Form AEC-592
(7/67)

UNITED STATES ATOMIC ENERGY COMMISSION
DIVISION OF COMPLIANCE

I, II Re(3)

1. LICENSEE	2. REGIONAL OFFICE
Atlas Minerals Division of Atlas Corporation P. O. Box 488 Moab, Utah 84532	U. S. ATOMIC ENERGY COMMISSION REGION IV, DIVISION OF COMPLIANCE 10395 W. COLFAX, ROOM 200 DENVER, COLORADO 80215
3. LICENSE NUMBER SUA-917 (Docket 40-3453)	4. DATE(S) OF INSPECTION September 23 and 24, 1968

5. The following activities under your license (identified in Item No. 3 above) appear to be in noncompliance with AEC regulations or license requirements, as indicated.

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."

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."

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;

2. the packaging area during the year 1968; and,

3. the ball mill area during December, 1967.

Original Signed By
Herman J. Paas

Supplementary page None attached. Herman J. Paas, Jr. — AEC Compliance Inspector — OCT 9 1968 — Date

ORIGINAL: LICENSEE. COPIES: ☑ CO REGION ☐ CO HEADQUARTERS ☐ CO-ENFORCEMENT

1. Atlas Minerals
Division of Atlas Corporation
P. O. Box 488
Moab, Utah 84532

2. September 23 and 24, 1968

3. Reinspection (3)

4. 10 CFR 20 and 40

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

6. This inspection consisted of a review of all records pertinent to the processing of source material at the subject facility, interviews with persons responsible for the mill operation and related radiation protection programs, and tours of the operating mill, tailings area, effluent treatment area, and liquid and gaseous sampling locations.

The following items of noncompliance were noted or otherwise observed:

10 CFR 20.103, "Exposure of individuals to concentrations of radioactive material in restricted areas."

(a) in that, during the period December, 1967, through July, 1968, the sample tower operator was exposed to concentrations of airborne natural uranium which ranged from 1.8 to 3.5 times the applicable limit. (See par. 29)

10 CFR 20.405, "Reports of overexposures and excessive levels and concentrations."

(a) and (b) in that, the exposure of the sample tower operator referenced 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). (See par. 31)

10 CFR 20.201, "Surveys."

(b) in that, by failure to conduct time studies and correctly time-weight the available information, those surveys which were conducted in the crushing plant during the period January 1968 through September 1968, were not adequate to show compliance with 10 CFR 20.103(a). (See par. 30)

(b) in that, by failure to conduct time studies and correctly time-weight the available information, those surveys which were conducted in the packaging area during the year 1968, were not adequate to show compliance with 10 CFR 20.103(a). (See par. 32)

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10 CFR 20.201

(b) in that, by failure to conduct time studies and correctly time-weight the available information, those surveys which were conducted in the ball mill area during December 1967, were not adequate to show compliance with 10 CFR 20.103(a). (See par. 30)

7. November 9 and 10, 1966

8. No

Initials		Herman J. Paas, Jr.		Inspector		10/8/68	Date
Initials		Glen D. Brown		Reviewer		10/9/68	Date

Inspection History

9. The second reinspection of the Atlas Minerals mill was conducted on November 9 and 10, 1966. As a result of this inspection, the licensee was cited in respect to 10 CFR 20.201, "Surveys," for not performing surveys pursuant to 10 CFR 20.106(a), in that, environmental surveys performed by the licensee did not show the wind speed, and direction and weather conditions. This item was found to be corrected in accord with the licensee's statement in his letter to CO:IV dated December 16, 1966.

Current Inspection

10. An announced reinspection (3) of the subject licensee was conducted on September 23 and 24, 1968. This inspection consisted of a tour of all facilities of the mill, a review of records for the period covered by this inspection, discussions with those responsible for the use and radiation safety practices associated with the license, and the performance of several measurements for purposes of validating the licensee's radiation record program.

11. Mr. P. V. Betherum, Manager, Utah Operations, and Resident Manager of the Moab mill, was contacted at the outset and conclusion of the inspection. Other Atlas personnel contacted during the course of the inspection included Messrs. Waynard Jensen, General Plant Superintendent; William Badger, Chief Metallurgist; and R. McCormick, Special Projects Engineer. Mr. McCormick was the principal interviewee as he is assigned the supervisory responsibility for all analytical work and for the overall radiation protection program associated with the licensee's activities at the Moab mill.

Organization

12. Mr. Betherum stated that he joined Atlas Minerals in June, 1967, following resignation from a similar position with Susquehanna-Western. He stated that the entire top management team underwent a change during the year 1967 with Jensen joining the organization in August, 1967; Badger joining in November, 1967; and Don Field joining the organization in February, 1968, as chief chemist. Betherum stated that he reports to Roy F. Hollis, President of Atlas Minerals, who maintains his office at 910 Security Life Building, Denver, Colorado.

Operation

13. Mr. Betherum stated that the mill processes about 1,000 tons of uranium-bearing ore per day. Ore processed over the past year contains approximately 0.2 to 0.25% U_3O_8 by weight. U_3O_8 recovery averages approximately 96.5%.

14. Betherum stated that nearly all ore processed is done on a custom basis and that very little of the ore processed through the mill originates from Atlas Minerals mine sources. He stated that presently nearly all U_3O_8 is produced for the U. S. AEC. The only exceptions mentioned were the accumulation of some product in storage under an agreement that Atlas has with Homestake Mining. He further stated that the company has some agreements nearing completion with West Germany and General Electric which could influence the customer allocation of product during the ensuing year.

15. Atlas Minerals, under the direction of the Denver management office, employs 231 people. The Moab mill operations account for 207 of these employees. The remaining employees are either incorporated in the company's operations of an acid plant at Mexican Hat, Utah, or in the Denver main office.

16. Betherum stated that the only circuit or process changes taking place during the period covered by this inspection were related to the vanadium plant and the addition of an acid leach circuit for uranium and vanadium. He stated the vanadium plant was completed and started in January, 1967, and the acid leach circuit was initiated in February, 1968.

LIQUID EFFLUENTS

Description

17. The licensee employs three ponds in the effluent discharge system. The tailings that are released from the mill are discharged to a large tailings pond estimated to contain between 5 and 10 million tons of tailings which have been accumulated over a 12-year operation period. The surface area of this pond is approximately 78 acres. Overflow from this pond, which is controlled by a vertical pipe, is discharged to a small adjacent pond where the overflow effluent is treated with barium chloride as it flows to another small settling pond. The treated liquid is released to the Colorado River from this pond through an effluent ditch in which the flow is measured by readings taken at a calibrated weir and from which a continuous sample which is proportional to the quantity of liquid released is collected. The licensee samples the Colorado River at one location upstream from the confluence of the effluent stream and at five locations ranging from 1/4-mile to 10 miles below the confluence on a month basis. Annual downstream samples are collected at locations 20, 30, and 50 miles below the confluence of the effluent discharge.

Barium Chloride Treatment

18. Records maintained by the licensee showed that the licensee adds approximately 6,000 pounds of barium chloride per month to the effluent stream as it leaves the large tailings pond. The records showed that for the period January 1, 1968 through September 20, 1968, the

licensee added 56,300 pounds of barium chloride. The decontamination effect of this addition was estimated to range from a factor of 7 to 60 for Ra-226 and to range from a factor 2 to 3 for Th-230. The licensee maintains continuous records on the activity in the feed solution and in the effluent discharged. These were examined on a spot-check basis and the values summarized in the following table were believed typical of normal operations:

Effect of Barium Chloride Addition

Month	Ra-226, 10^{-8} uc/ml		Th-230, 10^{-6} uc/ml	
	Feed Solution	Effluent Discharge	Feed Solution	Effluent Discharge
January, 1968	14.6	0.5	0.037	0.012
February, 1968	16.5	1.25	0.005	0.003
March, 1968	13.9	1.76	0.005	0.002
June, 1968	12	0.5	0.023	0.011
July, 1968	6.4	0.09	0.013	0.008

Activity Measured in Effluent Discharge To Colorado River

19. The concentrations of nuclides of interest in the effluent discharged to the Colorado River are determined by the licensee on a monthly basis from data collected from the measured flow rate and proportional sample accumulation method described in paragraph 17. In a letter dated May 29, 1968, from the licensee to the AEC, the licensee submitted a summary of these measurements by month for the year 1967. During the course of this inspection, the values for flow rate and Ra-226, Th-230, and Natural Uranium concentrations, as stated by the licensee, were checked and found to be accurate as submitted in the licensee's letter. The following data were extracted from the licensee's record for the period January, 1968, to date:

Concentrations of Radio-nuclides in Liquid Effluent Discharged to Colorado River

Month 1968	Effluent Flow Rate, GPM*	Ra-226 10^{-8} uc/ml	Th-230 10^{-6} uc/ml	U Nat 10^{-5} uc/ml
January	996-1661	0.51	0.012	0.05
February	956-1580	1.25	0.003	0.019
March	826-1176	1.76	0.002	0.003
April	1090-1611	0.30	0.004	0.020
May	1046-1472	0.47	0.008	0.057
June **	543-1472	0.52	0.011	0.026
July	934-1324	0.09	0.008	0.029
August	880-1634	0.17	0.006	0.011
September	996-1373	(Composite not complete on date of inspection.)		

* Variation by factor of 2 is due to the use of two RIP circuits or one RIP circuit.
** During the month of June, the flow to the River was zero for 12 days.

It was noted that the average concentrations of Ra-226, Th-230, and natural uranium, as computed for a period not exceeding one year, have not exceeded the appropriate 10 CFR 20 limits. It was also observed that these same concentrations temporarily exceeded the applicable 10 CFR 20 limits for short periods during the summer of 1967; however, the short duration of the period and the coincident low effluent discharge rate preclude any item of noncompliance.

20. It was also noted that the licensee analyzes a composite monthly sample for Po-210 and Pb-210. A review of these results showed that the monthly averages for Pb-120 range from 0.04 to 0.37 picocuries/ml, except that during September and October, 1967, the monthly average was 0.61 and 0.77 picocuries/ml. Po-210, during the period April, 1967, through August, 1968, averaged $< 1 \times 10^{-12}$ uc/cc throughout the period.

21. In discussing the temporary high concentrations of Ra-226 and Th-230 which were noted during the summer of 1967, the licensee stated that these higher results were related to the startup of the acid circuit which was performed without the alkaline circuit running. McCormick stated that after July, 1967, no further high concentration problems were experienced as both circuits were run simultaneously since that date. In an effort to provide a mechanism for identifying any comparable problem in the future, the licensee initiated a program for determining the pH of the solution. The pH records show that normal values of around 7 are experienced and expected as compared to a pH of 2 which was experienced during the summer of 1967. It was apparent to the inspector that no further problem should be anticipated in this respect as the licensee realizes the acid circuit cannot be run alone without effecting a special neutralizing of the tailings.

Tailings Pond Stabilization

22. During a tour of the tailings pond area, it was noted that the program of covering the banks of the tailings pond with shale and silt which was underway at the time of the previous inspection (reinspection (2)), had been completed and that this same program had been undertaken periodically as the need arose because the banks increased in height. Visual observation indicated structural integrity of these banks. It was further noted that the licensee has provided emergency ponds on the lower end of the main tailings area which are intended to act as receiving ponds for any tailings that may seep from the main pond. It was apparent to the inspector that considering the structural integrity of the existing pond and the topographic features of the emergency pond, the licensee's had little likelihood of experiencing any tailings release that would result in spreading tailings to an area that is not controlled by the licensee.

Colorado River Sampling Program

23. In addition to sampling the effluent as it is discharged from the last settling pond, the licensee samples the Colorado River at six locations on a monthly basis and at six additional locations on an annual basis. Monthly samples are collected upstream from the confluence of the effluent stream and at downstream locations located 1/4-mile, 1/2-mile, one mile, five miles, and 10 miles from the confluence of effluent stream. The licensee's records were reviewed in respect to the concentrations of Ra-226, Th-230, and natural uranium measured at these locations during the period January, 1967, to September, 1968, and were found to be as follows:

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

	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
Jan., 1967						
Ra-226	0.030	0.040	0.040	0.010	0.020	0.003
Th-230	0.002	0.0005	0.001	0.001	0.0008	0.0005
U Nat	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006
Feb., 1967						
Ra-226	0.062	0.058	0.054	0.059	0.110	0.010
Th-23	0.003	0.003	0.001	0.002	0.003	0.004
U Nat	0.0006	0.0003	0.0003	0.0010	0.0006	0.0006
March, 1967						
Ra-226	0.040	0.050	0.059	0.034	0.076	0.040
Th-230	0.009	0.004	0.005	0.003	0.004	0.007
U Nat	0.0008	0.0008	0.0006	0.0008	0.0006	0.0006
April, 1967						
Ra-226	0.017	0.029	0.030	0.042	0.023	0.016
Th-230	0.002	0.004	0.002	0.005	0.003	0.003
U Nat	0.0006	0.0006	0.0006	0.0006	0.0010	0.0006
May, 1967						
Ra-226	0.029	0.021	0.023	0.033	0.062	0.025
Th-230	0.007	0.008	0.007	0.012	0.014	0.013
U Nat	0.0006	0.0008	0.0008	0.0008	0.0010	0.0010
June, 1967						
Ra-226	0.040	0.037	0.034	0.028	0.020	0.025
Th-230	0.010	0.009	0.020	0.034	0.021	0.008
U Nat	0.0008	0.0010	0.0230	0.0230	0.0290	----
July, 1967						
Ra-226	0.048	0.038	0.057	0.030	0.061	0.071
Th-230	0.009	0.003	0.011	0.009	0.010	0.009
U Nat	0.0004	0.0001	0.001	0.0004	0.001	0.001
August, 1967						
Ra-226	0.033	0.040	0.095	0.028	0.016	0.092
Th-230	0.020	0.008	0.012	0.010	0.007	0.009
U Nat	0.0009	0.0009	0.0014	0.0017	0.0011	0.0006

Sept., 1967						
Ra-226	0.039	0.060	0.035	0.023	0.020	0.097
Th-230	0.020	0.012	0.006	0.007	0.005	0.003
U Nat	0.0006	0.0017	0.0011	0.0011	0.0006	0.0006
Oct., 1967						
Ra-226	0.039	0.033	0.170	0.052	0.120	0.069
Th-230	0.006	0.007	0.010	0.015	0.005	0.004
U Nat	0.0017	0.0014	0.0011	0.0011	0.0009	0.0017
Nov., 1967						
Ra-226	0.030	0.025	0.032	0.043	0.097	0.044
Th-230	0.009	0.004	0.008	0.008	0.006	0.007
U Nat	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006
Dec., 1967						
Ra-226	0.018	0.033	0.038	0.015	0.068	0.045
Th-230	0.004	0.006	0.007	0.004	0.004	0.004
U Nat	0.0006	0.0004	0.0001	0.0006	0.0006	0.0004
			= = = =			
Jan., 1968						
Ra-226	0.038	0.198	0.187	0.015	0.030	0.043
Th-230	0.009	0.008	0.006	0.006	0.007	0.004
U Nat	0.0009	0.0006	0.0006	0.0009	0.0009	0.0006
Feb., 1968						
Ra-226	0.097	0.141	0.21	0.57	0.108	0.102
Th-230	0.007	0.003	0.005	0.003	0.006	0.004
U Nat	0.001	0.006	0.010	0.006	0.006	0.009
March, 1968						
Ra-226	0.076	0.019	0.038	0.092	0.036	0.050
Th-230	0.009	0.004	0.003	0.004	0.006	0.007
U Nat	0.001	0.001	0.001	0.001	0.001	0.001
April, 1967						
Ra-226	0.126	0.038	0.036	0.009	0.090	0.041
Th-230	0.003	0.004	0.008	0.009	0.006	0.006
U Nat	0.0009	0.001	0.0006	0.0006	0.0009	0.0009
May, 1968						
Ra-226	0.059	0.029	0.008	0.023	0.037	0.013
Th-230	0.005	0.003	0.008	0.007	0.005	0.006
U Nat	0.0006	0.0006	0.0006	0.001	0.001	0.0006
June, 1968						
Ra-226	0.032	0.079	0.057	0.10	0.048	0.024
Th-230	0.003	0.004	0.004	0.005	0.007	0.008
U Nat	0.0009	0.001	0.001	0.0006	0.0006	0.0006
July, 1968						
Ra-226	0.37	0.016	0.042	0.077	0.025	0.086
Th-230	0.008	0.004	0.006	0.002	0.012	0.006
U Nat	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002
Aug., 1968						
Ra-226	0.032	0.020	0.008	0.028	0.016	0.004
Th-230	0.006	0.005	0.006	0.009	0.005	0.004
U Nat	0.0003	0.0003	0.0003	0.0003	Nil	0.0003
Sept., 1968						
Ra-226	In process					
Th-230	0.010	0.013	0.011	0.011	0.020	0.011
U Nat	0.0006	0.0009	0.0006	0.0006	0.0006	0.0006

Based on the results as summarized in the above table, it was concluded that the concentrations of Ra-226, Th-230, and natural uranium in the Colorado River at locations directly below the confluence of the licensee's effluent stream and the Colorado River, were less than the limits specified in Appendix B, Table II, 10 CFR 20, at all times during this inspection period.

24. It was noted in the licensee's records that annual samples are collected from the Colorado River at locations 20, 30, and 50 miles downstream from the confluence of the effluent stream. In addition, annual samples are collected at the confluence of the Green River and Colorado River, at locations above this confluence, below this confluence, and upstream in the Green River. The results of analyses of these samples for concentrations of Ra-226, Th-230, and natural uranium showed that the respective concentrations were below the limits specified in Appendix B, Table II, 10 CFR 20, in all cases.

Independent Measurements

25. The inspector collected a grab sample from the liquid effluent stream at a point directly below the last tailings settling pond which is the same location at which the licensee collects the continuous proportional sample of this stream. This sample was submitted to the Analyses Branch, Health & Safety Division, IDO, for analysis on September 30, 1968, and upon receipt of the results from the analyses for the concentrations of the nuclides of interest, these data will be supplemented as part of this report in the CO:IV files.

PERSONNEL MONITORING

26. Based on the results of film badges programs which the licensee conducted during periods prior to the period of inspection covered by this inspection, the licensee has concluded that all exposures to personnel engaged in mill operations are less than 25% of the applicable 10 CFR 20.101(a) limits . To compliment these earlier studies and to assure continued compliance with 10 CFR 20.202(a)(1), the licensee currently participates in a film badge exchange program supplied and processed by R. S. Landauer wherein employees are badged on a monthly exchange basis during any quarter in which the licensee experiences any change in classification or circuit. Two situations of this type were experienced by the licensee during this inspection period. During the quarter January 1 through March 30, 1967, coincident with the period when the licensee changed to the acid circuit startup, and during the first quarter of 1968 coincident with the period when the licensee added the vanadium process to the acid circuit. In each of these cases, the licensee employed 12 badges for purposes of determining any change in whole body exposure. A review of these records as determined from the vendor reports showed that the maximum quarterly exposure during the 1st quarter of 1967 was 220 mr and, during the first quarter of 1968 was 70 mr.

It was apparent that these measurements were in general agreement with the previous experience of the licensee and that the operation of the mill in its current status precludes any likelihood of any employee receiving a dose in any calendar quarter in excess of 25% of the applicable 10 CFR 20.201(a) limits. No items of noncompliance were noted or believed apparent.

AIRBORNE RADIOACTIVE MATERIAL RESTRICTED AREA

Sample Collection Program

27. The licensee evaluates the concentrations of airborne radioactive material from the results obtained from a monthly air sampling program that includes general air samples collected at 23 different locations in the mill and breathing zone samples that are collected at five job sites. The sampling locations, procedures employed, and analytical methods were observed to be consistent with those described in previous inspection reports of this series.

General Air Samples

28. The records maintained by the licensee consist of a tabulation of monthly and quarterly averages which show the concentration of natural uranium at all general air sampling locations. A review of these results for sampling locations at the head end where the sample tower operator and crusher operator work a 40-hour week showed that natural uranium concentration did not exceed the MPC of 2.5×10^{-11} uc/ml during the year 1967. It was noted however that commencing in January, 1968, these airborne concentrations showed an increasing trend which continued through the sampling period conducted in September, 1968. Concentration values during this period were consistently above the reference MPC. The following table summarizes this trend for the six sample locations at the head end of the mill:

Sample Tower Operator and Crusher Operator Exposures
Average Airborne Concentrations of Uranium in Units of 10^{-11} uc/ml

Work Location	Oct. thru Dec. 1967	Jan. thru March 1968	April thru June 1968	July thru Sept. 1968
Sample tower, 1st floor	1.06	4.66	6.54	11.93
Sample tower, 2nd floor	1.5	3.08	3.42	11.50
Sample tower, 4th floor	0.9	3.23	4.00	4.23
Belt ramp	0.8	2.61	1.83	1.57
Deck	0.9	0.84	3.68	0.95
Doghouse	0.5	0.55	1.34	0.67

A review of the licensee's records of monthly air sample results which comprise the quarterly averages tabulated above show the average airborne concentrations exceeded the MPC of 2.5×10^{-11} uc/ml during the following 160-hour work periods:

Month	Location	Airborne Concentration Uranium - Units of 10^{-11} uc/ml
January 1968	Belt Ramp	3.36
March 1968	Belt Ramp	4.07
March 1968	Sample tower, 4th floor	6.19
January 1968	Sample tower, 2nd floor	7.95
January 1968	Sample tower, 1st floor	4.95
February 1968	Sample tower, 1st floor	4.42
March 1968	Sample tower, 1st floor	4.60
April 1968	Sample tower, 1st floor	11.67
May 1968	Sample tower, 1st floor	3.36
June 1968	Sample tower, 1st floor	4.60
April 1968	Sample tower, 2nd floor	4.07
May 1968	Sample tower, 2nd floor	4.77
April 1968	Sample tower, 4th floor	7.07
June 1968	Sample tower, 4th floor	3.00
June 1968	Belt ramp,	3.18
June 1968	Deck	7.87
June 1968	Doghouse	3.18
August 1968	Sample tower, 1st floor	30.6
August 1968	Sample tower, 2nd floor	31.9
July 1968	Sample tower, 4th floor	4.2
August 1968	Sample tower 4th floor	3.9
September, 1968	Sample tower, 4th floor	4.6

It was noted that based on general air sample results, the sample tower operator who spends his full 40-hour week on the first floor was exposed to concentrations in excess of the MPC (2.5×10^{-11} uc/ml) during the period January, 1968, through June, 1968, and during August, 1968. Further confirmation of the higher airborne concentrations as measured by the general air sample, were noted when reviewing the results of breathing zone samples for the crusher operator and tower operator. The monthly breathing zone sample results for the tower operator showed an average concentration of 9.8×10^{-11} uc/ml in December, 6.7×10^{-11} uc/ml in February, 4.5×10^{-11} uc/ml in March, 2.7×10^{-11} uc/ml in April, 4.2×10^{-11} uc/ml in March, 2.8×10^{-11} uc/ml in June, and 3.8×10^{-11} uc/ml in July. Similar measurements for the crusher operator showed the average concentrations of 6.12×10^{-11} uc/ml in June and 3.09×10^{-11} uc/ml in July.

29. Based on the above breathing zone sample results and considering that the tower operator spends 100% of his 40-hour week on the first floor, it was agreeably concluded with Messrs. McCormick and Betherum that the tower operator was exposed to concentrations 1.08 & 3.5 times the MPC (2.5×10^{-11} uc/ml) during the period December 1967 through July 1968. Upon being informed that this exposure was in noncompliance with the requirements of 10 CFR 20.103(a), Messrs. Betherum and McCormick stated they would undertake a study to determine the cause of the increased airborne concentrations and would implement remedial action such that these concentrations would be reduced to a level below the MPC. McCormick implied that it may be necessary for the licensee to install an air-conditioned doghouse on the first floor of the sample tower.

30. Although it appeared that the crusher operator was overexposed to airborne concentrations of uranium, the failure of the licensee to perform time studies and time-weight the exposure in accord with the time spent at worklocations on the second floor, fourth floor, belt ramp, deck, and doghouse, ~~it was concluded that it was~~ made it impossible to accurately evaluate the extent of this exposure. McCormick stated that he estimated that the crusher operator spent approximately 50% of his time in the doghouse, 35% of his time on the deck, and the remaining 15% of time divided between operations on the second and fourth floors. The licensee was informed that he was in noncompliance with 10 CFR 20.201(b), in that by failure to perform time studies and thereby correctly time-weight the available information, those surveys which were conducted in the crushing plant during the period January to September, 1968, were not adequate to show compliance with 10 CFR 20.103(a). It was further noted that this same citation applies to the ball mill operator whose breathing zone sample showed 1.011×10^{-10} uc/ml during December, 1967, and 3.09×10^{-11} uc/ml during May, 1968.

31. During the discussion regarding the overexposure to the sample tower operator referenced in paragraph 29 above, McCormick was informed that the licensee was in noncompliance with 10 CFR 20.405(a), in that this exposure was not reported in writing to the Atomic Energy Commission within thirty days of its occurrence. Additionally, he was informed that they were in noncompliance with the requirements of 10 CFR 20.405(b), in that the crusher operator did not receive a report in writing of this exposure, contrary to the requirements of 10 CFR 20.405(b). McCormick stated that the referenced reports to the Commission and employee would be made.

Packaging Area

32. McCormick stated that in the packaging area, the licensee conducts a 24-hour continuous operation during which four operators become involved in a shift rotation which involves an exposure period of 42 hours per week to each of the four operators. It was noted that the general air samples collected in this area showed uranium airborne concentrations to be 1.64×10^{-10} uc/ml during February 1968, 7.07×10^{-11} uc/ml during March 1968, 3.07×10^{-10} uc/ml during June 1968, and 7.8×10^{-11} uc/ml during early September 1968. These values exceeded the MPC of 5.7×10^{-11} uc/ml for a 42-hour work week. The excessive airborne concentrations were confirmed in breathing zone samples which showed values of 8.09×10^{-11} uc/ml during January 1968, 1.54×10^{-10} uc/ml during February 1968, 2.43×10^{-10} uc/ml during April 1968, and 1.01×10^{-10} uc /ml during July 1968. Again McCormick stated that the packaging operators perform other duties and are not exposed to these concentrations at all times. He further stated that he had not performed any time

studies on these operators during the period covered by this inspection and for that reason was unable to approximate a time-weighted exposure. He was informed that by failure to perform time studies and correctly time-weight the available information, those surveys which were conducted in the packaging area during 1968 were not adequate to show compliance with 10 CFR 20.103(a). McCormick admitted that the failure to perform time studies was a deficiency that he recognized and that he would impliment a time study program which would allow adequate evaluation of airborne exposures in the future.

AIRBORNE RADIOACTIVE MATERIAL
UNRESTRICTED AREA

33. The licensee exhibited records showing that air samples are collected at 20 locations over an area within a 5 to 10-mile radius of the mill, on a quarterly basis. Samples are collected with a high volume sampler for periods of 30 minutes each and the total volume of collection is approximately 21,200 liters of air. The records maintained by the licensee showed the location, date, time of collection, volume of air sampled, airborne concentration, wind velocity , wind direction, humidity and temperature. A review of these records showed that all values were less than 8×10^{-13} uc/ml. It was noted that the airborne concentration values were generally less than 1×10^{-13} uc/ml. The maximum measurement noted in a review of the two years of records was 5.7×10^{-13} uc/ml which was measured in a sample collected immediately outside the entrance to the mill. No items of noncompliance were noted orotherwise observed.

RADIATION SURVEYS

34. The licensee exhibited records showing that radiation surveys are performed on a quarterly basis at 108 locations in the mill and 13 locations adjacent to the tailings area and effluent stream. A review of these records showed that the average dose rate was approximately 0.5 mr/hr at m ll location s and 0.8 mr/hr at locations adjacent to the tailings area and effluent stream. The maximum measurements noted were on the order of 2.0 to 2.5 mr/hr at an in-plant tailings pipe location, the house dryer doghouse, and the solvent extraction tank wall. No items of apparent significance were noted or otherwise observed.

Instruction of Personnel

35. The licensee exhibited copies of a brochure which is used for employee instruction in regard to protection from external and internal radiation hazards. McCormick stated that all mill employees have a copy of this brochure. It was noted that Forms AEC-3 were posted at several locations throughout the mill.

POSTING, LABELING, AND SECURITY

36. The status of these items was observed to be identical to that described in previous reports of inspection of this licensee and no items of noncompliance were noted or otherwise observed.

DISCUSSION WITH MANAGEMENT

37. The four items of noncompliance noted during the course of the inspection were discussed in the office of P. V. Bethérum, Utah Operations Manager, with Messrs. Waynard Jensen, General Plant Superintendent, and Richard McCormick, Special Projects Engineer, in attendance. Mr. Bethérum expressed surprise at the airborne concentrations that were measured at different areas of the mill and stated that he had not realized that these values were as high as the records indicated. Bethérum and McCormick agreed that they would initiate a time study program throughout the mill and implement corrective measures as necessary to preclude any overexposures of personnel in the future. McCormick also stated that the necessary reports to the Commission and to the employee regarding overexposure situations would be made by the licensee. Mr. Bethérum was informed that correspondence from the Regional Office would be forthcoming regarding the items of noncompliance mentioned in the discussion.

Employee Indoctrination on Radiation

The care utilized in processing uranium and the safety mindedness of the operating personnel can play a large part in keeping exposures to radiation at an absolute minimum. The company recognized the importance of attempting to keep working surroundings free from radioactive materials as evidenced by frequent air sampling, monitoring personnel, use of personal protective equipment, and maintaining huge dust collecting systems.

Even though the amount of radiation you may receive here at Atlas Minerals is very small, we want to keep it as low as possible. Our concern, then, is how you can be protected from even small amounts of radiation. Radioactive materials can attack the body from a source external to the body and from a source inside the body.

1. Protection From External Radiation

Protection from external radiation exposure may be obtained by the use of the safety factors of time and distance.

a. The Safety Factor of Time

The shorter the period of time the body is exposed to radioactive materials, the less radiation it will receive.

b. The Safety Factor of Distance

The farther away the body is from the source of radiation, the smaller is the amount of radiation received.

Therefore, to protect yourself from external radiation you should spend only the minimum time required in highly radioactive areas. Secondly, keep the source of radiation as far away from your body as possible. This would also indicate keeping radioactive materials off your face, hands and clothing.

2. Protection From Internal Radiation

There are four possible ways to get radioactive materials into the body:

a. By breathing
b. By swallowing
c. Through breaks in the skin
d. By absorption through the skin

To protect yourself from internal radiation you should observe the following:

1. Maintain good housekeeping techniques by using vacuum cleaners and by wetting down dusty areas when required.

2. Don't smoke in areas where radioactive materials are handled. Radioactive materials can be transferred from the hands, to the cigarette, to the mouth, and into the body.

3. Wash up before you eat. Reason: Radioactive materials on the hands can go on food, to the mouth and into the body.

4. Wear a respirator or gas mask when required.

At the present time it is believed that the body can withstand low dosages of radiation spread over a long period of time without any apparent effect. However, it is to the mutual advantage of everyone connected with this plant to make every effort to keep exposure to radioactive materials at an absolute minimum. In general, follow company procedures and regulations regarding radiation, they are made for your protection.

_____ Date

_____ Signature

Form 21

ATLAS MINERALS MOAB, UTAH

UNRESTRICTED AREA GENERAL AIR SURVEY 3rd Q1. 1968

August- 19-68

LOCATION	DATE	TIME	VOLUME	RADIATION DATA gU_3O_8/L	ACTIVITY (N X 10^{-13} uc/ML)	WEATHER DATA WIND VELOCITY	DIRECTION	% HUMIDITY	TEMP.	OBSERVATIONS
1. Top of Moab Canyon	8/16	7:30 AM	21,240	.19	.12	slight	EAST	18	56	clear.
2. Arches Monument	8/16	8:[illegible]		.19	.2	5-10 mph	South	18	57	clear
3. Mill Entrance	8/15	2:45 PM		4.3	5.7	5 mph	EAST	20	84	clear.
4. Arches Head Quarters	8/16	9:00		1.1	1.86	10-15 mph	EAST	18	62	clear with rising dust
5. North Prop. Line	8/16	10:30		1.01	1.33	10-15	EAST	18	68	clear - dusty
6. Atlas Pump House No. 1	8/15	3:20 PM		.43	.57	slight	EAST	20	82	clear.
7. East Prop. Line	8/15	9:40		.50	.67	10-15	EAST	16	70	clear dusty
8. Moab End of Bridge	8/15	6:30 PM		.31	.41	slight	West	20	75	clear
9. Old Ranch House	8/15	2:20 PM		.19	.25	slight		21	83	clear.
10. Slaven's Lumber Company	8/15	1:15 PM		.25	.33	slight		24	82	clear
11. Below Hospital	8/15	1:10 PM		.63	.84	Nil		26	80	clear
12. Mouth of Mill Creek	8/15	11:10 AM		.25	.33	Nil		39	71	clear
13. Miller's Supermarket	8/15	10:30 AM		.25	.33	Nil		40	71	clear
14. Junction Old Highway	8/15	9:50 AM		.25	.33	Nil		58	50	clear
15. Above City Dump	8/15	8:10 AM		.37	.49	Nil		52	60	clear
16. Old Cemetery	8/15	8:35 AM		.56	.74	Nil		50	62	clear
17. 1st North and 4th East	8/15	9:15 AM		.43	.57	Nil		40	70	clear
18. High School	8/15	9:50 AM		.25	.33	2-3 mph	E	40	70	clear
19. New City Park	8/15	12:30		.44	.59	V	V	26	78	clear
20. Top of Blue Hill	8/16	6:30 AM	V	.44	.59	Nil		52	50	clear

ID – 104
(REV. 8 – 66)

U.S. Atomic Energy Commission
Region IV, Division of Compliance
10395 West Colfax Ave., Room 200
Denver, Colorado 80215

ROUTINE ___ SPECIAL X

U.S. ATOMIC ENERGY COMMISSION
IDAHO OPERATIONS OFFICE
ANALYTICAL CHEMISTRY BRANCH

SAMPLE RECORD SHEET

REFERENCE: HEALTH & SAFETY DIVISION

SERIAL NO. 45116

SAMPLE FROM: Atlas Minerals
COLLECTED BY: H. J. Paas, Jr.
DATE SUBMITTED: Sept. 27, 1968

SAMPLES RECEIVED: 10/11/68
ANALYSIS COMPLETED: 10/14/68

ANALYZED BY: RB DBM ADH

SAMPLE NO.	SAMPLE DATE	SAMPLE HOUR	SAMPLE DESCRIPTION	ANAL. FOR	INST. USED	QUANT. USED ml	TIME CNTD. min	COUNT TIME min	TOTAL COUNT	GROSS COUNT c/30m	BKGD. c/30m	NET COUNT c/30m	Blank	RESULTS ~~pc~~ μc/ml
1	9/24	1400	Effluent to Colorado River	U Nat		0.1	1	= 0.0003	13,611 ± 1.7		51.9 sec. dis.			2.3×10^{-8}
				Ra 226		500	1450 10/4/68	60	2901	2901/60 min	18/60 min	2883 ± 54 c/60 min	70 ± 9%	$(3.7 \pm 0.1) \times 10^{-8}$
				Th 230	~~5~~ 3	~~500~~ 3	11.03 ~~10/7/68~~	30	170	170	53	117 ± 15		$< 2 \times 10^{-3}$
				Po 210		100 λ	30		174 c/30m	174 c/30	20 c/30	154 c/30m		$< 7 \times 10^{-8}$
				Pb 210		250	30		22	22	9	13		$< 0.05 \times 10^{-7}$

NOTIFIED: H. J. Paas, Jr. TIME: 1130, 10/14/68 DP

RESAMPLING RECOMMENDED: YES ___ NO ___

APPROVED: [signature] SECTION CHIEF