



Ashman Center  
July 8, 2002

The Dow Chemical Company  
Midland, Michigan 48674

Mr. Sam Nalluswami  
U.S. Nuclear Regulatory Commission  
11545 Rockville Pike  
Rockville, MD 20852

40-17

RE: LICENSE STB-527 - Bay City, Michigan

Dear Mr. Nalluswami:

The Dow Chemical Company ("Dow") submitted the revised "Supplement to the Decommissioning Plan for removal of Magnesium-Thorium Slag from The Dow Chemical Company's Bay City, Michigan Site" (Supplement) on January 28, 2002. This revision included responses to NRC technical and administrative issues listed in the May 29, 2001, and September 25, 2001, letters and raised during a conference call conducted October 4, 2001.

Dow met with NMSS and Region I staff on April 29, 2002, at NRC headquarters to discuss Dow's responses to the NRC issues and to fully understand any additional information that NRC may need to support the Supplement. At that meeting, Claudia Craig, NMSS Branch Chief, reaffirmed NRC's position stated in the May 29, 2001, letter from Robert Nelson, NMSS Branch Chief, to Ben Baker, Dow Project Manager, that a determination can be made that Dow's proposed plan to provide protocols to remediate subsurface contamination in the saturated zone based on compliance with the 10 uR/hr exposure rate criteria and the EPA National primary Drinking Water Standards is consistent with the intent of the SDMP Action Plan.

The April 29, 2002, meeting resulted in several action items. One of the key action items pertained to the use of the *in-situ* ratio of Ra-228<sub>water</sub> to Ra-228<sub>slag</sub> in the saturated zone in the calculation of the saturated zone unrestricted use criteria as described in the Supplement. During the meeting NRC staff requested additional information on the sampling and analytical methods used to generate the saturated zone slag and water concentrations reported in Table 2 of the Supplement. A detailed report on the subject was provided to NRC via E-Mail (Attachment 1) and discussed in a follow-up conference call on May 16, 2002.

During the May 16, 2002, call NRC indicated that additional samples of background and onsite saturated zone water should be collected and analyzed to ensure that the concentration of Ra-228 in the water is not trending upward. Per NRC's request, on May 30, 2002, Dow submitted a proposed plan for additional water samples to NRC via E-Mail (Attachment 2).

On June 11, 2002, NRC comments on the May 30, 2002, sampling plan were faxed to Dow. One of the NRC comments was "If the Ra-228 concentration is determined not to be trending upward, the average water concentration should be based on the July 30, 2001 data for F5-4(A) and I5-5(C), and the February 17, 2001, data for I5-5(C)." A follow up call with NRC clarified that well I5-5(C) was not sampled in July 2001 and that the results from the July 2001 F5-4(A) and February I5-5(C) would be used. This appeared to be acceptable to NRC.

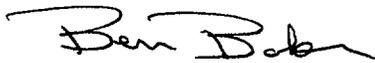
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Dow is revising the sampling plan to collect and analyze a number of additional background and onsite water samples and will submit the revised plan for NRC approval. However, before proceeding Dow requests formal NRC feedback on the following technical issues. Based on correspondence, meetings, and teleconferences with NRC, Dow understands that these technical methods are acceptable to NRC. It is important that Dow receive feedback on these four components of the Supplement before proceeding with the expenditure of the additional resources required to plan and conduct another water sampling and analysis campaign.

Dow Requests Formal NRC Feedback/Acceptance of the Following:

- 1) The use of the 10 uR/hr exposure rate criteria and EPA National primary Drinking Water Standards, as described in the Supplement, to calculate the SDMP Action Plan unrestricted use criteria for the material in the saturated zone at the Bay City site is acceptable.
- 2) The use of *in-situ* ratio determination method proposed in the Supplement for projecting future Ra-226 water concentrations assuming that Dow demonstrates that the Ra-228 water concentrations are not trending upward.
- 3) The method for determining the Ra-228 water concentration in the site saturated zone will be to subtract the average background Ra-228 water concentration (derived from NRC approved background wells) from the results of the July 2001 F5-4(A) and February I5-5(C) samples reported in Table 2 of the Supplement.
- 4) The  $Ra-228_{\text{water}}/Ra-228_{\text{slag}}$  ratio calculation will use the  $Ra-228_{\text{water}}$  concentrations determined in accordance with #3 above and the  $Ra-228_{\text{slag}}$  concentrations (pCi/g) reported for locations F5-4(A) and I5-5(C) in Table 2 of the Supplement.

Dow has spent considerable time and resources in developing the Supplement, including close coordination with NRC on approaches that are consistent with NRC guidance and regulations. In addition, DOW has responded to several rounds of NRC comments on the Supplement over the last two years, many of which are much more technical in nature than is typical of an NRC "Acceptance Review." We believe that the detailed information provided to date demonstrates that the four components of the Supplement described above provide the foundation for the safe, conservative, and efficient remediation of the remaining material in the saturated zone of the Bay City Site and that formal NRC feedback/acceptance of these methods is warranted at this time.



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Attachments

Cc: David Fauver, Babcock Services  
Corey McDaniel, EOP Group

## ATTACHMENT 1

### **Additional Information on Methods and Results of Saturated Zone and Groundwater Sampling**

#### **Introduction**

In a meeting between NRC and The DOW Chemical Company (DOW) held on April 28, 2002, NRC requested additional information on the methods for sampling and analyzing slag and groundwater used to determine the  $Ra-228_{\text{water}}/Ra-228_{\text{slag}}$  ratios provided in the "Supplement To The Decommissioning Plan For Removal of Magnesium-Thorium Slag From the Dow Chemical Company's Bay City, Michigan Site" (Supplement) dated January 28, 2001. The requested information is provided below.

#### **Saturated Zone Slag Sampling and Analysis**

Saturated zone samples have been collected from over 740 locations. A "direct push" 2 inch macro-core geoprobe was used to collect the samples. The geoprobe was pushed to the confining till layer underlying the site. The core samples were collected during two rounds of sampling. The first round of samples (about 360) were selected as follows:

- Each subgrid was divided into four quadrants,
- A quadrant was selected from each subgrid using random number tables,
- The sample was collected at the center of the randomly selected subgrid,
- The second round of samples were collected from the subgrid in the opposite corner from the location in the first round resulting in two samples in each subgrid.

The entire sample was retained and separated in the field into two parts; unsaturated (above groundwater table) and saturated (within groundwater). The groundwater elevation and total core length were recorded at the time of collection. Samples were dried and homogenized to a powder consistency. A 500 ml sub-sample was obtained for laboratory analysis using the onsite gamma spectroscopy system.

The analytical results of all saturated and unsaturated zone samples collected are attached. The depth to water and total geoprobe sampling depth is also provided for each sample location.

#### **Water Sampling and Analysis**

Two rounds of water samples were collected and analyzed for Ra-228. The first round of samples was collected February 2, 2001 and the second round was collected on July 30, 2001. The wells were located in areas where the saturated zone soil/slag radionuclide concentrations were determined to be the highest based on over 740 saturated zone samples. The attached figure shows where the water samples were collected. It is important to note that majority of the samples were located in a fairly small area where the slag concentration appears to be generally elevated.

## ATTACHMENT 1

The sampling wells consisted of a 1" sleeve and screen placed in the 2" hole resulting from the geoprobe sampling of the saturated zone. The wells were located in exactly the same locations as the saturated zone samples that were used in the Ra-228<sub>w</sub>/Ra-228<sub>s</sub> slag ratio calculations. Before sampling, the wells were purged using the micro purge method. Measurements of pH, conductivity, and dissolved oxygen were collected until three successive measurements were within 10% to ensure the samples were representative. The samples were filtered using a 0.40 um filter and shipped in 1 liter bottles provided by the laboratory (STL Richland) and certified clean by the laboratory.

The samples in the first round were analyzed for gross beta, gross alpha, Ra-228, and Ra-226. The second round samples were analyzed for Ra-228 only. A summary sheet of the analytical results from the first round is attached to provide the results of the gross beta, gross alpha, and Ra-226.

The data and results for the Ra-228 ratios were provided in the Supplement. Six of the eight reported Ra-228 water concentrations were the average results from two rounds of samples and two concentrations were from the first round of samples only since a second round was not collected at these locations. In addition, three results from the first round of samples were less than MDA. These results were not reported in the Supplement and a second round of samples was not collected at these locations.

To clarify the source of the concentrations reported in the Supplement, the individual results, including those that were less than MDA, are provided in Table 1 below.

**Table 1 - Individual Results of Groundwater Sampling for Ra-228 at Bay City Site**

Well Location	Ra-228 Water Concentration (pCi/l)	
	February 2, 2001	July 30, 2001
C5-2(D)	1.16	0.87
F5-4(A)	2.62	4.85
F5-5(D)	0.53	1.77
F5-6(D)	1.06	1.84
F7-3(A)	1.77	1.45
F7-4(A)	0.76	3.05
I5-5(C)	7.59	--
I6-8(C)	1.74	--
F7-7(B)	<MDA (0.52)	--
D5-2(C)	<MDA(0.52)	--
D6-1(A)	<MDA(0.46)	--
BKG-N1	--	1.42
BKG-SE1	--	1.63
BKG-SR1	--	1.36
BKG-SW4912	--	2.42

## ATTACHMENT 1

### Ratio of Ra-228<sub>w</sub>/Ra-228<sub>s</sub>

The purpose of the groundwater sampling was to determine an in-situ ratio of the concentration in water to that in slag. This is believed to be the most representative method for determining the actual and potential leach and/or dissolution rate of radium from slag. The ratios of Ra-228<sub>w</sub> to Ra-228<sub>s</sub> reported in Table 2 of the Supplement were based on individual sample locations and ranged from 6.3E-02 to 5.0E-04. The range of ratios was assumed to result from the variability of the slag concentration in the saturated zone since all of the water samples, regardless of surrounding slag concentration, were essentially within the range of natural background water concentrations.

A realistic method for selecting the ratio would be to take the ratio resulting from the location with the highest slag concentration (1167 pCi/g), which is 5.0E-04. This 5.0E-04 ratio represents an actual case and it could readily be argued that the ratios resulting from the areas with lower slag concentration (2.0E-02 and 6.3E-02) are not the result of higher water concentrations but from lower slag concentrations. Nonetheless, DOW selected a very conservative approach and rounded the highest ratio up to 0.1.

There are other ways to analyze the existing data to help validate the assumption that the ratio of 0.1 selected by DOW is likely to be conservative. First, the average of the water samples in the slag area is 1.66 pCi/l and the average of the background samples is 1.71 pCi/l. This qualitatively supports the assumption that the range of ratios seen in Table 2 of the Supplement is most likely the result of varying slag concentrations, not varying water concentrations. It also supports the assumption that leaching or dissolution is very low since the water concentrations in the areas of the highest slag concentrations appear to be very close to concentrations in the background areas.

Another way to view the data is to recognize that grid F5 appears to contain generally elevated concentrations of slag. Six water samples and 18 saturated zone slag samples were collected in grid F5, which has an area of 10,000 ft<sup>2</sup> (~1100 m<sup>2</sup>). The average of all 18 saturated zone slag samples collected in grid F5 is 72 pCi/g. The average of the six water samples collected in grid F5 is 2.11 pCi/l. After subtracting the 1.71 pCi/l background, the net average is 0.40 pCi/l. The ratio of Ra-228<sub>w</sub>/Ra-228<sub>s</sub> in grid F5 would then be 0.006, which is 18 times lower than the 0.1 ratio assumed by DOW in the Supplement. This shows that the conservative ratio assumption holds over larger areas as well as individual sample locations.

The above two analyses are intended to provide additional qualitative information to support the assertion by DOW that the 0.1 ratio is a conservative value and suitable for use in the Supplement calculations.

## ATTACHMENT 2

### The DOW Chemical Company Bay City Site

#### Additional Ra-228 Groundwater Sampling and Calculation of Saturated Zone Unrestricted Use Criteria 5/30/01

NRC requested that additional groundwater samples be collected and analyzed for Ra-228 to determine if the concentration of Ra-228 in the site saturated zone was trending upward with time. NRC also requested additional justification for the selection of the background well locations to ensure that the background wells were not affected by the slag in the site saturated zone. The proposed plan for additional GW sampling is provided below.

Also provided are the proposed methods for using the new groundwater data to calculate the  $Ra-228_{\text{water}}/Ra-228_{\text{slag}}$  ratio for use in calculating the saturated zone unrestricted use criteria.

#### Background Sample Locations

The groundwater flow in the site area is generally North/Northeast. The background data presented in the Supplement to the Decommissioning Plan dated January 28, 2002, (Supplement) is believed to result from wells that are unaffected by plant operations. Well BKG-SW4912 is located ¼ mile to the southwest, i.e., upgradient, of the site. Location SR-1 is actually an upstream sample of Saginaw river water, not a well sample, which should not be impacted by site GW. Well BKG-N1 is from an area north of the site that has not been affected by plant operations and has been used by both DOW personnel and NRC inspectors as a background area in the past. Well BKG-N1 is separated from the site by a canal and two ponds which would intercept any contaminated water from the site if it were to migrate that distance in measurable concentrations. The fourth well, BKG-SE1 is located in the site parking lot located northwest of the contaminated. While this well is close to the contaminated area, it is believed to be upgradient and appropriate as a background location.

The results of pH measurements in wells BkG-N1 and BKG-SW4912 were both 6.6. This is significantly lower than the pH in the contaminated area, which averaged about 9.0, and provides further evidence that these wells are not impacted by GW from the contaminated zone.

Additional background wells will be sampled to ensure high confidence in the background concentrations used in the calculation of the saturated zone unrestricted use criteria. There are currently many monitoring wells in place near the DOW site that are located to the south or southwest, i.e., upgradient, of the Thorad site. The attached figure shows the general site areas where these monitoring wells are located. Three wells will be selected from these areas, each located at least ¼ mile to the south or southwest of the Thorad site. Two samples will be collected from each of the three wells and analyzed for Ra-226, Ra-228, and gross alpha.

## ATTACHMENT 2

### Site Saturated Zone Water Sampling

Two samples will be collected from wells located in grids F5-4(A), F5-5(D), F5-6(D), and I5-5(C) to evaluate the potential for trending. Grid F-5 was selected since it contains the highest saturated zone slag concentrations. Grid I5-5(C) will be sampled since it was the location with the highest Ra-228 GW concentrations identified during the two rounds of sampling. The water will be analyzed for Ra-226, Ra-228, and gross alpha.

### Sampling Methods

Before sampling, the wells will be purged using the micro purge method. Measurements of pH, conductivity, and dissolved oxygen will be collected until three successive measurements are within 10% to ensure the samples were representative. The samples will be filtered using a 0.40 um filter and collected in 1 liter sample containers provided by the laboratory (STL Richland) and certified clean by the laboratory. The samples will be acidified prior to shipment for analysis.

### Evaluation of Potential Trends of Ra-228 Concentrations in Groundwater

The results of the saturated zone samples will be reviewed and analyzed using appropriate statistical tests to determine whether the Ra-228 concentrations in site groundwater are trending upward. The statistical tests will compare the results from the proposed six Grid F-5 samples to the results of the Grid F-5 samples collected in 2001. A simple qualitative comparison of the results from Grid I5-5(C) will be performed. If the evaluation indicates that Ra-228 concentrations are not trending upward, the ratio of Ra-228<sub>water</sub> to Ra-228<sub>slag</sub> will be calculated as follows.

### Calculation of Ra-228<sub>water</sub> to Ra-228<sub>slag</sub> Ratio

1. Average the Ra-228 concentrations from the six water samples in Grid F-5
2. Average the Ra-228 concentrations from the six background water samples
3. Subtract the Background average from the Grid F-5 average to determine the net Ra-228 concentration
4. Average the Ra-228 slag concentrations in the 18 saturated zone samples from Grid F-5
5. Divide the net Ra-228 groundwater concentration by the Grid F-5 average saturated zone concentration

### Calculation of Saturated Zone Unrestricted Use Criteria

The result of Step # 5 above will be used as input to the equations provided in the Supplement to the Decommissioning Plan to determine the unrestricted use criteria for the saturated zone slag.