

DRAFT
EPSTEIN:rc
7/14/64

PART 40 INSPECTION

INSPECTOR: Eugene Epstein

W. R. GRACE & COMPANY
Davison Chemical Division
P. O. Box 488
Pompton Plains, New Jersey

License No. STA-422

Date of Inspection: July 1, 1964 (Announced Reinspection)

Persons Accompanying Inspector:

New Jersey authorities were notified, but no representative appeared.

Persons Contacted:

Mr. Richard Mandle, Plant Manager
Mr. Donald C. Hubbard, Manager, Division of Industrial
Relations, W. R. Grace, Irwin, Tennessee
Mr. Peter Carino, Plant Chemist and RSO

NOTE: PARAGRAPHS SA-SH REFERRING TO PROCESSING
ARE TO BE CONSIDERED COMPANY CONFIDENTIAL.

REPORT DETAILS

Background Information

1. An initial inspection of the licensee's facility was performed November 25, 1959. Items of noncompliance were noted and it was felt that a hazard existed and a follow-up inspection was warranted. A follow-up inspection was conducted on June 29, 1961 and no items of noncompliance were noted.

Organization and Administration

2. The Rare Earths Division of ^{the Davison Chemical Company, a subsidiary of W.R. Grace and Company} ~~W. R. Grace and Company~~ is engaged totally in the manufacturing of polishing compounds for the optical trade. Optical polishing compounds are reportedly obtained from the refining of monazite sands. Mr. R. Mandle, Plant Manager, stated they intend to be completely out of the monazite sand refining process within the next six months. He stated that new polishing compounds have been developed which do not contain source material. He stated currently

use of monazite sand is 33% of all processing and will be gradually phased out. Mr. Peter Garino, a graduate chemist, acts as RSO. Garino took a two week course in methods of radiation detection, counting and surveys at the Grace Col Plant at Irwin Tennessee. Garino reports directly to Mandle, Plant Manager. Mandle stated a total of 14 employees, 7 production workers and location of the facility in P. 10000.

Facilities and Uses of Byproduct Material

3. The scope of the license was reviewed with Garino. The licensee is permitted to have Thorium in unlimited quantities for thorium ore processing.
4. Garino was noted to maintain a monthly inventory. The inventory as of 7/1/64 showed the possession of the following
 - 4854 pounds Thorium (nat) in monazite sand;
5% enrichment
 - 1005 pounds as thorium nitrate
 - 58 pounds as thorium oxide

Garino stated the final product cerium oxide powder contains from 0.1 to 0.2% natural thorium.

Company Confidential Processing Methods

5. Garino described the manufacturing process as follows:
 - A. Monazite ore is received as #60 mesh and is reduced to #200 mesh in a closed circuit ball mill.
 - B. The 200 mesh material is acidulated in large outside tanks with concentrated sulphuric acid.
 - C. The mixture is heated and decomposed with phosphoric acids and rare earth crystals are formed.
 - D. The crystal mixture is then centrifuged.
 - E. Crystals are redissolved.
 - F. The water removed from the centrifuge in step D above contains 99% of the thorium which is precipitated as thorium phosphate dake.

- G. The redissolved rare earth crystals, are further refined by treatment with sodium fluoride. This causes any remaining thorium to precipitate as thorium fluoride.
- H. The thorium fluoride and the thorium phosphate are considered waste products according to Mandle. He stated that in prior years there was a market for the waste materials which were sent to the American Potash Company for further refinement. Mandle stated there is no longer a market for refined natural thorium and thorium is considered as a waste product other than the small quantity retained in the optical polishing compound.
6. The facilities used consist of a separate room for ball mill operations which Garino stated creates the most dust. A storage area, a centrifuge area, a filter press area and numerous wooden tanks 12 feet high and 10-12 feet in diameter.
7. The rear of the licensee's property, open fields for a distance of 300 feet is used for burial of thorium wastes.
8. The inspector noted that in order to go from the second floor offices to the counting laboratory or to other offices a person had to pass over the open heating and decomposing area by means of a catwalk and enter the filtration area where thorium phosphate cake was being formed. The inspector also noted workmen wearing work clothes and shoes entering the offices as they went to various manufacturing areas. Mandle stated this was a bad arrangement, but that they were cramped for space.
9. Mandle stated that operating personnel, however, do remove their work clothing and work shoes when leaving the plant. He stated they wear respirators for the ball mill operations

which produce high concentrations of dust. He stated personnel enter the ball mill area for only 15 minutes daily for loading and unloading. Mandle stated that 7 persons handle materials over two shifts daily. He stated that from 2000-2500 lbs of monazite sand is processed daily over 30 weeks during the year.

Instrumentation and Calibration

10. The licensee had on hand an Anton #Model 5 GM survey meter with a range of 0-100 mr/hr. He also had a Nuclear Corporation gas flow proportional counter and a Radiation Instrument ^{Corp} decade scaler. He stated the survey meter is sent to Lionel Corporation the successor to Anton Instrument for calibration at six month intervals. He stated the proportional counter is calibrated using an external uranium oxide standard.

Radiation Safety Precsustions and Procedures Instructions

11. The licensee has written instructions entitled "Health Physics Manual, Davison Chemical Company, Pompton Plains, New Jersey".
The manual was used to contain provisions describing radiation dose limits, airborne concentrations limits, air sampling, definition and location of restricted areas, water effluent control, personnel monitoring and waste disposal. Mandle stated all plant personnel were given a copy and instructed in its provisions as well as pertinent Federal regulations.
12. Mandle had on hand a file containing a copy of the license together with copies of 10 CFR 20 and 40. He stated the file was available to all users upon request.

Surveys

13. Garino stated he makes direct physical surveys using the Anton GM survey meter monthly. He was noted to maintain records of these surveys. The last survey record dated 6/25/64 reported radiation levels in restricted areas, at 3 feet

distance from surfaces of 3.5 mr/hr in the monazite storage area and 1 mr/hr at three feet from the surface of a sludge pile in the rear of an open field. Garino reported maximum radiation levels of 0.15 mr/hr to exist at the fence line of the licensee's property, the boundary of the unrestricted area. A chain link fence, 8 feet high was noted to encircle the entire property of the licensee.

14. Independent surveys were made by the inspector using a serial #3532 Precision Instrument thin end window GM survey meter calibrated 6/5/64 and a serial #1624 Juno ionization chamber also calibrated 6/5/64. Radiation levels were noted as follows:

At the surface of a stack of paper bags containing monazite sand - 8.0 mr/hr

At a rope barrier 2 feet in front of the stack -
1.0 mr/hr

At the surface of the ball mill - 2 mr/hr

At the surface of the centrifuge - 10 mr/hr

At the surface of the filter press - 10 mr/hr

At the surface of a pile of thorium waste in the rear of the licensee's facility - 20 mr/hr and
3 mr/hr at 18" distance - restricted area

At the fence line - 0.05 mr/hr

15. The inspector noted that all the floor surfaces were dusty in both restricted manufacturing areas and in unrestricted offices. The radiation levels at 1 cm distance from floor surface in manufacturing areas was from 1.0 - 1.5 mr/hr with the beta-gamma shield off, and from 0.05 - 0.2 mr at 1 cm distance in unrestricted offices.

16. Mandle stated he realized there was widespread removable contamination due to dust, spillage of materials and tramping back and forth. He stated the building has been used for thorium processing for the past 17 years. He also stated the building is a converted dairy barn with the entire low floor and part of the second floor completely open without partitions and that dust from the monazite sands and processing is strewn about by natural convection.

17. Gariho stated they have not made any surveys or taken any smear samples to determine the amount and location of re-

movable contamination existing in the licensee's facility. *in restricted areas of the production Department. Lic. Cond. 8(a) requires use of monitors according to an application dated 7/24/50. The application refers to the licensee's Health Physics Manual. It is of the record that Health Physics will monitor contaminated areas.*

18. The inspector took smear samples by wiping surfaces in restricted and unrestricted areas with filter paper. The filter paper smears were counted for alpha activity by MASL, NYO, who reported activity as follows:

Unrestricted Analytical	-	87 alpha dpm/100 cm ²
Unrestricted Office	-	65 alpha dpm/100 cm ²
Unrestricted 3rd floor counting room	-	58.4 alpha dpm/100 cm ²
Unrestricted Office entrance	-	81.0 alpha dpm/100 cm ²
Restricted Ball Mill Room Floor	-	1225 alpha dpm/100 cm ²
Restricted area outside Ball Mill Room	-	527 alpha dpm/100 cm ²

19. The above information indicates widespread low level contamination in the restricted Ball Mill Room and surrounding areas.

Air Surveys

20. Carino stated he performs air surveys by collecting air at a rate of 100 ft³/min for five minutes using a Staplex high volume air sampler with Whatman 41 filter paper. Carino stated he samples air in the restricted and unrestricted areas as stated on page 11 of the licensee's written procedures. The maximum concentration reported by Carino in a restricted area occurs in the Ball Mill Room and was noted as 1.7×10^{-11} uc for insoluble Th (nat). Other restricted areas had a maximum reported air concentration of 3.5×10^{-12} uc/ml air for insoluble Th (nat) occurring in the monazite storage area. Unrestricted areas, the office, lunch room and control laboratory had maximum concentrations of Th (nat) of 1.7×10^{-12} uc/ml air. Air sampling, according to Carino, is done on a weekly basis.

21. The inspector took several air samples using a Staplex Air Sampler and Whatman 41 filter paper. The activity collected on the filter paper was counted for alpha by HASL, NYC. The results as reported by HASL are as follows:

Restricted Monazite Sand Storage Area	-	1.1×10^{-12}	$\frac{\text{uc th}}{\text{ml air}}$
Unrestricted Upstairs Office	-	1.7×10^{-12}	$\frac{\text{uc th}}{\text{ml air}}$
Restricted Ball Mill Room	-	1.4×10^{-12}	$\frac{\text{uc th}}{\text{ml air}}$
Restricted Centrifuge Area	-	1.0×10^{-12}	$\frac{\text{uc th}}{\text{ml air}}$

Waste Disposal

22. Liquid Effluent

The licensee's property is located on a hill with the rear of the property approximately 30 feet higher than the front of the property bordering on Black Oak Ridge Road. Carino stated

that all drainage from waste burial pits located at the top of the hill drains into a concrete sump of the licensee's property. The effluent in the sump is pumped into a mixing tank equipped with an automatic ph adjustment designed to keep ph at 7.0. The adjusted effluent is then pumped to a settling tank and then to a settling pond where samples are taken for counting. If any activity is detected, this effluent is then sent to a filter to remove any particulate. Garino samples water effluent before any discard to the sewerage system. He was noted to maintain records of these disposals showing no activity over background.

23. Waste acids from acidification process containing phosphates is treated with silica to destroy fluorides and the residual is sent to the Agricultural Chemical Corp., Amenia, New York as fertilizer. Garino samples and counts all liquid before transfer. The records of these assays show no activity over background.

Solids

24. Garino stated that all other waste is disposed of by burial on the licensee's property at the top of the hill. Garino stated that thorium cake as phosphate and thorium fluoride sludge is buried in pits from 12 to 15 feet deep and from 6 to 10 feet wide.
25. Garino stated that each pit contains waste from 3 to 4 weeks of processing. He stated a pit is dug and waste as it accumulates is dumped into the pit. He stated that earth is mixed with the waste as the pit is being filled and that a minimum of 6' of earth fill covers earth pit. Garino stated that four pits were dug and filled in 1963 and that a total of 11,654 pounds total of natural thorium was dumped into the four pits. He stated and

records show that from 2900-3000 pounds of thorium (natural) was buried in each pit. According to 10 CFR 20.5(c)(1) 2900 pounds of thorium (natural) is equivalent to 146,000 uc. 10 CFR 20.304(a) permits the burial in one location of 50,000 uc natural thorium. The records also show that during 1964 a total of 7003 pounds of natural thorium have been buried in three pits with 2300 to 2400 pounds of thorium per location. This quantity per pit also exceeds the limits imposed by 10 CFR 20.304 for one location. Records were noted to be maintained showing the location, date of burial and quantity buried.

Effluents to the Atmosphere

26. Garino stated that effluent from the furnace is sent through a water scrubber which removes particulate. He stated all release is as insoluble thorium particulate. He stated, however, that the scrubber cannot be used on all phases of the furnace operation because a concrete like substance would form which would ruin all equipment. He stated that since the entire rear of the building is open and ventilation is mainly by natural convection, he has taken air surveys using the high volume Staplex Sampler, and has never detected concentrations in air greater than 1.9×10^{-12} uc/Th nat/ml air, at the top of the furnace during operations. He stated the scrubber would reduce this value still further.

Storage of Material

27. The entire building is surrounded by a chain link fence 6 feet high. Entrance to the building must lead to the office. The building is occupied 24 hours daily. Monazite sand is stored in a huge pile in 100 pound paper bags in the rear of the manufacturing area. There does not appear any likelihood of unauthorized removal of material.

Receipt of Materials

28. Garino stated that Monazite sand is received from all over the world and sold through brokers located in New York, N. Y. Records were noted to be maintained showing kind, quantity and date of receipt.

Personnel Monitoring

29. St. John's X-Ray Corporation film badges which are processed monthly are used for personnel monitoring. Records are maintained on film badge processor's reports as well as Form AEC-5. The records were examined from 1962 to date of inspection and show that furnace operators receive maximum exposures. Richard Silsbury showed a maximum exposure of 850 mrem gamma exposure during the first calendar quarter year of 1964. C. Ackers another furnace operator showed a maximum of 550 mrem during the same calendar quarter. All other exposures did not exceed 200 mrem per calendar quarter year.

Posting and Labeling

30. The inspector noted that all processing rooms were posted with signs reading "Caution - Airborne Radioactivity Area", "Caution - Radiation Area", and "Caution - Radioactive Materials", all with conventional symbol. The storage pile was similarly posted.

License Conditions

31. The specific documents referred to in license conditions 8A and 8B were reviewed with Garino and compliance was noted.

Items of Noncompliance

32. 10 CFR 20.201(b) - in that the licensee has not made any surveys or any evaluation to determine the quantity of removable contamination existing throughout his facility. (See paragraphs _____ of the report details.)

33. 20.304(a) - in that the licensee has exceeded the quantity of natural thorium he may dispose of by burial in any one location. (See paragraphs _____ of the report details.)

Conference with Management

34. A conference regarding the items of noncompliance was held immediately following the inspection. Attending the conference were Mr. Richard Mandle, Plant Manager and Mr. Donald Hubbard, Manager, Division of Industrial Relations, Davison Chemical Co., Irwin, Tennessee. Mandle indicated his willingness to comply with the regulations. He stated that he believed that surface contamination should be evaluated and that they would apply for an exemption or an amendment to 10 CFR 20.304(a) to permit burial at one location of natural thorium in amounts greater than 50,000 uc.
35. The inspector believes that a hazard does not exist from the above items of noncompliance and no follow-up inspection will be made. Management appeared familiar with the hazards connected with processing natural thorium and efforts to comply with the regulations were noted.

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE

HEALTH AND SAFETY LABORATORY

376 HUDSON STREET
NEW YORK 14, N. Y.

SAMPLE REQ. **D 1483**

DATE SENT _____
DATE RECEIVED 7-2-64
DATE REPORTED 7/13/64

PLANT <u>W.R. Grace</u>				TYPE OF SAMPLE			
MAILING ADDRESS <u>Pompton Plains NJ</u>				METHOD OF DETERMINATION <u>α Scintillation</u>			
ROUTE RESULTS TO				ANALYZE FOR <u>Th (nat) α</u>		SAMPLING	
						RATE TIME	
						<u>α d/m</u>	
SAMPLE NO.	DATE	START	STOP	SAMPLE DESCRIPTION			RESULTS
0	<u>7/1/64</u>	<u>11:30 AM</u>		<u>AIR collect. Receiving Room 5min @ 18cfm.</u>		<u>6.26</u>	
1	<u>"</u>			<u>AIR collect. Mangles office 8min @ 15cfm</u>		<u>13.1</u>	
2				<u>AIR collect. Ball mill room 7min @ 20cfm.</u>		<u>13.0</u>	
3				<u>AIR collect. Centrifuge Area 6min @ 16cfm.</u>		<u>5.83</u>	
4				<u>Smear analytical LAB floor 100 cm²</u>		<u>87</u>	
5				<u>Smear manager office floor "</u>		<u>65</u>	
6				<u>Smear ball mill room floor 1,</u>		<u>1225</u>	
7				<u>Smear outside ball mill room floor 1,</u>		<u>527</u>	
8				<u>Smear 3rd floor counting room floor 1,</u>		<u>584</u>	
9				<u>Smear floor upstairs office entrance</u>		<u>81.</u>	
COLLECTED BY <u>E. Epstein</u>				ANALYZED BY <u>J. H. ...</u>			

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
HEALTH AND SAFETY LABORATORY
376 HUDSON STREET
NEW YORK 14, N. Y.

SAMPLE REQ. **D** 1480

DATE SENT _____
DATE RECEIVED 7-13-64
DATE REPORTED 7/13/64

PLANT <u>W. R. Grace</u>		ROUTE RESULTS TO <u>Compliance</u>		ANALYZE FOR <u>Th (net)</u>		TYPE OF SAMPLE	
MAILING ADDRESS		Counter Standardized UTR 230 Stds. And 24		METHOD OF DETERMINATION <u>α scintillation</u>			
SAMPLE NO.	DATE	HOUR START	HOUR STOP	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	RESULTS
0							
11	7/1/64	2:00		smears stairs to office		Ad/m	
12	7/1/64			* Soil sample from sledge burial area.		54	
2						166 d/m/gamma	
3				* To be reported at a later date			
4				just.			
5							
6							
7							
8							
9							
COLLECTED BY <u>E. Epstein</u>				ANALYZED BY <u>J. W. Harris</u>			

SURVEYOR TO RETAIN LAST COPY—RETURN ALL OTHERS TO HEALTH AND SAFETY LABORATORY

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
HEALTH AND SAFETY DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

B 1777

SAMPLE REQ. NO.
DATE SENT
DATE RECEIVED
DATE REPORTED

PLANT
MAILING ADDRESS
ROUTE RESULTS TO

R.E. N.J.
N.Y.O.O.
P. K. Loren

ANALYZE FOR
THORIUM

SAMPLE NO.	DATE	HOUR PLANT	SAMPLE DESCRIPTION	SAMPLING		TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS
				RATE	TIME				
T-205	11/25	3:30 PM	Rare Earth waste press area No operations in progress	27.5 L/min	34 min	11	15	0.56	d/m/m
T-207	11/25	3:00 PM	Micro Thorium area waste silver press No operations in progress	27.5 L/min	18 min	124	15	8.04	6.0
T-206	11/25	3:30 PM	Storage area hopper feeding to Ball mill. No operations in progress	32.5 L/min	29 min	80	15	5.13	20
T-299	11/25	3:00 PM	4 m ² area off Hardings Ball mill casing (Sneers)		16 min	964	5	192.17	d/m/m
T-201	11/25	3:00 PM	Smear of Naval rail from guiding mill to storage		8 in ²	215	5	42.37	120
T-202	11/25	3:00 PM	Smear of floor by hopper from 44 (GA) Press (clean storage area)		16 in ²	568	5	112.97	~ 240 d/m/press
T-203	11/25	3:00 PM	waste silver press (micro H) (area sample of paper)		(sample paper size) (18")	347	5	68.77	190
T-204	11/25	3:00 PM	Rare Earth waste press from surface of wooden hopper ledge		16 in ²	941	16	58.18	~ 300 d/m/press

ANALYZED BY
Sig. A.C.B.
J. Loren

SURVEYOR TO RETAIN LAST COPY - RETURN ALL OTHERS TO HEALTH AND SAFETY DIVISION

COPY

COPY

EXHIBIT B

January 6, 1959

R. M. Mandle

FILES

Survey of Plant for St. John X-Ray Lab

Monazite Storage area	2-10	mr/hr
Ball Mill area	1	mr/hr
Monazite transfer drums	3	mr/hr
Centrifuge and Press #5	1-2	mr/hr
Barrels stored by tank #31	1-2	mr/hr
Crystal Dissolve Tank	1	mr/hr
Tank #1	1	mr/hr
Tank #2	1	mr/hr
Tank #3	0.5-1	mr/hr
Tank #4-5	0.1-0.2	mr/hr
Packing room	0.2-0.3	mr/hr
WTP near Press	0.5	mr/hr

Dr. Isenberger - Callion 49

Badges - 150 for \$85.00 - Send holders and film. Enter numbers on reports and return them to St. John. They process and notify. We keep film and reports.

New AEC regulations require a 13 week accumulation - Mr. Isenberger suggests we purchase and load two films and keep one of them in for 13 week period.

Holders \$1.50 each.

R.M.M.

MCB:l

COPY

COPY

EXHIBIT C

Survey of Plant
(New batteries installed in Geiger Counter)

Control Lab	0.15
Sample-Thorite	6
Sample - Indian Sand	2.5
Sample - Idaho Sand	1.0
Area between office and lab	0.15
Background in front of plant	0.1 - 0.3
Sump in front Th shed	0.5
Barrels along fence	3.5 - 5
Barrels near Milling Bldg.	3.5 - 5
Monazite Storage	6
Th(OH) ₄ under Whitney Press	3