Form AEC-417 (4-58)

UNITED STATES ATOMIC ENERGY COMMISSION

COMPLIANCE INSPECTION REPORT

II-A, II

1. Name and address of licensee
American Potash and Chemical Corp.
258 Ann Street
West Chicago, Illinois

2. Date of inspection
December 15, 16 and 17, 1964

3. Type of inspection Reinspection

4. 10 CFR Part(s) applicable
20 & 40

5. License number(s), issue and expiration dates, scope and conditions (including amendments)
STA-583 2-27-63 3-31-66 Docket No. 40-2061 Reinspection #4

6. Inspection findings (and items of noncompliance)

The only items of noncompliance observed or otherwise noted are:

10 CFR 20.101(a) - "Exposure of individuals to radiation in restricted areas."
- In that the licensee has permitted individuals within a restricted area to receive in a period of one calendar quarter a radiation dose in excess of 1.25 rem of whole body exposure. (See paragraphs 44-56 and Exhibit D.)

10 CFR 20.201 - "Surveys"
(b) - In that the licensee did not evaluate personnel exposures resulting from high thorium airborne concentrations as determined by breathing zone air sample results, in order to establish compliance with 10 CFR 20.103(a). (See paragraph 65 of details.)

(b) - In that the licensee did not survey surplus equipment, which had been used in the thorium process, prior to disposal by sale. (See paragraph 68 of details.)

(b) - In that the licensee did not make adequate surveys, thereby resulting in the overexposure of licensee personnel to external sources of radiation. (See paragraph 57 of details.)

- continued -

7. Date of last previous inspection
August 16, 1962

8. Is "Company Confidential" information contained in this report? Yes ☐ No ☒
(Specify page(s) and paragraph(s))

9. DISTRIBUTION:
Division of Compliance
Headquarters (orig. & 2)
Division of State & Licensee Relations
Headquarters (1 cy)

James M. Allan
Edgar C. Ashley (Inspector)

Approved by
Eugene J. Moretti, Radiation Specialist (Review), Region III (Operations office)

January 12, 1965 (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.

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RECOMMENDATIONS SHOULD BE SET FORTH IN A SEPARATE COVERING MEMORANDUM

6. Inspection Findings (and Items of Noncompliance), Continued

10 CFR 20.203 - "Caution signs, labels, and signals."
(c)(2) - In that the Prep Room in Building W-1 in which natural thorium was used or stored in an amount exceeding 100 times the quantity specified in Appendix C of 10 CFR 20 was not posted with a sign or signs bearing the radiation caution symbol and the words, "Caution (or Danger) - Radioactive Materials." (See paragraph 69 of details.)

DETAILS

GENERAL INFORMATION

9. This was an announced reinspection conducted on December 15, 16 and 17, 1964 by J. M. Allan and E. C. Ashley. Mr. Bruce J. Bennett, Plant Manager, was notified by telephone of this forthcoming inspection on December 8, 1964.

10. Mr. Robert French, Illinois Department of Public Health, was notified of this forthcoming inspection, by telephone, on December 10, 1964. Mr. Leroy Stratton, and Mr. Louis Kreppert, of the Illinois Department of Public Health, accompanied the AEC representatives during this inspection.

11. The following persons were interviewed during the course of this inspection:

    Mr. Bruce J. Bennett, Plant Manager
    Mr. Gerald Sinke, Safety Engineer and RSO
    Mr. Theodore Fields, Consulting Radiological Physicist
    Mr. Edward Maryniw, Radiation Hygienist (Technician)
    Mr. Dave Lindblom, Head of Sales Order Section

    All information is given in substance unless otherwise noted.

INSPECTION HISTORY

12. Reinspection #3 was conducted on 4/30-5/362; 6/14 and 8/16/62. The licensee was cited for: a) permitting individuals within a restricted area to receive in a period of one calendar quarter a radiation dose in excess of 1.25 rem of whole body exposure contrary to 10 CFR 20.101(a); b) causing levels of radiation to exist in unrestricted areas which, if an individual were continuously present in the area, could result in his receiving a dose in excess of 100 millirems in any seven consecutive days contrary to 10 CFR 20.105(b); c) not making adequate surveys thereby resulting in the overexposure of licensee employees to external sources of radiation as set forth in 10 CFR 20.101, contrary to 10 CFR 20.201(b); and d) not making adequate airborne surveys during the monazite ore roasting operation to assure that employees would not be exposed to airborne concentrations of thorium in excess of the limits of 10 CFR 20.103, contrary to 10 CFR 20.201(b).

13. Corrective action taken by the licensee concerning the above mentioned items of noncompliance was as follows:

    a. Certain tanks were noted to have been shielded with lead in order to reduce the levels of radiation exposure to employees. It is further noted that since the last previous inspection six employees have been reported to have received exposures in excess of 1250 millirem in one calendar quarter. Three of these were determined to have been valid. (For further details please see paragraphs 44 through 56 of report details.)

    b. The licensee is authorized, by License No. STA-583, Condition No. 9, dated February 27, 1963, to produce not more than 2.5 millirems per hour at the boundary to subject unrestricted area.

    c. Although the licensee did correct this specific item of noncompliance it is felt that the item is of the repetitive type in that licensee employees have been permitted to receive overexposures on several occasions since that time.

INSPECTION HISTORY, Continued

13. Continued
    d. This item was corrected by the establishment of a frequent routine breathing zone and general air sample program in the sand roasting shed. It is noted that that facility was eliminated from the thorium process during 1964.

PROGRAM

14. The licensee's facilities constitute the West Chicago Plant of the American Potash and Chemical Corporation. This plant produces rare earth and thorium compounds. The licensee stated that approximately 4 tons of monazite sand are used daily in the production of the rare earth and thorium compounds. The monazite sand was formerly obtained from Africa but at the present time the sand is procured from Florida. This Florida monazite sand consists of approximately 45% rare earth oxides and 4% thorium oxide.

15. According to the licensee, the rare earth portion of the plant is in full production while the thorium compound production is partially curtailed at the present time.

PROCESS

16. A flow diagram, including updated modifications, of the licensee's chemical process for the treatment of the monazite sand and the extraction of the rare earths and thorium has been submitted to the Division of Material Licensing of the Atomic Energy Commission. The licensee states that he considers information within this flow diagram as "Company Confidential" information. The licensee demonstrated to the AEC representatives at the time of the inspection a copy of this diagram. Due to the fact that this information is "Company Confidential" a copy or description of this chemical process is not included as a portion of this inspection report. The flow diagram, as such, is not pertinent to determinations of safety and/or compliance. From this flow diagram, the licensee identified certain portions of his operation which he considers to be the most likely to result in airborne radioactivity. These areas are considered in more detail in other sections of this report.

ORGANIZATION

17. The plant manager of the licensee's West Chicago plant is Mr. Bruce J. Bennett. Mr. Bennett reports to Mr. G. T. Deck, the licensee general manager. In the operational portion of the West Chicago plant, reporting to Mr. Bennett, is Mr. Roy MacLean, Production Superintendent. Reporting to Mr. MacLean are two General Plant Foremen, Mr. Everett Lewis and Mr. Kermit Moskop. Reporting to Lewis and/or Moskop are various plant foremen and reporting to these foremen are the individual workers.

18. Mr. Gerald Sinke is the Radiation Safety Officer. Mr. Sinke stated that the position of RSO is a part time position and utilizes approximately 20% of his time. As Radiation Safety Officer, Mr. Sinke reports directly to Mr. Bennett, the plant manager. Mr. Sinke's primary position is that of Safety Engineer. As Safety Engineer, Mr. Sinke reports to Mr. Robert Gregg, the licensee's Personnel Manager. Mr. Sinke stated that he has been assigned and accepts full responsibility for the radiation safety program. He has assisting him one full-time technician, Mr. Edward Maryniw. Mr. Maryniw makes essentially all the surveys and collects all the samples including their analysis; however, Mr. Sinke is responsible for radiation safety program.

19. The licensee has no Radiation Safety Committee. Mr. Theodore Fields, Radiological Physicist, Health Physics Associates, Ltd., Highland Park, Illinois, is retained by the licensee on a consulting basis. Mr. Fields stated that he reviews the licensee's data, records, changes in process, and discusses up to date regulations, etc. on a quarterly basis.

ADMINISTRATIVE CONTROL

20. Mr. Sinke stated that, as the Radiation Safety Officer, the entire radiation safety program of this licensee is his responsibility. In discharging this responsibility, Mr. Sinke stated that he can require that operations be suspended. This would be accomplished by Mr. Sinke going to the various persons mentioned above in paragraph 17 according to the type of problem involved. Mr. Sinke said that he has the authority to go directly to the licensee's control office in Los Angeles, California if necessary. Mr. Sinke cited three occasions in which he had to shutdown processes. Two of these involved industrial hygiene problems while the third involved radiation safety concerning the malfunctioning of a dust collector. None of the shutdowns lasted more than approximately 2 hours, according to Mr. Sinke. Mr. Sinke stated, however, that the method of accomplishing radiation safety generally did not involve the closing down of processes. Rather, if an area appears to present a "problem", the method of operation in that particular area would be reviewed and then he would recommend changes in technique of operation within this area instead of closing down the area or requiring that equipment be changed. If the change of technique did not eliminate the probelm, the next step would then be to change the process equipment. In reviewing such an area from the standpoint of eliminating any potential hazard which may exist, Mr. Sinke stated that the area would be sampled in detail to determine the actual hazard present. The AEC representatives inquired as to whether, in this detailed review of the particular area, consideration would be given to reducing the time spent by employees within that area. Mr. Sinke stated that he has considered controlling time spent by employees on certain processing operations but that this has not been done. Mr. Sinke stated that it was not the intention of the licensee to operate on a control time basis for employees. However, the licensee stated that some personnel rotation has been done as a result of air sample and film badge data. This rotation has been by the day or week according to Mr. Sinke.

21. Since there is no quantitative limit on the amount of source material which the licensee may possess under License No. STA-583, procurement control is not exercised as a function of the radiation safety officer. Rather, material procurement control is exercised by the purchasing department and is based on an economic control function.

RADIOLOGICAL SAFETY PROCEDURES

22. The licensee has no written operating procedures specifically for radiological safety for distribution to his employees. However, Mr. Sinke stated that procedures concerning the general subject of safety for certain process operations are being written. Some of these procedures, which include general information as to radiation safety, are in effect now, according to Mr. Sinke.

23. The licensee has devised a full page statement drawing a new employee's attention to the fact that he may be working with radioactive materials and requiring the employee's signature. Except for a brief orientation period for new employees, all training is on the job type given by either the individual's foreman or experienced fellow workers. Foremen hold weekly safety meetings in their particular areas. Mr. Sinke stated that radiation safety is among the topics discussed. Also, it is the plant foreman's responsibility to assure that people working under him are familiar with radiological procedures. The foremen also verbally inform employees when respiratory protection is required during particular operations. Beyond this requirement, the employee is permitted to wear the respirator at any time that he chooses.

24. In visiting the production areas of the plant, it was noted by the AEC representatives that no particular radiological safeguards are employed by the licensee other than hooded equipment for certain operations and one case of demonstrated use of respiratory equipment.

RADIOLOGICAL SAFETY PROCEDURES, Continued

25. The licensee provides rubber shoes, boots, gloves, splash goggles, raincoats, and hard hats. The licensee does not provide any other clothing for his employees except that listed above. The licensee does provide shower rooms and space for a change of clothing for the employees. However, it is not a company requirement that an employee take a shower or change his clothes prior to leaving work, although "most" workers do shower and change clothes prior to leaving the facility at the end of a work shift, according to Mr. Sinke. The licensee provides 5 minutes at noon for "wash-up" time, but employees must shower and change clothes on their own time at the end of the work shift. The licensee stated that the employees take their dirty work clothes home to be laundered. It was observed on one occasion, by the AEC representatives that the majority of employees did shower and change clothes at the end of the work day.

FACILITIES

26. The licensee's research and development facilities, known as "W-1", are located at West Washington and Wood Streets in West Chicago, Illinois. The licensee's production facilities are located at 258 Ann Street, West Chicago, Illinois.

27. At the research and development facilities, the licensee has research and development chemical laboratories and small scale pilot plant operations.

28. The production facility covers an area approximately 300 yards by 100 yards in size. Within this production area the licensee produces both thorium compounds and rare earth compounds. To a large extent, production facilities for the two classes of compounds are physically separated by being located within different areas and different rooms within the processing buildings. The thorium generally is handled during processing within three separate areas of the production facilities. These areas are arbitrarily designated as facilities A, B, and C for purposes of this report.

    Facility A: Four-story thorium building.
    Facility B: Furnace Room (calcinating room) within building No. 3.
    Facility C: Blender area in Southwest section of building No. 1.

29. Facility A, the four-story thorium building is building No. 9. It is the licensee's main processing facility. The monazite sand ore is received in the loading area on the first floor of building No. 9 in plastic lined burlap sacks. A bag is placed inside an open faced hood ("sand hopper") and ripped open by an operator. For this operation the upper part of the operator's body is partially inside the hood to afford him sufficient leverage for ripping open the bag. While opening the bags, the operator wears both respirator and gloves. The emptied bags are placed in a "tote" which is a metal container without a lid approximately 3 feet high by 5 feet long and 4 feet wide. The empty bags are then transferred to an area known as "twelve acres" and burned in an open pit.

30. The monazite sand is transferred from the "sand hopper" on the first floor to the fourth floor of building No. 9 by way of a worm gear in enclosed ductwork. At the fourth floor level, the sand is emptied into totes in one-ton quantities. These totes are carried by crane to baking pots where they are dumped and the sand baked with H_2SO_4. The pot baking operations take about 6 hours, after which the material is allowed to sit for about 2 days. There are 6 sets of 4 pots each for a total of 24 pots. At the present time only four pots are being used. Generally, one man works in the pot baking area according to Mr. Sinke.

FACILITIES, Continued

31. After baking, the material is unloaded into hopper-type portable bins and carried by crane to the front of the building. The material is allowed to fall into a funnel type duct into dissolving tanks located on the third floor. At this point in the process the material has the consistency of molasses. Also located on the third floor are the filter presses to which the material goes from the dissolving tanks. Filter cake from the filter presses is transferred to redissolving tanks on the second floor. Evaporator tanks and rotary filter presses are also located on the second floor. Additional dissolving tanks are on the first floor.

32. The thorium building is equipped with a variety of typical chemical processing equipment for the conversion of the monazite ore into rare earth and thorium compounds. This equipment includes acid digestion pots, bleaching, holding, treatment, and evaporation tanks, flat filter presses, rotary filter presses, crystallization kettles, and weighing and packaging equipment. The transfer of the material within the thorium building, after the introduction of the dry monazite sand into the acid digestion pots, is accomplished with the material in a liquid dissolved state or in a wet solid state with a consistency approaching mud. The liquids are transmitted by closed piping. The "mud" may be transmitted either in ductwork from one floor to another or in uncovered portable bins by use of cranes or fork lift trucks.

33. At the time of the inspection, the bulk of the final product from the thorium process consists of thorium oxide. It is necessary to convert thorium oxalate into thorium oxide by calcination. The calcination process, performed in building No. 3 furnace room, was not in operation at the time of the inspection. Located in the southwest section of building No. 1 is a twin shell blender used in the production of thorium nitrate. As stated previously, (please see paragraph 15) the current production of thorium compounds by the licensee is partially curtailed.

34. Approximately one-third of a mile south of the processing area, the licensee maintains an enclosed fenced area known as "twelve acres". Within "twelve acres" the licensee stores incoming ore shipments, semi-processed rare earth salts (pink salts), and grey mud waste from his thorium processes. The grey mud waste is kept for possible future re-use. In addition to this, a pond has been formed which is approximately 50 feet in diameter and about 25 feet deep. According to the licensee, all the liquid process waste generated with the plant is discharged to this pond. The licensee stated that the sides and bottom of the pond are not treated to provide for the retention of the liquid waste. The liquid waste in the pond is allowed to seep through the ground soil. The entire "twelve acre" area is enclosed with a chain-link fence approximately six feet high.

35. Posted at the entrances to, and throughout, the production facilities and "twelve acres" are magenta on yellow signs showing the standard radiation caution symbol and the words, "Caution Radiation Area, Airborne Radioactivity Area, Radioactive Material, Containers, tanks, etc., in this area may contain radioactive material". Posted by the time clock at the main entrance to the facility is a Form AEC-3. In addition, posted at the main entrance to the processing facility is a sign stating "All Lindsay employees working in this area must wear film badges as part of our radiation monitoring program."

36. Storage of the ore and of the finished products is accomplished in storage areas in the main processing area and "twelve acre" warehouses. The unprocessed ore usually is stored in 100 pound plastic lined burlap bags. The finished product generally is stored in 55 gallon drums.

FACILITIES, Continued

37. The "twelve acre" site is provided with padlocks for the gates and for the individual warehouses. The main production site, according to the licensee, is operated on a 24-hour basis. All access into this production facility is through locked doors, for which it is necessary to ring for admission, or by a guard desk. A 6 foot chain-link fence and/or the exterior walls of the buildings form the boundary of the licensee's facility.

38. The thorium workers' lunch room and locker room is located between the 3rd and 4th floor in building No. 9. The licensee stated that the room is mopped once every day. All people in the thorium plant eat their lunch here, and according to Mr. Sinke, are instructed to wash prior to eating.

39. During a tour of the various operating facilities, it was noted that food and drink dispensing machines were located in the general bay area of building No. 3. No surveys or other radiation safety precautions are taken in this area according to Mr. Sinke. With the exception of building No. 9, it was observed that workers in the various areas eat their lunch in or near their work area.

RADIATION SAFETY EQUIPMENT AND INSTRUMENTATION

40. The licensee provides respirators for his employees. The fitting of the respirators is accomplished under the supervision of the foreman of the production area to which the operator is assigned. Mr. Sinke stated that he has never made up checks to determine whether the masks were properly fitted, altho he will periodically check a man's mask for its general condition. The licensee stated that he has a sanitation program for respirators and other safety equipment. According to Mr. Maryniw, people routinely wipe masks inside and out after use - for the sake of cleanliness - not necessarily for radiation safety reasons. The licensee stated that respirator cartridges are changed only when a man has more than normal difficulty in breathing through the cartridge and not on a routine basis. Also, respirators are kept in the individual's locker when not in use. Mr. Sinke stated that the use of respirators is a secondary precaution for protection against airborne contamination, while good ventilation is the primary course of action.

41. The licensee cited four specific areas in which the use of respirators is required. They are: a) at the sand hopper in the loading area of the first floor of building No. 9; b) the thorium oxide room in building No. 3; c) the scales area in building No. 3; and d) the twin shell operation area in building No. 1. In addition, Mr. Sinke stated that respirators are required in these areas only when thorium operations are actually performed.

42. The licensee possesses three locally constructed air samplers. The samplers draw 35 liters per minute through 1¼ inch Whatman 41 filter paper. For the counting of air samples, the licensee possesses two Tracerlab Model CE-13, two 2Pi alpha scintillation counters, using a rubber hydrochloride window. These detectors feed into Tracerlab 1000 scalers. In addition, the licensee possesses a Tracerlab spectrometer and ratemeter with a two inch gamma scintillation detector located in a 2½ inch lead shield. The licensee also possesses a thin end window Geiger detector, which feeds into a Tracerlab 1000 scaler. For portable instrumentation, the licensee has one Nuclear-Chicago Model 2112 alpha survey meter, one Nuclear-Chicago Model 2612 beta-gamma survey meter, and one Victoreen Model 440 low energy survey meter. These portable meters were operable at the time of the inspection.

43. Dr. Fields stated that he calibrates the licensee's beta-gamma survey meters quarterly with a radium standard, and that the one alpha meter is calibrated each time it is used.

PERSONNEL MONITORING

44. All employees assigned to "plant work" at the licensee facilities are under film badge control service, except those classified as general office workers. Those individuals assigned to the thorium processing operations are on a weekly badge exchange period while those assigned to the rare earth and "other" operations are on a monthly basis. All film badges are obtained from R. S. Landauer, Jr. and Company, Matteson, Illinois. There are presently 120 people under monthly badge service and 19 people on weekly badges.

Employees not working in the thorium processing operations were assigned badges as of July 1, 1964 to comply with the requirements of the State of Illinois Radiation Monitoring Act.

45. Film badge racks have been placed at the employee entrance to Building No. 9. All hourly plant employees enter and leave through this entrance since time cards must be punched and this location alone has the necessary time clocks. Employees have been instructed to leave their film badge in the assigned rack each day according to Mr. Sinke. In addition a guard, whose office is located in the entrance area to Building No. 9, periodically checks to see if each employees leaves his badge upon leaving the building. This, however, is not done on a routine or required basis according to Sinke. According to Mr. Maryniw, he personally makes a tour of the plant each day to see if each person has his film badge on. According to Maryniw, badges are sometimes left at home or in the employees clothing locker at the plant. If the badge is at home the employee is reminded to bring it in the next day; if at the plant the employee is instructed to get it immediately and wear it. According to Maryniw, temporary badges are not issued for the forgotten badges.

46. Mr. Sinke puts out a weekly (sometimes bi-weekly) film badge exposure report to each foreman in the plant. This report advises the foreman of each of his workers current exposures. It is the foreman's responsibility, according to Sinke, to rotate the workers on a job if any one individual's quarterly exposure is likely to exceed 1250 mrem.

47. The licensee has chosen to restrict all personnel exposures to the 1250 mrem per quarter limit rather than obtain the prior occupational exposure history and prepare AEC-4.

48. A review of film badge records covering the period from the last previous inspection of 1962 to the latest film badge report of 11-9-64 was made during this inspection. This review showed that thorium processing workers average between 20 and 50 mrem per week and that rare earth workers average about 5 - 10 mrem per month. The supplier claims to be able to read down to 5 mrem. Licensee calendar quarters run from 1-15 to 4-15, 4-15 to 7-15, 7-15 to 10-15, 10-15 to 1-15, with the exception of the following, (see paragraphs 49-54) no exposures in excess of 1250 mrem in any calendar quarter were noted from film badge records.

49. [redacted]
By letter dated May 9, 1963, (see Exhibit D), the licensee reported an exposure of 1270 mrem to have been received by [redacted] during the period 1-15-63 to 4-15-63. In the May 9, 1963 letter the licensee advised Mr. [redacted]' exposure appeared to result from the improper storage of drums containing thorium nitrate in a working area. During the December 1964 inspection the following film badge exposure information was gleaned from the licensee's files regarding Mr. [redacted]' exposure during this period.

Month of	Body Film Badge Results-mrem
1-15-63 to 2-15-63	840
2-15-63 to 3-15-63	270
3-15-63 to 4-15-63	160
Total	1270 mrem

PERSONNEL MONITORING, Continued

49. [redacted], Continued

a. According to G. Sinke, Mr. [redacted] was working in Building No. 1 during this period and was performing packaging of thorium nitrate in 55 gallon drums. Mr. Sinke advised that a number of the filled drums apparently were stacked immediately adjacent to Mr. [redacted] work area and thus created a higher than normal background. The exposure appeared to be a valid personnel exposure and therefore the licensee is in noncompliance with 10 CFR 20.101(a), for permitting Mr. [redacted] to receive in excess of 1.25 rem during the first calendar quarter of 1963.

50. [redacted]

By letter dated May 9, 1963 (see exhibit D) the licensee reported whole body exposure of 1560 mrem for Mr. [redacted] during the first calendar quarter of 1963. The period of exposure is from 1-15-63 thru 4-15-63.

a. During the December 1964 inspection Mr. Gerald Sinke advised that Mr. [redacted] exposure was received while he was working in the D-7 tank area, 3rd floor of Building No. 9. According to Sinke large quantities of thorium sulfate was being stored in drums in this area and apparently [redacted] was not rotated on his work assignment as often as he should have been in order to hold down his exposure.

b. The exposure of 1560 mrem received by Mr. [redacted] during the period 1-15-63 thru 4-15-63 appears to be valid therefore the licensee is in noncompliance with 10 CFR 20.101(a) for permitting this employee to receive in excess of 1.25 rem during the first calendar quarter of 1963.

51. [redacted]

By letter dated September 5, 1963 (See Exhibit D) the licensee reported film badge readings of 1410 mrem (whole body) for Mr. [redacted] during the second calendar quarter of 1963, April 15 - June 15, 1963.

a. During the December 1964 inspection film badge records maintained for Mr. [redacted] were reviewed. This review showed the 1410 mrem exposure reported by the licensee did not include the entire quarterly exposure. When totaled Mr. [redacted] exposure for the second calendar quarter of 1964 was 1680 mrem rather than the reported 1410 mrem. The reason for the discrepancy, according to Mr. E. Marynik was the report was made according to the film badge supplier's quarters rather than their own established quarters and thus did not include two weekly film badge readings. The exposures shown for Mr. [redacted] are as follows:

	Badge Date	mrem	
1st Quarter	2-15-63	70	(first badge issued)
	3-15-63	150	
2nd Quarter	4-15-63	690	(noted by supplier as contaminated badge)
	5-15-63	410	(badge worn from 5-15-63 to 5-27-63 when [redacted] was put on a weekly badge - badge noted by supplier as contaminated)
	5-27-63	[illegible]	(first weekly badge)
	6-3-63	100	
	6-10-63	100	
	6-17-63	100	
	6-24-63	110	
	7-1-63	40	
	7-8-63	130	(badge noted as contaminated)

PERSONNEL MONITORING, Continued

49. [redacted], Continued

a. According to G. Sinke, Mr. [redacted] was working in Building No. 1 during this period and was performing packaging of thorium nitrate in 55 gallon drums. Mr. Sinke advised that a number of the filled drums apparently were stacked immediately adjacent to Mr. [redacted] work area and thus created a higher than normal background. The exposure appeared to be a valid personnel exposure and therefore the licensee is in noncompliance with 10 CFR 20.101(a), for permitting Mr. [redacted] to receive in excess of 1.25 rem during the first calendar quarter of 1963.

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By letter dated May 9, 1963 (see exhibit D) the licensee reported whole body exposure of 1560 mrem for Mr. [redacted] during the first calendar quarter of 1963. The period of exposure is from 1-15-63 thru 4-15-63.

a. During the December 1964 inspection Mr. Gerald Sinke advised that Mr. [redacted] exposure was received while he was working in the D-7 tank area, 3rd floor of Building No. 9. According to Sinke large quantities of thorium sulfate was being stored in drums in this area and apparently [redacted] was not rotated on his work assignment as often as he should have been in order to hold down his exposure.

b. The exposure of 1560 mrem received by Mr. [redacted] during the period 1-15-63 thru 4-15-63 appears to be valid therefore the licensee is in noncompliance with 10 CFR 20.101(a) for permitting this employee to receive in excess of 1.25 rem during the first calendar quarter of 1963.

51. [redacted]

By letter dated September 5, 1963 (See Exhibit D) the licensee reported film badge readings of 1410 mrem (whole body) for Mr. [redacted] during the second calendar quarter of 1963, April 15 - June 15, 1963.

a. During the December 1964 inspection film badge records maintained for Mr. [redacted] were reviewed. This review showed the 1410 mrem exposure reported by the licensee did not include the entire quarterly exposure. When totaled Mr. [redacted] exposure for the second calendar quarter of 1964 was 1600 mrem rather than the reported 1410 mrem. The reason for the discrepancy, according to Mr. E. Maryniuk was the report was made according to the film badge supplier's quarters rather than their own established quarters and thus did not include two weekly film badge readings. The exposures shown for Mr. [redacted] are as follows:

	Badge Date	mrem	
1st Quarter	2-15-63	70	(first badge issued)
	3-15-63	150	
2nd Quarter	4-15-63	690	(noted by supplier as contaminated badge)
	5-15-63	410	(badge worn from 5-15-63 to 5-27-63 when [redacted] was put on a weekly badge - badge noted by supplier as contaminated)
	5-27-63	[illegible]	(first weekly badge)
	6-3-63	100	
	6-10-63	100	
	6-17-63	100	
	6-24-63	110	
	7-1-63	40	
	7-8-63	130	(badge noted as contaminated)

PERSONNEL MONITORING, Continued

51. [redacted] Continued

	Badge Date	mrem	
3rd Quarter	7-15-63	100	
	7-22-63	90	
	7-29-63	90	(noted as contaminated)
	8-5-63	110	
	9-2-63	50	
	9-9-63	20	
	9-16-63	m	
	9-23-63	m	
	9-30-63	m	
	10-7-63	m	(minimal)

b. Mr. [redacted] terminated his employment with the licensee in November 1963.

c. According to G. Sinke, Mr. [redacted] worked in the thorium cascade room and part of his duties included transferring thorium bearing semi-liquid solutions from container to container. Sinke advised that during these transfer operations some of the solution would splash and settle on [redacted] clothing, etc., and that the badge contamination and resulting film exposures occurred because of this.

d. It will be noted that the badges for the weeks of 4-15-63 (690 mrem), 5-15-63 (410 mrem), and 7-8-63 (130 mrem) were all noted as contaminated and contributed 1230 mrem of the 1630 mrem quarterly exposure.

e. From information gathered during the inspection it appears the greater part of the exposure reported for Mr. [redacted] resulted from film badge contamination rather than as a valid personnel exposure.

52. [redacted]

By letter dated February 19, 1964 (see Exhibit D) the licensee reported an exposure of 1290 mrem (whole body) to Mr. [redacted] during the fourth calendar quarter of 1963, October 15, 1963 to January 15, 1964.

a. A reivew of film badge records was made during the December 1964 inspection and showed the following for Mr. [redacted] during the exposure period.

Badge Date	mrem	
1-15-63	120	
2-15-63	100	
3-15-63	90	
4-15-63	80	
5-15-63	120	
6-15-63	70	
7-15-63	300	
8-15-63	200	
9-15-63	560	
10-15-63	550	)
11-15-63	380	) Total 1290 mrem
12-15-63	360	)
1-15-64	390	
2-15-64	110	

b. According to Mr. Sinke, [redacted] is a thorium plant worker and was during the exposure period assigned to a thorium nitrate evaporation process and other associated jobs. According to Sinke, [redacted] was not rotated soon enough to prevent him from exceeding 1.25 mrem during the quarter.

PERSONNEL MONITORING, Continued

52. [redacted], Continued

c. The exposure appears to be valid, therefore the licensee is in noncompliance with 10 CFR 20.101(a) for permitting Mr. [redacted] to receive in excess of 1.25 rem during the fourth calendar quarter of 1963.

53. [redacted]

By letter dated July 24, 1964 (see Exhibit D) the licensee reported an exposure of 3210 mrem (whole body) to Mr. [redacted] during the second calendar quarter of 1964, April 15 to July 15, 1964.

a. During the December 1964 inspection a review of Mr. [redacted] film badge records showed the following exposure for 1964.

Film Date	mrem	Film Date	mrem
1-13-64	0 (minimal)	6-29-64	70
1-20-64	10	7-6-64	0
1-27-64	0	7-13-64	70
2-5-64	0	7-20-64	20
2-10-64	0	7-27-64	0
2-17-64	0	8-3-64	150
2-24-64	0	8-17-64	230
3-2-64	0	8-31-64	0
3-9-64	0	9-7-64	0
3-17-64	0	9-14-64	0
3-23-64	0	9-21-64	0
3-30-64	0	9-28-64	0
4-6-64	0	10-5-64	0
4-13-64	50	10-12-64	0
4-20-64	0	10-19-64	0
4-27-64	0	10-26-64	0
5-4-64	1130	11-2-64	0
5-11-64	80	11-9-64	0
6-15-64	650	11-16-64	0
6-22-64	90		

b. According to Mr. Sinke, Mr. [redacted] is a garageman who repairs all company vehicles. The company garage is physically separated from all thorium processing work on the plant site. The only contact Mr. [redacted] has with the thorium processing operation, according to Sinke, is when he is repairing a vehicle which is used in the processing facility. In addition, [redacted] may walk through the processing facilities on his way to other areas, but does not normally linger in any area.

c. Mr. [redacted] could not account for the higher than normal badge readings during the subject calendar quarter. Sinke suggested [redacted] may possibly have had his badge on a jacket pocket, removed the jacket and left it on a vehicle or container in which thorium was stored. Independent measurements taken in the garage area during the inspection showed a general background of less than 2 mr/hr. Independent measurements taken on a truck used for hauling sludge waste process materials from the processing area to "12 acres" showed a maximum reading of 35 mr/hr inside the truck at contact with lumps of "crud" within the box.

d. It does not appear from information gathered during the inspection that the exposures shown on the film badges can be considered a valid personnel exposure to Mr. [redacted].

PERSONNEL MONITORING, Continued

54. [redacted]
By letter dated July 24, 1964 (see Exhibit D) the licensee reported an exposure of 3210 mrem for Mr. [redacted] for the second calendar quarter of 1964, April 15 to July 15, 1964.

a. During the inspection a review of Mr. [redacted] film badge records was made and showed the following exposures for 1964:

Film Date	mrem		Film Date	mrem
1-15-64	150		7-6-64	80
2-15-64	60		7-13-64	120
3-15-64	m	(minimal	7-20-64	20
4-15-64	m		7-27-64	m
5-15-64	3090		8-5-64	m
6-15-64	40		8-12-64	m
6-22-64	40		8-31 thru	
6-29-64	40		10-26-64	m

b. The 2nd calendar quarter totals for Mr. [redacted], as seen from the above results, in fact are 3290 mrem. (Apparently the badge result for the week of 7-6-64 were not totaled in when the July 24, 1964 letter was written to the Commission).

c. Mr. Sinke advised that [redacted] was a warehouse man (thorium final product storage) and also delivered the intra-plant mail. Sinke stated that [redacted] never spent any unusual amounts of time in the immediate areas where thorium was stored in drums and containers, but would spend some time in their proximity during his normal job functions.

c. During the inspection independent measurements were made of drums containing thorium nitrate and which were being stored in the warehouse in which Mr. [redacted] worked. General background readings were from 0.3 to 0.5 mr/hr in normally occupied areas. Readings on 55 gallon drums containing thorium nitrate read up to 75 mr/hr at contact (Eberline E-500B BG meter probe) and between 20 and 30 mr/hr at a foot.

e. The exposures shown on Mr. [redacted] film badges for the period April 15, 1964 to July 15, 1964 do not appear to be consistent with other badge periods. According to Sinke there was a slightly greater quantity of thorium stored in the warehouse during the subject period than is normally encountered but [redacted] work habits did not change that much to show such an increase in exposure.

f. It does not appear from information gathered during the inspection that the entire film badge exposure for the period in question (particularly the 3090 mrem for the week of 5-15-64) was in fact valid personnel exposure to Mr. [redacted]

55. NOTIFICATION OF EXPOSURES TO PERSONNEL

Notification in writing was furnished each of the individuals mentioned above regarding their quarterly film badge results. The notification contained the information required by 10 CFR 20.405(b).

56. USE OF PLASTIC HOLDERS FOR FILM BADGES

The licensee representatives interviewed during the inspection stated they feel many of the exposures reported from the film badges are not valid personnel exposures but are attributable to badge contamination resulting from liquid material splashing from process containers and getting on the film badge.

PERSONNEL MONITORING, Continued

56. USE OF PLASTIC HOLDERS FOR FILM BADGES, Continued

a. In order to alleviate this problem, the licensee started placing all film badges in lightweight clear plastic holders on December 14, 1964. The holder completely encloses the film badge and is worn on the person.

RADIATION SURVEYS AND/OR EVALUATIONS

57. The licensee stated that direct reading instrument surveys are not performed on a routine basis except for surveys for alpha contamination in box cars and trucks after unloading of raw material. The licensee stated that the only thorium dust contamination "survey" made is a visual check of an area. Routine daily wash downs of thorium work areas is considered a sufficient control of area contamination by the licensee. Mr. Maryniw, who normally makes all surveys, stated that he carries a survey meter with him as he goes through the plant on his "rounds" and "spot checks" an area if he "sees something". No beta gamma surveys are performed by the licensee in order to evaluate personnel exposures to external sources of radiation in the various thorium work area. The lack of adequate evaluations, through surveys, has resulted in personnel overexposures to external radiation (please see paragraphs 44 through 56). Consequently, the licensee is in noncompliance with 10 CFR 20.201(b) for failure to adequately evaluate the radiation hazards resulting from his use of radioactive materials to assure compliance with 10 CFR 20.101(a).

58. The licensee stated that the only routine monitoring or surveys which are performed by him consists of the film badges worn by individuals and in-plant and environmental air sampling.

59. The licensee has established no limits for removable contamination within his process areas or other areas of his facilities. In addition, the licensee has established no limit for personnel contamination of his employees. The licensee has performed no surveys to determine the extent of removable contamination to the persons of his employees. The licensee provides no instrumentation to his employees for the purpose of personnel monitoring for contamination. Mr. Sinke stated that the licensee depends on continuous clean up to control contamination.

60. It was observed during the course of this inspection that several areas in processing Building No. 9 were dampened and operators were using hoses to wet down the floors of various thorium work areas in this building. Mr. Sinke stated he did not consider surface contamination as controlled by the licensee to constitute any problem.

61. The licensee performs occasional beta gamma surveys of the fenceline surrounding the "twelve acre" site to assure that radiation levels at that point do not exceed 2.5 millirems per hour as stipulated in License Condition No. 9.

62. The licensee stated that he has no waste streams, as such, leaving his plant site. As stated previously, liquid waste is discharged to the pond at "twelve acres". The licensee states he has done no sampling of this liquid discharge since the last previous inspection. The licensee states that he believes such sampling to be of little value due to the location of the discharge line and waste pond within the confines of his own facility. Results of previous samples taken by the licensee and AEC representatives of this liquid waste showed values which were less than those established for thorium for release into the sanitary sewerage system (per 10 CFR 20.303(f)(1)) and on the same order as those values permitted for release into unrestricted areas (per 10 CFR 20.106(b)).

RADIATION SURVEYS AND/OR EVALUATIONS, Continued

63. The licensee's in-plant air sampling program is of two types. These types are breathing zone (B.Z.) and general air samples (G.A.S.). The licensee stated that all the plant is sampled every two weeks. According to the current schedule, a total of 22 B.Z. and 43 G.A.S. samples are taken every two weeks. The in-plant areas and types of samples taken bi-weekly are listed as Exhibit A to this report. Mr. Maryniw, the person who takes all samples, stated that the breathing zone samples are collected at the individual operator's breathing zone while the operator is performing his assigned work function. Each of these B.Z. samples is taken for five minutes and counted and analyzed for natural thorium following a 106 hour waiting period to allow for the decay of all other natural airborne contaminates. A review of the licensee's breathing zone air sample results for the second half of 1962, all of 1963, and the first eleven months of 1964 revealed numerous occasions during which the sample results showed greater than the maximum permissible concentration for natural thorium (3×10^{-11} uc/cc), per Column 1, Table I, Appendix B, 10 CFR 20. Several of these routine B.Z. samples showed concentration results of 50 to 176×10^{-11} uc/cc of natural thorium. In addition, during 1964 a total of 151 B.Z. samples were taken during experimental thorium operations of which 81 samples showed concentration results in excess of 3×10^{-11} uc/cc of natural thorium. One of these 81 samples shows a result of 737×10^{-11} uc/cc (approximately 246 X MPC). A compilation of breathing zone air sample results for the periods mentioned above is shown as part of Exhibit B to this report.

64. According to Mr. Sinko, the maximum permissible concentration serves as the base line for operations within the plant. If an area is above this base line, the techniques are reviewed and corrections made. If this does not reduce the airborne concentration, then equipment will be replaced and/or operating techniques revised. (It is here where the experimental breathing zone samples are taken). If air sampling indicates that an area is below this base line, regardless of the absolute value of the air sample, no action is taken to reduce the airborne concentration.

65. The licensee stated that weighted time studies have been made for certain thorium operations. In the performance of this weighted time study, the foreman and the operator involved have estimated the elapsed time for an operation in a given area. The time study is based on the number of hours per day which the particular operation will take. A particular operation may or may not be performed every day. The licensee stated that it has estimated that the length of time for the various thorium operations range from several minutes to 3 - 4 hours. The licensee does not use a time study as a basis for limiting the amount of time which any employee spends within a given area within the plant. The licensee stated further that he does not control exposures to airborne concentrations of radioactive materials by limiting the time spent by employees within such concentrations. When asked by the AEC representatives if determinations of personnel overexposures, based on a 40 hour work week, were made following high breathing zone air sample results (please see paragraph 63 and Exhibit B), Mr. Sinko stated he did not. Rather, the operation which yielded the high air sample would be resampled, and if the second sample is also high, then action would be initiated to correct the situation; that is, checking of the equipment and/or cleaning of the area. The licensee also stated that any one particular employee may or may not be involved in any one thorium operation. Also, the licensee had no idea (or record) as to just who was involved in the thorium operations which had yielded excessive airborne concentrations, as previously discussed. The licensee was advised that failure to evaluate personnel exposures resulting from high thorium airborne concentrations as determined by breathing zone air sample results in order to establish compliance with 10 CFR 20.103(a), constituted noncompliance with 10 CFR 20.201(b).

RADIATION SURVEYS AND/OR EVALUATIONS, Continued

66. The licensee's in-plant general air samples (G.A.S.) are collected in all areas where thorium work is now or has been done. Each G.A.S. sample is taken for 5 minutes and counted after a 106 hour decay period as in the case of the breathing zone samples. As stated previously, each designated area (please see Exhibit A) is sampled bi-weekly. Mr. Maryniw stated that these samples are collected near the center of the particular area, perhaps several feet from the nearest thorium operation. During the first eleven months of 1964 the licensee collected a total of 645 G.A.S. samples. Four of these samples showed results in excess of natural thorium MPC of 3×10^{-11} uc/cc. The highest results showed 14.9×10^{-11} uc/cc. For more detailed information concerning licensee's G.A.S. sample results, please see Exhibit B, attached to this report.

67. For environmental sampling, the licensee currently collects weekly samples at 3 different locations and quarterly samples at 42 different locations. All environmental samples are sixty minute samples collected at a rate of 35 liters per minute through 1¼ inch Whatman-41 filter paper. The weekly samples are taken at Ball's Green House (West of the plant), Vedder's House (East of the plant), and on the plant property located between the other two locations. The quarterly samples are taken at various points along the entire boundary line surrounding the licensee's property. The licensee stated that no environmental sample result has exceeded MPC for unrestricted areas per column 1, Table II of Appendix B, 10 CFR 20.

68. The licensee stated that old, surplus equipment that had been used in thorium process operations was usually steam-cleaned prior to being sold as scrap but that this was not done in every case. Also, Mr. Sinke stated that the scrap equipment had never been surveyed for contamination prior to release insofar as he knew. The licensee was advised that failure to make surveys of such equipment prior to sale to determine the presence of radioactive material constituted noncompliance with 10 CFR 20.201(b).

POSTING AND LABELING

69. Numerous bottles of thorium compounds are stored in the prep room of the licensee's building No. W-1 facility. Each bottle was noted to be labeled with a magenta on yellow standard radiation caution symbol and showing the kind and quantity of material contained therein. The Prep Room Area entrance however was not posted to indicate the presence of source material stored therein. The licensee was therefore advised that failure to post the Prep Room Area constituted noncompliance with 10 CFR 20.203(e)(2), in that the room contained greater than 100 lbs. of source material and was not posted. This was corrected in the presence of the AEC representatives by the placement, by the licensee, of a sign on the entrance door to the Prep Room showing the standard radiation caution symbol of magenta on yellow and the words "Caution - Radioactive Materials". For further information concerning Posting and Labeling please see paragraph 35 under Facilities.

TRANSPORTATION

70. The licensee utilizes fork-lift trucks and dump trucks to move raw material, material in process, and waste material between areas within the production facility and to and from "twelve acres." Mr. Sinke stated that these vehicles never leave the licensee's facilities.

WASTE DISPOSAL

71. As stated previously (please see paragraph 29), emptied, plastic lined burlap bags which had contained monazite sand are burned at the licensee's "twelve acre" site. This method of disposal has been approved in that the raw ore monazite sand is exempt under 10 CFR 40.13(b) since the raw ore residue in the bags had not entered the process.

WASTE DISPOSAL, Continued

72. Airborne radioactive material effluent is discharged through bag-type dust collectors from various hoods and stacks in the process areas. These dust collectors are cleaned out periodically and reused, according to the licensee.

73. The methods of solid and liquid waste disposal and/or treatment were discussed previously in paragraph 34 of report details.

RECORDS

74. The licensee's records of receipt were not reviewed during the inspection. The licensee is authorized to receive and possess unlimited amounts of thorium.

75. The licensee's transfer of material records, both domestic and export, were spot checked during the inspection. The licensee's primary export customer was noted to be Woo Brothers, Inc., 1202 Caroline Mansion, 12th floor, 8 Yun Ping Road, Hong Kong. It was observed their approximate monthly shipments of 2240 lbs. of thorium nitrate (gas mantle grade) have been made to this customer under various thorium export license numbers.

76. Mr. Lindblom stated that the licensee's export license matters are handled by their New York office. The New York office will send the particular STE license number with each thorium order to be filled and shipped from West Chicago, according to Mr. Lindblom. For example, the above mentioned shipments to Woo Brothers, Hong Kong, were made as follows:

Date Shipped	License Number
12-9-64	STE-7168
11-9-64	STE-7166
10-22-64	STE-7158
8-21-64	STE-7135

77. Information gleaned from the licensee's records include the following domestic shipments:

Customer	Pounds of Thorium	Dates
Aladdin Industries, Inc.	360	12-8-64
Nashville, Tenn.	360	11-11-64
License No. R-117	517	11-4-64
Laboratory Equipment Co.	60	12-9-64
St. Joseph, Michigan	100	9-24-64
License No. C-4946	99	7-31-64
Doe and Ingalls, Inc.	2	12-11-64
Everett, Mass.	6	12-3-64
License No. STL-737	6	9-30-64
	6	3-3-64
Catalytic Combustion Co. Bloomer, Wisconsin (Under General License)	4	3-9-64

78. Of the licensee's survey records, primary interest was given to his air sampling results. These records were reviewed for the period of the second half of 1962 thru November 1964. A summary of the licensee's in-plant air sample results is attached as Exhibit B to this report. A review of the licensee's environmental air sampling results showed all samples to be less than MPC. (Please see paragraph 67 of report details.)

INDEPENDENT MEASUREMENTS

79. Independent measurements were made by the AEC representatives of the licensee's facilities during the course of this inspection. The surveys included those for beta gamma, surface alpha contamination, and removable alpha contamination. At this same time, beta gamma and surface alpha contamination surveys were performed by the licensee and representatives of the State of Illinois.

80. Results of the direct reading independent measurements performed by the AEC representatives are shown in Exhibit C to this report. These measurements were performed with an Eberline Model E-500B survey meter with a 30 mg/cm^2 probe (beta gamma) and an Eberline Model PAC-3G survey meter with a 62 cm^2 area probe (alpha) (calibrated for 50% apparent yield).

81. Independent measurements of removable contamination were made using HV-70 filter paper. Each wipe area was of approximately one foot square. These filter paper samples were analyzed at Argonne National Laboratory. The results of these samples are listed below:

a.	Floor in dock area, first floor, bldg. No. 9	β - 4432 dpm α - 4052 dpm
b.	Floor in front of sand conveyor, 4th floor, bldg. No. 9	β - 2133 dpm α - 2132 dpm
c.	Floor in front of elevator, 4th floor, bldg. No. 9	β - 2306 dpm α - 2903 dpm
d.	Top of lunch room table, 3rd floor, bldg. No. 9	β - background α - 54 dpm
e.	Floor in locker room, 3rd floor, bldg. No. 9	β - 189 dpm α - 359 dpm
d.	Toilet seat in locker room, 3rd floor, bldg. No. 9	β - background α - 55 dpm

MANAGEMENT DISCUSSION

82. The results of this inspection were discussed with Mr. Bruce Bennett, Plant Manager; Mr. Gerald Sinke, Safety Engineer and RSO; Mr. Edward Maryniw, Radiation Hygienist (technician); and the licensee's health physics consultant, Dr. Theodore Fields. Items of probable noncompliance discussed included a) determination of possible personnel overexposures to airborne radioactivity based on high breathing zone air sample results; b) surveys of outgoing surplus scrap equipment; c) radiation exposure to personnel to greater than 1250 millirems per quarter; and d) posting of Prep Room in Bldg. W-1. Other items discussed included the use of signs to denote respirators usage areas, consideration of exposure determinations of outside contractors and other visitors in thorium processing facilities, possibility of bio-assay sampling of thorium workers, monitoring of dirty clothes taken home by thorium workers, tighter control of eating, drinking, and smoking in thorium work areas.

83. Concerning the four items of noncompliance listed above, the licensee representatives stated that, a) a determination of possible personnel overexposure to airborne radioactivity would be made following high breathing zone air sample results; b) he stated that surveys would be made of outgoing surplus equipment to assure that the equipment is not contaminated; c) continued evaluation of the thorium process would be made to reduce personnel exposures to external sources of radiation; d) the fourth item, posting deficiency, was corrected at the time of the inspection.

Enclosures:
Exhibits A, B, C & D

CURRENT SCHEDULE OF ROUTINE IN-PLANT BI-WEEKLY AIR SAMPLES

Area	Number of Specific Locations	
	B.Z.	G.A.S.
Bldg. No. 1, General Area	0	4
Bldg. No. 2, Main Area	2	4
Bldg. No. 2, Balcony	0	3
Bldg. No. 3, General Area	0	5
Bldg. No. 3, ThO_2 Room	4	0
Bldg. No. 5, Main Area	0	5
Bldg. No. 5, Balcony	0	4
Bldg. No. 9, 1st Floor	4	5
2nd Floor	4	2
3rd Floor	4	2
4th Floor	4	2
Roof	0	4
Bldg. No. 4A (Sand Roasting Shed)	0	2

NOTE: B.Z. = Breathing Zone
G.A.S. = General Air Sample

EXHIBIT A
American Potash
& Chemical Corp.

IN-PLANT AIR SAMPLING RESULTS

Period Reviewed	No. of Samples	No. of Samples >MPC	Highest Results of Those > MPC
GENERAL AIR SAMPLES:			
10-3-62 to 12-13-62	53	2	$4.2X10^{-11}$uc/cc
1-2-63 to 12-31-63	350	22	$53.7X10^{-11}$uc/cc
Jan. thru Nov., 1964	645	4	$14.9X10^{-11}$uc/cc
For current schedule of In-Plant Air Sampling see Exhibit A.			
BREATHING ZONE AIR SAMPLES - 1962:			
Bldg. No. 9, 3rd floor 9-6-62 thru 12-28-62	28	12	$37X10^{-11}$uc/cc
Bldg. No. 9, 4th floor 11-6-62 thru 11-30-62	8	1	$3.3X10^{-11}$uc/cc
Bldg. No. 9, 2nd floor 11-16-62 thru 12-18-62	12	0	--
Bldg. No. 2, Th.Cascade Rm. 12-5-62	4	0	--
Bldg. No. 3, ThO_2 Furnace Rm. 11-23-62	4	4	$176X10^{-11}$uc/cc
BREATHING ZONE AIR SAMPLES - 1963:			
Sand Roasting Shed 1-30-63 thru 12-17-63	32	15	$15.4X10^{-11}$uc/cc
Bldg. No. 2, Cascade Rm. 1-9-63 thru 12-19-63	89	10	$68X10^{-11}$uc/cc
Bldg. No. 3, Th.Furnace Rm. 2-13-63 thru 12-5-63	36	6	$14X10^{-11}$uc/cc
Bldg. No. 9, 2nd floor 1-23-63 thru 12-13-63	67	4	$7.76X10^{-11}$uc/cc
Bldg. No. 9, 3rd floor 1-23-63 thru 12-12-63	66	18	$37.9X10^{-11}$uc/cc
Bldg. No. 9, 4th floor 1-2-63 thru 12-11-63	68	5	$6.2X10^{-11}$uc/cc
BREATHING ZONE AIR SAMPLES - 1964:			
Experimental - Various Areas 2-24-64 thru 11-23-64	151	81	$737X10^{-11}$uc/cc
Bldg. No. 2, Cascade Rm. 1-6-64 thru 11-25-64	29	8	$115X10^{-11}$uc/cc
Bldg. No. 3, Th.Furnace Rm. 2-5-64 thru 11-6-64	45	25	$158X10^{-11}$uc/cc
Bldg. No. 9, 1st floor 4-14-64 thru 11-16-64	51	6	$58X10^{-11}$ uc/cc
Bldg. No. 9, 2nd floor 1-9-64 thru 11-4-64	58	4	$19.5X10^{-11}$uc/cc
Bldg. No. 9, 3rd floor 1-2-64 thru 7-9-64	39	16	$54.7X10^{-11}$uc/cc
Bldg. No. 9, 4th floor 1-7-64 thru 11-19-64	95	27	$83X10^{-11}$uc/cc
Sand Roasting Shed 1-9-64 thru 10-26-64	24	1	$16.4X10^{-11}$uc/cc

EXHIBIT B
American Potash & Chemical Corp.

INDEPENDENT MEASUREMENTS

At "Twelve Acres"

S.W. Storage Shed

Material from torn Malaysian sand bag	7500 cpm - Alpha
Radiation at surface of bag	10-12 mr/hr
General background at sand storage area	1-5 mr/hr
Background at fence line near shed	0.3 mr/hr
Background between pond and shed	0.06 mr/hr

Pink Salt Storage Bldg.

Radiation at surface of chunk of thorium hydrate	75 mr/hr
Radiation at surface of drum of thorium nitrate	75 mr/hr
General background at thorium nitrate & hydrate storage	15 mr/hr

Outside of Buildings

Radiation at surface of grey mud waste pile	8.5 mr/hr
Background at fence line near north end of pile	0.7 mr/hr
Background at fence line near south end of pile	1.4 mr/hr
Background at radiation caution sign near pile	2-3 mr/hr

Truck in Garage (on-site use only)

Radiation at surface of "crud" coated on various outer surfaces	5-35 mr/hr
Background at driver's head position in cab	2 mr/hr
General interior of cab	up to 600 cpm - Alpha

Shipping Warehouse

Background at wall by street	background
General background in building	0.3-0.4 mr/hr
General floor surface	200 cpm - Alpha
Radiation at surface of Code 100 material on shelf at shipping table	10 mr/hr
Background at eye level at shipping table	0.35 mr/hr
Surface of scale platform	2000 cpm - Alpha

Building No. 9

First Floor

Pants of Fred Boerner (sand hopper loader)	7000 cpm - Alpha
Gloves " " "	5000 cpm - Alpha
Fork lift truck - forks	7000 cpm - Alpha
Fork lift truck - seat & instrument panel	1000 cpm - Alpha
Fork lift truck - floor board	4000 cpm - Alpha
General floor surfaces	3000-3500 cpm - Alpha
Floor inside multi-use elevator	3500 cpm - Alpha
Surface on top of dissolver tanks	1000 cpm - Alpha
General background	0.07 mr/hr

- continued -

INDEPENDENT MEASUREMENTS, Continued

Building No. 9

Fourth Floor

Surface of pot and in front of sand conveyor	4000 cpm - Alpha
Floor surface in front of elevator	5000 cpm - Alpha
Radiation at surface of cooked sand in pot tray	1.5 mr/hr

Locker Room Between Third and Fourth Floor

Top surfaces of table and bench	250-500 cpm - Alpha
Floor surface	2500 cpm - Alpha

Third Floor

Radiation at surface of dissolving tanks	1 mr/hr
Edge of filter presses	9000 cpm - Alpha
Edge of filter presses	5 mr/hr
Top surface of cover on D-7 tank	up to 30,000 cpm - Alpha
Top surface of cover on D-7 tank	<1 mr/hr

Second Floor

Radiation at surface of D-8-3 tank	16 mr/hr
Floor surfaces near tanks	10,000 cpm - Alpha
Various surfaces of fork lift truck	1000-5000 cpm - Alpha

Control Laboratory

General floor surfaces	up to 900 cpm - Alpha

Bldg. No. 3

Surface of pallet outside of Th furnace room	600 cpm - Alpha
Floor at entrance to furnace room	6000 cpm - Alpha
Floor in front of food dispensing machines	350 cpm - Alpha

EXHIBIT C
American Potash
& Chemical Corp.

From: G. Sinkr

Subject: [illegible]

BLunnell
EJuzwiak
[illegible]
[illegible]
DSmith
RVreeland

YEARLY QUARTER 1 2 3 (4) (circle one)

LIMITS - 1250 mr/quarter, 96 mr/week. Do not exceed 80 mr/week

COMMENTS - A - Not returned.
C - Evidence of contamination
T - Terminated

M - Exposure's below minimum quantity meas[illegible] are recorded "M". "M" in current period columns equals less than 10 millirens of "X gamma, 40 millirems hard beta, 20 millirems fast nuetrons.

1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
10/03	10/10	10/17	10/24	10/31	11/07	11/14	11/21						
90	30	M	M	50	70	70	30						
20	30	M	M	M	20	30	M						
30	20	M	M	M	M	M	M						
M	M	20	M	M	M	M	M						
40	M	M	M	M	30	M	M						
80	30	70	90	40	70	90	20						
M	M	M	M	M	M	M	M						
40	M	M	M	M	20	M	20						
C-30	C-20	M	M	M	M	M	M						
M	M	50	M	30	50	M	M						
40	30	30	50	30	40	20	20						
30	20	40	30	M	20	M	M						
20	M	20	M	20	M	M	M						
A20	M	M	M	M	M	M	M						
M	30	M	M	M	30	M	M						
M	M	M	M	M	M	M	M						
M	M	M	M	M	M	M	M						
M	M	M	M	M	M	M	M						
40	10	20	M	20	20	M	20						
M	M	M	M	60	40	M	M						

EXHIBIT A

WEEK	1	2	3	4	5	6	7	8	9	10	11	12	13	14
WEEK STARTING	10/03	10/10	10/17	10/24	10/31	11/07	11/14	11/21						
	40	30	M	M	30	40	40	20						
	30	30	30	M	30	40	40	20						
	M	M	M	M	M	M	M	M						
	30	M	20	M	M	M	M	M						
	C-80	C M	M	M	20									
	30	30	20	M	20	M	M	M						
	20	20	20	M	M	M	M	M						
	M	M	M	20	M	M	M	M						
	M	M	50	70	M	M	M	M						
	M	30	50	50	M	M	20	M						
	40	M	50	M	M									
	30	M	20	M	20	20	M	M						
	M	M	30	30	30	20	M	M						
	30	M	10	30	30	40	M	20						
	90	60	100	100	30	110	60	60						
	30	M	30	20	90	20	20	M						
	20	M	M	20	20	M	20	M						
	30	90	50	M	30	60	70	40						
						M								
						90	M	M						

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 consistant 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. In signing this, you are not agreeing to do anything, nor are you signing away any rights.

LINDSAY CHEMICAL DIVISION
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 R

SKETCHES AND INDEPENDENT MEASUREMENTS

The attachments to this exhibit show sketches of the licensee's production facilities in West Chicago and results of independent measurements. Air samples were analyzed by the Health and Safety Division of the Idaho Operations Office. All other samples were measured by the Argonne National Laboratory.

Except for Attachment 2, on all sketches of facilities, the circled numbers show the locations of smears taken by the Commission representatives. Results of these smears are shown in Attachment 5. Except for Attachment 2, on all sketches of facilities, the numbers in squares show the location of air samples. Results of air samples are shown in Attachment 4. Written on the sketches are numbers with mr/hr units. These are direct instrument readings at the locations shown.

In Attachment 4, showing air sample results, Sample No. 3 was taken while an individual (wearing a respirator) scooped thorium nitrate from a larger into smaller containers. This required approximately 45 minutes. Sample No. E-84 was taken on the catwalk above the D7-3 tank while the tank was being agitated. Sample No. E-94 was taken by the automatic tote loader in the Sand Roasting Shed. Samples No. E-97, E-98, E-99, and E-103 were taken at the rotary kilns in the Sand Roasting Shed. The kilns were undergoing maintenance at the time the samples were taken.

Solid black circles will be noted on the sketches of the process areas. It is at these locations that air samples routinely will be taken by the licensee.

The following is a list of Attachments:

Attachment 1 - Sketch of Plant Site
2 - Sketch of "twelve acre" area
3 - Water Sample Results
4 - Air Sample Results
5 - Results of Smear Tests
6 - Sketch of Sand Roasting Shed
7 - Sketch of Balcony, Building 2
8 - Sketch of Cascade Room
9 - Sketch of First Floor, Building 9
10 - Sketch of Second Floor, Building 9
11 - Sketch of Third Floor, Building 9
12 - Sketch of Fourth Floor, Building 9
13 - Sketch of Roof Area, Building 9