1. Petrotomics Company
P. O. Drawer 2450
Casper, Wyoming

2. August 10 and 11, 1964

3. Reinspection (1)

4. 10 CFR 20, 40

5. License No. SUA-551, as issued March 8, 1962
Docket No. 40-6659 as amended by letters dated June 20, 1962, and November 9, 1962
as renewed June 7, 1963
Expiration date: May 31, 1966

6. The inspection revealed that the licensee had introduced appropriate corrective action in response to the items of noncompliance noted during the last inspection. However, in the case of surveys to evaluate airborne radioactive material in the unrestricted areas, the program initiated was allowed to lapse for a period that exceeded the license requirements. With the exception of the crushing crew, the air sample program was adequate to evaluate the exposure of the process operators to airborne radioactive material. It was determined that surveys were not made to evaluate the exposure of maintenance employees while performing nonroutine work involving a potential for significant exposure from airborne contamination. The licensee's records of analyses of liquid samples from a small creek that originates immediately below the tailings area revealed that some seepage to the unrestricted area was occurring. While the samples showed consistent concentrations of thorium-230 that exceeded the permissible limit, the results for radium-226 and natural uranium were always less than their respective permissible concentrations.

The following items of noncompliance were observed or otherwise reported:

10 CFR 20.106(b) in that, the average concentration of thorium-230 in the tailings pond seepage released to the unrestricted area for calendar year 1963 exceeded the limits specified in Appendix B, Table II of 10 CFR 20. (See par. 26 of the report details.)

10 CFR 20.201(b) in that, surveys were inadequate to determine compliance with 10 CFR 20.103, "Exposure of individuals to concentrations of radioactive material in restricted areas", in the following respects:

1. From October 25, 1962 to August 11, 1964, breathing zone samples were not taken during routine cleanup operations in the crusher

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buildings to evaluate fully the exposures of the crusher operator and helper. (See par. 20 of the report details.)

2. From October 25, 1962 to August 11, 1964, air samples were not collected to evaluate the exposure of maintenance employees while performing such nonroutine work as occurred on June 10-12, 1964, when the ventilation system for the yellow cake dryer and packaging areas was modified and repaired. (See par. 21 of the report details.)

10 CFR 20.201(b) in that, from July 23, 1963 to August 11, 1964, surveys were not made to determine the concentrations of airborne radioactive material released to unrestricted areas to show compliance with 10 CFR 20.106(b), "Concentrations in effluents to unrestricted areas". License Condition No. 8, which incorporates the licensee's letter of February 14, 1962, requires that such surveys be conducted at a minimum of once each year. (See par. 23 of the report details.)

7. October 23-25, 1962

8. No

LCR	Leland C. Rouse	8/26/64
Initials	Inspector	Date
Initials	Reviewer	Date

Type of Inspection and Persons Contacted

9. An unannounced reinspection of the subject licensee was conducted on August 10 and 11, 1964. The principal interviewee was John D. Crozier, who is the Plant Radiologist as well as Chief Chemist and Metallurgist. Other employees of the licensee contacted during the course of the inspection were: G. K. Coates, Project Manager; Keith Ryder, Shift Foreman; and Rod Beattie, Maintenance Foreman. At the conclusion of the inspection, the results were reviewed with Mr. Coates and Mr. Crozier.

Organization

10. There has been no change in the partnership of the firms holding interest in the Petrotomics Company. Since the last previous inspection, Mr. Coates has been promoted to the position of Project Manager and Mr. Emerson Kemp has replaced Mr. Coates as Mill Superintendent. (Mr. Kemp was on vacation at the time of the inspection and Mr. Crozier was acting in his place.) Mr. Norman A. Grant, previous Project Manager, has been appointed to the position of Production Manager, International Division, Tidewater Oil Company, replacing Mr. John McCabe. The current number of employees assigned to the mill, including operating, maintenance, laboratory and supervisory personnel, is 46.

11. Mr. Burt Moulden, who held the position of Radiologist at the last inspection, was replaced by Mr. D. S. Hutchinson in December 1963. On the termination of Hutchinson in March 1964, the duties of the Radiologist were assumed by Mr. Crozier, who also functions as the Chief Chemist and Metallurgist for the mill. Mr. Crozier stated that in his function as Radiologist he reports directly to Mr. Coates. Crozier also reported that, until the week prior to the current inspection, he had relied on a Mr. Bittle, solvent exchange operator and part-time laboratory analyst, to assist him with the air sampling and survey program. He added that the termination of Bittle had left him without an assistant, and that he was in the process of training another operator for these duties.

Facilities

12. During a scheduled two-week shutdown in May - June 1964, the dust collection system for the yellow cake drying and packaging area was modified through removal of the American Air Filter skimmer (a centrifugal precipitator). Mr. Coates stated that the precipitator, which preceded and was in series with the American Air Filter rotoclone, was removed because extensive corrosion had long ago eliminated any effectiveness that the equipment may have had initially. No other significant changes in the facilities have been made since the last previous

inspection, according to Coates.

13. During the inspection of the facilities, it was noted that housekeeping in the main mill building appeared to be very good. Mr. Crozier said that the floor area of the mill was washed down once each shift and that the dryer room and yellow cake packaging room were often washed more frequently. It was also noted that the sample preparation room, which is located in the main mill building, was very clean with no visible dust in the room or sample preparation hoods. Mr. Crozier said that the plant control samples continue to be pulps (leach slurry) rather than dry ore, and that this practice had eliminated any dust problem often associated with this operation.

Airborne Radioactive Material - Restricted Areas

14. To determine the concentration of airborne radioactive material in work areas, the licensee has collected general air samples at 31 locations throughout the mill and associated facilities on a monthly frequency. These locations correspond to the sampling points listed in the licensee's letter to the Commission dated February 14, 1962, which is incorporated in the license through Condition No. 8. In addition, and as a result of the last inspection, breathing zone samples were obtained each month in the yellow cake drying and packaging areas during specific operations where general air samples were not considered to be representative of the air inhaled by the worker. Until renewal of the license on June7, 1963, the licensee was required to furnish quarterly reports on his survey program to the Commission. These reports, the last of which listed data through May 1963, including a summary of the results from the air sampling program. The inspection revealed that the air sample results and the exposures resulting from airborne radioactive material have continued to be very similar to those indicated in the submitted reports.

15. The sampling equipment and the analytical procedures of the licensee were described in the last previous inspection report. However, a review of the licensee's calculations showed that the Radiologist has consistently neglected to include the atomic weight factor of 0.85 in converting from the laboratory fluorometric units of micrograms of U_3O_8 per sample to units of uc nat. U/cc of air. Thus, all recorded air sample results reflect this 15% error on the conservative side. Similarly, all subsequent references to licensee air sample results in this report, unless specifically noted, include this error.

16. Subsequent to the last inspection, the licensee conducted time studies on the precipitation and sample preparation operators which included the time required to perform certain specific duties in the yellow cake dryer room and in the yellow cake packaging room. These time studies reflected the changes made in the work assignments for these job classifications after the last inspection and to which the licensee refers to in his letter to the Commission dated March 25, 1963. These changes resulted in the assignment of all yellow cake packaging operations to the sample preparation operators. The precipitation operators continued to provide the occasional attendance to the yellow cake dryer that is required during its operation. However, Crozier stated that the work assignments for these two job classifications were again changed as of August 10, 1964 (the first day of the current inspection). Mr. Crozier added that the duty assignments again required precipitation operators to perform some of the yellow cake packaging operations and that he was aware that new time studies would have to be made to properly evaluate the exposures for these job classifications. Crozier stated that the time studies are performed by measuring and recording the time spent in various locations and job assignments by different operators in the job classification of interest. The average time required at a location or to perform a specific task is then used to evaluate the exposure for the job classification.

17. Mr. Crozier stated that the shift schedules for mill personnel had not changed from those described in the last inspection report. While the licensee is authorized to average airborne concentrations over 80 hours in any consecutive fourteen days (License Condition No. 12), the work schedule results in a usual total of 84 hours on the job in fourteen days; however, every twelve weeks each individual begins a work period that results in a total of 120 hours in fourteen consecutive days (or 78 hours in seven consecutive days; see letter from N. A. Grant to the Commission dated November 2, 1962). The above schedule is effective for all operators except for the crusher operator and helper, who continue to work ten-hour shifts for four days each week. From the licensee's records of time weighted exposures for the sample preparation and precipitation operators, it was determined that the applicable MPC's had been appropriately adjusted for these work schedules as shown below:

Work Schedule	Licensee's Adjusted MPC (uc Nat. U/cc)
84 hours/14 days	2.38×10^{-11} (ore dust)
84 hours/14 days	5.7×10^{-11} (final product)
120 hours/14 days	1.67×10^{-11} (ore dust)
120 hours/14 days	4.0×10^{-11} (final product)

To accommodate the time weighted exposure calculations for the sample preparation operators, the licensee had also determined a "weighted MPC". The weighted MPC properly responds to the time study which showed that the sample preparation operator was required to spend one-third of his time in the sample preparation room where the exposure is to uranium with its daughters. The weighted MPC, as determined by the licensee, is 4.6×10^{-11} uc nat. U/cc for 84 hours in fourteen days and 3.2×10^{-11} uc nat. U/cc for 120 hours in fourteen days.

18. A review of breathing zone samples, which were collected each month as the operator performed various phases of the yellow cake packaging operation, showed concentrations that varied from less than the applicable MPC to 7.0×10^{-10} uc nat. U/cc. The licensee had calculated time weighted exposures each month for the sample preparation operator. The calculations showed that all significant exposures were attributable to the yellow cake packaging operation and that the maximum exposure, corresponding to about 0.8 of the weighted MPC, occurred during May 1964. This exposure and the high air sample result noted above, covered the unusual conditions that existed in the yellow cake packaging room after a "blow back" occurred in the dryer system, according to Crozier. Mr. Coates said that the "blow back" occurred when the discharge hole of the dryer became plugged. The records revealed that the high air sample results collected during this period were averaged with a second set of samples collected later in the month during more normal conditions to evaluate the exposures. Crozier stated that this still provided an overestimate of the exposure for the 80 hours in fourteen days since the blow back only affected conditions for one day.

19. A review of the results of breathing zone samples collected while the precipitation operator was checking and tending to the operations of the yellow cake dryer revealed that only occasionally did concentrations approach or exceed the applicable MPC. When it was noted that air sample results for the dryer room had previously indicated it to be a problem area (see last inspection report), Mr. Coates explained that the improvement was due to: (1) proper adjustment of the dryer feed rate which eliminated the periodic "burping" in the dryer, and (2) the fact that the operator was rarely required to rake the grates on the top level, as was observed during the last inspection. A review of time weighted exposures for the precipitation operators revealed that the maximum exposure corresponded to about 0.5 of the MPC. This, again, was the exposure calculated for May 1964, and was primarily attributable to the high general air sample in the dryer room following the blow back in the dryer.

20. Because the general air samples in the primary and secondary crusher buildings were routinely less than the MPC for uranium ore dust, the licensee had not performed time studies nor collected any breathing zone samples for the crusher operator and helper. While the moisture content of the ore, which averages about 7%, results in a relatively dust-free atmosphere during normal operation, it was noted that a substantial amount of crushed ore accumulated on the floors of the crusher buildings. This material was falling from the conveyor belts, particularly at transfer points. It was also observed that visible dusty conditions were created when the helper used a broom and shovel to clean up the floors of the secondary crusher building. It was learned from Mr. Keith Ryder, Shift Foreman, that this was the usual method for cleanup in the crushing plant and that both the operator and helper accomplished this periodic cleanup at various times during the shift. He was able to offer only a rough estimate of one to one and one-half hours for the time spent by the crusher operator and helper on this task each day. Crozier was unable to associate any of the general air sample results for the crusher plant with the cleanup operations. He agreed that general air samples would be inadequate to evaluate the exposures received by the employees during the cleanup work. Mr. Coates and Mr. Crozier were informed that the failure to obtain breathing zone samples during the cleanup operations to evaluate fully the exposure of the crusher operator and helper constituted inadequate surveys to show compliance with section 20.103, contrary to paragraph 20.201(b). Mr. Coates stated that breathing zone samples would be obtained and, if the results so indicated, time studies would be performed to enable the calculation of time weighted exposures.

21. The review of the licensee's records revealed that no air samples had been taken to permit evaluation of the exposures of maintenance personnel for work involving a potential for significant airborne activity. It was learned that the Maintenance Foreman had provided notes to the Radiologist on several occasions listing the number of hours spent by individual maintenance employees in the yellow cake dryer and packaging rooms for the preceding month. The notes did not specify what work was performed. A discussion with Mr. Beattie, Maintenance Foreman, regarding these notes for the months of March and April, revealed that the work was primarily electrical in nature and, according to Crozier, the routine general air sample for the area would have been applicable. However, it was learned that on June 10 and 11, 1964, two maintenance employees worked the entire shift replacing the impeller and baffles on the rotoclone for the drying and packaging ventilation system.

On June 11 and 12, 1964, one employee worked the entire shift removing the centrifugal precipitator from this same ventilation system. Crozier reported that every attempt was made to keep the equipment wet down during the jobs, but admitted that no air samples were taken during any phase of the work. Mr. Coates and Mr. Crozier were informed that the failure to perform surveys to adequately evaluate the exposures of maintenance employees to show compliance with section 20.103 was contrary to paragraph 20.201(b). They indicated that communications would be established between the Maintenance Foreman and the Radiologist to provide advance warning for work which might involve significant exposures to airborne radioactive materials. Mr. Crozier added that he would conduct the surveys considered necessary for the job.

22. During the inspection, a total of five independent air samples were collected in the crusher plant and the yellow cake packaging and dryer rooms. The samples were sent to the Health & Safety Division, ID, for analysis. The licensee collected similar samples for comparison. The results of the samples and the corresponding results of the licensee will be added to this report as a supplement when the data becomes available.

Airborne Radioactive Materials - Unrestricted Areas

23. As described in the licensee's quarterly report to the Commission dated March 15, 1963, an air sampling program to determine concentrations of airborne radioactive materials in the adjacent unrestricted areas was initiated after the last inspection. Crozier was unaware of the diffusion equations that had been applied using the mill parameters, according to the above report, and was unable to locate any records of these calculations. He indicated that he would attempt to contact Hutchinson to determine if these records were available. Mr. Crozier provided records of the air sample results referenced in the licensee's quarterly report to the Commission dated June 14, 1963, and for the results of samples obtained on July 23, 1963. The latter survey consisted of five air samples around the perimeter of the mill, two of which were collected down wind at different distances from the dryer stack with the wind speed measured at 11 and 14 miles per hour. All results were substantially less than the MPC for uranium ore dust in unrestricted areas, 8×10^{-13} uc nat. U/cc. The licensee's records provided no evidence that surveys had been made subsequent to July 23, 1963, and Crozier stated that he had not yet conducted such a survey since assuming the duties of Radiologist. Mr. Coates stated that the collection of stack samples had been discontinued by Hutchinson late in 1962 or early in 1963. Mr. Crozier and Mr. Coates were informed that

failure to conduct surveys to evaluate the concentrations of airborne radioactive materials released to unrestricted areas from July 23, 1962 to August 11, 1963, to show compliance with paragraph 20.106(b) was contrary to paragraph 20.201(b). It was also pointed out that the letter submitted by the licensee dated February 14, 1962, which was incorporated in the license by Condition No. 8, stated that such surveys would be conducted on a semi-annual or annual basis. Crozier stated that he would promptly obtain air sample data at the previously established survey points.

Liquid Effluents

24. The licensee exhibited records of monthly analyses of the mill's potable and culinary water through May 1964. Results of the June and July samples were not yet available. The source of this water is the same as that described in the last inspection report. The analytical results, as determined from samples submitted to Tracerlab, have continued to show thorium-230 and natural uranium concentrations much less than the permissible concentrations. Excluding the radium-226 concentration of 3.4×10^{-8} uc/cc reported for the January 1964 sample, the average radium-226 concentration from June 1963 through May 1964 was 2.0×10^{-9} uc/cc. The range for these samples was from a minimum of 5×10^{-10} uc/cc to a maximum of 6.3×10^{-9} uc/cc. The majority of the results were near the average concentration. The licensee regarded the exceptionally high January result as invalid.

25. The results of monthly samples from the test wells described in the last report have shown isotopic concentrations similar to those reported for the drinking water samples.

26. The licensee has also obtained monthly samples, weather permitting, from a small creek that begins just below the secondary tailings dam. The sampling point for this creek is about 200 yards below this dam where the flow was estimated by Crozier as about 20 gallons/minute. The isotopic concentrations for this creek were comparable to the results for the drinking water and test wells for the early part of 1963. Subsequent to April 1963, the results have shown significant thorium-230 concentrations. The sample results for the creek are shown below for 1963:

Month	Ra-226 ($\times 10^{-9}$ uc/cc)	Th-230 ($\times 10^{-6}$ uc/cc)	U Nat. ($\times 10^{-6}$ uc/cc)
January	0.3	< 0.005	0.1
February	0.6	0.01	0.1
March	7.7	0.1	0.5
April	3.0	< 0.005	0.01
May	0.4	2.0	0.8
June	6.7	3.4	2.1
July	--	--	--

Month	Ra-226 (x 10^{-9} uc/cc)	Th-230 (x 10^{-6} uc/cc)	U Nat. (x 10^{-6} uc/cc)
August	4.1	2.2	3.5
September	4.2	5.4	4.3
October	1.9	7.3	7.0
November	0.6	13.0	5.0
December	0.9	6.8	1.5

Because of snow conditions no samples were obtained for January through April 1964. The results for May 1964 showed concentrations of 7.4×10^{-9} uc/cc, 6.3×10^{-6} uc/cc, and 1.2×10^{-8} uc/cc for radium-226, thorium-230, and natural uranium, respectively. Mr. Coates said that the creek has two sources, a spring that is visible near the base of the dam and some seepage from either the primary or secondary tailings pond. Mr. Crozier estimated that the flow of the creek is probably about equally divided between these two sources and stated that the flow remains relatively constant. The creek originates in the unrestricted area outside the fence enclosing the tailings area and it is completely absorbed into the soil about one-half mile below the secondary dam. The average thorium-230 concentration at the sampling point for calendar year 1963 was 3.6×10^{-6} uc/cc, which exceeded the permissible concentration of 2×10^{-6} uc/cc. Mr. Coates and Mr. Crozier were informed that the average concentration of thorium-230 in the tailings seepage released to the unrestricted area exceeded the limit specified in Appendix B, Table II of 10 CFR 20, contrary to paragraph 20.106(b). Mr. Coates stated that he had considered the construction and enclosure of a third dam across the small ravine where the creek flows, but had not received the approval of the Bureau of Land Management. He reported that he would probably request an exemption from the Commission in view of the negligible hazard of the release.

27. Independent liquid samples were obtained from the drinking water supply for the mill, the tailings pond that had formed behind the secondary dam, and the creek discussed in the previous paragraph. The samples were sent to the Health & Safety Division, ID, for analysis and the results will be added as a supplement to this report when they become available. The licensee collected samples at the same points to permit a comparison of analytical results.

Waste Disposal

28. Mr. Crozier stated that the filter cloths from the yellow cake filter presses were buried at the mill site after leaching the yellow cake from the cloths.

Radiation Surveys

29. Mr. Crozier had performed a general radiation survey of the mill in June 1964, which confirmed

previous survey results recorded by Hutchinson on several occasions and those reported in the last inspection report. The survey instrument available to the licensee was also described in the last report.

Film Badge Records

30. The licensee has continued to supply film badges to sixteen employees as described in the last inspection report. Film badge service is supplied by Tracerlab on a two-week frequency. A review of film badge records for calendar year 1963 and for 1964 through June showed all exposures to be less than 25% of the limits specified by paragraph 20.101(a). Because of this, the use of Form AEC-5 for recording individual exposures was discontinued.

Posting and Labeling

31. It was observed that all mill entrances were posted in accordance with License Condition No. 10. It was also noted that the entrances to the yellow cake dryer room and the packaging room were posted in accordance with subparagraph 20.203(d)(2). The fencing and entrances to the mill tailings area were posted as required by subparagraph 20.203(e)(2) and as described in the licensee's letter to the Commission dated April 22, 1963.

Instruction of Employees

32. It was observed that Form AEC-3 was posted on the bulletin board located near the mill office entrance and on a bulletin board which was located at the entrance to the mill employee's change room. A booklet describing the safety program at the mill is provided each new employee. It was also noted that operating procedures, which include references to radiation safety, were posted in various areas of the mill. Mr. Crozier exhibited copies of the license and of Part 20 which he said were available to any employee for review on request.

Management Review

33. At the conclusion of the inspection, the results of the inspection were reviewed and discussed with Mr. Coates and Mr. Crozier. The corrective action proposed by the licensee with respect to each item of apparent noncompliance was noted in the appropriate, preceding paragraphs of this report.