

1. Petrotomics Company
P. O. Drawer 2450
Casper, Wyoming
2. August 18 and 19, 1965
3. Reinspection (2)
4. 10 CFR 20, 40
5. License No. SUA-551, (Docket No. 40-6659), as issued March 8, 1962
Expiration May 31, 1966
6. The inspection showed that the licensee had taken appropriate corrective action with regard to the items of noncompliance noted during the last inspection. The licensee's facilities and process for separating uranium from the ore remain unchanged from that noted during the previous inspection.

The licensee's survey program to determine the concentration of airborne uranium is comprehensive and takes into account dust generated as a result of special maintenance or cleanup operations. The licensee takes numerous breathing zone samples which are used to establish concentrations of uranium in the breathing zone of the employee.

The circumstances regarding the overexposure to airborne radioactive material during the replacement of the refractory in the yellow cake dryer by two maintenance engineers were reviewed and found to be essentially as reported to the Commission in letter dated January 25, 1965. The corrective action instituted by the licensee to prevent future exposures included: the dryer will never be worked on dry; the rotocline will be left on during the work; only one door to the dryer will be opened at a time; and, wherever possible, the replacement of parts will be done remotely.

The items of noncompliance noted or otherwise observed during the inspection included:

10 CFR 20.203(f)(2) in that, in lieu of posting the entrance to the mill in accordance with Condition No. 10 of the license, containers within the plant holding uranium in quantities greater than 10 times the quantity specified in Appendix C were not labeled, "Caution - Radioactive Material", contrary to 10 CFR 20.203(f)(2).
"Caution signs, labels and signals". (See par. 26)


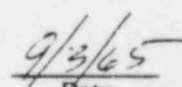
10 CFR 20.103(a)

in that, during the period December 13 through December 26, 1964, two maintenance employees, replacing the refractory in the yellow cake dryer, were exposed to concentrations of airborne natural uranium that exceeded the limits specified by 10 CFR 20.103(a), "Exposure of individuals to concentrations of radioactive material in restricted areas". (It is noted that these exposures were reported to the Commission in accordance with 10 CFR 20.405(a).) (See par. 20)

10 CFR 20.201(b)

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

1. During the period August 12, 1964 through August 19, 1965, time-weighted exposures were not computed for the precipitation and crusher operators during those periods when concentrations of airborne uranium exceeded the MPC.
(See par. 17)
2. The time study performed for the precipitation operator in October, 1962, does not currently reflect the actual time required to clean the yellow cake rotocloner where the concentrations of airborne uranium, on occasions, exceeded the maximum permissible concentration. (See par. 18)

	ORIGINAL SIGNED BY	
	N. PAUL ALLEY	
	N. Paul Alley	
Initials	Inspector	Date
	Original signed by	
	Roger T. Woolsey	SEP 3 1965
Initials	Reviewer	Date

GENERAL INFORMATION

9. Type of Inspection and Persons Contacted

An unannounced, reinspection of the subject licensee was conducted on August 18 and 19, 1965. The principal interviewee was Mr. Claude Duffield, 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 Mr. G. K. Coates, Project Manager, and Mr. Emerson Kemp, Mill Superintendent. At the conclusion of the inspection, the inspection findings were reviewed with Messrs. Coates, Kemp, and Duffield.

ADMINISTRATION

10. Organization

There has been no change in the partnership of the firms holding interest in the Petrotomics Company. Since the previous inspection, which was conducted on August 10 and 11, 1964, Mr. Claude Duffield has replaced Mr. John D. Crozier as Plant Radiologist, Chief Chemist and Metallurgist. The licensee has not elected to continue producing uranium in the "stretch-out" program and continues to hire the same number of employees as that noted during the previous inspections.

11. Responsibilities

Mr. Claude Duffield, as Plant Radiologist, is responsible for the plant's radiation safety program. In this capacity, Duffield performs all surveys pertinent to determining compliance with the regulations. Mr. Duffield stated that he has no assistant to help him in these duties and that he reports directly to Mr. Coates on matters pertinent to radiation safety.

12. Facilities

With the exception of routine maintenance (such as changing the refractory in the yellow cake dryer) there has been no change in the licensee's facilities from that noted during the previous inspection. All systems designed to reduce air concentrations of uranium in the restricted area were operating as designed.

13. Housekeeping

During the inspection, a tour of the plant facilities and tailings area was made and it was observed that the general housekeeping in all sections of the plant appeared good. In particular, the packaging and dryer areas appeared exceptionally clean with no visible dust observed. Mr. Coates stated that good housekeeping in the mill is impressed on personnel and washdown of facilities is an integral part of employee duties.

RADIOLOGICAL PROCEDURES

14. Airborne Radioactive Materials - Restricted Areas

The licensee has collected monthly general air samples at 27 locations throughout the mill and an additional 9 breathing zone samples during specific jobs. These locations correspond to the sampling points listed in the licensee's letter to the Commission dated February 14, 1962, which is incorporated in License Condition No. 8. In addition to the routine air sampling performed by the licensee, breathing zone samples have been taken during the crusher cleanup and during maintenance on the yellow cake dryer. The only areas within the plant where concentrations of uranium exceeded the MPC were in the dryer room (during the cleaning of the rotocloner) and in certain sections of the crusher plant.

15. Shift Schedule and MPC

The plant work schedule remains the same as that noted during the previous inspection. The licensee is authorized by condition 12 of the license to average airborne concentrations of uranium over an 80-hour period in any 14 consecutive days. The licensee's work schedule results in 84 hours on the job in 14 days. Weighted exposures are computed each month for the package operator using an MPC of 4.6×10^{-11} uc/ml since the package operator is required to spend 1/3 of his time in the sample preparation room where the exposure is to uranium with its daughters.

16. Equipment

The sampling equipment and the analytical procedures employed by the licensee remain the same as that noted during previous inspections. During the previous inspection it was noted that the licensee failed to include the atomic weight factor of 0.85 in converting the laboratory fluorometric units of micrograms of U_3O_8 per

sample to units of microcuries natural uranium per cc of air. A review of the licensee's calculations showed that this discrepancy had been corrected and the correct conversion factors were used.

17. Time Studies

According to Duffield, a stop watch time study is performed each month for the yellow cake packaging operator. The time study reflects the time it takes in minutes for the yellow cake package operator to perform specific duties. In addition to the foregoing, the licensee has made a time study showing the amount of time involved during special maintenance on the yellow cake dryer and during cleanup in various sections of the plant. Although the licensee has made a time study for the crusher and precipitation operators, the licensee does not compute time-weighted exposures for these job classifications. The precipitation operator provides occasional attendance to the yellow cake dryer that is required during its operation. One of the jobs involves the cleaning of the rotoclone. The licensee collects monthly breathing zone samples for the precipitation operator during the cleaning of the rotoclone. A review of the records showing the air concentration of uranium during this particular operation showed several occasions where concentrations of uranium exceeded the MPC. The following information was extracted from the licensee's records:

Precipitation Operator *

Uranium uc/cc x 10^{-11}

	9/64	12/64	1/65	2/65	5/65
Cleaning rotoclone	21.56	287.5	404.7	114.1	226.2

* MPC 5.7×10^{-11} uc/cc.

A review of the concentrations of airborne uranium in the crusher portion of the plant during crusher cleanup and during normal operations showed that the MPC for the dust was exceeded as follows:

Crusher Operator *

	8/64	10/64	12/64	1/65	2/65	5/65
Crusher pit floor			9.47 **	5.71	4.82	1.10
Second crusher floor		1.37	6.82 **	3.58		5.14
Impactor	8.92 **					6.19
Screen floor	9.17 **					1.1

* MPC 2.4×10^{-11} uc/cc

** Breathing zone during cleanup.

As noted previously, the licensee failed to time-weight the above noted airborne uranium concentrations to determine exposures for the precipitation and crusher operators. The licensee was reminded that surveys performed to show compliance with 10 CFR 20.103, "Exposure to concentrations of radioactive material in restricted areas", includes a complete evaluation of employee exposure during those periods when the concentration of uranium exceeded the MPC and failure to make such evaluation constituted noncompliance with 10 CFR 20.201(b), "Surveys". Mr. Duffield stated that he would re-evaluate the time studies that had been made by his predecessor, Mr. Crozier, and that time-weighted exposures would be calculated in all instances where air concentration data showed levels in excess of MPC.

18. Time Study - Precipitation Operator

The only time study that the licensee could locate for the precipitation operator was one made in October, 1962. The time study showed that 24 minutes had been allocated to clean the rotoclone per 12-hour day. Utilizing this data an independent calculation was made for the precipitation operator's time-weighted exposure using the airborne concentration of uranium that was determined in January, 1965 (404.7×10^{-11} uc/cc). The calculation was made by multiplying the time worked by the precipitation operator at various locations by the airborne concentrations of uranium at those locations. The sum of the time-weighted concentrations for all locations was determined. This value was divided by 720 minutes to determine the average concentration per 12-hour day. The data showed that the average concentration during a 12-hour day was 14.28×10^{-11} uc/cc. Using the MPC for the precipitation operator of 5.7×10^{-11} uc/cc, (for 84-hour week) the precipitation operator was exposed to 2.5 times the maximum permissible concentration during each 12-hour day. Mr. Duffield was questioned regarding this computation and he stated that the time involved cleaning the rotoclone had been reduced significantly since the October, 1962, time study was made. The precipitation operator was interviewed and he stated that the cleaning of the rotoclone is no longer a daily job and that it is now done about twice a week. However, he added that the job takes about an hour to complete. The licensee was informed that an up-to-date time study should be conducted for the precipitation operator so that time-weighted exposures could be calculated to show compliance with 10 CFR 20.103(a), "Exposure to concentrations of radioactive material in restricted areas", and that failure to update such time studies constituted noncompliance with 10 CFR 20.201(b), "Surveys". Mr. Duffield stated that a time study would be performed in the near future for all job classifications.

19. Time-Weighted Exposure - Packaging Operator

The calculations made by the licensee for the time-weighted exposure for the packaging operator showed that the operator's exposure varied from $0.919 \times \text{MPC}$ to $0.919 \times \text{MPC}$. There were no instances noted wherein the packaging operator received exposures in excess of the permissible limits.

20. Special Maintenance

Duffield stated that time studies are conducted and breathing zone samples are taken for all work of a special maintenance nature wherein there is a potential for generation of airborne uranium. Such maintenance work included replacing and knocking scale from the rotocone, maintenance in the yellow cake dryer, and cleaning of the crush building. The highest concentration of uranium noted during the special maintenance job was during the replacement of the dryer refractory that was performed on December 16, 1964. Two breathing zone samples taken during this maintenance showed concentrations of 841 and 916×10^{-11} $\mu\text{Ci/cc}$, respectively. The time weighting of the exposure of the two maintenance personnel performing the job showed that they were overexposed to the extent of $3.74 \times \text{MPC}$. In accordance with 10 CFR 20.105(a), the licensee reported this overexposure in a letter to the Commission dated January 13, 1965. A review of the circumstances surrounding these overexposures indicated the following as described in the licensee's letter. The corrective action volunteered by the licensee to prevent future recurrence of such exposure was (1) the yellow cake dryer will not be worked on dry; (2) the rotocone which exhausts the dryer will be left in place during work; (3) only one door of the dryer will be open at one time; (4) the replacement of parts within the dryer will be performed remotely whenever possible; and (5) personnel will be rotated to limit the amount of time each man is exposed to high concentrations of uranium. The licensee was informed that the overexposure to the two maintenance personnel that occurred on December 16, 1964, constituted noncompliance with 10 CFR 20.103(a), "Exposure of individuals to concentrations of radioactive material in restricted areas".

21. Previous Violations - Surveys

The licensee was cited at the time of the previous inspection as follows:

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

- (1) From October 25, 1962 to August 11, 1964, breathing zone samples were not taken during routine cleanup operations in the crusher building to evaluate fully the exposure of the crusher operator and helper.
- (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."

It was determined during the inspection that the licensee was taking breathing zone samples during cleanup operations and also had taken breathing zone samples on all special maintenance that had been performed since the previous inspection which was conducted on August 10 and 11, 1964. With the exception of the two maintenance men who changed the refractory in the yellow cake dryer, there were no instances noted wherein licensee personnel received exposure in excess of the permissible limits performing such maintenance.

22. Independent Samples

During the inspection, a total of 4 independent air samples were collected in the crusher plant and the yellow cake packaging and dryer rooms. Included in this total was a sample taken during the cleaning of the yellow cake retort line. The samples were sent to the Health and 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.

23. Airborne Radioactive Material - Unrestricted Areas

Dating from the previous inspection which was conducted on August 10 and 11, 1964, the licensee has taken samples in the unrestricted area on September 10, 1964, and on March 9, 1965. The licensee had noted, on the survey records, the wind velocity, direction, and meteorological conditions at the time of sampling. The final report

of samples taken on September 10, 1964, were three with the maximum concentration of uranium in the unrestricted area recorded as 0.42×10^{-13} uc/cc. Four samples were taken on March 9, 1965, and the maximum concentration of uranium in the unrestricted area was 8.91×10^{-13} uc/cc. This location was 30 yards southeast of crusher feed bins. All other samples showed < MPC. With respect to the sample that indicated 8.91×10^{-13} uc/cc, the average concentration of the two samples taken at this location was < MPC. It is to be noted that the licensee was cited at the time of the previous inspection for failing to conduct surveys of the airborne concentration of uranium in the unrestricted area. The foregoing surveys conducted by the licensee since the previous inspection indicates that corrective action had been taken with respect to performing surveys in the unrestricted area.

24. Radiation Surveys

Mr. Duffield stated that a radiation survey of the mill had been performed by Mr. Crozier in June 1964. This survey confirmed previous survey results recorded by the licensee on several occasions. The licensee's survey results were reported in the report of the inspection conducted on October 23-25, 1962. The survey instrument available to the licensee was also described in previous reports.

25. Personnel Monitoring

The licensee continues to supply film badges to about sixteen employees as described in the previous inspection report. The film badge service is supplied by Tracerlab on a two-week frequency. A review of the film badge records for the calendar year 1964 and 1965 through May, showed all exposures to be less than 25% of the limit specified by paragraph 20.101(a). The licensee has elected not to complete a form AEC-5 for recording individual exposures.

26. Posting and Labeling

It was noted at the time of the previous inspection that the licensee had posted all mill entrances in accordance with License Condition No. 10. During the interim period, however, the licensee had started extracting uranium from low grade ore in a heap leach treatment process. The heap leach ore pad and draining reservoir for the uranium-rich uranium solution was located just outside and adjacent to the main mill fence.

The licensee had extended the existing fence in order to enclose the heap leach location. In so doing he had installed a new main gate; however, this date was not posted in accordance with Condition 10 of the license. The licensee had, however, posted various areas within the mill perimeter where there was a potential for dust generation with a sign in accordance with 10 CFR 20.203(d)(2). The licensee was informed that in lieu of posting all mill entrances in accordance with Condition 10 of the license, containers within the plant in which natural uranium was transported, stored, or used, in quantities greater than 10 times the quantity specified in Appendix C, required labeling in accordance with 10 CFR 20.203(T)(2). Mr. Coates stated that the new gate would be posted as soon as possible.

27. Liquid Effluents

The licensee has five sources of water that are sampled for Ra-226, Th-230, and uranium. The water analyzed includes the mill potable water, three test wells located below the tailings area and a seepage stream which originates in the unrestricted area outside the fence enclosing the lower tailings dam. The licensee was granted an amendment to the license dated December 22, 1964, that authorizes the licensee to discharge into the unrestricted area Th-230 concentrations in the seepage in excess of the limits specified in Appendix B, Table II, Column 2, of Part 20. In addition, the amendment specifies that the mill potable be sampled at six month intervals, the three test wells be sampled at twelve month intervals, and the mill seepage be sampled at monthly intervals. A review of the licensee records from the date of the previous inspection which was conducted on 8/10 - 8/11/64, through December, 1964, showed that samples from the five locations were obtained at monthly intervals. In accordance with the provisions of the amendment granted December 22, 1964, the licensee started sampling the mill potable and the three test wells at six month and twelve month intervals, respectively. The seepage stream, which the licensee is required to sample at monthly intervals, was not sampled during the months of January, February, and March 1965, due to adverse weather conditions. The amendment to the license does not require the licensee to sample the seepage stream during adverse weather conditions. The licensee again sampled the seepage in April, May, and June of 1965, and the mill potable water in May, 1965. The results of the June sampling were not available at the time of the inspection. With the exception of the mill seepage stream which showed, on occasion,

thorium-230 content in excess of the permissible limit, there were no instances noted wherein the mill potable or the three test wells showed concentrations of radium-226, thorium-230 or uranium in excess of the regulatory limit.

20. Seepage Stream

The description and origin of this stream were discussed in some detail in the report of the previous investigation and will not be reviewed. In accordance with the amendment to the license dated December 23, 1964, the licensee is collecting water samples from the seepage at a weekly frequency and compositing the samples on a monthly basis. The samples are sent to Tracerlab for assay for radium-226, thorium-230, and uranium. The sample results for this seepage stream, which originates both from underground as well as tailings seepage, are shown below for 1964.

<u>Month (1964)</u>	<u>Radium-226</u> <u>(X 10⁻⁸ mc/cc)</u>	<u>Thorium-230</u> <u>(X 10⁻⁶ mc/cc)</u>	<u>Uranium-Natural</u> <u>(X 10⁻⁶ mc/cc)</u>
January*			
February*			
March*			
April*			
May	.74	6.3	0.0012
June	.44	0.0025	.16
July	.16	22.33	
August	.34	13.14	
September	2.9	1.12	.14
October	.36	3.66	.04
November	1.3	.98	.8
December	0.007	7.7	.7

*No samples taken due to snow.

Again in 1965 because of snow conditions no samples were obtained for the months of January, February, and March, 1965. The results for April and May 1965, are outlined below:

<u>Month (1965)</u>	<u>Radium-226</u> <u>(X 10⁻⁸ mc/cc)</u>	<u>Thorium-230</u> <u>(X 10⁻⁶ mc/cc)</u>	<u>Uranium-Natural</u> <u>(X 10⁻⁶ mc/cc)</u>
April	0.55	167	0.00534
May	nil	6.2	.03

The licensee has constructed a weir and the seepage flow rate is determined at the time of sampling. A review of the licensee's record showed that the flow rate when the seepage is not frozen over is approximately 20 gallons per minute. The average flow during the period June 1964, through May 1965 was approximately 14 gallons per minute.

The licensee is permitted to discharge Th-230 in concentrations in excess of the Appendix B limits based on flow rate providing the concentration of thorium never exceeds 8 times the Appendix B limits. Based on the flow rate during the past twelve months' history, the licensee can dispose of Th-230 in concentrations up to about 14×10^{-6} uc/cc. Assuming no flow during the first four months of 1964, the average concentration of Th-230 discharged to the unrestricted area was 4.6×10^{-6} uc/cc. The table for 1965, above shows a Th-230 concentration of 167×10^{-6} uc/cc for the month of April. On the basis of past sampling data for Th-230 content of the seepage stream, the licensee and the inspector considered the analytical data questionable. The licensee has requested Tracerlab to re-determine the Th-230 content of the sample. On the basis of the foregoing evaluation, the 167×10^{-6} uc value was not used to determine licensee compliance with the provisions of the amendment. The licensee was not cited for discharging Th-230 in concentrations exceeding the Appendix B levels for 1964, since the provision of the amendment permits the licensee to average concentrations over a period of a year. Further, the only month in which the licensee exceeded the limits specified in Condition 13.1(b) was for the month of July 1964, and the licensee was cited at the time of the previous inspection for this discrepancy.

29. Corrective Action

The licensee has dumped two carloads of limestone in the seepage area in order to reduce the pH of the effluent streams and thereby make the Th-230 less soluble. In addition, Mr. Coates stated that a dam would be constructed before the onset of winter which would enclose both the tailings seepage and the underground spring seepage in an effort to further control the concentrations of isotopes released to the unrestricted areas.

30. Instruction of Employees

It was observed that Form AEC-3 was posted on the bulletin board located near the mill entrance and on the bulletin board which was located in the entrance to the mill employees change room. A booklet describing the safety program at the mill is provided each new employee. Mr. Duffield had prepared a manual entitled, "Radiological Safety and Final Product Packaging", which is issued to the employees working in this portion of the mill.

The licensee possessed both copies of the license and Part 20, which are available to the employees upon request.

30. Management Review

At the conclusion of the inspection, the results of the inspection were reviewed and discussed with Messrs. Coates, Kemp, and Duffield. The corrective action proposed by the licensee with respect to each item of apparent noncompliance is noted in the appropriate preceding paragraphs in the report.

MEMO ROUTE SLIP

Form AEC-98 (Rev. May 14, 1947)

See me about this.

For concurrence.

For action.

Note and return.

For signature.

For information.

TO (Name and unit)

INITIALS

REMARKS

RE: PETROTOMICS COMPANY

DATE

CASPER, WYOMING

LICENSE NO. SUA-551

40-6659

TO (Name and unit)

INITIALS

REMARKS

Attached for your information is the Form AEC-592
inspection report with letter to licensee and
the licensee's reply thereto.

DATE

TO (Name and unit)

INITIALS

REMARKS

DATE

FROM (Name and unit)

REMARKS

Attachment

Form 592 report and reply

R. G. Page

SLR:EB

PHONE NO.

7422

DATE

10-4-65

USE OTHER SIDE FOR ADDITIONAL REMARKS

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