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Ms. Cheryl Howe
Waste and Hazardous Materials Division
Michigan Department of Environmental Quality
Constitution Hall
525 West Allegan Street
P.O. Box 30241
Lansing, MI 48909-7741

Dear Ms. Howe:

SUBJECT: Comments: Tittabawassee River Floodplain Soils – Scope of Work Submittal -The Dow Chemical Company – February 17, 2004

I introduced myself in my March 19, 2004 letter to Mr. George W. Bruchmann in which I offered comments on Dow's SOW submittal on Midland Area soils. I hope that Mr. Bruchmann found those comments pertinent and worthy of consideration.

I would now like to comment on Dow's SOW for the Tittabawassee River Floodplain soils.

1. Floodplain Soil Sampling – Confidence Level

In my March 19,2004 comments, I provided information that the New York State Department of Health sampled the residential areas surrounding the Love Canal landfill approximately 30 locations per acre to assure the residents that all locations of high dioxin contamination had been found to a 95% confidence level.

The Tittabawassee River is approximately 20 miles in length. If we assume that the floodplain is fifty yards wide on both sides of the river, the floodplain is approximately 727 acres in area. To achieve the very desirable 95% confidence level, approximately 21,800 locations should be sampled and analyzed to determine dioxin and furan levels.

The floodplain has only been sampled at approximately 225 locations. If confidence levels are proportional to the number of locations, there is less then a 1% confidence level that all locations with high dioxin levels have actually been identified.

I could not locate the section in Dow's SOW where additional sampling is proposed. I believe that it is mandatory that Dow sample additional locations, especially those being used for residential and agricultural purposes.

With restrictions being placed on property contaminated with dioxins, I believe that every owner of property along the river should be provided with comprehensive information as to the extent of dioxin contamination. Since only 225 locations have been analyzed in 20 miles of river frontage, it is very likely that some property owners do not have any information as to the extent of dioxin contamination on their property.

I am not aware of any regulatory condition that requires Dow to analyze property for dioxin contamination if the landowner so requests. While I am very certain that Dow would not refuse such a request, a permit condition might be very welcome to any property owner that distrusts Corporate America, for whatever the reason.

2. River Floodplain Soil Sampling – Depth of Samples

I would like to include, by reference, my previous comments of March 19, 2004 that sampling only the 1"-3" topmost layer of soil is <u>not</u> a guarantee that deeper layers are not heavily contaminated.

Information provided by the DEQ in February, 2004 clearly show that there were several floodplain residential locations in which dioxin levels increased with depth. I would like to draw your attention to the following locations and sample id's.

5885 Midland Road	Samples 1-1, 1-3, 1-6, 1-15
1133 St. Andrews	Samples 2-1, 2-3
1901 Midland Road	Samples 4-1, 4-3, 4-6, 4-15
5768 River Road	Samples 2-1, 2-3, 2-6
5585 Michigan	Samples 2-1, 2-3, 2-6, 2-15
1180 River Road	Samples 3-1, 3-3, 3-6, 3-15

I believe that, in addition to a substantial increase in the number of sampled locations to assure a very high confidence level, a significant number of locations should also be sampled to better define the extent of dioxin contamination with increasing depth.

3. Impervious Barrier Layer – Depth of Covering Fill

In the SOW, Dow proposed to cover certain areas with an impervious barrier of some sort and then cover the barrier layer with six inches or more of clean topsoil. The SOW did not provide any information as to how durable the barrier layer would be to erosion by springtime flooding.

There are many locations in which high levels of dioxins can be found at depths of 15 inches in the floodplain. Although it is possible that these deeper layers may have been deposited in the 1920's to 1930's, there is no evidence to support this assumption.

It is possible that the deeper level dioxins could have been deposited more recently during springtime floodings that were particularly strong and displaced a great deal of floodplain soil.

Although the SOW did not specify the type of barrier layer that would be installed, it is possible that Dow is contemplating the use of a clay barrier. In the event that a clay barrier and only six inches of topsoil were used in certain locations, washing away and penetration of such a barrier may not be very noticeable and unrecognized dioxin exposure could occur.

I would recommend that a combination of (1) 24 inches of compacted clay, (2) a thick synthetic plastic liner, sealed at all overlap joints, (3) 24 inches of compacted clay over the plastic liner and, finally, (4) 24 inches of topsoil with turf overlay to prevent erosion of the topsoil would be a much more durable barrier.

In the event that a springtime flood washes away the topsoil and topmost layer of clay, the plastic liner would be visible alerting the property owner that repairs are required. If the plastic liner is thick and strong enough, it may resist damage during flooding and may prevent dioxin release and relocation.

4. Undefined Toxicity

I am certain that you recognize that the TEF-TEQ system is a regulatory convenience in which a dioxin/furan combination with a certain TEQ level is assumed to have the same toxicity as an equivalent level of TCDD. I am also certain that you are aware that there is only a small amount of scientific evidence that supports this assumption and that the relevant studies only examined synthetic mixtures of a few dioxins and furans. I am not aware of any study that confirms that the TEQ-toxicity of the highly variable combinations being found in the floodplain soils is truly equal to the toxicity of an equivalent level of TCDD.

In fact, EPA-2000 concluded, "One reason the TEF system was developed was because [all the required] data were not available, and it was unlikely that all the relevant chemicals would be tested for all responses in all species, including humans."[1]

Perhaps a summary of some of the dioxin analysis taken from the Tittabawassee floodplain by the DEQ can help in understanding this issue.

[1] USEPA, *Draft Exposure and Human-Health Reassessment of 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) and Related Compounds*, September, 2000

Tittabawassee River Floodplain Analysis

Sample ID	14	C15	**37**	**SS-2**	13	SS-7	16	C4	55
TEQ, ppt	891	962	**1012**	**1075**	1146	1261	1527	1599	2076
Total dioxins, Furans, ppt	8982	11830	**9791**	**46862**	30466	21380	12916	12876	24511
TCDD, ppt			**5.1**	**33.4**					

Based on the TEF-TEQ assumptions, location 37 (1012 ppt-TEQ) should have the same relative toxicity as location SS-2 (1075 ppt-TEQ) since both have the same approximate TEQ level.

However, it is well recognized that certain combinations of dioxins/furans may be more lethal that the TEQ calculation suggests, especially if the dioxins and furans attack the same groups of organs. In these cases, the combinations may be synergistic and not just additive.

Location SS-2 with 46,862 ppt of total dioxins has approximately five times the total dioxin level of location 37 (9791 ppt-total). It is reasonable to assume that the location with the higher level of total dioxin would be more toxic than the location with the lower level of total dioxin.

Two samples taken of Midland soils raise the same issue:

Midland Area Soil Analysis

Sample ID **Location**	**NE-47** (1)	**NE-20** (2)
TEQ-ppt	598	602
Total Dioxin/Furan, ppt	74,659	30,116
TCDD, ppt	288	85.6

Due to the large number of persons exposed to varying levels of TCDD, TEQ and total levels of dioxins/furans, I believe that it extremely important that Dow provide some degree of scientific assurance that confirms or denies the assumptions inherent in the TEF-TEQ system. Specially, the data and assurance should be germane to the dioxin levels and combinations present in the Midland area soils and in the Tittabawassee floodplain.

5. Unconfirmed Continuing Discharge of Toxic Compounds

I believe that the MDEQ mentioned in its comments on Dow's original SOW that the revised SOW should address whether the discharge of hazardous compounds to the river is still on-going. I support the MDEQ's concerns and comments.

Let me provide some information that could support the possibility that discharges of toxic materials are on-going.

As you already know, in the early years of the company Dow operated three types of earthen waste ponds that discharged untreated chemical wastes to the river. In 1937, Dow started up its Phenolic Waste Water Treatment Plant (P-WWTP) for several reasons.

Dow was aware that the City of Saginaw had started up a public drinking water plant in 1929 that used the Saginaw River as its source of water. Dow was also aware that the outflow from the Saginaw River could be diverted, under certain wind and wave conditions, such that the contaminated river water could reach the intake of the Bay City water plant located three miles west of the mouth of the river.

Another compelling reason was that chemical pollution from Dow's Midland plant was causing a foul chemical taste in the fish taken from the Tittabawassee River, the Saginaw River and the Saginaw Bay. The strong chemical taste was threatening to economically harm the commercial fishing industry that had developed in these bodies of water.

After the P-WWTP was started up, the chemical taste disappeared. To show that the problem had been identified and eliminated, Dow would expose caged fish to a mixture of P-WWTP effluent and river water and then use the fish in a fish-tasting program held at the Dow cafeteria. Dow employees, riverside residents and government officials agreed that the problem of foul chemical tasting fish had been solved. It is not known when the fish-tasting was discontinued.

From 1937 to 1946, approximately 30% to 40% of Dow's chemical waste waters were biologically treated. The remaining 60% to 70% of the chemical discharges were untreated. However, it was acknowledged that the fish taste problem had been solved by the start-up of the P-WWTP. Unfortunately, at the levels that have been found in fish from the river, dioxins and furans must not have a strong enough foul taste to warn against ingestion.

In 1946, Dow started up its General Waste Water Treatment Plant (G-WWTP) and, essentially, all of Dow's chemically contaminated waste water was now being biologically treated.

In the early 1970's, the MDNR began to receive complaints of off-flavored fish taken from the Saginaw Bay watershed. In 1972, Dow and the MDNR carried out a joint caged fish study that confirmed that fish from the Tittabawassee and Saginaw Rivers has a repulsive taste. It is believed that Dow partially corrected the problem by reducing the levels of chlorinated phenols and chlorinated benzenes in the effluent to acceptable levels.

In the late 1970's and early 1980's, it was recognized that high levels of chlorinated phenols and benzenes were infiltrating into the WWTP during certain times of the year. It was determined that the infiltration of toxic chemicals was associated with the underground flows of heavier-than-water organic chemicals that were leaking from the old earthen chemical waste ponds and were flowing into the river.

It was found that a certain section of river frontage was experiencing a particularly high leakage of underground chemical waste flow. In subsequent years, Dow would confirm that a large sand layer connected the chemical waste ponds to the river in the general vicinity of high underground flows. As you know, this area is located between Lift Station No. 5 and Lift Station No. 6

Analysis of contaminated ground water from the 1Q98 sampling indicates that the combined flows from Lift Station No. 4 to Lift Station No. 7 contained 141.9 ppm of purgeable and extractable organics. During the 1Q98 sampling, the combined LS-4 to LS-7 effluent contained 8,698 ppt of 2378-substituted dioxins. The 2Q98 sampling of LS-4 to LS-7 effluent indicated a 2378-substituted dioxin level of 7,487 ppt.

It is surprising that the analysis of wastes being collected by the Revetment Groundwater Interception System (RGIS) does not show the presence of even more highly concentrated wastes. During excavations on both sides of the "raw ditch" and in other areas adjacent to the river, a layer of flowing tars approximately 12 inches in thickness was often observed. Perhaps, a re-examination of the procedures and frequency used to collect and analyze wastes collected by the RGIS would be appropriate.

These levels of organics and dioxins are still present even though the old chemical waste ponds have been emptied, filled-in and capped with a clay water barrier. It's difficult to speculate on what levels of organics and dioxins were leaking into the river when the ponds were still in operation and the groundwater interceptor system had not been installed. It is possible that the riverbed and floodplain sediments cover a large inventory of heavier-than-water dioxins and furans. With the increase in riverflow during the springtime, it is possible that some of the dioxins/furans are uncovered and re-distributed throughout the river system.

Even though a revetment system and chemical collection system has been installed, there may be areas in which the steel piling is not deep enough to completely intercept the flow of toxic chemicals. In addition, when the river is at flood and the level of the river is higher than the top of the sheet piling, I believe that the chemical waste collection system is turned off. The river's increased hydraulic action may allow the un-pumped chemical wastes behind the piling to escape into the river. This release/dilution is representative of Dow's waste practices in the early days of the company when certain ponds were emptied into the river to take advantage of the dilution effects of the river.

It is also possible that not all of the heavily contaminated soil that lined the riverbank on the east side of the river was removed when the revetment-collection system was installed. As you know, the riverbank soil is so heavily contaminated that the soil is being stored in a permitted long-term storage facility. It is possible that Dow may be waiting for the licensing of the new 32 Bldg. Incinerator before disposing of the dioxin contaminated soils.

The uncertainty as to whether leakage from the old chemical waste ponds to the river has been totally eliminated warrants further investigation and a determination if unidentified releases of toxic chemicals are still occurring.

I hope that these comments are helpful to the MDEQ as it attempts to resolve the many issues associated with dioxin contamination of Midland area soils and the Tittabawassee River floodplain. If you would like any additional information on these matters, please feel free to contact me.

Sincerely,

David L. Linhardt

Cc: Susan Carrington, The Dow Chemical Company