

COMPLIANCE INSPECTION REPORT

1. Name and address of licensee American Potash and Chemical Corporation Lindsay Chemical Division 258 Ann Street West Chicago, Illinois	2. Date of inspection April 19, 20, 21, 24 and June 23, 1961
	3. Type of inspection Reinspection
	4. 10 CFR Part(s) applicable 20, 30 and 40

5. License number(s), issue and expiration dates, scope and conditions (including amendments)

12-4932-1Amendment 2 2-27-61
(amended in entirety)3-31-63 - Reinspection #1 *IC, III*R-234Amended 8-1-608-31-61 - Reinspection #2 *II-A, III*C-3377

7-5-55

7-1-56 - Reinspection #1 *III-E, V*

6. Inspection findings (and items of noncompliance)

A reinspection of the licensee's byproduct and source material program revealed that, at present, activities are restricted to rare earth production.

The licensee, the principal U.S. supplier of thorium products contemplates a resumption of full-scale thorium operations early in 1962.

The licensee's use of byproduct material for research purposes has been limited. Isotopes now in possession are in storage.

The only items of noncompliance noted or otherwise observed are as set forth below:

License No. 12-4932-1

✓ 10 CFR Section 20.203(e)(1) "Posting" - The licensee was in noncompliance for failing to post the isotope storage area. (See Report Detail No. 22.)

License No. R-234

✓ 10 CFR 20 Section 20.201(b) "Surveys" - The licensee was in noncompliance for failing to conduct adequate radiation surveys. (See Report Detail No. 13.)

(CONTINUED)

7. Date of last previous inspection June 12, 1959	8. Is "Company Confidential" information contained in this report? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> (Specify page(s) and paragraph(s))
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Rudolph M. Jezik
John A. Finn

Approved by:

Roy C. Hageman, Director
Chicago Compliance Area
(Operations office)

July 13, 1961

(Date report prepared)

If additional space is required for any numbered item above, the continuation may be extended to the reverse of this form using foot to head format, leaving sufficient margin at top for binding, identifying each item by number and noting "Continued" on the face of form under appropriate item.

RECOMMENDATIONS SHOULD BE SET FORTH IN A SEPARATE COVERING MEMORANDUM

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18. Waste Disposal

The licensee does not dispose of solid radioactive wastes. All radioactive wastes, including contaminated equipment, are stored in a restricted area known as the "12-acre plot." Process wastes are transferred via the plant sewage system to a holding pond in the 12-acre plot. The entire plant sewage system, excluding sanitary facilities, functions such that no liquid radioactive process wastes leave the plant.

Waste handling operations involve waste collection at the holding pond, dredging, and piling dredged material in the plot. A specially fabricated leak-proof dump truck is used to eliminate leakage during transfer of materials. This vehicle is also used to transfer gangue and other material from plant buildings to the 12-acre plot.

The Compliance representatives observed that piled dredgings and gangue occupy an area of several acres and extend to a height of about 15 feet. The pile of gangue is located at the southwest corner of the plot and is within 30 feet of the west fence.

A broad radiation field generated by wastes ranges from 20 to 55 milliroentgens per hour within several meters of the piles. Radiation levels outside the fence, which defines the licensee's property lines, ranged from 1.2 to 1.8 milliroentgens per hour. This area is located between the licensee's west fence and the E&J Railroad and is the property of the E&J Railroad. It is an unrestricted area which may be entered by the general public.

There are no streams, rivers, or waterways on the licensee's property. There is no holding pond drain. Water in the pond is allowed to filter through the subsoil. The waste piles are stored fully exposed and are therefore subject to atmospheric conditions.

Airborne radioactive effluent problems arise as a result of thorium operations. To control the thorium plant effluent discharges, a Dracchi dust collector is attached to the discharge stack. Mr. Vedder explained that this device is continuously operated during thorium operations and has substantially reduced dust concentrations in the discharge air. The Compliance representatives noted the licensee's air samples collected in the vicinity of the Dracchi collector indicated concentrations ranging from 2 to 3 times MPC.

19. Source Material Transfers

The following information was gained from a review of the licensee's inventory records with the assistance of Messrs. Benoit and Bennett.

The last delivery of monazite sand was on January 21, 1959. The suppliers were the Metal Traders 26 Broadway, New York, acting as agents for Monazite and Mineral Ventures, Capetown, South Africa.

The present inventory consists of 1,556,770 lbs. of monazite sand containing approximately 5.5 percent of thorium. At present 239,183 lbs. of thorium compounds are on hand with thorium contents ranging from 40 to 99 per cent. Approximately 639,000 lbs. of Thorium Oxide are on hand.

Mr. Bennett stated that Lindsay has approximately 2000 customers. In all shipments of thorium compounds not generally licensed, Mr. Bennett stated that a customer is required to supply his AEC License Number. A review of purchase requisitions by the Compliance representatives verified this statement. It was observed that in each instance, an AEC License Number was shown.

Continuation Sheet #1
Lindsay Chemical Company
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6. Inspection Findings (continued)

✓ 10 CFR 20 Section 20.203(d)(2) "Posting" - The licensee was in noncompliance for failing to post airborne radioactivity areas. (See Report Detail No. 13.)

✓ 10 CFR 20 Section 20.206(c) "Employee Instruction" - The licensee was in noncompliance for failing to post form AEC-3. (See Report Detail No. 17.)

10 CFR 20 Section 20.401(b) "Records" - The licensee was in noncompliance for failing to maintain records in the same units used in the regulations. (See Report Detail No. 13.)

All items of noncompliance were discussed with a representative of licensee management. The licensee's corrective action is shown in the report.

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DETAILS

9. History

On April 2, 1956, representatives from Division of Inspection, Headquarters, and from Inspection, New York, conducted an informal type visit at the Lindsay Chemical Company, West Chicago, Illinois. The primary purpose of the visit was to determine whether the manufacture and processing of thorium nitrate would require inspection under 10 CFR 20. In conjunction with the visit, the Compliance representatives conducted radiation surveys, including in-plant air sampling.

The air-sampling techniques and related counting procedures which were used were those developed by the New York Operations Office, Division of Health and Safety. These procedures were subsequently adopted by Lindsay as a standard method of determining airborne radioactivity concentrations.

No items of noncompliance were noted as a result of the above visit.

This office conducted the initial inspection of the licensee's source material license on December 3 and 12, 1957, and April 9, 1958. As a result of the inspection, this office reported that air concentrations existed at in-plant locations in excess of the permissible limits established by 10 CFR 20. No other items of noncompliance were noted as a result of the inspection.

The first reinspection of the licensee was conducted on June 12, 1959. In a letter to the licensee dated September 4, 1959, Licensing and Regulation stated that no items of noncompliance had been noted as a result of the June 12, 1959 inspection.

By memorandum to Compliance, Headquarters, dated April 4, 1961, Licensing and Regulation requested that during the next inspection special attention be given to Lindsay's rare earth facility in the following respects:

1. That CD-CH review the air sampling procedures used by Lindsay.
2. That air samples be collected in the vicinity of the rare earth processing and production facilities.
3. That measurements be made of the external radiation from quantities of rare earth material.

By memorandum dated April 6, 1961, Compliance, Headquarters, requested CD-CH to furnish the information requested by Licensing and Regulation in the inspection report. The requested information is included in this report.

This concludes the licensee's past history.

10. An unannounced reinspection of the licensee's byproduct and source material program was conducted on April 19, 20, 21, and 24, 1961. Additional information was obtained during a subsequent visit on June 23, 1961. The items of noncompliance were discussed with Dr. Healy on June 23, 1961.

Present on April 19, 20 and 21, 1961 were the following persons:

Dr. Robert Healy - Radiation Safety Officer, Lindsay
Mr. Edward Maryniw - Radiation Safety Technician, Lindsay
Mr. Edward Wedder - General Foreman, Lindsay
Mr. Louis Kreppert - Illinois Department of Public Health
Mr. James Bates - Illinois Department of Public Health
Mr. Arthur W. Holmes - Compliance Representative - Idaho Compliance Area
Mr. John Finn - Compliance Representative - Chicago Compliance Area
Mr. Rudolph Jezik - Compliance Representative - Chicago Compliance Area

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10. (continued)

On April 24, 1961, the following persons were present: Dr. Robert Healy; Mr. Edward Maryniw; Mr. John Finn; Mr. Rudolph Jezik; Mr. Bruce Beckett, Production Superintendent, Lindsay; and Mr. David Benoit, Traffic Manager, Lindsay.

On June 23, 1961, the following persons were present: Dr. Robert Healy; Mr. Edward Maryniw; Mr. John Finn; and Mr. Rudolph Jezik.

The information contained in this report was gained by observation, interview, and measurement, and is presented in substance unless otherwise indicated.

License No. R-234

11. Scope

The licensee, Lindsay Chemical Division American Potash and Chemical Corporation, West Chicago, Illinois, has engaged in large scale production of rare earth and thorium compounds since 1941. Lindsay produces approximately 95 per cent of the thorium compounds used in this country.

In April 1960 the reduced demand for thorium forced the licensee to curtail thorium operations such that all production activities involving the conversion of monazite ore to thorium and rare earth products ceased as of April 7, 1961. The licensee continues to refine and repackage thorium nitrate on a limited basis. Rare earth production utilizing stock piles of low thorium content "pink salts" (rare earth sodium sulphate) continues on a slightly below normal basis.

Resumption of full-scale thorium production is not anticipated until such time as the "pink salt" stock piles are depleted. An estimated resumption date of January 1962 was given by Lindsay officials. Production may be resumed earlier if current negotiations result in a Government contract for thorium. The licensee volunteered to notify CO-CH, when full-scale thorium production is resumed.

12. Inspection Procedures

Inspection of Licenses 12-2932-1 and C-3377 was not affected by the curtailment of thorium production. However, since observation of normal thorium operations was not possible, inspection of License No. R-234 was conducted on the following basis:

1. A review of records to determine status of compliance prior to production curtailment.
2. A review of safety procedures and procedures for taking air and water samples.
3. Independent measurements of radiation levels and airborne radioactivity levels.

These data were needed to provide Licensing and Regulation with the information they requested; and to provide background data to be later compared with data obtained during normal thorium operations. The inspection was, therefore, conducted along the following lines:

- A. Independent Measurements - After touring the entire plant, at which time operational procedures were reviewed, the Compliance representatives selected various locations susceptible to airborne contamination.

The following factors were considered in making these selections: visible dust concentrations; effluent discharge points; handling operations involving direct contact with materials; and ventilation control. Dr. Healy and Lindsay personnel assisted in this selection by pointing out potential trouble areas.

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12. Inspection Procedures (continued)

All operations were reviewed from the standpoint of areas most likely to generate excessive radiation levels due to the type or quantity of materials handled. A series of radiation surveys were made to provide information related to radiation levels which might exist in unrestricted and restricted areas. Particular attention was devoted to radiation levels encountered during rare earth and thorium refining and repackaging operations. Results of independent measurements made by Compliance representatives are shown in Exhibit C.

B. Radiation Safety - To determine the adequacy of the licensee's radiation safety program, the following areas were reviewed:

- (1) Air sampling - A review of the licensee's air sampling procedures, taking into consideration collection and counting techniques, occupancy determinations, and environmental monitoring.
- (2) Radiation surveys - Survey records were reviewed with respect to levels in restricted and unrestricted areas. Monitoring techniques were also examined with respect to contamination control, background determinations, etc.
- (3) Personnel monitoring - Personnel monitoring methods and records were reviewed.
- (4) Employee instruction - Procedures for instructing employees were examined.
- (5) Waste disposal - Attention was given to discharges and disposals of solid, liquid, and airborne radioactive wastes.
- (6) Source material transfers - In conjunction with a review of the licensee's receipt and transfer of source materials, Compliance representatives discussed with the licensee his methods for assuring that the transferees were in possession of valid AEC licenses.

13. Air Sampling

In 1957 the licensee initiated an air sampling program which included both in-plant and off-site air monitoring. In conjunction with this program a total of 7,000 air samples have been collected to date.

In order to ascertain the effectiveness or validity of these air samples the Compliance representatives discussed in detail with the licensee his collection methods and his counting procedures. The Compliance representatives also investigated the type of equipment used by the licensee.

It was noted that the licensee uses, with only minor deviations, the same air sample procedures at both in-plant and off-site locations. These procedures are as follows: The licensee, using a self-fabricated sampling device, draws a measured volume of air. The sampler collects air at a rate of approximately 35 liters per minute. Each sampler has attached to it a filter paper holder, approximately 2 inches in diameter which contains Whatman 41-H filter paper. Air is drawn through the filter paper for exactly 15 minutes. Each filter paper is then stored for one week. The licensee pointed out that one week's storage is for the purpose of allowing short-lived natural-occurring radioisotopes to decay.

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13. Air Sampling (continued)

The filter papers are then placed in a Nuclear- Chicago lead pig and are counted in a single channel analyzer for two minutes. The analyzer is a Tracerlab Model CE-13 2P1 Scintillation Counter. Used in conjunction with the counter is a Tracerlab Model 1000 Scaler. The scintillation counter is calibrated with Tracerlab R-15 Uranium 238 standards. Activities of these standards are 2700 and 3290 disintegrations per minute, respectively.

It was noted that the licensee does not use a self-absorption factor in determining "corrected counts." A sample is counted and the background counts are subtracted. The net counts are then compared with the known standards. In order to eliminate the need for an additional correction factor allowing for the efficiency of the counting device the licensee makes a direct comparison of the sample's net counts per minute with the standard's net counts per minute. The percentage of permissible limits has been previously calibrated with respect to the known standards. Thus, in the final comparison, the licensee is able to convert directly to percentage of MPC. The percentage of MPC or the number of times greater than MPC is recorded directly on air sample data sheets. These data sheets provide the collection location and date, the counting date, and the percentage of MPC, as well as the name of the individual who collected the air sample.

Since the results are not recorded in microcuries per milliliter of air, Dr. Healy was informed that the licensee was in noncompliance with Section 20.101(b). Dr. Healy stated that future records would be maintained in the units required.

In 1957, the licensee conducted environmental surveys at collection points up to 70 miles from the West Chicago plant. Since that date, environmental surveys have been limited to West Chicago at locations one-half mile east and west of the plant.

It was noted that results of off-site samples have ranged from background to as much as 12 times MPC. The majority of high airborne concentration results were obtained in Chicago along the lake front.

In discussing this situation, Dr. Healy expressed an opinion concerning the validity of the air sampling results and their relation to permissible limits established by 10 CFR 20. Specifically, he stated that he believed the off-site air samples indicate excessive airborne concentrations exist of naturally-occurring radioactive materials in unrestricted areas over which one has control. He then stated that, taking these high concentrations into consideration in the evaluation of airborne concentrations at in-plant sites, leaves one to believe that a great deal of leeway might be placed in the interpretation of any air sample results.

In extending the questionability or the interpretations of the evaluations of the licensee's air sample data the Compliance representatives, with Dr. Healy, undertook a discussion concerning the licensee's recorded air sample data.

Specifically it was noted that high airborne concentrations existed in several areas. In reviewing air survey results, excessive airborne concentrations appeared in those operations directly associated with thorium production. The concentrations of airborne activity ranged from background to as much as 35 x MPC. Plant areas or sites where excessive airborne concentrations existed are as follows:

- Plant No. 2 - The Cascade Room
- Plants 1 and 2 - The Roof Area
- Plant No. 3 - The Thorium Furnace Room
- Building No. 9 - All floors with the highest airborne concentrations appearing on Floors 3 and 4.
- Building No. 9 - Roof area - that area in and around a Drachil dust collector.

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13. Air Sampling (continued)

The monazite roasting shed and the south end of Building No. 1 directly across from the solvent extraction plant.

The air survey records showed that each of the above areas have airborne concentrations exceeding the limits specified in Appendix B Table I, Column I of the revised Part 20. The licensee's MPC, however, was based upon the value of 5×10^{-11} microcuries per milliliter as given in the unrevised Part 20.

In some instances it was noted that the licensee has required operators to wear respirators in areas of high airborne concentrations. These areas were Building No. 9, the third floor, during the thorium solvent extraction operations and in the monazite roasting shed. In this operation the monazite ore bags are opened and their contents placed on the conveyor system for roasting. The empty bags are then placed in an incinerator for disposal.

It was noted that in only one instance had the licensee made an occupancy determination study. In this instance the licensee averaged dust exposure concentrations based upon measurements taken at several locations in an area where an operation was taking place. It was noted that the records stated that the individual working on this particular floor would receive a maximum weekly exposure to airborne concentrations of $3 \times \text{MPC}$. It was also noted that this evaluation had taken into consideration the fact that the operator would be dividing his working time between operations involving exposure to high concentrations and operations with exposure to minimum concentrations.

Based on the licensee's air sample results, it appears that Lindsay employees have been exposed to air concentrations in excess of those listed in 10 CFR 20, Appendix B, Table I. However, insufficient information with respect to occupancy times is available to support a citation against 10 CFR 20.103(b). This deficiency was discussed with Dr. Healy. Dr. Healy was informed that it would be necessary to hold Lindsay in noncompliance with Section 20.202(b), entitled "Surveys." It was pointed out that sufficient occupancy studies to support an employee's exposure to airborne concentrations were unavailable. It was explained that if this data were available it would be examined to determine if employees were being exposed to airborne radioactive material in excess of the limits established by Section 20.103.

Dr. Healy was also informed that the above areas were "Airborne Radioactivity Area" as defined by 10 CFR 20.203(d)(2), and should have been posted accordingly. The Compliance representatives observed that, with the exceptions of signs posted at the plant entrances (see Report Detail No. 22), no "Airborne Radioactivity Area" signs were posted. Dr. Healy stated that the above signs were the only signs displayed in the plant. It was pointed out that these signs were not sufficient to maintain compliance with 10 CFR 20.203(d)(2).

14. Independent Air Samples

A. W. Holmes, Compliance, Idaho, conducted air sampling at various operations. Idaho's air sampling equipment was used and included the following: a Gelman sampler with a 35 liter per minute capacity; a sequential air sampler, capacity 8 liters per minute; and a continuous tape sampler, capacity 4 liters per minute.

Samples were analyzed at Idaho using fluorometric techniques. Volumes of air sampled ranged from 240 to 1050 liters. Altogether 59 samples were taken throughout the plant. Except as shown below, the results indicated less than 0.07×10^{-11} microcuries per milliliter thorium present.

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14. Independent Air Samples (continued)

<u>OPERATION</u>	<u>THORIUM CONTENT</u>
(1) Dry screening - Rare earth oxide	0.4×10^{-11} microcuries per milliliter
(2) Breathing zone - Thorium nitrate repackaging	46×10^{-11} microcuries per milliliter
(3) General area - Thorium nitrate repackaging	6.4×10^{-11} microcuries per milliliter

The rare earth oxide dry screening operation was a crude, dusty, hand operation. The operator wore a respirator. The oxide is supposed to be free of thorium at this stage.

The thorium nitrate repackaging operation is located in the rare earth processing building. The thorium nitrate is dissolved and recrystallized in the second floor "Cascade Room." The wet recrystallized nitrate is dropped by chute to the first floor for repackaging in drums. Using the figure of 3×10^{-11} microcuries per milliliter, the air sample results reported above are therefore 0.13, 15.3 and 2.1 times the MPC for natural thorium.

According to Dr. Healy the operator involved in thorium repackaging operations, only spends a few minutes in the area at a time. The rest of his time is spent with rare earth operations. Repackaging is limited by the capacity of the Cascade Room.

The air sample results were discussed with Dr. Healy. It was pointed out that occupancy studies should be made, recorded and analyzed to show status of compliance with 10 CFR 20.103(b).

15. Radiation Surveys

The licensee maintains radiation survey records of radiation levels encountered during processing operations. The records also show that the licensee has surveyed railroad cars after their unloading and recorded the results; and has measured the radiation levels associated with each finished product.

The following was shown in the radiation survey records: Radiation levels at in-plant areas ranged as high as 40 milliroentgens per hour. The highest radiation levels are encountered in those operations which involve concentrations of thorium products. Surveys of railroad cars loaded with 50 gallons of thorium hydrate showed radiation levels of 1 to 20 milliroentgens per hour at the boxcar sides and 1 to 5 milliroentgens per hour at one meter. Surveys of railroad cars which had contained monazite indicated only background levels. It was also noted that in addition to beta-gamma measurements, the licensee employs a Pee Wee Model No. 2111 alpha survey meter to survey the box cars. Alpha survey results of the box cars indicated background radiation levels. Independent surveys made by Compliance representatives are shown in Appendix B.

16. Personnel Monitoring

The licensee provides film badges to all workers in restricted areas. Restricted areas established by the licensee consist of all in-plant locations where thorium and rare earth operations are conducted. Every individual working in this area is assigned an individual film badge which he is required to wear at all times while in the plant. Badge racks have been placed at time clocks such that when an employee "punches in" he is expected to "pick-up" his badge. During peak operations, approximately 250 workers are assigned film badges.

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16. Personnel Monitoring (continued)

Film badges are supplied by R. S. Landauer and Company on a monthly basis. The licensee requires that these film badges be worn by a worker on the left shirt pocket. The Compliance representatives observed that, for the most part, all employees not only were wearing badges but were wearing them in the required body position.

The Compliance representatives reviewed film badge records dated from the present to the last reinspection. The maximum reading of 675 millirems per month was noted. No exposures were observed to exceed 3 roentgens per 13-week period.

In discussing the limits of exposures established by the revised Part 20, Dr. Healy stated that all workers are to be placed on the $1\frac{1}{2}$ rem per 13-week period. He also stated that as in the past each worker's film badge reports will be carefully checked to insure that no worker exceeds $1\frac{1}{2}$ rem per quarter.

Discussion at this time was also undertaken concerning the maintenance of film badge records in accordance with Form AEC-5. The Compliance representatives observed that the licensee's method of record keeping is such that the information required by Form AEC-5 is available for inspection. It was noted that these records consist of original film badge records provided by the supplier, plus a coded Kardex card for each employee. By means of this dual system the licensee is complying with Section 20.401(a).

17. Employee Instruction

Dr. Healy was questioned with respect to the instructions or orientation employees and supervisors are given regarding the related radiation hazards associated with thorium products.

Dr. Healy stated that before any worker begins work he is given an orientation lecture about plant operations and is given written information which he is to read. This information includes "Radioactivity Statement," (see Exhibit A) which the employee is required to sign signifying that he has read the above referenced information.

In conjunction with the continuing program of employee instruction, Dr. Healy stated that safety meetings which deal with industrial and radiation safety are conducted monthly. During these monthly safety meetings employees are again given orientation or instructions in any matters pertaining to radiation safety.

Dr. Healy also stated that training and orientation is given in greater detail to plant supervision. He stated that each supervisor has been given instruction in Lindsay's radiation monitoring program and has been informed of his individual responsibility. Instructions to the supervisors have included lectures on radiation measurements, the hazards associated with each type of radiation, the use of survey meters, and air and personnel monitoring.

Dr. Healy reemphasized the point that continued instructions in radiation safety are provided through safety meetings. He stated quite frankly that he believes that Lindsay is "within the law" with respect to the instructions and orientation that has been given to its employees.

During the inspection, the Compliance representatives noted that no AEC-3's were posted at the thorium plant. This was brought to Dr. Healy's attention and he stated that this was an oversight on their part. Dr. Healy was informed that this constituted noncompliance with 20.206(c). Dr. Healy was given copies of Form AEC-3 which he then posted at the entrances to the thorium plant.

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License No. 12-4932-1

20. Program and Scope

Only two licensed items had been obtained:

J. Yttrium 91	10 millicuries	Obtained in March 1961
E. Iron 55	1 millicurie	Obtained in 1959

Dr. Healy stated that an attempt was made to count the Iron 55 but it was found that the beta radiation was too soft. No other use has been made of the material. The Yttrium 91 had not been opened yet.

21. License Conditions

Condition 11 - The material was stored in the laboratory located at West Washington and Wood Streets in compliance with this condition. The place of storage is either locked or continuously attended;

Condition 12 - states that the licensee shall comply with 10 CFR 20.

Condition 13 - requires use by or under the supervision of Dr. Robert Healy. Dr. Healy stated that the material is so used.

Condition 14 - According to Dr. Healy, use of the material has been limited to date, but it has not been used and will not be used in humans or in products distributed to the public.

Condition 15 - It was observed that the licensee used the materials in accordance with the referenced statements and documents.

22. Posting

License No. 12-4932-1

It was noted during the inspection on April 24, 1961, that the room or area in which the licensed material was stored was not posted with a "Caution - Radioactive Material" sign as required by 10 CFR 20.203(e). This was corrected by Dr. Healy prior to the visit on June 23.

License No. E-234

The licensee has entrances to the thorium and rare earth plant, as well as the "12-acre" waste storage site, posted with a large sign upon which are displayed the conventional radiation symbol and colors and which state the following: "This entire plant is a Radiation Area Caution - Airborne Radioactivity - Radioactive Materials. Containing tanks, etc., in this area may contain Radioactive Materials."

As shown in Report Detail 13, the licensee failed to post individual airborne radioactivity areas and was in noncompliance.

It was observed that the licensee affixes a label to each thorium shipping container which bears the conventional radiation symbol and colors. In addition, the label states the words "Caution - Radioactive Materials", and refers to the material content in kind and quantity.

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23. License No. C-3377

On hand were two pounds of thorium metal which had been obtained for display purposes. The pieces were obtained machined and mounted on a wooden plaque, and include:

Plate	3" x 5" x 1/4"
Rod	4" x 3/8" diameter
Rod	2" x 3/4" diameter
Bar	3" x 1/2" x 1/4"
Threaded Pipe	4" x 3/4" diameter

No items of noncompliance were noted with respect to this license.

Enclosures:

Exhibit A

Exhibit B

Exhibit C (4 pp.)

Radioactivity Statement

The Lindsay Chemical Division hereby informs its employees that some of the materials handled by the Division are radioactive, and that radioactivity is present in parts of the plant and laboratory areas.

Materials such as monazite ore and thorium materials are radioactive. Radioactive materials are substances whose atoms spontaneously break up, and in so doing give off several different kinds of radiation.

Radiation is not new to man. The most common forms of radiation with which we are familiar are ordinary light and sound. Although we cannot see them, the radiations from radioactive materials are somewhat more powerful than visible light.

Ordinary light is not harmful, yet exposure to strong sunlight for several hours can cause painful sunburn. Similarly exposure to small quantities of radiation from radioactive materials probably does no harm, but exposure to large amounts of radiation can cause damage.

Actually there are naturally occurring radioactive materials and radioactivity in everyone's body, in the food we eat, in the earth, in the bricks and stones in our homes, and in the air we breath.

The amounts of radiation in and around the Lindsay facilities are small, although somewhat greater than ordinary natural radiation. Lindsay has an extensive program continuously in effect to assure that these amounts are small, and that personnel do not receive more radiation than is presently recommended as a maximum permissible amount by such expert authorities as the National Committee for Radiation Protection and the National Bureau of Standards. Although these amounts of radiation are small, efforts are continuously being made by Lindsay to decrease them by means such as better housekeeping, exhaust and disposal systems, and rotation of jobs.

In working with any hazardous material, including radioactive materials, it is desirable to reduce exposure to the hazard to a minimum. This can be done by following safety instructions on the use of proper protective equipment such as gloves and dust masks, and instructions on the handling of thorium-containing materials. Although the radiation hazard at the Lindsay facilities is believed to be small, it is recommended as a general safeguard that contact with radioactive materials and inhalation and ingestion of dust, etc. be kept at a minimum consistent with practical operating conditions.

During the more than 55 years of Lindsay's history in business handling these materials, there has been no evidence, either direct or indirect, of any harm to the health of any employee working with these radioactive materials.

The Radiation Safety Officer or other qualified persons will be glad to discuss this matter with you personally at any convenient time.

Your signature in the space provided below indicates that you have read the statements given above, and that you understand the nature of the hazard involved in you signing away any objection.

American Potash & Chemical Corporation
West Chicago, Illinois

I have read the above statement concerning radioactivity at the Lindsay Chemical Division.

West Chicago, Illinois
Date: _____

EXHIBIT A

On tracks: 0.4 mr/hr

Four feet from
fence: 0.9 to
1.2 mr/hr

Note: unrestricted
area between fence
and track is an
8-foot ditch about
30 feet wide.

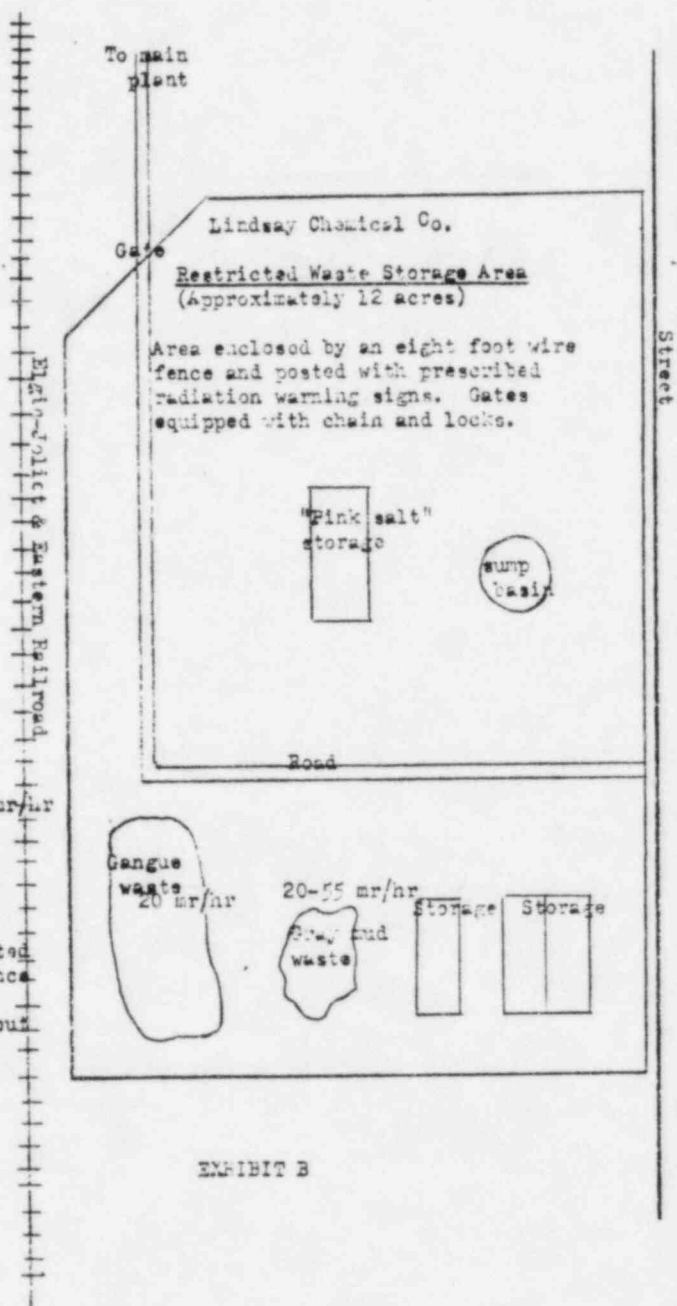


EXHIBIT B

INDEPENDENT MEASUREMENTS

The following measurements were obtained by the Compliance representatives as the result of independent measurements performed with a Technical Associates Junc Survey Meter Model No. 6.

The measurements listed below are primarily associated with thorium operations:

<u>Location</u>	<u>Restricted or Unrestricted Area</u>	<u>Object or Area Surveyed</u>	<u>Survey Results</u>
Monazite Roasting Shed	Restricted	Storage Area Containing Bagged Ore 7-10 ft. high	7 mr/hr at 1 meter 10-12 mr/hr at 1 foot
Between Bldg #9 & Bldg #1	Restricted	Pink Salt Stock Pile-Approx. 20 tons	No measurable Activity
Bldg #9	Restricted	1st Floor Gen. Background	1-5 mr/hr
"	"	2nd Floor Gen. Background	1-5 mr/hr
"	"	3rd Floor Gen. Background	1-7 mr/hr
"	"	3rd Floor Drums of Thorium Nitrate (ThNo ₃)	30 mr./hr at two inches from surface
"	"	4th floor Gen. Background	0.3 mr/hr
"	"	Lunch Room & -2nd Floor Locker Rooms	No Measurable Activity
North Plant Entrance	Unrestricted	Sidewalk	0.05 - 0.1 mr/hr
Perimeter of Fence-East Side- Adjacent to Rare Earth Operations	Unrestricted		No Measurable Activity
Bldg. #9	Unrestricted	Outer Wall-East Side through window in adjacent street	0.18 mr/hr No Measurable Activity
Bldg. #12	Unrestricted	South End-approx. 25 ft. from Bldg. #12	0.4 mr/hr
road	Unrestricted	At 2 ft. from	1.2 mr/hr

INDEPENDENT MEASUREMENTS (CONTINUED)

<u>Location</u>	<u>Restricted or Unrestricted Area</u>	<u>Object or Area Surveyed</u>	<u>Survey Results</u>
Burial Site (12 acre plot)	Restricted	At surface of Gangue	20 mr/hr
"	"	At 15 feet from pile	15 mr/hr
Burial Site (12 acre plot)	Restricted	Recent dredgings	55 mr/hr
"	Restricted	Weathered dredgings	20 mr/hr
Road connecting main plant & burial site	Unrestricted	At road surface	0.2 mr/hr
Railroad bed adjacent to burial site	Unrestricted	At railroad track	0.4 mr/hr
Burial site (12 acre plot)	Unrestricted	Measurements made along outer perimeter of cyclone fence at 4-5 feet (West fence)	0.9 to 1.2 mr/hr
Bldg. #2	Restricted	Thorium Nitrate Repackaging-In Aisles	3-4 mr/hr
"	"	Drums containing Thorium Nitrate	20 mr/hr
Bldg #2	Restricted	Cascade Room 2nd Floor - Gen. Exch.	5-7 mr/hr
Bldg #2	Restricted	"Hammer Hood" (At face)	5 mr/hr

Appendix-B

INDEPENDENT MEASUREMENTS (CONTINUED)

The measurements listed below are primarily associated with rare earth operations.

<u>Location</u>	<u>Restricted or Unrestricted Area</u>	<u>Object or Area Surveyed</u>	<u>Survey Results</u>
Bldg #1	Restricted	Muffle Furnace-Used for ThO ₂ & Rare Earth Drying-At outer surface	2-3 mr/hr
"	"	Duct work from roof to Dust Collector	2 mr/hr
"	"	Roof Area	No measurable activity
Bldg #2	Restricted	Bag Collectors for Rare earth oxide Rotary Driers	No measurable activity
Bldg. #3	Restricted	Barnesite Rotary Driers	No measurable activity
Storage Areas of Bldgs. 1, 2 & 3	"	Praseodymium Oxalate- Not in containers but piled loosely	No measurable activity
"	"	Containers of Crude Yttrium	2 mr/hr at surface
"	"	Deodymium (wet) stored loosely	No measurable activity
"	"	Rare earth chloride. (Stored loosely)	No measurable activity
"	"	Purified Yttrium in containers	No measurable activity
"	"	Barnesite - in 50 lb. drums	No measurable activity
"	"	Polishing Compound Lindsay Code Number 711 - 150 lb. drums	
"	"	At drum surface	0.2 - 0.3 mr/hr
"	"	At 1 meter from a 9 drum pellet	No measurable activity
"	"	Optical ^{scope} Erbium - 50 lb drum- at surface	0.1 - 0.2 mr/hr
"	"	Rare earth fluoride Lindsay code #370	

Appendix BINDEPENDENT MEASUREMENTS (CONTINUED)

<u>Location</u>	<u>Restricted or Unrestricted Area</u>	<u>Object or Area Surveyed</u>	<u>Survey Results</u>
Storage Area of Bldgs. 1, 2 & 3	Restricted	Rare earth nitrate Lindsay code #350 500 lb drum	No measurable activity
"	"	Zero X-Optical scope 50 lb containers	No measurable activity
"	"	Rare earth chloride Lindsay code 340 X 50 lb drum	No measurable activity
"	"	Rare earth oxide - 50 lb drum At Surface	0.1 mr/hr

44-2361
C-3377

SEP 4 1959

Lindsay Chemical Division
American Potash and Chemical Corporation
251 Ann Street
West Chicago, Illinois

Attention: Mr. Robert Neely

Gentlemen:

This refers to the inspection conducted on June 12, 1959 of
your activities authorized under AEC source Material License
Nos. R-136 and C-3377.

No items of noncompliance have been noted as a result of the
inspection.

We appreciate the cooperation given the AEC representative.

Very truly yours,

Lyell Johnson, Chief
Licensing Branch
Division of Licensing
and Regulation

cc: Division of Inspection, Wash.
Division of Inspection, CGO
Public Document Room

DLR:RSB DLR:RSB DLR:LB
JJLane:bkm RECunningham LJohnson
9-1-59

H. L. Price, Director
Division of Licensing and Regulation
Washington, D. C.
Roy C. Hageman, Director, Inspection Division
Chicago Operations Office

July 20, 1959

INSPECTION REPORT - LINDSAY CHEMICAL DIVISION - WEST CHICAGO, ILLINOIS
LICENSE NOS. 12-4932-1, R-126, C-3377, S-4533, S-4750, S-4850, S-4869,
S-4869A, S-4869B, S-4962, S-5088, S-5088D, S-5091A, S-5091B, S-5091C,
S-5098A, S-5098B, S-5098C, S-5098D, S-5107A, S-5107B, S-5107C, S-5107D,
S-5107E, S-5120, S-5148A, S-5148B, S-5148C, S-5232, S-5232A, S-5232B,
S-5239, S-5239A, S-5239B, S-5239C, S-5267, S-5267A, S-5267B, S-5267C,
S-5267D, S-5337A, S-5478C, S-5478B, S-5478A, S-5488A, S-5488B, S-5488C,
S-5380A, S-5442, S-5442A, S-5442B, S-5469A, S-5469B AND S-5469C. (PARTS 30 & 1
S-5088A, S-5148D, S-5206, S-5206A, S-5337B, S-5380B

SYMBOL: ID:RCW

Enclosed is an inspection report for the Lindsay Chemical Division
at West Chicago, Illinois.

No items of noncompliance were observed or otherwise noted during
the course of the inspection.

Enclosure:
Inspection Report (1 cy)

CC: Marvin H. Mann, Asst. Dir., Div. of Inspection, Wash.-w/encl.(orig.)

Draft ok'd by JWB

OFFICE ▶	ID <i>RCW</i>	ID <i>RCW</i>				
SURNAME ▶	Williams/eb	Hageman				
DATE ▶	7-20-59	7-20-59				

COMPLIANCE INSPECTION REPORT

1. Name and address of licensee Lindsay Chemical Division American Potash & Chemical Corporation 258 Ann Street West Chicago, Illinois	2. Date of inspection June 12, 1959
	3. Type of inspection Initial and Reinspection
	4. 10 CFR Part(s) applicable 20, 30, and 40

5. License number(s), issue and expiration dates, scope and conditions (including amendments)
12-4932-1 3-23-59 3-31-61 Scope: The following materials in any form, total
10 millicuries, to be used for laboratory research:

IC

Barium 140	Promethium 147
Lanthanum 140	Phosphorus 32
Cerium 141	Potassium 42
Cerium 144	Praseodymium 143
Praseodymium 144	Rubidium 86
Cesium 134	Samarium 153
Europium 152	Scandium 46
Europium 154	Strontium 90
Iron 55	Yttrium 90
Iron 59	Sulfur 35
Neodymium 147	Mixed fission products

Conditions: #10-Material to be used at above stated address. #11-Material may also be used at West Washington and Wood Streets, West Chicago, Illinois. #12-To comply with 10 CFR 20, Chapter 1. #13-Materials shall be used by or under direct supervision of Dr. Robert M. Healy. #14-Material shall (CONTINUED)

6. Inspection findings (and items of noncompliance)

The persons interviewed, who supplied the information contained in this report, were:

Dr. Robert Healy, Radiation Safety Officer and
Head of Product and Process Development Section
Dr. R. S. Landauer, Sr., Radiation Physicist, Consultant
Edward B. Maryniw, Radiation Technician

The inspector was unaccompanied.

License Number 12-4932-1

This program will be done under the supervision of Dr. Healy but the program has not yet been started and no isotopes have been procured. Dr. Healy could not set a date for the anticipated start of the program but said he would notify the COO Inspection Division 30 days after the program is begun.

License Number R-106

The scope of the program and the description of the extraction process (with pictures) are elaborately described in the inspection report of June 16, 1958, and will not be repeated here. The amount of inventory is still maintained around 10,000 tons (CONTINUED)

7. Date of last previous inspection R-106 - 12/3-12/57 4-9-58	8. Is "Company Confidential" information contained in this report? Yes <input type="checkbox"/> No <input type="checkbox"/> (Specify page(s) and paragraph(s))
---	---

DISTRIBUTION:

Marvin M. Mann, Assistant Director
Division of Inspection
Washington (Orig.)
H. L. Price, Director
Division of Licensing and Regulation
Washington (1 cy)

Richard C. Williams

Approved by:

Roy C. Hageman, Director
Inspection Division, COO

(Operations office)

July 6, 1959

(Date report prepared)

If additional space is required for any numbered item above, the continuation may be extended to the reverse of this form using foot to header format, leaving sufficient margin at top for binding, identifying each item by number and noting "Continued" on the face of form under appropriate item.

16-72814-2 U. S. GOVERNMENT PRINTING OFFICE

RECOMMENDATIONS SHOULD BE SET FORTH IN A SEPARATE COVERING MEMORANDUM

Continuation Sheet #1
Lindsay Chemical
West Chicago, Illinois

June 12, 1959

5. License number(s), issue and expiration dates, scope and conditions (including amendments) (continued)

12-4932-1 (continued)

Conditions: (continued) not be used in or on human beings. #15-Material shall not be used in products distributed to the public. #16-Licensee shall possess and use material in accordance with statements, representations, and procedures contained in his application received 3/16/59.

R-106 9-15-58 4-1-59

IIA

Scope: Licensed to receive possession of and title to raw source material without quantity limitation from persons licensed by the AEC, and through importation in accordance with the procedures described in application of 3/11/58, as amended 7/12/58, for processing and resale; and 20,000 pounds of refined source material containing approximately 12% ThO₂ for use in experimental development of recovery techniques. Further licensed to transfer and deliver possession of and title to refined source material to any person licensed by the AEC within limits of his license.

Conditions: Required to maintain records of inventories, receipts and transfers of source material. Subject to all provisions of the AE Act of 1954 as amended, and to all valid rules and regulations of the AEC, including 10 CFR 20, except that, pursuant to the provisions of Section 20.501, exempt from compliance with the provisions of Section 20.203(f)(2) as applicable to the labeling of inner containers used in the shipment of monazite ores, and as applicable to the labeling of containers of natural thorium material used in factory processing operation as described in application of 12/4/57. Neither this license nor any right thereunder to be assigned or otherwise transferred.

C-3377 7-5-55 7-1-56

II E

Scope: Licensed to receive possession of and title to 2 pounds thorium metal for use as part of an exhibit for educational purposes.

Conditions: Subject to all provisions of the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.

S-4533 1-28-58 7-31-58

Not Exported
II E

Scope: 2 pounds thorium chloride and 1 pound thorium for shipment to Canada.

Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.

Continuation Sheet #2
Lindsay Chemical
West Chicago, Illinois

June 12, 1959

5. License number(s), issue and expiration dates, scope and conditions (including amendments) (continued)

S-4750 4-22-58 10-31-58

Scope: 5 pounds thorium carbonate for shipment to Canada.

Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.

S-4850 6-25-58 12-31-58

Scope: 10 pounds thorium sulphate for shipment to Ontario.

Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.

S-4869 7-10-58 12-31-58

Scope: 2,500 pounds thorium nitrate, for shipment to Toronto, Ontario, and Canada.

Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.

S-4869A 7-10-58 12-31-58

Scope: 2,500 pounds thorium nitrate for shipment to Toronto, Ontario, and Canada.

Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.

S-4869B 7-10-58 12-31-58

Scope: 2,500 pounds thorium nitrate for shipment to Toronto, Ontario, and Canada.

Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.

S-4962 8-25-58 1-31-59

Scope: Sorax IV fuel assembly sections containing thorium for shipment to Switzerland.

Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.

S-5088 10-15-58 3-31-59

Scope: 2,000 pounds thorium oxide for shipment to Canada.

Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.

Continuation Sheet #3
Lindsay Chemical
West Chicago, Illinois

June 12, 1959

5. License number(s), issue and expiration dates, scope and conditions (including amendments) (continued)

S-5088B	10-21-58	3-31-59	Scope: 2,000 pounds thorium oxide for shipment to Canada. Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.
S-5094A	10-21-58	3-31-59	Scope: 2,000 pounds thorium oxide for shipment to Canada. Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.
S-5094B	10-21-58	3-31-59	Scope: 2,000 pounds thorium oxide for shipment to Canada. Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.
S-5094C	10-21-58	3-31-59	Scope: 2,000 pounds thorium oxide for shipment to Canada. Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.
S-5098A	10-22-58	3-31-59	Scope: 3,000 pounds thorium oxide for shipment to Canada. Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.
S-5098B	10-22-58	3-31-59	Scope: 3,000 pounds thorium oxide for shipment to Canada. Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.
S-5098C	10-22-58	3-31-59	Scope: 2,000 pounds thorium oxide for shipment to Canada. Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.

Continuation Sheet #4
Lindsay Chemical
West Chicago, Illinois

June 12, 1959

5. License number(s), issue and expiration dates, scope and conditions (including amendments) (continued)

S-5098D	10-22-58	3-31-59	Scope: 2,000 pounds thorium oxide for shipment to Canada. Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.
S-5107A	11-3-58	4-30-59	Scope: 2,000 pounds thorium oxide for shipment to Canada. Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.
S-5107B	11-3-58	4-30-59	Scope: 2,000 pounds thorium oxide for shipment to Canada. Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.
S-5107C	11-3-58	4-30-59	Scope: 2,000 pounds thorium oxide for shipment to Canada. Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.
S-5107D	11-3-58	4-30-59	Scope: 2,000 pounds thorium oxide for shipment to Canada. Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.
S-5107E	11-3-58	4-30-59	Scope: 2,000 pounds thorium oxide for shipment to Canada. Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.
S-5120	11-7-58	4-30-59	Scope: 16 ounces thorium oxide for shipment to Bermuda. Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.

Continuation Sheet #5
Lindsay Chemical
West Chicago, Illinois

June 12, 1959

5. License number(s), issue and expiration dates, scope and conditions (including amendments) (continued)

S-5148A	12-2-58	6-30-59	Scope: 2,000 pounds thorium oxide for shipment to Canada. Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.
S-5148B	12-2-58	6-30-59	Scope: 3,000 pounds thorium oxide for shipment to Canada. Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.
S-5148C	12-2-58	6-30-59	Scope: 3,000 pounds thorium oxide for shipment to Canada. Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.
S-5232	1-28-59	7-31-59	Scope: 2,500 pounds thorium nitrate for shipment to Canada. Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.
S-5232A	1-28-59	7-31-59	Scope: 2,500 pounds thorium nitrate for shipment to Canada. Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.
S-5232B	1-28-59	7-31-59	Scope: 2,500 pounds thorium nitrate for shipment to Canada. Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.
S-5239	1-30-59	7-31-59	Scope: 1,500 pounds thorium oxide for shipment to Canada. Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.

Continuation Sheet #6
Lindsay Chemical
West Chicago, Illinois

June 12, 1959

5. License number(s), issue and expiration dates, scope and conditions (including amendments) (continued)

S-5239A 1-30-59 7-31-59 Scope: 1,500 pounds thorium oxide for shipment to Canada.
Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.

S-5239B 1-30-59 7-31-59 Scope: 2,000 pounds thorium oxide for shipment to Canada.
Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.

S-5239C 1-30-59 7-31-59 Scope: 5,000 pounds of thorium oxide for shipment to Canada.
Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.

S-5267 2-13-59 8-31-59 Scope: 1,000 pounds thorium oxide for shipment to Canada.
Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.

S-5267A 2-13-59 8-31-59 Scope: 1,000 pounds thorium oxide for shipment to Canada.
Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.

S-5267B 2-13-59 8-31-59 Scope: 1,000 pounds thorium oxide for shipment to Canada.
Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.

Continuation Sheet #7
Lindsay Chemical
West Chicago, Illinois

June 12, 1959

5. License number(s), issue and expiration dates, scope and conditions (including amendments) (continued)

S-5267C	2-13-59	8-31-59	Scope: 1,000 pounds thorium oxide for shipment to Canada. Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.
S-5267D	2-13-59	8-31-59	Scope: 1,000 pounds thorium oxide for shipment to Canada. Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.
S-5337A	3-26-59	9-30-59	Scope: 3,500 pounds thorium oxide for shipment to Canada. Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.
S-5478C	5-18-59	11-30-59	Scope: 2,000 pounds thorium oxide for shipment to Canada. Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.
S-5478B	5-18-59	11-30-59	Scope: 2,000 pounds thorium oxide for shipment to Canada. Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.
S-5478A	5-18-59	9-30-59	Scope: 1,000 pounds thorium oxide for shipment to Canada. Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.
S-5488A	5-20-59	11-30-59	Scope: 1,000 pounds thorium oxide for shipment to Canada. Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.

Continuation Sheet #8
Lindsay Chemical
West Chicago, Illinois

June 12, 1959

5. License number(s), issue and expiration dates, scope and conditions (including amendments) (continued)

S-5488B 5-20-59 11-30-59 Scope: 1,000 pounds thorium oxide for shipment to Canada.
Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.

S-5488C 5-20-59 11-30-59 Scope: 2,000 pounds thorium oxide for shipment to Canada.
Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.

S-5380A 4-17-59 10-31-59 Scope: 2,500 pounds thorium oxide for shipment to Canada.
Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.

S-5442 4-23-59 10-31-59 Scope: 1,000 pounds thorium oxide for shipment to Canada.
Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.

S-5442A 4-23-59 10-31-59 Scope: 2,000 pounds thorium oxide for shipment to Canada.
Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.

S-5442B 4-23-59 10-31-59 Scope: 2,000 pounds thorium oxide for shipment to Canada.
Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.

S-5088A COO, Inspection Division, does not have license.
S-5148D COO, Inspection Division, does not have license.
S-5206 COO, Inspection Division, does not have license.
S-5206A COO, Inspection Division, does not have license.
S-5337B COO, Inspection Division, does not have license.
S-5380B COO, Inspection Division, does not have license.

June 12, 1959

5. License number (s), issue and expiration dates, scope and conditions (including amendments) (continued)

S-5469A 5-12-59 11-30-59 Scope: 1,000 pounds thorium oxide for shipment to Canada.
Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.

S-5469B 5-12-59 11-30-59 Scope: 2,000 pounds thorium oxide for shipment to Canada.
Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.

S-5469C 5-12-59 11-30-59 Scope: 2,000 pounds thorium oxide for shipment to Canada.
Conditions: To comply with 10 CFR 20 and the AE Act of 1954 as amended, and all valid rules and regulations of the AEC. Neither this license nor any right thereunder to be assigned or otherwise transferred.

6. Inspection findings (and items of noncompliance) (continued)

of monazite sand with an average content of six per cent thorium oxide; the daily usage is about 30 tons.

The work force now numbers about 250 people of which about 215 people wear film badges on a regular basis; the office personnel do not wear film badges. The process is a 24-hour per day, six days per week operation. All of the ore is received in bags as -200 mesh sand and is imported from South Africa.

A review of the film badge records shows the majority of the gamma readings to be recorded as less than 50 milliroentgens for a two-week period.

In the past several months, some unexplained beta exposure readings have been reported. For example, for the period ending March 30, 1959, the following results were reported:

<u>Badge Number</u>	<u>Beta Exposure (milliroentgens)</u>
200	95
195	135
199	170
196	350
198	590
197	930

June 12, 1959

6. Inspection findings (and items of noncompliance) (continued)

The operator who wore badge number 197 also wore badge number 275 at the same time, side by side on his shirt pocket. The latter badge reading was reported as zero for beta exposure.

(A subsequent visit was made by the inspector to the film processor to investigate these six films. The rectangular open window area of the film was not uniformly darkened and a very definite dark circle was visible to the eye; further, the six films could be stacked and the circles on the film coincided. Mr. K. H. Stelter (R. S. Landauer, Jr. and Company) and the inspector concurred that the film was exposed outside the film badges. However, the method of exposure is still unexplained.)

Records of radiation surveys, air surveys, personnel monitoring, material receipt, use and shipments are kept. The latest radiation survey showed the highest radiation level to be 8 milliroentgens per hour.

Air samples are taken using two portable units. All samples are numbered and to date about 4600 samples have been analyzed. Air is drawn through a 1-1/8-inch diameter Whatman #41 filter at a rate of 35 liters per minute for fifteen minutes. An alpha count is made seven days later using a zinc sulfide crystal.

A review of the sampling analysis records shows considerable progress in the reduction of air contamination levels. The following table is a list of the highest concentrations taken from the latest air surveys. Some buildings have over 100 sampling locations and only the highest values are reported here. In areas where the MPC (Maximum Permissible Concentration) is exceeded, the operators are required to wear face dust masks. The base MPC used by Dr. Healy is 5×10^{-11} microcuries per milliliter.

Building Number	Area	Number times MPC
9	D7-1,2,3 Tanks	30 (Not a normal working area)
5	West side	0.29
5	East side	0.10
5	Balcony	0.54
Sand Roasting Shed	(Roof)	0.10
1	Ion Exchange	0.36
1	Solvent Extraction	0.36
3	Thorium Furnace	1.32
3	Pilot Plant	0.23
2	Cerium Oxide	1.50
2	Balcony	1.53
Sand Roasting Shed	(Inside)	0.35
9	Roof	0.56
9	Ore attack	3.00
9	Roof-Stack Outlet	2.16
9	Thorium crystallization	10.0
9	Drum Packaging	0.83

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Lindsay Chemical
West Chicago, Illinois

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6. Inspection findings (and items of noncompliance) (continued)

All waste products from the process goes to a 12-acre plot of ground which is fenced and posted. The area is a restricted area and the entrance gates are kept locked.

License Number C-3377

Two pounds of thorium metal were obtained from Oak Ridge for display purposes to illustrate the machinability of thorium metal. The pieces, which were obtained machined and mounted on a wooden plaque, include:

Plate	3" x 5" x $\frac{1}{4}$ "	(rolling)
Rod	$\frac{1}{4}$ " x $\frac{3}{8}$ " diameter	(extrusion)
Rod	2" x $\frac{3}{4}$ " diameter	(extrusion)
Bar	3" x $\frac{1}{2}$ " x $\frac{1}{4}$ "	(extrusion)
Threaded pipe	$\frac{1}{4}$ " x $\frac{3}{4}$ " diameter	(threading)

Export Licenses

Exhibit "A" is a list of export licenses that were used and shows the license number, the amount shipped, the consignee and the date shipped.

No items of noncompliance were noted or otherwise observed during the course of the inspection.

Enclosure:
Exhibit A

Exhibit "A"

<u>EXPORT LICENSE NUMBER</u>	<u>AMOUNT SHIPPED</u>	<u>CONSIGNEE</u>	<u>DATE SHIPPED</u>
S-4533	2# Thorium Chl. 1# Thorium Flu.	Dow Chemical of Canada	2-4-58
S-4750	5# Thorium Carb.	Dept. of Mines & Tech. Surveys	4-29-58
S-4850	10# Thorium Sulp.	"	7-3-58
S-4962	Thorium Fuel	Geneva A.E.C. Conference	8-29-58
S-5120	16 Oz. Thorium Oxide	Owen Harries Warwick, Bermuda	11-14-59
S-4869	2500#	Coleman Lamp & Stove	7-31-58
S-4869-A	2500#	"	8-29-58
S-4869-B	2500#	"	10-1-58
S-5088	2000#	Dominion Magnesium	10-15-58
S-5088-A	2000#	"	10-24-58
S-5088-B	2000#	"	10-27-58
S-5094-A	2000#	"	10-21-58
S-5094-B	2000#	"	10-24-58
S-5094-C	2000#	"	10-27-58
S-5098-A	2000#	"	10-28-58
S-5098-B	2000#	"	10-31-58
S-5098-C	3000#	"	10-28-58
S-5098-D	3000#	"	10-31-58
S-5107-A	2000#	"	11-14-58
S-5107-B	2000#	"	11-14-58
S-5107-C	2000#	"	11-14-58
S-5107-D	2000#	"	11-20-58
S-5107-E	2000#	"	11-20-58
S-5148-A	2000#	"	12-16-58
S-5148-B	2000#	"	11-28-58
S-5148-C	3000#	"	12-16-58
S-5148-D	3000#	"	11-28-58
S-5232	2500#	Coleman Lamp And Stove	1-30-59
S-5232-A	2500#	"	2-27-59
S-5232-B	2500#	"	3-31-59

<u>EXPORT LICENSE NUMBER</u>	<u>AMOUNT SHIPPED</u>	<u>CONSIGNEE</u>	<u>DATE SHIPPED</u>
S-5206	2000#	Dominion Magnesium	1-19-59
S-5206-A	2000#	"	1-19-59
S-5239	1500#	"	2-4-59
S-5239-A	1500#	"	2-6-59
S-5239-B	2000#	"	2-6-59
S-5239-C	5000#	"	2-12-59
S-5267	1000#	"	2-18-59
S-5267-A	1000#	"	2-18-59
S-5267-B	1000#	"	2-18-59
S-5267-C	1000#	"	2-18-59
S-5267-D	1000#	"	2-18-59
S-5337-A	3500#	"	3-24-59
S-5337-B	1500#	"	3-27-59
S-5380-A	2500#	"	4-20-59
S-5380-B	2500#	"	4-24-59
S-5469-A	1000#	"	5-14-59
S-5469-B	2000#	"	5-14-59
S-5469-C	2000#	"	5-14-59
S-5442	1000#	"	5-5-59
S-5442-A	2000#	"	5-5-59
S-5442-B	2000#	"	5-5-59
S-5478-A	1000#	"	5-21-59
S-5478-B	2000#	"	5-18-59
S-5478-C	2000#	"	5-21-59
S-5488-A	1000#	"	5-26-59
S-5488-B	2000#	"	5-26-59
S-5488-C	2000#	"	5-26-59