

1. Utah Construction & Mining Co.
550 California Street
San Francisco 4, California
2. July 14 and 15, 1964
3. Reinspection - License No. SUA-672
Initial - License No. SUA-729
4. 20, 30 and 40
5. License No. SUA-672, Docket No. 40-2259
License No. SUA-729, Docket No. 40-7000
6. A reinspection of the subject licensee's activities at the Lucky Mc uranium mill in the Gas Hills region of Wyoming as well as an initial inspection of the licensee's pilot plant solution mining activities a short distance from the mill were conducted on July 14 and 15, 1964. The licensee's milling activities had been shut down since July 1, 1964, and had just started up prior to the inspection visit. The licensee's crusher circuit was the only portion of the mill in operation. The Assistant Mine Manager, Mr. M. I. Ritchie, stated that there had been no major changes in the plant since the last inspection. The licensee's pilot plant solution mining activities (licensed under SUA-729) was in full operation and approximately 3,000 pounds of uranium concentrates were being cycled into the Lucky Mc mill circuit per month.

The items of noncompliance noted during the course of the inspection of the licensee's activities under License Nos. SUA-729 and SUA-672 are outlined below:

License No. SUA-729

10 CFR 20.203(f)(2)

in that, the licensee failed to label each container in which natural uranium is transported, stored, or used in quantities greater than ten times that specified in Appendix C and in concentrations greater than that specified in Appendix B, Table I, Column 2 of 10 CFR 20. (See par. 27)

10 CFR 40.3

in that, the licensee started the solution mining uranium upgrading activities at their pilot plant in the Gas Hills region on May 22, 1963, whereas, the license authorizing such activities was not granted until October 4, 1963. (See par. 15)

License No. SUA-672
10 CFR 20.203(f)(2)

in that, the licensee failed to label each container in which natural uranium is transported, stored, or used in quantities greater than ten times that specified in Appendix C and in concentrations greater than that specified in Appendix B, Table I, Column 2 of 10 CFR 20. (See par. 26)

Condition No. 14

in that, the licensee failed to sample the three monitoring wells for ~~uranium-235~~, radium-226 and thorium-230 at intervals not to exceed three months. Additionally, the licensee failed to analyze the water from the three monitoring wells for uranium. (See par. 24)

<u>PA</u>	<u>N. Paul Alley</u>	<u>8/5/64</u>
Initials	Inspector	Date
<u> </u>	<u> </u>	<u> </u>
Initials	Reviewer	Date

Inspection History

9. The following inspections have been completed, to date, of the licensee's basic mill license
(Lucky Mc uranium mill located in the Gas Mills region):

License No. R-223	
Initial inspection	August 21, 1958
First follow-up inspection	January 12-14, 1960
Second follow-up inspection	December 13-15, 1960
Third follow-up inspection	December 19, 20, 31, 1961 and January 19, 1962

General Information

10. An announced, initial inspection of the licensee's activities authorized by License No. SUA-729 and an unannounced inspection of the licensee's activities authorized by License No. SUA-672 was conducted on July 14 and 15, 1964. The individuals contacted at the time of the inspection included:

M. E. Pratt, Manager of the Lucky Mc uranium mill
M. I. Ritchie, Assistant Manager and Mill Superintendent
D. F. Anderson, Chief Metallurgist
Richard Haddenham, Radiation Safety Officer

Mr. Robert Sundin, Wyoming State Health Department, and Mr. John Huggel, summer student with the U. S. Public Health Service, accompanied the inspector during portions of the inspection.

11. Unless otherwise noted, all information contained in this report was obtained either from the licensee's records or the above noted licensee employees.

Organization and Administration

12. According to Ritchie, mill employment reflects the mill's stretch-out program with respect to their reduced uranium production quota. The mill employs a total of thirty individuals - twenty for mill operation and ten administrative. The licensee's solution mining activities authorized by License No. SUA-729 employs one foreman and one truck driver for each of three shifts per day. The licensee's administrative structure remains unchanged from that reported to the Division of Licensing & Regulation under Information Item No. 1 of the licensee's May 7, 1962 application. In summary, Haddenham continues as Radiation Safety Officer for the licensee and reports directly to D. F. Anderson, Chief Metallurgist. Haddenham's responsibility includes taking of all air and liquid samples in the mill. Haddenham fluorometrically assays all air and liquid samples (for uranium) in the mill laboratory. The licensee's uranium

procedure is the same as C. S. (IDO H&S) and the reported sensitivity of the procedure is 1.24×10^{-11} uc/ml for a sample volume of 200 liters. All radium-226 and thorium-230 assays are done by the Ionics, Corp., Cambridge, Massachusetts.

Facilities and Process (SUA-672)

13. Ritchie stated that the average mill production is approximately 2,000 pounds of uranium concentrates per day. The mill process remains unchanged from that noted during the previous inspection. In summary, the ore passes through the grizzly to a crusher. Water is added to the crushed fraction after which concentrated sulfuric acid is added. The slurry is digested while passing in cascade through four tanks where the uranium is dissolved. The liquid passes from the dissolving circuit to the thickener, after which the supernatant solution is passed over activated charcoal. The pregnant liquor is cycled through three large counter-current ion exchange columns wherein the liquor passes in one direction and the resin passes in the opposite direction. The barren liquor passes either to the tails or is reused in the thickener cycle. The resin is eluted with acidic ammonium nitrate and the uranium finally precipitated as the ammonium diuranate. With the exception of a newly installed closed-circuit TV system in the crushing and sampling plant, the licensee's facilities remain unchanged from that noted during the previous inspection. Ritchie stated that the TV system serves a two-fold purpose, one - the number of technicians required in the crusher circuit have been reduced, and two - the operators spend less time at transfer points where dusting could occur.

Facilities and Process (SUA-729)

14. The licensee had started a pilot plant solution mining activity about seven miles from the Lucky Mc mill in the Cas Hills region of Wyoming. The licensee's activities authorized by this license are patterned after the Utah Construction & Mining Co.'s solution mining process in the Shirley Basin area (authorized under License No. SUA-442). The licensee produces on the average 100 pounds of uranium concentrates per day. Ritchie stated that the overall process differs somewhat from the Shirley Basin solution mining process in that dilute sulfuric acid is injected into one well until a certain quantity has been injected into the formation. The acid is permitted to digest in the formation and then the solution is pumped from the single well into the process building. Each well is pumped approximately two days. Seventeen production wells have been drilled to date. The product from the well undergoes very little treatment

after being pumped from the well and the pregnant solution is hauled to the Lucky Mc mill for processing. According to Ritchie, the liquid transported to the Lucky Mc mill contains approximately 0.2% contained uranium by weight. The licensee hauls approximately 10,000 gallons of the solution every two days to the mill. The licensee's facilities consist of pumps, process tanks for agitation, process tanks for neutralization, and storage tanks for the slightly enriched uranium solution. The licensee was using a dish-shaped area ^{IN THE GROUND,} a short distance from the process building, to contain the barren raffinate. No liquid effluents are discharged from the perimeter of the licensee's property.

Unauthorized Uranium Processing (SUA-729)

15. The licensee started pilot plant activities at the solution mining site (approximately seven miles from the Lucky Mc mill) on May 22, 1963. Ritchie stated that approximately 362 pounds of uranium were produced in the remaining days in May, and that thereafter, 2,000 pounds of uranium concentrates per month were produced from the pilot plant activities. License No. SUA-729 authorizing the use and processing of uranium ore was not granted until October 4, 1963. The licensee did not possess a license for processing ore by solution mining in the Gas Hills region during the period May 22, 1963 through October 3, 1963, as required by 10 CFR 40.3 of the regulations.

Surveys for Airborne Uranium - Restricted Areas (SUA-672)

16. The licensee takes both general air and breathing zone samples to determine employee exposure to airborne uranium. The licensee possessed two Hudson, Model 606, rotary-type compressor air samplers with a maximum air capacity of 40 liters per minute. The general air samples taken by the licensee are taken approximately 5 feet from the floor for approximately 30 to 45 minutes. The breathing zone samples are taken at the same rate, but the samples are collected a few inches from the operator's nose. Haddenham takes approximately 25 to 30 samples per month in ⁹ general areas. These areas are:

Sample Preparation	Leaching
Crushing	Ion Exchange
Ore Drying	Concentrate Drying and Precipitation
Pine Ore Storage	Concentrate Packaging and Concentrate Storage
Grinding	

According to Haddenham, the only breathing zone samples taken are in areas where the airborne uranium concentration is above the maximum permissible levels. There are only two

areas in the plant where airborne uranium consistently exists in concentrations above MPC. These areas are the concentrate barreling enclosure and crushing. The licensee takes only breathing zone samples in the concentrate barreling area and both breathing zone and general air samples in the crushing area. Haddenham computes from the general air and breathing zone samples the average uranium concentration for the period involved. Haddenham makes the restricted area survey on a monthly basis and submits the findings to plant management. A review of the average concentrations for the ten areas noted above for the last twelve months are outlined below:

Average Airborne Radioactivity Concentrations

	<u>uc/ml x 10⁻¹¹</u>						
	5/18 - 6/14/64	4/20 - 5/17/64	3/23 - 4/19/64	2/24 - 3/22/64	1/27 - 2/23/64	1/1 - 1/6/64	12/2/63 1/1/64
Sample Preparation	0.74	1.06	1.06	1.06	1.06	1.06	1.06
Crushing	2.28	2.14	2.74	2.64	2.81	3.14	3.17
Ore Drying	1.73	2.40	2.40	1.33	1.13	1.13	1.13
Fine Ore Storage	0.96	0.84	1.08	1.66	1.66	2.21	1.34
Grinding	0.91	0.91	0.91	0.91	0.60	0.65	0.60
Leaching	0.55	0.55	0.73	0.73	1.11	1.25	1.25
Ion Exchange	1.11	0.75	0.74	0.79	0.77	0.74	0.60
Conc. Drying & Prec.	2.06	2.21	2.06	1.82	1.39	1.55	1.31
Conc. Packaging	6.63	5.52	6.04	6.72	8.26	7.82	8.32
Conc. Storage	1.16	0.98	1.30	1.30	1.54	1.21	1.74

	11/4 - 12/1/63	10/7 - 11/3/63	9/9 - 10/6/63	8/12 - 9/8/63	7/15 - 8/11/63	6/17 - 7/14/63
Sample Preparation	1.42	1.42	2.18	2.18	2.18	1.37
Crushing	4.54	11.85	2.28	1.97	2.52	2.69
Ore Drying	0.77	0.53	0.53	0.53	0.65	0.65
Fine Ore Storage	1.34	1.87	1.87	1.87	0.82	0.82
Grinding	0.29	0.46	0.48	0.48	0.48	0.48
Leaching	0.40	0.52	0.55	0.55	0.55	0.55
Ion Exchange	0.50	0.55	0.54	0.68	0.73	0.70
Conc. Drying & Prec.	1.24	1.56	1.33	1.78	1.87	1.83
Conc. Packaging	8.91	8.28	7.28	7.93	8.16	7.58
Conc. Storage	1.74	1.71	0.64	0.83	1.22	1.11

The above tabulated data shows that, for the most part, the average airborne radioactive concentration for the various areas was within the permissible MPC. The licensee averages the ^{EMPLOYEE EXPOSURE} concentrations of uranium over a 28-day period and computes weighted exposures for all mill personnel on a monthly basis (see paragraph 18 below). The licensee's records for each month subsequent to the last inspection were obtained at the time of the inspection and are being retained as backup to this inspection report. The licensee's work papers showing sampling data and computations were spot checked against the monthly summary report submitted to management. There were no discrepancies noted with respect to the licensee's data.

17. The licensee had made extensive time studies for personnel working in areas where the concentration of uranium was above MPC. According to Haddenham, the shift foreman submits a daily breakdown of each employee's activities to the personnel department and a complete time study is made by IBM machine for the entire pay period. Haddenham stated that ~~no individual in the plant works longer than~~ ^{EMPLOYEE EXPOSURES ARE AVERAGED OVER} a 28-day period; however, the hours an individual works in the 28-day period may vary from 140 to about 200 hours. Haddenham computes for each individual their own personal MPC based on the total number of hours per area they put in per each 28-day period. If personnel work for longer than 160 hours, the individual's MPC is reduced correspondingly, and if the individual works less than 160 hours, the MPC is increased correspondingly. The last time study for the crusher operator was made on March 10, 1964. The time study showed that during an 8-hour day the operator works at the control console 398 minutes, at the secondary crusher 67 minutes, and at the primary crusher 15 minutes. On March 16, a time study was made for the sample bucket and final package operator. During an 8-hour day, the operator stores barrels for 413 minutes, is in the package enclosure 61 minutes, and is splitting a sample 6 minutes. The licensee uses 2.5×10^{-11} uc/ml as the MPC for uranium with its daughters and 6.0×10^{-11} uc/ml as the MPC for uranium without its daughter products. These MPCs are reduced or increased in accordance with Condition No. 12 of SUA-672 when employee work schedule requires more or less than 160 hours work in 28 consecutive days.
18. The licensee uses the time study together with the IBM employee work record and the average concentration found during a specific period to compute employee exposure. Each employee's exposure is computed separately (on the basis of the IBM time study). A review of the licensee's records, dating from the last inspection, showed no instance wherein licensee personnel received exposures to airborne uranium in excess of MPC. The licensee's records substantiating the foregoing statement are being retained in CQ:IV as backup to this report.
19. During January 2 and 3, 1962, the licensee performed a clean-up operation in the Proctor-Schwartz Dryer. In memorandum from Haddenham to Ritchie dated January 5, 1962, Haddenham stated (1) that each man was instructed relative to minimizing exposure to the radioactive dust; (2) each man was required to wear a respirator when entering the area inside the dryer; (3) air samples - breathing zone and general air samples were taken during the clean-up operation;

and (4) a time study was made of the operation to determine actual employee exposure. Examination of the licensee's work papers showed that the licensee rotated fourteen individuals during the clean-up operation. Records showed that the average concentration in the dryer during the clean-up operation was approximately 300×10^{-11} uc/ml; that two men worked a total of 86 minutes each in the dryer; and, that the remaining twelve men worked a total of 57 minutes each in the dryer. Weighted exposure calculations for each of the individuals involved in the clean-up operation together with the exposures received during normal operational duties, showed that no individual received exposures in excess of the permissible limits. Time-weighted exposures for the two individuals working the longest time in the dryer for the period January 1, through January 28, 1962, showed that the maximum exposure received by the two individuals was 3.3×10^{-11} uc/ml.

20. As noted previously in the report, the licensee's final packaging section of the plant was not in operation. The crushing circuit, however, was in operation. During the inspection, the AEC and the licensee ran simultaneous general air samples in the crusher area in the vicinity of the control console. The AEC samples were submitted to the Analysis Branch, H&S Division, ID, for analysis. After completion of the analysis, an addendum report will be prepared and submitted to CO:HQ and DS&LR with results of the sampling.

Surveys for Airborne Uranium in the Unrestricted Area

21. Airborne uranium concentration measurements are made at thirty-six locations on the perimeter of the mill on a semi-annual basis. The licensee samples approximately six to eight different locations at a random frequency so that all thirty-six locations in the unrestricted area are sampled every six months. The licensee uses a Gelman "Hurricane" sampler, Model 1602, Hi-Volume instrument. The maximum air capacity of the instrument is 150 cfm. The licensee records wind direction and speed for all samples taken in the unrestricted areas, and according to Haddenham, air samples are taken down wind whenever possible. Records of all unrestricted air sampling done by the licensee since the previous inspection were provided the inspector at the time of the inspection. These records are being retained as backup information to the report. No sample taken by the licensee in the unrestricted area showed levels in excess of the limits set forth in 10 CFR 20. The maximum concentration of uranium noted was 8.0×10^{-13} uc/ml.

22. At the time of the inspection, a duplicate air sample was obtained in the unrestricted area northeast of the mill. The air sample was submitted to ID H&S for uranium analysis. Upon completion of the analysis the data will be submitted to COHQ and DS&LR with the other independent sampling data obtained during the inspection.

Film Badge Program

23. Between 8 and 12 individuals are routinely supplied film badges by the Radiation Detection Company. Badges are worn for a full quarter and then processed. A review of the records generated since the previous inspection showed that, on occasion, some of the licensee personnel doses have approached 25% of the applicable limits. The licensee had completed a Form AEC-5 for each individual wearing a film badge. There were no exposures noted wherein licensee personnel received doses in excess of the applicable limits.

Liquid Sampling Program

24. The licensee normally does not discharge process liquids to the unrestricted area. The inspector, Haddenham, and Anderson toured the effluent pond area. It was noted that all dykes appeared to be secure. The licensee's Lucky Mc effluent tailings system is extensive, consisting of four reservoirs at various elevations ^{from} from the plant. The barren raffinate solution is discharged to the No. 1 reservoir, decants to the second, and so on to the No. 4 reservoir. Condition No. 14 of the license states, "As a minimum, the three monitoring wells described in Item 6 of the licensee's application dated May 7, 1962, shall be sampled for natural uranium, radium-226 and thorium-230 at intervals not to exceed three months". The three monitor wells described in Condition No. 14 of the license are located just below the No. 4 tailings dam. A review of the licensee's quarterly sampling records showed that the licensee had sampled the three monitor wells in July and October 1962; in February, April, and October 1963; and, in January and June, 1964. The licensee submitted these samples to Ionics, Inc., Cambridge, Massachusetts, for radium-226 and thorium-230 assay. All liquid samples taken from the monitor wells showed concentrations of radium-226 and thorium-230 within the applicable limits. A review of the sampling frequency for the monitoring wells showed that the licensee failed to sample the three monitor wells on a 3-month basis between April and October 1963, and between January and June 1964. Further, the licensee did not perform uranium assays on the three monitoring wells.

25. An unusual amount of rain fell in June 1963. The Lucky Mc mill management reported in telegram dated June 17, 1963, that the Lucky Mc mill solution system overflowed on June 16, 1963. The essential facts relating to the breaching of the No. 4 dam are outlined in the licensee's letter to the Division of Licensing & Regulation dated July 23, 1963. Shortly after the rain stopped, the No. 4 dam was increased in height by the licensee to prevent future breaches under similar circumstances. In connection with the flooding, the licensee estimated that 23 million gallons of plant effluent was released. The licensee sampled for uranium and nitrate subsequent to the flooding at various locations in the unrestricted areas adjacent to the mill. The results of the sampling are outlined below:

Date 1963	Location	Uranium uc/ml x 10 ⁻⁵	Nitrate Grams/liter
6/17	Stock pond above pipeline work	0.006	0.014
6/17	Pipeline road crossings	0.761	0.932
6/17	North of Gas Hills road crossing	0.723	0.977
6/17	Roberts Ranch north of Muskrat Ridge	0.395	0.571
6/17	Fraser Reservoir discharge	0.14	0.391
6/17	Flow into Muskrat Creek	0.003	0.005
6/18	Pipeline road crossing	0.017	0.019
6/18	North of Gas Hills road crossing	0.014	0.022
6/18	Willow Creek at Gas Hills road crossing	0.085	nil
6/18	Fraser Reservoir discharge	0.028	0.182
6/18	Muskrat Creek below Fraser Reservoir overflow	0.113	0.084
6/19	Fraser Reservoir discharge	0.023	0.141
6/19	Poison Creek at Moneta	0.060	nil
6/19	Bygon Reservoir	0.003	nil
6/21	Fraser Reservoir	0.037	0.141
6/24	Fraser Reservoir	0.034	0.182
6/27	Fraser Reservoir	0.031	0.174
6/28	Fraser Reservoir	0.037	0.188
7/1	Fraser Reservoir	---	0.189

The above tabulated data shows the uranium concentration did not exceed the MPC for uranium in the unrestricted area. The data also shows the effect of the continued rain in diluting the uranium concentration in the unrestricted area. The review of the licensee's sampling data for the three monitor wells, which are located in the vicinity of dam overflow immediately below the No. 4 tailings dam, showed that the licensee sampled the wells for radium-226 and thorium-230 on three occasions subsequent to the tails overflow. Samples were collected in October 1963, and in January and June 1964. The data showed no instance where the radium-226 or thorium-230 exceeded 10 CFR 20 Appendix B limits for the unrestricted area.

Posting (SUA-672)

26. Condition No. 10 of the licensee's mill license (Lucky Mc mill) states, "The licensee is hereby exempt from the requirements of Section 20.203(e)(2) and 20.203(f)(2), 10 CFR 20, for areas and containers within the mill providing all entrances to the mill are conspicuously posted in accordance with Section 20.203(e)(2) and with the words, 'ANY AREA OR CONTAINER WITHIN THIS MILL MAY CONTAIN RADIOACTIVE MATERIAL'." The licensee had elected to post the various entrances to the crusher and process buildings rather than the various gate entrances into the general plant area. It was noted that the licensee had posted all garage-type entrance doors into the buildings in accordance with Condition No. 10. Further, it was observed that all personnel entrance doors had been posted in accordance with 20.203(e)(2) and each area in accordance with 20.203(d)(2). The licensee, however, had not posted the personnel entrance doors with signs stating "ANY AREA OR CONTAINER WITHIN THIS MILL MAY CONTAIN RADIOACTIVE MATERIAL". The personnel entrance doors in the crusher and mill process buildings, in many cases, were located so that personnel could not observe the "ANY AREA OR CONTAINER ..." sign that had been posted on the garage-type doorways. Since the licensee was not complying with the provisions of Condition No. 10, each container within the plant must be labeled in accordance with 20.203(f)(2). The licensee had not labeled each container in the crusher building and mill process building, containing in excess of 10 times Appendix C quantities of natural uranium, in accordance with 20.203(f)(2).

Posting (SUA-729)

27. The licensee had posted the pilot plant solution mining building with a sign stating "ANY AREA OR TANK WITHIN THIS MILL MAY CONTAIN RADIOACTIVE MATERIAL". Further, the licensee had posted a large uranium storage tank with a "Caution - Radioactive Material" sign with magenta symbol on yellow background. According to Ritchie, the pilot plant solution mining containers within the pilot plant building contained in excess of 10 times Appendix C quantities of natural uranium. The containers had not been labeled in accordance with 20.203(f)(2) of the regulations. Ritchie stated that the concentration of the solution pumped from the solution mining well approximated 0.2% by weight uranium. This would be approximately 4 pounds of uranium per 2,000 pounds or 240 gallons of solution or approximately 6.6×10^{-4} uc/cc of solution. The licensee's storage tanks (three - only one of which was correctly labeled) and process vats held in excess of 2,000 pounds or 240 gallons of solution with a uranium concentration of 6.6×10^{-4} uc/cc, thereby requiring labeling in accordance with 20.203(f)(2).

Direct Radiation Surveys

28. The licensee makes a quarterly, direct radiation survey at 52 locations in the uranium mill.

A review of the licensee's data showed no high or unusual radiation levels.

Security

29. Both the licensee's Lucky Mc mill and the pilot plant process areas are completely fenced and personnel are in continuous attendance at both sites. The fence also bears signs denoting "Caution - Radioactive Materials" and "No Trespassing".

Instruction to Employees

30. The licensee had posted on the employee bulletin board copies of the license, regulations, Form AEC-3 and training bulletins.

Discussion with Management

31. At the conclusion of the inspection, a discussion was held with Messrs. Pratt and Ritchie and the discrepancies noted with respect to posting, liquid sampling of the monitor wells and processing of uranium ore prior to issuance of the license were discussed. Pratt stated that suitable corrective action would be taken to achieve compliance, both with respect to the licensee's activities at the Lucky Mc mill (SUA-672) and the activities at the pilot plant (SUA-729).