Form AEC-417
(4-58)

UNITED STATES ATOMIC ENERGY COMMISSION

COMPLIANCE INSPECTION REPORT

1. Name and address of licensee
The Dow Chemical Company
Midland, Michigan

2. Date of inspection
April 20, 21 and 22, 1959

3. Type of inspection Initial

4. 10 CFR Part(s) applicable
20, 30, 40 and 70

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

21-265-1
Amendment #3 7-31-58 7-31-60

Renews license in entirety.

Scope: Any byproduct material from Atomic Nos. 3 and 83, inclusive, plus Hydrogen 3, any, 1000 millicuries of each byproduct material, except Krypton 85, 1200 millicuries; Hydrogen 3, 20 curies; total possession limit 70 curies.
Conditions: #10-Material to be used at address given. #11-Material as Cesium 137 sealed sources in Ohmart Liquid Level Gauges may also be used at the Dow Chemical Company, Bay City, Michigan. #12-To comply with 10 CFR 20, Chapter 1. #13-Materials shall be used by, or under direct supervision of, trained individuals designated by the Radiation Hazards Committee, Dr. W. H. Beamer, Chairman. #14-A curie of Iridium 192 is defined. #15-Sealed sources fabricated or acquired containing byproduct materials shall be subjected to tests for external contamination and/or leakage immediately after being fabricated or upon receipt from another person at six-month (CONTINUED)

6. Inspection findings (and items of noncompliance)

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

The Radiation Hazards Committee is a subcommittee of the Executive Safety Council, to which it makes a report annually. On administrative problems it reports to the Director of Research and to the General Manager.

The Radiological Safety Officer is a member of the Environmental Research Laboratory, which functions as the operating health physics group.

Each isotope user receives a copy of the extensive Radiation Protection Manual issued by the Radiation Hazards Committee. The Committee sponsored a Radiation Safety Training Course for all users of isotopes.

Inventory, leak testing, personnel monitoring, radiation survey, waste disposal, and other records are maintained by the Radiological Safety Officer and by the Environmental Research Laboratory.

There were no overexposures.

7. Date of last previous inspection
None

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

DISTRIBUTION:
Marvin M. Mann, Assistant Director
Division of Inspection
Washington Headquarters (Orig.)

H. L. Price, Director
Division of Licensing & Regulation
Washington Headquarters (1 cy)

Eugene J. Mapes (Inspector) E. J. Mapes

Approved by: Ray C. Engelken, Director
Inspection Division, OCO
(Operations office)

May 11-18, 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 head information in this record was deleted in accordance with the Freedom of Information Act, exemptions 6 FOIA 2007-0158

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RECOMMENDATIONS SHOULD BE SET FORTH IN A SEPARATE COVERING MEMORANDUM.

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

21-265-1 Amendment #3 (continued)			Conditions: (continued) intervals. #16-Written administrative instructions required. #17-Total amount of Hydrogen 3 acquired and all authorizations for tritium shall not exceed 20 curies. #18-Material shall not be used in products distributed to the public. #19-Radioactive wastes containing Carbon 14, Phosphorus 32, Sulfur 35, Hydrogen 3, Iodine 131, Sodium 24, Potassium 42, Zirconium 95, Cerium 144-Praseodymium-144, Cesium 137-Barium 137, Cobalt 60, Chlorine 36, and other contaminated combustible wastes may be incinerated provided concentrations of stack effluents to unrestricted areas are in accordance with Section 20.103 of 10 CFR 20, and letters dated 6-24-58 and 7-11-58.
21-265-1 Amendment #4	1-14-59	7-31-60	Scope: No change. Conditions: #20-Pursuant to Section 20.302 of 10 CFR 20, liquid wastes containing Hydrogen 3 in a form readily soluble or dispersible in water can be disposed of by release to the plant effluent sewage stream in accordance with letter dated 12-24-58. Disposal shall not exceed a total of one curie.
21-265-1 Amendment #5	3-6-59	7-31-60	Scope: Any byproduct material from Atomic Nos. 84 to 96, inclusive, irradiated uranium metal samples, 100 millicuries total, for studies of nuclear reactor fuel processing systems. Plutonium 239, irradiated uranium metal samples, 35 micrograms, same use. Conditions: No change.
21-265-2	9-21-56	9-30-61	Scope: Cobalt 60, Brookhaven cylindrical sealed source, 1000 curies, to be used in a Brookhaven type irradiator for radiation chemistry studies. Cobalt 60, Aluminum clad slugs to be encapsulated in copper rods per letter of 7-6-56, 28,001 curies, to be used in an irradiation facility as described in application dated 6-8-56 and related correspondence, for high level radiation chemistry research. Conditions: #10-Material to be used in the Nuclear and Basic Research Department at address given. #11-Material to be used by, or under the supervision of, Mr. Bruce W. Wilkinson. #12-To comply with 10 CFR 20. #13-Material shall be encapsulated prior to possession by licensee. #14-Sealed sources shall not be opened. #15-Written administrative instructions required. #16-Shall report to the Commission within 48 hours from discovery thereof, any incident which has resulted or could have resulted in an exposure to any individual in excess of a dose of 3 rem.

Continuation Sheet #3
The Dow Chemical Company
Midland, Michigan

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

C-1634	2-10-59	2-29-60	Scope: Licensed to receive possession of and title to 100 pounds of refined source material during term of license for analytical, research and development work. This license extends to your Freeport, Texas and Midland, Michigan plants. Can transfer and deliver possession of and title to refined source material to any AEC licensee, within limits of his license. Conditions: Required to maintain records of inventories, receipts and transfers. Subject to all provisions of the Atomic Energy Act of 1954, including 10 CFR 20. Neither this license nor any right thereunder shall be assigned or otherwise transferred.
C-2782	1-1-59	1-1-60	Scope: Licensed to receive possession of and title to thorium metal and/or thorium compounds, without limitation as to quantity, both domestically and through import from Canada, during term of license for use in the preparation of magnesium alloys at your plants located in Midland, Michigan; Bay City, Michigan; and Madison, Illinois. Can transfer and deliver possession of and title to refined source material to any AEC licensee, within limits of his license. Conditions: Required to maintain records of inventories, receipts and transfers. Subject to all provisions of the Atomic Energy Act of 1954, including 10 CFR 20, except Sections 20.203(e)(2) and (f)(2) during the storage and fabrication of magnesium-thorium alloys containing not more than four percent thorium. Neither this license nor any right thereunder shall be assigned or otherwise transferred.
S-4581	2-25-58	7-31-58	Scope: Licensed to export 15 ounces of thorium sulfate and 3 ounces of thorium oxide to Dr. James D. Head, The Dow Chemical Company, Midland, Michigan. This license extends to the licensee's duly authorized shipping agent. Conditions: Neither this license nor any right thereunder shall be assigned or otherwise transferred. Subject to the right of recapture or control reserved by Section 108 of the Atomic Energy Act of 1954.
SNM-282	3-2-59	2-28-62	Scope: Licensed to possess 10 grams of U-233 for use in the evaluation of analytical procedures and as a tracer in low level uranium studies using the procedures described in application dated 10-2-58, as amended 11-25-58. Conditions: Subject to all applicable rules, regulations and orders of the AEC, including provisions of Section 70.32(a).

DETAILS

9. The inspector was not accompanied. The Michigan Department of Health had been notified of the scheduled inspection.

10. The following persons were interviewed and furnished the information given in this report: Dr. R. H. Boundy, Vice-President and Director of Research of the Dow Chemical Company; Dr. W. H. Beamer, Head of the Radiochemistry Laboratory; Dr. B. B. Holder, Industrial Physician, Medical Department; Mr. A. W. Wilson, Assistant Manager, Safety Department; Mr. L. G. Silverstein, Radiological Safety Officer; Mr. D. E. Harmer, Supervisor, Radiation Section, Nuclear and Basic Research Laboratory (NBRL); Dr. G. A. Stoner, Radioanalytical Laboratory, NBRL; Dr. R. J. Teitel, Metallurgical Laboratory, NBRL; Mr. G. S. Layne, Raw Materials Laboratory, NBRL; Dr. Grant Smith, Supervisor, Agricultural Chemicals Laboratory; Mr. W. Otis Heath, Statistical Department; Mr. R. A. LaCroix, Dow Chemical International Limited S.A.; Mr. T. A. DeWyse, Safety Manager, and Mr. D. E. Harth, Manager, Industrial Relations, Dow Chemical Company, Bay City Division.

11. Administrative Control

The Radiation Hazards Committee was established as a subcommittee of the Executive Safety Council of The Dow Chemical Company in October, 1954. It replaced the Isotopes Committee formed in 1947.

The members of the Radiation Hazards Committee are:

B. B. Holder, M. D., Industrial Physician, Medical Department, Chairman
H. R. Hoyle, B.S., Head of the Environmental Research Laboratory
A. W. Wilson, B.S., Assistant Manager of the Safety Department
J. D. Head, Ph.D., General Manager, Rio Tinto Dow, Ltd.
A. W. Hanson, B.S., Director of Research Laboratory for Dow-Detroit Edison Atomic Power Project
W. H. Beamer, Ph.D., Head of the Radiochemistry Laboratory

The Committee set up the methods of control for the procurement, use, storage, and waste disposal of radioactive materials as outlined in the Radiation Protection Manual. The Committee reviews the designs for new buildings, equipment, and processes involved in the utilization of radioisotopes. The Committee keeps records of all radioactive materials received.

The Committee meets as necessary when called by the chairman. It makes a report annually to the Executive Safety Council.

On administrative problems the Committee reports to Dr. R. H. Boundy, Vice-President and Director of Research of the Dow Chemical Company, and to Dr. W. H. Schmutte, Vice-President and General Manager of the Midland Division of Dow.

The Radiological Safety Officer is Mr. L. G. Silverstein, who was a participant in an AEC Radiological Physics Fellowship at the University of Rochester and Brookhaven National Laboratory in 1954-1955.

The R.S.O. reports to the head of the Environmental Research Laboratory, who is a member of the Radiation Hazards Committee.

DETAILS (CONTINUED)

19. Material on Hand (continued)

License S-4561

Samples comprising 15 ounces of thorium sulfate and 3 ounces of thorium oxide were carried to Europe and distributed by Dr. James D. Head.

License SNM-282

Nothing had been obtained under this license at the time of the inspection.

Uranium 233 is to be used as a tracer in analytical procedures for research in processing fuel elements.

The material will be used in a dry box in the Nuclear and Basic Research Laboratory.

DETAILS (CONTINUED)

11. Administrative Control (continued)

The Environmental Research Laboratory functions as the operating health physics group with the technical assistance of the Safety Department and the research groups working with radioisotopes.

12. Radiological Protection Instruction

Each isotope user receives a copy of the Radiation Protection Manual. The Radiation Hazards Committee sponsored a Radiation Safety Training Course for all users of isotopes.

The Radiation Protection Manual was issued by the Radiation Hazards Committee in August, 1957. It covers the following subjects: procurement and storage of radioactive materials, maximum permissible dose, radioisotope laboratory procedures, decontamination and cleanup, radiation monitoring, emergency procedures and fire fighting, waste disposal, maximum permissible concentration of radioisotopes in air and water, definitions, useful information for safe handling of radioisotopes, beta and gamma shielding. The manual incorporates the Dow Safety Standard for Control of Radiation Hazards, which was issued originally in May, 1952 and was revised in June, 1955.

The Radiation Safety Training Course was given in January and February, 1959 in eight 2-hour sessions. The course covered hazards, fundamentals of radioactivity, properties of radiation, principles of radiological safety, biological effects of radiation, maximum permissible exposure, radiation safety instruments, radiation safety in practice, the Dow program.

A Record of Radiation Safety Education for registrants in the course is to be kept up-to-date by the R.S.O.

13. Material Control Procedures

When a need arises for some radioactive material, a requisition is written by the prospective user to the Purchasing Department requesting the purchase of this material.

The Purchasing Department notifies the Environmental Research Laboratory that it has received a requisition for this radioactive material. A copy of the purchase order is sent to the Environmental Research Laboratory and the Safety Department when the material is ordered from the supplier.

The Stock and Receiving Department is responsible for notifying the Environmental Research Laboratory of the arrival of the material. The package containing the material is then sent to the user unopened.

The user opens and inspects the package. If he desires, he may call for assistance from the Environmental Research Laboratory in this operation.

DETAILS (CONTINUED)

13. Material Control Procedures (continued)

Storage of the radioactive material by the plant group having control over it depends on its radiation characteristics. The Radiochemistry Laboratory has a vault specifically designed for the storage of radioactive materials which is available to other plant groups not having suitable storage facilities.

The job of disposal of radioactive materials is primarily the joint responsibility of the Environmental Research Laboratory and the Waste Disposal Department.

14. Material Control Records

When the isotope user writes a requisition for a radioisotope, he also fills out in duplicate Radioisotope Safety Data and Material Records, giving the following information: Purchase order number, radioisotope, half-life, radiation, chemical state, physical state, internal hazard group, maximum permissible body burden, critical organ, effective half-life in body, permissible airborne and water concentrations, single exposure limits, maximum laboratory quantity, shielding required, gamma dose rate, special precautions. Date, amount received, amount dispensed, balance on hand, disposition and remarks are filled in later.

One copy of the Radioisotope Safety Data and Material Record is kept by the user in his Radioactive Material Record Book. The second copy is sent to the Environmental Research Laboratory for the Midland Division Radioactive Material Record Book, which is kept up-to-date by the R. S. O.

A medical card for the specific isotope is made out by the R. S. O. if none exists, giving the single exposure limits. Information on specific treatment of wounds, inhalation, ingestion, and skin contamination is being sought.

A Radiation Record Sheet is kept by the R. S. O. for each sealed source. This gives the type of source, amount of source, principal radiation produced, source number, history of the source, location, use, record of wipe tests, record of radiation survey.

15. Personnel Monitoring

Film badges are supplied on a two-week basis by Picker X-Ray Corporation and by Health-Physics Services, Inc., Baltimore, Maryland.

The film badge exposures reported are recorded by the Environmental Research Laboratory for the two-week periods on sheets which show the badge number, name, department, building, and exposure.

There were no exposures in excess of 300 milliroentgens per week.

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DETAILS (CONTINUED)

15. Personnel Monitoring (continued)

The highest film badge exposures were reported for [redacted] who uses Cobalt 60 sources for radiography, and for [redacted], who encounters radiation from various sources including X-rays, radium, and radioisotopes in his health physics work.

The Summary of Radiation Exposures for the period from 12-8-55 to 10-1-57 shows these cumulative exposures:

PERIOD	[redacted]	[redacted]
12-8-55 to 3-12-56	80 milliroentgens	-
3-12-56 to 8-20-56	120	0
8-20-56 to 3-4-57	330	60 milliroentgens
3-4-57 to 10-1-57	850	1220

For [redacted] the cumulative exposure for the year from 3-31-58 to 3-31-59 was 175 milliroentgens, with two-week exposures of 15, 30, 24, 30, 5, 19, 25, and 27 milliroentgens. For [redacted] the cumulative exposure for the year from 3-31-58 to 3-31-59 was 174 milliroentgens, with two-week exposures of 13, 15, 17, 35, 12, 18, 34, 12, and 18 milliroentgens. All other exposures were reported as less than 10 milliroentgens for 2 weeks.

16. Radiation Surveys

The radiation surveys made by the H. S. O. are recorded on a plot of the laboratory surveyed, on which are marked the spots where samples were taken and information on the counts obtained.

The Radiochemistry Laboratory and the Agricultural Chemicals Laboratory are surveyed by taking wipe samples periodically and by making end-window Geiger-Mueller counter surveys. The Nuclear and Basic Research Laboratory is also to be covered by this technique.

End-window Geiger-Mueller counter surveys and occasional wipe tests of their clothing and work areas are also made by the individual radioisotope users.

17. Waste Disposal

The Radioactive Waste Disposal Record maintained by the Environmental Research Laboratory gives the following information: date, kind and amount of material, contamination (compounds if known), estimated activity, source and explanation of estimate, disposition.

Liquid wastes (aqueous and organic) from the Radiochemistry Laboratory and the Nuclear and Basic Research Laboratory are picked up by the H. S. O. and disposed to sewage (30,000 gallons per minute flow) at the input to the company waste treatment plant. The maximum activity in each can is estimated in order to keep the concentrations within the limits specified in 10 CFR 20.

DETAILS (CONTINUED)

17. Waste Disposal (continued)

Incineration of wastes is performed so that the concentrations of stack effluents to unrestricted areas are in accordance with Section 20.103 of 10 CFR 20. The new incinerator burner operates at 1800° - 2000°F. The effluent goes from the kiln into a combustion chamber, then through a spray chamber, and then up the 200-foot stack. The air flow is 40,000 cubic feet per minute. The effluent temperature is 200° - 400°F at release. The slag moves from the kiln to a dumpster and is trucked away to a land fill area. Unburned drums go to salvage. The slag has been monitored, and no activity above normal background has been found.

Burial of radioactive wastes is at a site within the plant boundaries at a corner of a land fill area. Contaminated paper, glassware, and other waste materials generated in the laboratory use of isotopes comprise the main part of the buried wastes. Animal carcasses and excreta from studies involving Phosphorus 32, Carbon 14, and Chlorine 36 are a major item buried. Burial procedures are in accordance with 10 CFR 20, Section 20.304.

18. Facilities and Program

Radiochemistry Laboratory, Building 294.

Hydrogen 3, Carbon 14, Sulfur 35, Phosphorus 32, Strontium 90, Thallium 204 and other isotopes are used in laboratory research studies and in the preparation of labeled compounds for other laboratories in the company.

Equipment includes a California-type hood for work with Carbon 14 and tritium, posted isotope hoods, a large custom-made stainless steel hood for biological experiments involving plants or animals containing labeled compounds, a glove box, a tritium monitor, and labeled metal waste cans with yellow step-on covers. There is a posted vault, specifically designed, for the storage of radioactive materials. This has one-foot concrete walls and door; the door is on rollers and is electrically operated. For fire protection the vault was built independent from the rest of the building.

Agricultural Chemicals Laboratory, Building 687

Phosphorus 32, Chlorine 36, and Carbon 14 are used in studies of the metabolic fate of agricultural chemicals in animals and plants. Tagged compounds are made in the Radiochemistry Laboratory.

Equipment includes posted isotope hoods, labeled waste cans, and chromatography apparatus. Gelatin capsules containing millicurie amounts of tracers are prepared in a glove box, in which isotopes are stored in labeled lead pigs and in the original labeled shipping containers. Excreta samples in labeled containers are stored in a posted refrigerator.

DETAILS (CONTINUED)

18. Facilities and Program (continued)
Agricultural Chemicals Laboratory, Building 687 (continued)

Feeding of cattle and sheep is done at the farm in the barn, which is posted. The gelatin capsules in wheat middlings are fed to the animals by balling gun in the posted Hot Animal Room.

Some work on parasiticides, which may also be used as insecticides, is done cooperatively with the U. S. Department of Agriculture at Kerrville, Texas.

Saran Plant, Building 348

Krypton 85 is used in film thickness gages on the extruders on the Extrusion Floor. At the time of the inspection, five Industrial Nucleonics Accuray gages were installed and were posted with the conventional radiation symbol and the words CAUTION RADIOACTIVE MATERIAL. More gages were to be installed.

Room 114, Building 294

Two Cobalt 60 sources used for in-plant radiography are stored in posted lead pots. The carts used to transport the pots are posted. Also kept here are the caution signs which are posted when an exposure is made in the plant.

Radiation Section, Nuclear and Basic Research Laboratory, Building 366

The Gamma Radiation Cave is located in the [illegible] and is posted with a sign comprising the conventional radiation symbol and the words DANGER, DO NOT ENTER, HIGH RADIATION AREA. The cave is equipped with a lead glass window 27 inches thick and a master slave manipulator and has thick concrete brick walls and a maze entrance.

Two separate Cobalt 60 sources are used in the cave, one of 10,000 curies originally and one of 18,000 curies originally. One source is stored in a 7-foot-deep cement pit with a 14-inch-thick lead cover. The source and the cover are pneumatically actuated. The second source is stored in a 12-foot-deep water well and is raised by an electrically run winch.

There are interlocks on the steel cave door and the source control mechanisms. Operating procedures and emergency instructions are posted on the control panel.

A 300-curie Cobalt 60 source in a stainless steel capsule inside a stainless steel vessel filled with lead is stored in a lead vault in the cave.

A 1000-curie Cobalt 60 source is stored in a Brookhaven type irradiator in a posted section of the Development Area in Building 685.

DETAILS (CONTINUED)

19. Material on Hand
License 21-265-1

At the time of the inspection the byproduct material on hand consisted of 500 millicuries of Cobalt 60; 500 millicuries of Carbon 14; 700 millicuries of Phosphorus 32; 4500 millicuries of Krypton 85; 12 curies of Hydrogen 3; and less than 100 millicuries of each remaining byproduct material of Atomic Numbers 3 to 83, inclusive, which has been obtained.

License 21-265-2

Four Cobalt 60 sources were on hand with original strengths of 300, 1000, 10,000 and 18,000 curies, respectively.

License 21-265-3

No byproduct material was purchased under this license. The experiment was not done.

License C-448

On hand were 22.153 pounds of uranium metal; 2.576 pounds were used in 1958; nothing was purchased in 1958.

In 1958, 1.651 pounds of thorium metal were purchased; 0.1282 pound was used; 4.109 pounds were on hand.

Forty pounds of thorium fluoride were on hand.

License C-1634

During 1958, 55 pounds and 1 ounce of thorium and uranium metals and compounds were purchased.

License C-2782

On 3-31-59, 1312 pounds of thorium scrap were on hand; in 1958, 22,521 pounds were used and 23,833 pounds were purchased.

On 3-31-59, 10,277 pounds of thorium metal pellets were on hand; in 1958, 42,547 pounds of thorium metal were used, and 42,260 pounds were purchased.

On 12-31-58, 23 pounds of thorium chloride were on hand.

On 12-31-58, 9700 pounds of thorium fluoride were on hand; 793 pounds were used in 1958.

On 12-31-58, 8.9 pounds of crude thorium concentrate were on hand; 626.1 pounds were received from Rio Tinto Dow-Canada in 1958.

On 12-31-58, 47.7 pounds of thorium sulfate were on hand.