


U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Docket No: 040-00017  
License No: STB-00527  
Report No: 040-00017/97001(DNMS)  
Licensee: Dow Chemical Company  
Facility: The Dow Chemical Company-Michigan Division  
Location: Main Street, Midland, MI 48667  
Dates: May 13 - 14, 1997  
Inspectors: E. Kulzer, Radiation Specialist  
P. Lee, Ph. D., Radiation Specialist  
Approved By: B. L. Jorgensen, Chief   
Decommissioning Branch

## EXECUTIVE SUMMARY

DOW CHEMICAL COMPANY  
MAGNESIUM-THORIUM REMEDIATION PROJECT  
MIDLAND, MI  
NRC Inspection Report No. 040-00017/97001(DNMS)

This was a confirmatory survey and inspection at the Midland, Michigan site. The survey was conducted at the request of the licensee, to verify the condition of the location which had been excavated to remediate the presence of radioactive thorium. In addition, a site tour was conducted at the Bay City site, where remediation activities were continuing.

During this inspection, the NRC inspectors also assessed the licensee's implementation of selected radiological controls on its contractor's decontamination and remediation activities and found licensee oversight was effective.

Direct radiation surveys of the area in and around the excavation found the area to be below the licensee's proposed release guidelines for unrestricted use. The backfill, planned as fill for the excavation, was also surveyed and found to contain no radiation levels distinguishable from background.

The concentrations of thorium in soils taken from the areas in and around the excavation which had the highest direct radiation levels were, on average, within the proposed unrestricted release guidelines. Samples of the planned backfill contained no detectable amounts of licensable radioactive contamination.

The Dow Chemical site at Midland, Michigan appeared acceptable for release under the licensee's proposed guidelines for unrestricted use.

## DETAILS

### 1.0 Background

The Dow Chemical Company (Dow) was issued a license by the Atomic Energy Commission (AEC) in 1962 to use thorium metal compounds for the production of thorium-magnesium alloys at Bay City and Midland, Michigan. In 1973, the license was amended to authorize storage only or transfer of metal or process slag to authorized recipients. Licensed operations resulted in the production of slag material and contaminated soil containing thorium that required disposal.

Waste material and contaminated soil have been stored at both the Midland and Bay City sites. Dow was authorized via NRC license Amendment No. 6, dated July 19, 1996, to excavate the contaminated thorium slag/soil materials, and transport the materials by rail to the Envirocare facility in Clive, Utah, for disposal. The licensee estimated that approximately 400 railcars (approximately 96-100 cubic yards per railcar) would be needed to transport contaminated slag/soil to the Envirocare facility. The licensee projected completion of the decontamination and remediation activities to be by the end of November 1996. This was delayed because of additional contamination that was identified. At the time the final survey was prepared, 1087 truck loads of material had been removed from the Midland site.

The health and safety guidelines and procedures to be used by the licensee in remediating these two sites are described in Dow's *Radiological Health & Safety Plan For the Remediation of the Magnesium-Thorium Slag Piles at The Dow Chemical Company's Midland and Bay City, Michigan Sites*. These controls are incorporated in the license (condition 9) in Amendment No. 6.

The licensee's proposed final survey plan was reviewed by the NRC, and will be incorporated into the license via an amendment. After NRC review of the final survey report regarding Midland, the NRC conducted an inspection and confirmatory survey at the Midland site, as described in this report. Active remediation was continuing at the Bay City site at the time of the inspection. Based on the results of the licensee's final survey and the NRC confirmatory survey, Dow's license may be terminated, allowing the release of the Midland and Bay City sites for unrestricted use.

### 2.0 Radiological Controls (IP 87104)

#### 2.1 Scope

The inspection included a review of selected issues from the final survey report submitted by Dow, to evaluate details of the licensee's activities which were not fully explained in the survey plan.

## 2.2 Observations and Findings

### 2.2.1 Groundwater

Section 4.3 of the final report mentioned filtering of ground water. The inspector found that water from the Midland excavation was filtered. The filter was meant to remove particulate and radioactive material. This prevented the radioactive material from possibly contaminating Dow's water leachate collection system. The contaminated filters were sent to Envirocare for disposal as radioactive waste.

### 2.2.2 Construction Debris

Section 2.2 of the survey report addresses contaminated construction equipment and debris. The inspector found that the construction equipment and debris that was removed from the Midland site was properly surveyed and wipe samples were taken before the material was released. A log of construction equipment and debris (i.e., posts) that went through this procedure was reviewed and found to be in compliance with the plan.

### 2.2.3 Survey Procedures

Section 3.1 describes surveying areas of elevated background and applying the "three times" limit, as described in Dow's final survey plan and letter of March 31, 1997. Inspector review of applicable records indicated that this procedure was followed. Elevated levels (three times background) that were found, were removed until soil levels were brought to within background range. A composite sample was then collected.

## 2.3 Conclusions

Licensee implementation of selected radiological controls via its contractor resulted in compliance to proposed guidelines and good radiological practices and indicated effective oversight of the contractor's activities.

## 3.0 Independent Measurements (IP 87104)

### 3.1 Scope

The NRC confirmatory survey plan included, at a minimum, direct scanning of at least 20% of the surface area, and at least 20% of the grid line intersects in the affected area. In addition, soil samples were collected from locations where activity was identified through surface scans to be in excess of twice background. This resulted, by intent, in a group of samples which were biased to represent the maximum potential amounts of thorium contamination remaining at the site. The inspection plans also included surface scans of the planned backfill material and collection of soil samples from this area on a random basis.

### 3.2 Observations and Findings

Surface scanning surveys were performed using geiger-mueller (G-M) Ludlum Model 2241-2 Meters with 2x2 NaI probes. The background reading using these instruments was approximately 5,000 counts per minute (cpm). Exposure measurements were conducted using micro R (Ludlum Model 19) meters at a height of one meter above the surface. Doserate background readings were about 5-7 microroentgens (uR) per hour. Specific data on the instruments is contained on Attachment A.

Direct radiation levels measured throughout the excavated area were within acceptable ranges, all less than 10 uR per hour above background. They varied from background to approximately 10 uR per hour, measured at one meter.

The guideline for the thorium buried at the Dow sites ranges from 10.0 to 21.0 picocuries of total thorium per gram of soil (Th-232 + Th-230 + Th-228) depending on the isotopic ratio. This guideline is site-specific to the Dow sites. It was developed by Dow to address the presence of Th-230 in the slag which was not previously licensed material. This approach is conservative. Since Th-230 is not readily detectable by conventional gamma spectroscopy, Dow used alpha spectroscopy to establish the activity ratio of the Th-230 to the Th-232 + Th-228. This resulted in an effective average limit of 6.2 pCi/g for Th-232 + Th-228.

Attachments B and C show the locations and analytical results, respectively, of soil samples collected during the inspection.

### 3.3 Conclusions

The confirmatory survey results and sample analytical results showed that the residual radioactive material at the Midland site was within the licensee's proposed guidelines established for this location. Activity concentrations at the areas of highest direct radiation readings averaged less than 6.2pCi/g, as shown in Attachment C.

## 4.0 Bay City Site Tour

A tour of the Bay City site was conducted on May 14, 1997, for the purpose of observing the conduct and status of remediation activities there. The licensee and contractor representatives pointed out the identified affected areas, described survey techniques and results, and discussed the difficulties encountered in remediating soils in numerous areas which are below the level of the adjacent Saginaw River. By agreement with the State of Michigan, the remediated excavations will not be backfilled at the Bay City location, but will be left fallow to become restored wetlands. Techniques for future NRC independent verification of the success of the remediation were briefly discussed.



5.0 Exit Meeting (IP 87104)

At the conclusion of the onsite inspection at the Midland site on May 13, 1997, the preliminary results of the inspection were discussed with the individuals identified below.

Partial List of Persons Contacted

- \*L. Giebelhaus, Project Manager, THORAD Project, Dow
- \*K. Baker, Ph.D., Radiation Safety Officer (RSO), Environmental Restoration Group, Inc., (ERG)

\*Attended onsite exit meeting conducted May 13, 1997.

INSPECTION PROCEDURES USED

IP 87104: Decommissioning Inspection For Materials Licensees

LIST OF ACRONYMS USED

|         |                                    |
|---------|------------------------------------|
| G-M     | Geiger-Mueller                     |
| uR/h    | microrentgens per hour             |
| nC/kg/h | nanocoulombs per kilogram per hour |
| cpm     | counts per minute                  |
| KCPM    | thousands of counts per minute     |

ATTACHMENTS

|               |                                 |
|---------------|---------------------------------|
| Attachment A: | Survey Instruments              |
| Attachment B: | Locations of Soil Samples       |
| Attachment C: | Results of Soil Sample Analyses |

## Attachment A

### Survey Instruments

| Instrument | Model No. | Serial No. | Probe        | Last Calibration |
|------------|-----------|------------|--------------|------------------|
| Ludlum     | 2241-2    | 115135     | Ludlum 44-10 | 08/02/96         |
| Ludlum     | 2241-2    | 059756     | Ludlum 44-10 | 06/14/97         |
| Ludlum     | 19        | 014808     |              | 11/4/97          |

A Cs-137 foil source was used for the constancy check for the NaI probes. The Model 19 meter varied from 6 to 12 microrentgens per hour background radiation ( $\mu\text{R/h}$ ) (1.6 to 3.1 nanocoulombs per kilogram per hour ( $\text{nC/kg/h}$ )), depending on the composition of the surrounding structures. The background readings for the Ludlum 2241-2 with the 44-10 probes was approximately 5,000 counts per minute.

Dow Chemical  
Midland, Michigan



APPROXIMATE LOCATION OF SOIL SAMPLE



## ATTACHMENT C

### Survey Data

| Soil Number | Location/Description           | Direct Measurement<br>KCPM | pCi/g   |  |
|-------------|--------------------------------|----------------------------|---------|--|
|             |                                |                            |         |  |
| 1           | D3-5                           | 12                         | 6.8±0.7 |  |
| 2           | D4-1                           | 10                         | 1.4±0.5 |  |
| 3           | D6-6                           | 12                         | <1.0    |  |
| 4           | D2-9                           | 13                         | 2.6±0.5 |  |
| 5           | C4-4                           | 12                         | 4.0±1.0 |  |
| 6           | C5-1                           | 9                          | 6.4±0.6 |  |
| 7           | C6-7                           | 10                         | 3.2±0.6 |  |
| 8           | C6-8                           | 9                          | 2.8±0.5 |  |
| 9           | B5-4                           | 9                          | <1.0    |  |
| 10          | B6-5                           | 13                         | 2.4±0.4 |  |
| 11          | D3-9                           | 6                          | <1.0    |  |
| 12          | Salzberg clean soil (backfill) | 6                          | <1.0    |  |
| 13          | Salzberg clean soil (backfill) | 6                          | <1.0    |  |

Based on the derived thorium activity ratio, the limit is 6.2 pCi/g (average) for Th-232+ Th-228.  
(Based on the derived thorium levels for Midland).