records were believed typical for the entire period covered by this inspection:

Flow Rates of Colorado River and Effluent Discharge to the River

Period	River Flow g/m	Effluent Flow Rate g/m
October, 1969	2,337,000	405
November, 1969	2,173,000	814
December, 1969	1,876,000	907
January, 1970	1,731,000	1,020

Colorado River Sampling Program

26. Records maintained by the licensee showed that the licensee repetitively conducted the requisite sampling program of the Colorado River. A review of the monthly sampling results from one upstream and five downstream locations showed that concentrations of Ra-226, Th-230, and natural uranium did not exceed the respective maximum permissible concentrations of 3×10^{-8}, 2×10^{-6}, and 2×10^{-5} uc/ml during any month of this inspection period. The following table summarizes the concentrations measured in this program:

Results From Colorado River Sampling Program - Moab Mill

All Ra-226 Analyses N x 10^{-8} uc/ml
All Th-230 Analyses N x 10^{-6} uc/ml
All U Natural Analyses N x 10^{-5} uc/ml

Period	Sampling Locations					
	One Mile Above Mill	1/4-Mile Below Mill	1/2-Mile Below Mill	One Mile Below Mill	Five Miles Below Mill	Ten Miles Below Mill
Oct. 1968						
Ra-226	0.062	0.079	0.058	0.087	0.053	0.045
Th-230	0.009	0.011	0.014	0.039	0.025	0.023
U Nat	0.001	0.001	0.001	0.001	0.001	0.00002
Nov. 1968						
Ra-226	0.018	0.011	0.026	0.038	0.032	0.038
Th-230	0.005	0.010	0.005	0.005	0.006	0.007
U Nat	0.00014	0.0011	0.00089	0.00089	0.00089	0.00057
Dec. 1968						
Ra-226	0.015	0.025	0.026	0.019	0.048	0.063
Th-230	0.0069	0.0038	0.0110	0.0047	0.0065	0.0028
U Nat	0.00140	0.00085	0.00120	0.0014	0.0014	0.0012
Jan. 1969						
Ra-226	0.014	0.015	0.021	0.068	0.030	0.048
Th-230	0.029	0.032	0.024	0.024	0.019	0.023
U Nat	0.0019	0.0036	0.0019	0.0020	0.0013	0.0011
Feb. 1969						
Ra-226	0.016	0.043	0.038	0.037	0.020	0.029
Th-230	0.006	0.007	0.006	0.008	0.005	0.005
U Nat	0.0012	0.0010	0.0004	0.0004	0.0004	0.0019
March 1969						
Ra-226	0.014	0.015	0.025	0.026	0.018	0.020
Th-230	0.006	0.004	0.003	0.005	0.006	0.003
U Nat	0.0014	0.0016	0.0017	0.0017	0.0016	0.0017
April 1969						
Ra-226	0.024	0.011	0.032	0.020	0.043	0.029
Th-230	0.006	0.005	0.005	0.005	0.004	0.009
U Nat	0.002	0.0005	0 0012	0.0007	0.0007	0.0007
May 1969						
Ra-226	0.016	0.014	0.014	0.019	0.015	0.009
Th-230	0.005	0.005	0.003	0.006	0.004	0.005
U Nat	0.001	0.0006	0.001	0.001	0.001	0.0006
June 1969						
Ra-226	0.028	0.124	0.016	0.047	Nil	Nil
Th-230	0.013	0.008	0.007	0.007	0.006	0.007
U Nat	0.006	0.006	0.006	0.006	0.006	0.006
July 1969						
Ra-226	0.040	0.081	0.039	0.033	0.012	0.025
Th-230	0.004	0.012	0.003	0.009	0.003	0.004
U Nat	0.001	0.0006	0.0006	0.0006	0.0006	0.0006
Aug. 1969						
Ra-226	0.053	0.054	0.037	0.043	0.050	0.037
Th-230	0.009	0.008	0.005	0.008	0.008	0.004
U Nat	0.001	0.0006	0.0004	0.0009	0.0001	0.0006
Sept. 1969						
Ra-226	0.039	0.040	0.062	0.037	0.072	0.059
Th-230	0.008	0.007	0.007	0.004	0.005	0.005
U Nat	0.0009	0.0009	0.0006	0.0006	0.0009	0.0009

(continued)

Continued from page 7.

Period	Sampling Locations: One Mile Above Mill	1/4-Mile Below Mill	1/2-Mile Below Mill	One Mile Below Mill	Five Miles Below Mill	Ten Miles Below Mill
Oct. 1969						
Ra-226	0.034	0.028	0.033	0.034	0.035	0.034
Th-230	0.005	0.006	0.005	0.011	0.013	0.005
U Nat	0.001	0.0001	0.0001	0.0004	0.0006	0.0006
Nov. 1969						
Ra-226	0.026	0.044	0.020	0.014	0.043	0.055
Th-230	0.004	0.004	0.007	0.005	0.004	0.003
U Nat	0.00014	0.00016	0.00040	0.0004	0.0004	0.0009
Dec. 1969						
Ra-226	0.039	0.025	0.039	0.032	0.042	0.013
Th-230	0.006	0.005	0.009	0.008	0.011	0.012
U Nat	0.0001	0.0003	0.0004	0.0006	0.0003	0.0003
Jan. 1970						
Ra-226	0.044	0.021	0.035	0.029	0.026	0.033
Th-230	0.006	0.006	0.007	0 .005	0.005	0.006
U Nat	0.0006	0.0009	0.0006	0.0006	0.0006	0.0006
Feb. 1970						
Ra-226	Samples in process - records show collection on 2/24/70					
Th-230	0.004	0.006	0.008	0.007	0.006	0.005
U Nat	0.001	0.0014	0.0013	0.0017	0.0017	0.0019

27. The liquid effluent sampling program conducted by the licensee also includes periodic evaluations for concentrations of Po-210 and Pb-210. Samples of the effluent feed and the effluent discharge are analyzed monthly for Po-210 and quarterly for Pb-210. A review of the licensee's records showed that the concentration of Po-210 in the feed solution ranged from 0.8 to 1.1 x 10^{-13} uc/ml and in the effluent as discharged to the River ranged from 0.072 to 0.569 x 10^{-13} uc/ml. Concentrations of Pb-210 in the effluent as discharged to the River showed values in the range of 2 x 10^{-14} to 6 x 10^{-14} uc/ml. It was apparent from the orders of magnitude and from the consistency of the monthly and quarterly measurements that the licensee was not experiencing any problem in the discharge of Po-210 or Pb-210 to the Colorado River.

Independent Measurements

28. No liquid effluent was being discharged to the Colorado River on the dates of this inspection. The inspector obtained a one-liter sample from the February collection from the proportionate sampler that samples the effluent discharged to the River and submitted this sample to the Analysis Branch, Health and Safety Division, ID, for analysis of Ra-226, Th-230, Natural uranium, Po-210 and Pb-210. The results from this sample will be incorporated as a supplement to this report when they are received from ID.

AIRBORNE RADIOACTIVE MATERIAL
UNRESTRICTED AREA

Program

29. Twenty representative locations within a 10-mile radius of the mill are sampled by the licensee on a quarterly basis. The licensee continues to use a high-volume Staplex type sampler for the collection of an approximately 20,000-liter air sample at each location. Records verified that the licensee records the wind velocity, wind direction, percent humidity, and temperature at the time of sampling.

Results

30. Records of the results of this sampling program showed that concentrations of natural uranium in the unrestricted area were consistently well below the maximum permissible concentration of 0.8×10^{-12} uc/ml. In general, uranium concentrations were not significantly different than the detection or sensitivity limit of the measurement at locations between 5 and 10 miles from the plant site. Concentrations in samples collected near the plant site were generally less than 25% of the applicable MPC. The following table summarizes the maximum concentrations that were measured during the quarterly periods covered by this inspection.

Maximum Concentration of Uranium Measured in Unrestricted Area

Period	Maximum Measurement	Location
4th Qtr., 1968	0.33×10^{-12}	High school
1st Qtr., 1969	0.27×10^{-12}	Mill entrance
2nd Qtr., 1969	0.21×10^{-12}	Mill entrance
3rd Qtr., 1969	0.18×10^{-12}	Mill entrance
4th Qtr., 1969	0.19×10^{-12}	Mill entrance

It was apparent from the review of concentrations experienced by the licensee in unrestricted areas that the usage of licensed material under this license was performed in a manner such that these concentrations did not exceed the limits specified in Appendix B, Table II, of Part 20.

AIRBORNE RADIOACTIVE MATERIAL
RESTRICTED AREA

Sample Collection Program

31. Air samples are collected from approximately 20 representative mill locations each month and are analyzed for purposes of determining airborne concentrations of uranium. The licensee employs a Staplex air sampler, which is operated for a 20-minute period at a rate of approximately 20 liters per minute, resulting in a sample on the order of 400 liters of air. Sampling procedures and subsequent analytical techniques were observed to be

identical to those described in previous inspection reports of this series.

Maximum Permissible Concentrations

32. Except for the short periods between the date of the previous inspection and the fire (September 24, 1968 to December 25, 1968) when the crusher was operated by personnel working a 40-hour work week, all personnel working in the licensee's milling operations work a 42-hour work week. The adjusted MPC's, based on an exposure in a 42-hour work week, were determined to be 5.714×10^{-11} uc/ml for those working in the final product area of the mill and 2.38×10^{-11} uc/ml for those working in the head end of the mill. Crusher operators working the 40-hour work week maintained an MPC of 2.5×10^{-11} uc/ml.

Time Studies

33. During the previous inspection, it was noted that the licensee's failure to conduct time studies for purposes of correctly time-weighting available air sample results, in terms of exposure to personnel, was deficient for the crushing plant, the packaging area, and the ball mill area during certain periods within the previous inspection (reinspection (3)). In accord with the licensee's statements regarding this deficiency, it was noted that the licensee conducted a thorough time study during the month of October, 1968, repeated this time study during August, 1969, and was in the process of conducting another time study at the time of this inspection. Time study records were reviewed by the inspector and were appraised as being adequate to properly evaluate airborne concentrations in terms of exposure to personnel. It should be noted that this action on the part of the licensee corrected a previous item of noncompliance.

Results of General Air Sampling Program

34. Airborne uranium concentrations as determined from the monthly air samples collected at 20 locations in the mill were reviewed. A review of the results of this program showed that uranium concentrations measured in individual samples were below the applicable MPC, as defined in the second paragraph above, in all cases except the following:

Crusher Area: Samples collected during October, 1968, and January, 1969, at the 4th floor of the sample tower showed concentrations of 11.49×10^{-11} uc/ml and 4.58×10^{-11} uc/ml. During July, 1969, a sample collected on the 1st floor of the sample tower showed an average concentration of 4.42×10^{-11} and during November, 1969, the sample obtained at the crusher deck showed a uranium concentration of 4.24×10^{-11} uc/ml. A sample collected on the cyclone deck during November, 1968, showed an average uranium concentration of 3.4×10^{-11} uc/ml.

as approaching

Final Product Area: Individual air samples exceeding the applicable MPC included the top hearth deck during November, 1968, where the concentration was measured at 6×10^{-11} uc/ml, the V_2O_5 packaging area which showed 5.57×10^{-11} uc/ml during January, 1969, the drum filter area which showed 5.83×10^{-11} uc/ml during May, 1969, and the U_3O_8 packaging area which showed concentrations of 3.63×10^{-11} uc/ml, 3.63×10^{-11} uc/ml, and 1.73×10^{-11} uc/ml during May, July, and November, 1969, respectively.

Exposure of Individuals to Concentrations of Uranium In Restricted Areas

35. The exposures of individuals to concentrations of airborne uranium during the periods and at the locations tabulated in the previous paragraph were considerably below the values indicated as a result of duplicate air samples that were taken during the same period which reflected significantly lower concentrations or by computing the true time-weighted exposure to the individual by applying correction values determined by the licensee when conducting time studies for these respective job locations. In reference to the locations at which the high values shown in the previous paragraph were found, the time studies conducted by the licensee showed that operating mill personnel spend less than 2% of their work time on the 4th floor of the crusher tower, 15% of operating time on the 1st floor of the sample tower and on the crusher deck, 14% of operating time on the cyclone deck, 2% of operating time on the hearth top deck, and less than 5% of operating time at the V_2O_5 packaging area, drum filter, and U_3O_8 packaging area. It was apparent that by applying the time-weighted factors as indicated by the licensee's studies to the airborne concentrations, as measured by the licensee, that no mill personnel were exposed to concentrations of uranium in restricted areas in excess of the limits specified in Appendix B, Table I, Part 20. It should further be noted that in many of the cases where the higher concentrations were measured in individual samples, the licensee conducted a duplicate sampling program wherein the concentrations measured in the second sample was well below the applicable MPC of 2.38×10^{-11} for crusher personnel and 5.714×10^{-11} for product operators.

Improvements Observed

36. During this inspection, it was noted that the frequency of the licensee experiencing high airborne concentrations of uranium was greatly reduced when compared to the period covered by the previous inspection. During a tour of the mill, it was noted that the licensee had implemented numerous corrective actions to minimize dusting conditions at locations where high concentrations were previously experienced. Hoods and drop curtains had been placed around the crusher and ball mills for purposes of retaining

uranium dust in the process, grid panels which had openings allowing dust to penetrate from the second floor of the sample tower to the first floor of the sample tower were observed to have been welded such that the second floor of the sample tower is now a solid wall-to-wall floor, air circulation devices had been installed in the sample tower to promote the exit of any dust that may occur, hoods have been installed at several locations where individuals operate equipment such that the dusting conditions would be retained in the operating system rather than admitted to the open atmosphere, louvered dome fans were added to the ceilings of the operating buildings for purposes of expediting the discharge of any dust that may accumulate, and general tidiness and housekeeping was observed to be vastly improved at locations where operating personnel spend most of their working time. Additionally, it was observed that the licensee had conducted several time studies which allowed a reasonably accurate calculation of personnel exposure based on airborne concentrations as measured through the monthly sampling program.

Breathing Zone Samples

37. The licensee employs a lapel sampler which samples at the rate of 3.5 l/m. Normal sampling periods range for periods between 5 and 6 hours. Records maintained by the licensee showed that these samplers are placed on five different mill operators each month; namely, crusher operator, sample tower operator, ball mill operator, precipitation operator, and product man. Typically, airborne concentrations of natural uranium measured by conduct of the routine breathing zone sampling program for the period after mill startup (July 1, 1969), averaged in the range of 8×10^{-12} uc/ml to 1.09×10^{-11} uc/ml for the crusher operator, from 1.1×10^{-11} uc/ml to 1.93×10^{-11} uc/ml for the sample tower operator, from 3×10^{-12} uc/ml to 1.9×10^{-11} uc/ml for the ball mill operator, from 6×10^{-12} uc/ml to 4.98×10^{-11} uc/ml for the precipitation operator, and on the order of 2.31×10^{-11} uc/ml for the product man prior to the discontinuation of the latter job assignment during the 3rd quarter of 1969. It was apparent from the results of these measurements that the licensee was not encounting any exposure problems related to airborne concentrations of natural uranium.

Non-Routine Breathing Zone Samples

38. Following procedures identical to those described in the previous paragraph, with the exception that sampling periods normally ran between 2 and 4 hours, the licensee performs evaluations of airborne concentrations of natural uranium during non-routine maintenance work where the natural of the work indicates that higher than normal concentrations of natural uranium may be experienced. Records exhibited by the licensee showed that the licensee experienced 13 occasions where the non-routine air sampling

program was performed. A review of the results of these measurements showed that all concentrations of natural uranium measured were less than 2.5×10^{-11} uc/ml, except for one sample which showed a concentration of 3.56×10^{-11} uc/ml. Although the latter sample was above the applicable MPC of 2.5×10^{-11} uc/ml, it was noted that the duration of the particular job was 4 hours and thus, on a time-weighted basis, the exposure to the personnel involved was in accord with limits defined in Appendix B, Table I, Part 20.

39. During the tour of the mill operations, it was personally observed by the inspector that the yellow cake dryer had been completely rebuilt. Discussion with Mr. Boyer and Mr. Badger verified this observation in that they stated that the dryer had been in need of maintenance and repair and that the licensee took advantage of the shutdown period following the fire in the solvent extraction circuit to completely rebuild the yellow cake dryer. They stated that the old dryer was completely disassembled, rebricked, and a new hearth was installed. Upon inquiry and review of air sampling records, it was verified that no evaluations of airborne concentrations were made during the period of disassembly and reassembly of the yellow cake dryer. Time card records showed that this work commenced on April 14, 1969, and was completed on May 16, 1969. Badger agreed with the inspector to the fact that the disassembly operations involved in rebuilding the yellow cake dryer, particularly those tasks associated with the chipping and removal of the old brick, provided a likely potential for high airborne concentrations of uranium in the atmosphere where personnel were working and further agreed that the licensee was deficient in not performing evaluations of airborne concentrations of uranium prior to and during the maintenance operations. Badger was informed that it was apparent that the licensee was in noncompliance with the requirements of 10 CFR 20.201(b) in that adequate surveys were not conducted in order to show compliance with the requirements of 10 CFR 20.103(a), "Exposure of individuals to concentrations of radioactive material in restricted areas" during the nonroutine replacement of the yellow cake dryer in the period April 14, 1969, to May 16, 1969. Boyer agreed that the licensee was deficient in that respect and further stated that all future operations involving nonroutine type maintenance would be accompanied by an air sampling program that would evaluate the concentrations of natural uranium to which employees may be exposed.

Personnel Monitoring

40. As noted during previous inspections of this licensee, the licensee periodically initiates a film badge monitoring program on a monthly basis for purposes of assuring that personnel engaged in mill operations received whole body exposures less than 25% of the applicable 10 CFR 20.101(a) limits. This same program was conducted during the months

of September, October, and November, 1969, through a service provided to the licensee by Landauer. Eighty-five mill operating personnel were badged on a monthly basis during this period. The exposure records, in the form of vendor reports which satisfy Form AEC-5 facsimile, were reviewed. It was noted that of the 82 people that were badged during this three-month period (one quarter), 18 people received an exposure in excess of 100 mr and 6 people received an exposure in excess of 150 mr. The highest exposure received by any personnel was noted to be that received by the ball mill operators. The four shift ball mill operators received quarterly exposures of 300 mr, 240 mr, 140 mr, and 100 mr. It was apparent that, based on these evaluations, no mill operating personnel had been exposed to a dose in any calendar quarter in excess of 25% of the applicable 10 CFR 20.101(a) limit of 1-1/4 rem per calendar quarter.

41. The significance of these evaluations was discussed at length with Messrs. Badger and Boyer, in that it was noted that the whole body exposure to the ball mill operators (300 mr) during the quarter was very close to approaching the limit of 312 mr, which defines the requirement of supplying appropriate personnel monitoring equipment to personnel in accord with the requirements of 10 CFR 20.202(a). Mr. Badger agreed that it was apparent that the licensee should initiate a continuing badge monitoring program for all ball mill operators and for other select personnel working in the mill. Badger stated that the licensee would initiate a repetitive badge program for approximately 15 different mill operators, including all ball mill operators, and upon receipt of several months' evaluation of this program would determine how extensive the badge monitoring program should be conducted.

Area Radiation Surveys

42. The licensee's records showed that radiation surveys are performed at 31 different plant locations on a quarterly basis. The licensee uses a Model 111 scintillation Precision Instrument for this purpose. A review of these records showed that all measurements were less than 1 mr/hr at all locations except those which were made in the vicinity of the ball mill classifier. Readings obtained at the ball mill classifier were shown as ranging from 2.8 mr/hr to 4 mr/hr throughout the period covered by the inspection. The higher readings noted at the ball mill classifier apparently verified the exposures received by the ball mill operators, as noted in the previous paragraph. Although no items of noncompliance were apparent from the area radiation survey results, the higher values noted at the ball mill classifier apparently confirmed that all personnel working in this area should be badged on a routine basis. This badging program was agreed upon as stated in the previous paragraph.

Personnel Instruction

43. Form AEC-3 was observed to be posted at several locations throughout the mill. Badger and Boyer stated that all licensee personnel are furnished with copies of the licensee's brochure which covers employee instructions in regard to health and safety items as well as protection from external and internal radiation exposure. The instruction program conducted by the licensee was appraised as being consistent with that observed during previous inspections.

Posting and Labeling

44. During the tour of the mill, it was observed that all entrances to the mill were properly posted and it was further observed that a frequency of posting around the perimeter property of the licensee was maintained in a manner such that allows visual observation by any one likely to engage in inadvertent unauthorized entry. In general, posting and labeling standards were maintained in a manner comparable to that observed during previous inspections of this series and no deficiencies were noted at this time.

Incidents

45. The licensee was involved in two incidents during the period covered by this inspection. These incidents, which involved a break in the tailings distribution pipe on November 23, 1968, and a fire in the solvent extraction circuit on December 25, 1968, were investigated by CO:IV and the results of the investigations were documented in Compliance Investigation Reports dated January 3, 1969, and February 11, 1969, respectively. As no items of noncompliance were noted during either of the investigations and the investigation reports are conclusive in summary of facts, no further discussion of the facts surrounding these incidents is included in this report. However, during the review of licensee records, it was observed that the licensee had documented the results of all measurements related to the environmental sampling that was conducted following these two incidents. Some of the documented measurements were not available at the time that the related investigations were conducted. For purposes of documentation and to further establish that the licensee was not involved in any areas of noncompliance as a result of these incidents, six tabular summaries related to environmental measurements are included in this report. Tables I through III relate to environmental measurements performed following the fire in the solvent extraction unit and Tables IV through VI relate to similar measurements following the tailings rupture. These summaries follow:

TABLE I

Fire in Solvent Extraction Impounded Solution

Sampled at 3:00 p.m., December 25, 1968
Results reported in grams per liter U308

Sample *	g/l U308
1	0.014
2	0.018
3	0.014
4	0.021
5	0.015
6	0.058
7	0.160
8	0.016
9	0.018

* Refer to investigation report for sample location identification; sampling point 9 was not plotted on map.

TABLE II

Fire in Solvent Extraction Air Samples

December 25, 1968

Sample	Time	U308 uc/ml	Location
1	10:30 am	1.68×10^{-13}	Approximately 50 yards NW of fire area.
2	10:50 am	2.15×10^{-13}	Approximately 50 yards West of fire area.
3	11:10 am	1.33×10^{-13}	Approximately 250 yards SE of fire area.
4	11:30 am	1.49×10^{-13}	Approximately 100 yards South of fire area.
5	11:50 am	1.33×10^{-13}	Approximately 250 yards SW of fire area.
6	12:20 pm	1.49×10^{-13}	Approximately 1-1/2 miles South of fire area (unrestricted).

Each sample was taken for 15 minutes. Air volume was 10,620 liters.
During the sampling period the weather was overcast with intermittent snow.

TABLE III

Fire in Solvent Extraction
Colorado River Samples
December 25, 1968

Location	Time	U Natural x 10^{-5}	Th-230 x 10^{-6}	Ra-226 x 10^{-8}
Above mill	7:00 am	0.0010	0.004	0.019
1 mile below mill	7:00 am	0.0290	0.003	0.025
5 miles below mill	7:00 am	0.0011	0.005	0.025
10 miles below mill	7:00 am	0.0020	0.003	0.042
Above mill	11:00 am	0.0011	0.005	0.074
1 mile below mill	11:10 am	0.0017	0.004	0.021
5 miles below mill	11:20 am	0.0027	0.004	0.599
10 miles below mill	11:35 am	0.0017	0.006	0.016
Above mill	3:00 pm	0.0014	0.004	0.021
1 mile below mill	3:00 pm	0.0014	0.004	0.020
5 miles below mill	3:00 pm	0.0014	0.005	0.026
10 miles below mill	3:00 pm	0.0023	0.004	0.030

Sampling times are approximate, but within a few minutes of accuracy. Three persons were involved in nearly simultaneous sampling at different locations.

TABLE IV

Tailings Pipe Rupture

Effluent Samples

Date	Time	Sample	uc/ml N x 10^{-5} U Natural	N x 10^{-6} Thorium-230	N x 10^{-8} Radium-226
11/23/68	1:30 pm	Solution	0.13	0.31	11.90
11/23/68	1:30 pm	Solids	0.46		24.46
11/23/68	6:30 pm	Solution	0.14	1.01	Nil
11/23/68	6:30 pm	Solids			11.53
11/23/68	9:30 pm	Solution	0.129	0.207	0.99
11/23/68	9:30 pm	Solids			13.79
11/24/68	2:10 am	Solution	0.140	0.362	Nil
11/24/68	2:10 am	Solids			10.10
11/24/68	5:45 am	Solution	0.134	0.213	Nil
11/24/68	5:45 am	Solids			9.54
11/24/68	12:10 pm	Solution	0.143	0.154	0.12
11/24/68	12:10 pm	Solids			9.49

TABLE V

Tailings Pipe Rupture
Ra-226 in Colorado River Solids

Date	Time	Location	uc/ml N x 10^{-8} Ra-226
11/23/68	5:50 pm	1 mile below mill	Nil
11/23/68	6:00 pm	5 miles below mill	0.25
11/23/68	6:10 pm	10 miles below mill	0.13
11/23/68	9:30 pm	Above mill	0.15
11/23/68	9:30 pm	5 miles below mill	0.16
11/23/68	9:30 pm	10 miles below mill	0.48

TABLE VI

Tailings Pipe Rupture
Colorado River Samples

Date	Time	Location	uc/ml N x 10^{-5} U Natural	N x 10^{-6} Th-230	N x 10^{-8} Ra-226
11/23/68	1:15 pm	Above mill	0.00086	0.003	0.030
"	3:50 pm	1/4 mile below mill	0.00057	0.005	0.038
"	3:56 pm	1/2 mile below mill	0.00057	0.003	2.68
"	1:45 pm	1 mile below mill	0.00098	0.007	0.052
"	1:55 pm	5 miles below mill	0.00057	0.004	0.24
"	2:05 pm	10 miles below mill	0.00086	0.003	0.37
"	5:50 pm	1 mile below mill	0.0010	0.023	0.021
"	6:00 pm	5 miles below mill	0.00043	0.019	0.15
"	6:10 pm	10 miles below mill	0.0043	0.022	0.11
"	7:20 pm	Above mill	0.00043	0.014	0.061
"	9:30 pm	Above mill	0.00057	0.014	0.074
"	9:30 pm	1 mile below mill	0.00057	0.009	0.024
"	9:30 pm	5 miles below mill	0.0043	0.005	0.04
"	9:30 pm	10 miles below mill	0.00057	0.004	0.16
11/24/68	2:20 am	1 mile below mill	0.00057	0.005	0.039
"	2:35 am	5 miles below mill	0.00043	0.003	0.020
"	2:50 am	10 miles below mill	0.00047	0.004	0.028
"	3:30 am	Above mill	0.00043	0.003	0.018
"	5:30 am	Above mill	0.00043	0.005	0.015
"	6:10 am	1 mile below mill	0.00057	0.003	0.005
"	6:25 am	5 miles below mill	0.00043	0.006	0.013
"	6:40 am	10 miles below mill	0.00043	0.003	0.023
"	10:20 am	Above mill	0.00043	0.004	0.038
"	10:30 am	1/4 mile below mill	0.00043	0.003	0.028
"	[illegible]	1/2 mile below mill	0.00057	0.005	0.028
"	10:50 am	1 mile below mill	0.00072	0.004	0.015
"	[illegible]	5 miles below mill	0.00057	0.005	0.028
"	[illegible]	10 miles below mill	0.00043	0.004	[illegible]

Discussion with Management

46. Mr. Paul Bethurum, Manager, of the licensee's Utah operations, was not in residence at the mill site on the days that the inspection was conducted. At the conclusion of the inspection, the inspector met with Messrs. Jensen, General Superintendent; Badger, Chief Metallurgist; Boyer, Process Metallurgist; and, Unger, Administrative Coordinator. These gentlemen were informed that one item of noncompliance was observed wherein the licensee failed to perform an adequate survey with respect to the requirements of 10 CFR 20.201(b) for purposes of showing compliance with 10 CFR 20.103(a), "Exposure of individuals to concentrations of radioactive material in restricted areas," during the replacement of the yellow cake dryer in the period April 14, 1969 to May 16, 1969. Messrs. Jensen and Badger acknowledged that the licensee was deficient in this respect and they stated that they would assure that airborne concentrations of uranium are evaluated during all future operations involving nonroutine maintenance. Mr. Jensen stated that he would inform Mr. Bethurum of the inspection findings.

47. It was also agreed that recent data were indicative that film badge monitoring should be conducted on a routine basis for certain operators in the mill. Badger and Jensen stated that they would initiate this program in the immediate future. The licensee was informed that Form AEC-592, describing the one item of noncompliance, would be transmitted from CO:IV.

48 Mr. Roy F. Hollis, President of the Minerals Division, whose office is located in Denver, Colorado, was contacted by telephone on March 17, 1970, and informed of the summary discussion described above.

(2) Redress from any hypothetical adverse environmental impact to the non-restricted area is not anticipated. However, should redress be necessary some of the following steps can be taken to correct such possibilities:

(a) If direct discharge of liquid and solid effluents into the river cannot be eliminated by present operating procedures planned for the new plant, it can be corrected by additional filtration units between the grinding units and the leach plant to reduce water consumption. Additional liquid-solid separation units after leaching can be added to the circuit to further reduce water requirements.

(b) If seepage into the Colorado River can be proven to be above standards promulgated by the State of Utah or the Federal Government, a new tailings pond will be constructed with a sealed base north of the present pond.

(3) Modifications during construction will be made if it is believed such alterations of current plans will benefit the environment. Current plans are not so rigid as to foreclose any reasonable changes. If ongoing research and development result in the discovery of economically sound opportunities to eliminate any possible adverse effect on the environment, they will be incorporated in the flowsheet during the construction period.

(4) A delay in immediate construction start-up is not in the public interest for a number of compelling reasons:

(a) It is expected that plant construction will take 18 months from start-up to completion. During this period in time the non-vanadium ores available for treatment, concurrently with construction, will be limited to about six months operation of the alkaline plant. Therefore, any delay in construction start-up will make it impossible for Atlas to meet present firm sales commitments in 1975 and 1976. More important, it will generally reduce the availability of U_3O_8 required over the long term to alleviate the national energy shortage.

(b) Current crude ore inventories and projected non-vanadium ore receipts indicate that the present alkaline plant will have to be shut down October 10, 1973. Approximately 22 key employees on the mill payroll will be retained as a personnel nucleus to assist in start-up when operations resume. If construction of the new process cannot be started prior to October 10, 1973, 40 employees will be laid

off who otherwise could be employed on construction. In addition, development of our vanadium mines will have to be delayed, resulting in further unemployment. Ancillary operations, such as transportation of ore from mine to mill, will be curtailed, contributing to additional unemployment in the area.

(c) As the non-vanadium mines have gradually been depleted, as noted in (a) above, receipts of such ores have reached the point where mill capacity is substantially in excess of requirements. The reduced scale of mill throughput cannot maintain a viable operation. It was for this reason that vanadium ore reserves were acquired and developed to augment ore supplies to the extent necessary to create and maintain a viable operation at Moab. It was hoped that vanadium reserves could be developed and a process to treat such ores constructed before our non-vanadium sources were depleted. If this could have been accomplished a viable operation would have been maintained without let up and no personnel lay-offs would have been necessary. We were successful in acquiring and developing enough vanadium ore to satisfy our requirements which, with our limited non-vanadium production, satisfies our ore requirements for the foreseeable future. However, our inability to coordinate the completion of our new plant with these developments make it necessary to put our plant operation on standby for most of the time prior to completion of construction. Since our standby costs are estimated to cost $48,000 per month, we are anxious to eliminate as much standby time as possible. This can be accomplished only by completing construction of our new processes at the earliest possible date.

(d) The maximum productive capacity of the new plant will be about 5,000,000 pounds of V_2O_5 per year. Currently the deficiency in domestic production against domestic consumption must be made up from foreign imports. The production from our proposed plant will make a significant contribution toward improving our balance of payments.

In view of the factual data submitted in the foregoing paragraphs, it is hereby requested that Atlas Minerals, Division of Atlas Corporation be granted an exemption from 10 CFR 40.31 (f) and 40.32 (e) prior to completion of the NEPA review.

Very truly yours,

R. F. Hollis

RFH:dh