



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

October 30, 2019

Dr. Paul O'Connor, Facility Director
Dow Chemical TRIGA Research Reactor
Dow Chemical Company
Building 1602
Midland, MI 48674

SUBJECT: DOW CHEMICAL COMPANY – U.S. NUCLEAR REGULATORY COMMISSION
ROUTINE INSPECTION REPORT NO. 05000264/2019201

Dear Dr. O'Connor:

From September 9 - 13, 2019, the U.S. Nuclear Regulatory Commission (NRC) conducted an inspection at the Dow Chemical TRIGA Research Reactor. The enclosed report documents the inspection results which were discussed on September 13, 2019, with you, members of your staff, and Dr. Wayne Konze, Chair of the Reactor Operations Committee.

The inspection examined activities conducted under your license as they relate to public health and safety, compliance with the Commission's rules and regulations, and compliance with the conditions of your license. Within these areas, the inspection consisted of selected examination of procedures and representative records, observations of activities, and interviews with personnel. Based on the results of this inspection, no findings of non-compliance with NRC requirements were identified. No response to this letter is required.

In accordance with Title 10 of the *Code of Federal Regulations* Section 2.390, "Public inspections, exemptions, requests for withholding," a copy of this letter, its enclosure, and your response (if any) will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records component of NRC's document system (Agencywide Documents Access and Management System (ADAMS)). ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>.

Should you have any questions concerning this inspection, please contact Mr. Michael Takacs at (301) 415-2042 or by electronic mail at Michael.Takacs@nrc.gov.

Sincerely,

/RA/

Anthony J. Mendiola, Chief
Non-Power Production and Utilization Facility
Oversight Branch
Division of Advanced Reactors and Non-Power
Production and Utilization Facilities
Office of Nuclear Reactor Regulation

Docket No. 50-264
License No. R-108

Enclosure:
As stated

cc: See next page

Dow Chemical

Docket No. 50-264

cc:

Office of the Mayor
333 West Ellsworth
Midland, MI 48640

Office of the Governor
Room 1 – Capitol Building
Lansing, MI 48913

Mr. Scott Bemis, Chair
Radiation Safety Committee
The Dow Chemical Company
Environmental Health and
Safety Responsible Care Leader
1790 Building
Midland, MI 48674

Dr. Wayde Konze
Global Research and Development Director for Analytical Sciences
Chair, Reactor Operations Committee
The Dow Chemical Company
1897 Building
Midland, MI 48667

Test, Research and Training
Reactor Newsletter
Attention: Ms. Amber Johnson
Dept of Materials Science and Engineering
University of Maryland
4418 Stadium Drive
College Park, MD 20742-2115

Radiological Protection Section
Office of Waste Management and Radiological Protection
Michigan Department of Environmental Quality
525 West Allegan Street
P.O. Box 30473
Lansing MI 48909-7973

SUBJECT: DOW CHEMICAL COMPANY – U.S. NUCLEAR REGULATORY COMMISSION
ROUTINE INSPECTION REPORT NO. 05000264/2019201 DATE:

DISTRIBUTION:

PUBLIC

RidsNrrDanuUnpl

RidsNrrDanuUnpo

MTakacs, NRR

GWertz, NRR

AMendiola, NRR

WKennedy, NRR

NParker, NRR

GCasto, NRR

ADAMS Accession No.: ML19294A090 *concurred via e-mail**NRC-002**

OFFICE	NRR/DANU/UNPO/SS*	NRR/DANU/UNPO/LA*	NRR/DANU/UNPO/BC
NAME	MTakacs	NParker	AMendiola
DATE	10/24/19	10/21/19	10/30/19

OFFICIAL RECORD COPY

U.S. NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION

Docket No. 50-264

License No. R-108

Report No. 05000264/2019201

Licensee: Dow Chemical Company

Facility: Dow Chemical Training, Research, Isotopes, General Atomics Research Reactor

Location: Midland, Michigan

Dates: September 9 -13, 2019

Inspector: Michael Takacs

Approved by: Anthony J. Mendiola, Chief
Non-Power Production and Utilization Facility
Oversight Branch
Division of Advanced Reactors and Non-Power
Production and Utilization Facilities
Office of Nuclear Reactor Regulation

Enclosure

EXECUTIVE SUMMARY

Dow Chemical Company
TRIGA Research Reactor
Inspection Report No. 05000264/2019201

The primary focus of this routine safety inspection was the onsite review of selected aspects of the Dow Chemical Company (the licensee's) 300 kilowatt, Class II research reactor safety programs including: (1) health physics; (2) design changes; (3) emergency planning; (4) maintenance logs and records; (5) experiments; (6) fuel handling logs and records; and (7) inspection of transportation activities. The licensee's programs were acceptably directed toward the protection of public health and safety, and in compliance with the U.S. Nuclear Regulatory Commission (NRC) requirements.

Health Physics

- Surveys were being completed and documented as required.
- Postings met regulatory requirements.
- Personnel dosimetry was being worn and recorded doses were within the NRC's regulatory limits.
- Radiation monitoring equipment was being maintained and calibrated as required.
- The radiation protection program satisfied regulatory requirements.
- The radiation protection training program was being administered as required.
- Environmental monitoring satisfied regulatory requirements.

Design Changes

- No changes, tests, or experiments, subject to the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) 50.59, "Changes, tests and experiments," were performed.

Emergency Planning

- The emergency preparedness program was conducted in accordance with the licensee's emergency plan and regulatory requirements.

Maintenance Logs and Records

- Maintenance activities were conducted in accordance with licensee procedures.

Experiments

- Experiments were reviewed and approved as required by the technical specifications (TSs).

Fuel Handling Logs and Records

- Fuel handling and inspection activities were completed and documented as required by the TS and licensee procedures.

Inspection of Transportation Activities

- The program for shipping radioactive material satisfied regulatory requirements.

REPORT DETAILS

Summary of Facility Status

The Dow Chemical Company (Dow) 300 kilowatt, Training, Research, Isotopes, General Atomics (TRIGA), Mark I research reactor is operated in support of research, reactor operator training, and periodic equipment surveillances. During the inspection, the reactor was operated to support irradiation of research samples.

1. Health Physics

a. Inspection Scope (Inspection Procedures (IP) 69001)

The inspector reviewed the following to verify compliance with 10 CFR Part 19, "Notices, Instructions and Reports to Workers: Inspection and Investigations," 10 CFR Part 20, "Standards for Protection against Radiation," and the applicable TS requirements:

- Radiological signs and posting in various areas of the facility
- Area and personnel dosimetry results from 2018 to present
- Radiation safety training records
- Maintenance and calibration of radiation monitoring equipment, including the water radioactivity monitor, area radiation monitor, and the continuous air monitor
- Dow TRIGA research reactor (DTRR) operating procedure No. 4.2.2, "Area Monitor Calibration," dated November 2006
- DTRR operating procedure No. 4.7.1, "Wipe Tests and Radiation Surveys," dated December 2016
- DTRR operating procedure No. 4.7.2.a, "Disposal of Waste Generated in the Neutron Activation Analysis Group," dated December 2012
- Semi-annual primary water radioactivity monitor calibration records from 2018 to the present
- Semi-annual continuous air monitor calibration records from 2018 to the present
- Semi-annual area radiation monitor calibration records from 2018 to the present

b. Observations and Findings

(1) Surveys

The inspector reviewed monthly radiation and contamination surveys of the reactor building, which were conducted by the facility staff. The results were documented on the appropriate forms and evaluated as required. The number and location of survey points was adequate to characterize the radiological conditions. The inspector noted that the Radiation Safety Officer (RSO) reviews all the survey records. The RSO also conducts an annual independent contamination survey of the facility and has verified that all the readings are as expected.

(2) Postings and Notices

The inspector reviewed the postings required by 10 CFR Part 19 at the entrances to various controlled areas including the Reactor Bay, and radioactive material storage areas. The postings were acceptable and indicated the radiation and contamination hazards present. The facility's radioactive material storage areas were found to be properly posted. No unmarked radioactive material was found in the facility.

(3) Dosimetry

The licensee uses a National Voluntary Laboratory Accreditation Program-accredited vendor to process personnel dosimetry. Through direct observation, the inspector determined that dosimetry was used in an acceptable manner by facility personnel. An examination of the records for the inspection period showed that all exposures were well within NRC limits and within licensee action levels. All of the staff and researchers associated with the facility wear Optically Stimulated Luminescent Dosimeter (OSLD) badges.

(4) Radiation Monitoring Equipment

The calibration records of portable survey meters, fixed radiation detectors, and air monitoring equipment in use at the facility were reviewed. Calibration frequencies met the requirements established in TS 4.6 and calibration records were being maintained as required. The inspector reviewed the licensee's tracking system for ensuring the instrument calibrations are completed on time and found it to be appropriate.

(5) Radiation Protection Program

The radiation protection program provides guidance for keeping doses as low as reasonably achievable and is consistent with the guidance in 10 CFR Part 20. The inspector verified that the radiation protection program was being reviewed annually as required by 10 CFR 20.1101, "Radiation protection programs," paragraph (c). No issues related to the radiation protection program were identified in the review of the program. The radiation protection program requires that all personnel who work with radioactive material, receive training in radiation protection, policies, procedures, requirements, and the facilities prior to having unescorted access at the facility. The RSO is responsible for conducting the training and all the training is typically conducted on a computer and a classroom presentation. A test is administered at the end of the training to verify that the individuals understood the material presented. The inspector reviewed the training materials and noted that the staff were instructed on the appropriate subjects.

(6) Environmental Monitoring

Several OSLDs were placed around the inside walls of the reactor facility and minimal doses were recorded. Records show that there was minimal radiation exposure to the environment from the reactor during the previous year. There was no liquid effluent discharged from the reactor facility. The licensee indicated that gaseous effluents from the reactor facility were less than 25 percent of the allowed or recommended maximum concentrations in 10 CFR Part 20.

c. Conclusion

The inspector determined that: (1) surveys were being completed and documented as required, (2) postings met regulatory requirements, (3) personnel dosimetry was being worn and recorded doses were within the NRC's regulatory limits, (4) radiation monitoring equipment was being maintained and calibrated as required, (5) the radiation protection program satisfied regulatory requirements, (6) the radiation safety training program was being administered as required, and (7) environmental monitoring satisfied regulatory requirements.

2. Design Changes

a. Inspection Scope (IP 69001)

To ensure that facility changes were reviewed and approved as required by TS Section 6.2 and 10 CFR 50.59(c)(2), the inspector reviewed selected aspects of:

- Reactor operation logbooks 127 and 128
- DTRR No. 4.5.3, "Facility Maintenance and Modifications," dated June 2014
- DTRR annual reports for 2018 and 2019
- Reactor Operations Committee (ROC) meeting minutes for 2018 and 2019

b. Observations and Findings

Through review of applicable records and interviews with licensee personnel, the inspector verified that no changes, tests, or experiments, subject to 10 CFR 50.59 requirements, were performed since the last inspection.

c. Conclusion

No changes, tests, or experiments have occurred since the last inspection.

3. Emergency Planning

a. Inspection Scope (IP 69001)

The inspector reviewed the implementation of selected portions of the emergency preparedness program including:

- DTRR emergency plan (E-Plan), dated December 4, 2012
- Emergency planning drill conducted June 12, 2019
- Emergency response facilities, supplies, equipment, and instrumentation
- Monthly inventories of emergency equipment
- Memorandum of Agreement, Office of Emergency Management, County of Midland Michigan, dated May 30, 2019

b. Observations and Findings

The inspector reviewed the E-Plan in use at the DTRR and verified that it was being properly implemented at the facility. The inspector reviewed the emergency facilities, instrumentation, and equipment and verified that the emergency response equipment, in general, was as described in the E-Plan. Through direct observation, records review, and interviews with emergency organization personnel, the inspector determined that they were capable to respond, and knowledgeable of the proper actions to take in case of an emergency. The facility staff is responsible for responding to an emergency during all hours. The responsibility and authority for directing and coordinating emergency response activities are assigned to either the Facility Director (FD) or the Reactor Supervisor (RS), to act as the emergency director. All facility personnel receive annual emergency response training. The inspector verified that the licensee has continually reviewed the E-Plan and conducted an inventory of the emergency response equipment.

Emergency drills had been conducted annually as required by the E-Plan. The drill for 2019 was a practical exercise and tested the notification and response of the Dow Emergency Services and Security (ES&S) personnel. The critique was written and discussed following the drill to document any issues identified during the exercise. The action items that resulted were incorporated into the lessons learned policy.

The inspector toured the Dow Medical Health Services Building, which contains the facility and equipment used to support a response to a contaminated and/or injured worker and found it to be properly maintained. The inspector interviewed the Senior Health Services Specialist and noted the individual to be knowledgeable of the facility's emergency support mission and its capabilities. The inspector also toured the ES&S headquarters (building 1105), which contains the emergency response equipment and vehicles, and the Dow ES&S Dispatch Center (building 2010), which is also the location of the Dow Emergency Operations Center. The inspector toured these facilities and discussed the functions and capabilities of these facilities with the ES&S Leader and the ES&S Operations Leader. The inspector found the ES&S personnel to be knowledgeable and both facilities to be properly staffed and well maintained. During the tour of the Dispatch Center with the RS, the inspector observed an actual emergency being called into the Dispatch Center from the reactor building (building 1602). The emergency involved a steam leak from the building heating system in the basement of building 1602. The steam leak caused a smoke detector to alarm which led to the evacuation of building 1602. The inspector noted that the reactor staff followed proper emergency procedure for a building evacuation to ensure that: (1) the reactor was shutdown and secured, (2) all

reactor staff were accounted for and had evacuated the building, and (3) the Dispatch Center and the RS were properly notified.

c. Conclusion

The emergency preparedness program was conducted in accordance with the licensee E-Plan and regulatory requirements.

4. Maintenance Logs and Records

a. Inspection Scope (IP 69001)

To ensure that maintenance activities were consistent with regulatory requirements, the inspector reviewed:

- Reactor operation logbooks 127 and 128
- DTRR No. 4.5.3, "Facility Maintenance and Modification," dated June 2014
- Completed maintenance forms 4.5.3.b, "Maintenance Form," from 2018 to present

b. Observations and Findings

The inspector reviewed the maintenance records for preventive and corrective maintenance activities. Routine/preventive maintenance activities were controlled and documented on DTRR reactor maintenance forms, which are maintained in a binder at the reactor console and reviewed by the RS. Implementation of changes to equipment, systems, tests, or experiments are generally performed by the reactor staff. After all maintenance items are completed, system operational checks are performed to ensure the affected systems function properly before returning them to service.

c. Conclusion

Maintenance activities were conducted in accordance with licensee procedures.

5. Experiments

a. Inspection Scope (IP 69001)

To ensure that the requirements of TS Sections 3.7 and 6.5 were being met concerning experimental programs, the inspector reviewed selected aspects of:

- Experimental administrative controls and precautions
- Review and approval process for experiments
- Completed experimental request forms, "TRIGA Activation Request Form," for 2018 to the present
- Completed Approval Sheet for Special Experiments, "Annual Fuel Inspection," for 2018 to the present

b. Observations and Findings

The system used for the irradiation of various materials in the reactor core is the Pneumatic Tube Irradiation Facility in conjunction with the Lazy Susan system that surrounds the reactor core. Samples that have been irradiated include various materials that are produced or utilized at Dow. All experiments conducted are in accordance with approved authorization requests. The FD or RS review and approve all routine experiments to be irradiated in the reactor core in accordance with the TS limitations for each sample. No new experiments had been initiated since the previous inspection at the facility. In 2019, one special experiment was approved to conduct the annual fuel inspection and was approved by all members of the ROC.

c. Conclusion

Experiments were reviewed and approved as required by TS.

6. Fuel Handling Logs and Records

a. Inspection Scope (IP 69001)

To verify that TS and procedural requirements were being met, the inspector reviewed selected aspects of:

- Reactor operation logbooks 127 and 128
- DTRR No. 4.3.2, "Movement of Fuel - General Requirements," dated December 2012
- DTRR No. 4.3.3, "Movement of Fuel - Approach to Criticality," dated December 2012
- DTRR No. 4.3.4 a, "Procedure for the Performance of the Annual Fuel Inspection," dated June 2014

b. Observations and Findings

The inspector determined that the licensee was maintaining the required records of the various fuel movements that had been completed and verified that the movements were conducted and recorded in compliance with licensee procedure. All fuel movements were noted in the reactor operations logbook, as well as on the fuel element position indication map in the reactor bay. The fuel element inspections generally included all of the fuel elements every four years and inspection of the control rods on an annual frequency, which is more frequent than the TS requirements. Inspections of the fuel elements and control rods showed consistency with accepted values and did not indicate any deterioration of cladding. Data recorded for fuel handling was clear and cross-referenced in the operations logs and the fuel element position indication map. Log entries clearly identified, as required by procedure, that a minimum of three persons were present when fuel was being moved. The inspector determined that the procedures and the controls specified for these operations were acceptable.

c. Conclusion

Fuel handling and control rod inspection activities were completed and documented as required by TS and licensee procedures.

7. Inspection of Transportation Activities

a. Inspection Scope (IP 86740)

To verify compliance with regulatory and procedural requirements for transferring or shipping licensed radioactive material, the inspector reviewed the following:

- Dow annual operating reports for 2017 and 2018
- Reactor operation logbooks 127 and 128

b. Observations and Findings

Through records review and discussions with licensee personnel, the inspector determined that the licensee had not shipped any radioactive material since the previous inspection in this area under the reactor license. Transfer of radioactive material to other Dow facilities was under the Broad Scope License (21-00265-06) with guidance from the Radiation Safety Committee, the RSO and the Dow Radiation Protection Manual.

c. Conclusion

No radioactive material shipments had been made under the auspices of the reactor license during the past year.

8. Exit Interview

The inspection scope and results were summarized on September 13, 2019, with members of licensee management. The inspector described the areas inspected and discussed in detail the inspection findings. The licensee acknowledged the findings presented and did not identify as proprietary any of the material provided to or reviewed by the inspector during the inspection.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

W. Konze	Director, Dow Analytical Sciences
P. O'Connor	Facility Director
S. Yusuf	Reactor Supervisor
B. Haskins	Senior Reactor Operator
N. Goodman	Senior Reactor Operator Trainee
R. Mabile	Leader, Dow Emergency Services and Security
M. Groendal	Operation Leader, Dow Emergency Services and Security
K. Wegener	Radiation Safety Officer
J. Cassiday	Health Physics Technologist
J. Morris	Senior Health Service Specialist

INSPECTION PROCEDURES USED

IP 69001	Class II Research and Test Reactors
IP 86740	Inspection of Transportation Activities (N/A for this inspection)

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened:

None

Closed:

None

Discussed:

None

LIST OF ACRONYMS USED

10 CFR	Title 10 of the <i>Code of Federal Regulations</i>
DTRR	Dow TRIGA Research Reactor
E-Plan	Emergency Plan
ES&S	Emergency Services and Security
FD	Facility Director
IP	Inspection Procedure
NRC	U.S. Nuclear Regulatory Commission
OSLD	Optically Stimulated Luminescent Dosimeter
ROC	Reactor Operations Committee
RS	Reactor Supervisor
RSO	Radiation Safety Officer
TRIGA	Training, Research, Isotopes, General Atomics
TS	Technical Specification