

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5

IN THE MATTER OF:

The Dow Chemical Company
Midland, Michigan, 48667.

Respondent.

ADMINISTRATIVE SETTLEMENT
AGREEMENT AND ORDER ON
CONSENT FOR REMOVAL ACTION

Reach D

Docket No.

V-W- '07-C-874

Proceeding Under Sections 104, 106(a), 107
and 122 of the Comprehensive
Environmental Response, Compensation,
and Liability Act, as amended, 42 U.S.C. §§
9604, 9606(a), 9607, and 9622

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I. JURISDICTION AND GENERAL PROVISIONS

1. This Administrative Settlement Agreement and Order on Consent ("Settlement Agreement") is entered into voluntarily by the United States Environmental Protection Agency ("U.S. EPA") and The Dow Chemical Company ("Respondent"). This Settlement Agreement provides for the performance of removal actions by Respondent and the reimbursement of certain response costs incurred by the United States at or in connection with the area known as Reach D, which is located at and in the vicinity of an historic flume situated along the northeast bank of the Tittabawassee River, within The Dow Chemical Company Midland Plant property with an address of 1000 East Main Street, 1790 Building, Midland Michigan, 48667.

2. This Settlement Agreement is issued under the authority vested in the President of the United States by Sections 104, 106(a), 107 and 122 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 U.S.C. §§ 9604, 9606(a), 9607 and 9622, as amended ("CERCLA"). This authority has been delegated to the Administrator of the U.S. EPA by Executive Order No. 12580, January 23, 1987, 52 Federal Register 2923, and further delegated to the Regional Administrators by U.S. EPA Delegation Nos. 14-14-A, 14-14-C and 14-14-D, and to the Director, Superfund Division, Region 5, by Regional Delegation Nos. 14-14-A, 14-14-C and 14-14-D.

3. U.S. EPA has notified the State of Michigan (the "State") of this action pursuant to Section 106(a) of CERCLA, 42 U.S.C. § 9606(a).

4. U.S. EPA and Respondent recognize that this Settlement Agreement has been negotiated in good faith and that the actions undertaken by Respondent in accordance with this Settlement Agreement do not constitute an admission of any issue of fact, or law, or liability. Respondent does not admit, and retains the right to controvert in any subsequent proceedings other than proceedings to implement or enforce this Settlement Agreement, the validity of the findings of facts, conclusions of law, and determinations in Sections IV and V of this Settlement Agreement. Respondent agrees to comply with and be bound by the terms of this Settlement Agreement and further agrees that it will not contest the jurisdictional basis or the validity of this Settlement Agreement or its terms.

II. PARTIES BOUND

5. This Settlement Agreement applies to and is binding upon U.S. EPA and upon Respondent and its successors and assigns. Any change in ownership or corporate status of Respondent including, but not limited to, any transfer of assets or real or personal property shall not alter Respondent's responsibilities under this Settlement Agreement.

6. Respondent is required to carry out all activities required by this Settlement Agreement.

7. Respondent shall ensure that its contractors, subcontractors, and representatives comply with this Settlement Agreement. Respondent shall be responsible for any noncompliance with this Settlement Agreement.

III. DEFINITIONS

8. Unless otherwise expressly provided herein, terms used in this Settlement Agreement which are defined in CERCLA or in regulations promulgated under CERCLA shall have the meaning assigned to them in CERCLA or in such regulations. Whenever terms listed below are used in this Settlement Agreement or in the appendices attached hereto and incorporated hereunder, the following definitions shall apply:

a. "CERCLA" shall mean the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, 42 U.S.C. §§ 9601, *et seq.*

b. "Effective Date" shall be the effective date of this Settlement Agreement as provided in Section XXX.

c. "Dioxin" or "dioxin" shall mean the seventeen chlorinated dibenzo-p-dioxins and chlorinated dibenzofurans identified by the World Health Organization in *The 2005 World Health Organization Re-evaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds*, expressed as toxic equivalence concentrations, as set forth below.

Compound (Full Name)	Compound (Abbreviation)	CAS No.
Dioxins		
2,3,7,8-Tetrachlorodibenzo-p-dioxin	2,3,7,8-TCDD	1746-01-6
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	1,2,3,7,8-PCDD	40321-76-4
1,2,3,4,7,8- Hexachlorodibenzo-p-dioxin	1,4-HxCDD	39227-28-6
1,2,3,6,7,8- Hexachlorodibenzo-p-dioxin	1,6-HxCDD	57653-85-7
1,2,3,7,8,9- Hexachlorodibenzo-p-dioxin	1,9-HxCDD	19408-74-3
1,2,3,4,6,7,8- Heptachlorodibenzo-p-dioxin	1,4,8-HpCDD	35822-39-4
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin	OCDD	3268-87-9
Furans		
2,3,7,8-Tetrachlorodibenzofuran	2,3,7,8-TCDF	51207-31-9
1,2,3,7,8-Pentachlorodibenzofuran	1,2,3,7,8-PCDF	57117-41-6
2,3,4,7,8-Pentachlorodibenzofuran	2,3,4,7,8-PCDF	57117-31-4
1,2,3,4,7,8-Hexachlorodibenzofuran	1,4-HxCDF	70648-26-9
1,2,3,6,7,8- Hexachlorodibenzofuran	1,6-HxCDF	57117-44-9
1,2,3,7,8,9- Hexachlorodibenzofuran	1,9-HxCDF	72918-21-9
2,3,4,6,7,8- Hexachlorodibenzofuran	4,6-HxCDF	60851-34-5
1,2,3,4,6,7,8- Heptachlorodibenzofuran	1,4,6-HpCDF	67562-39-4

1,2,3,4,7,8,9- Heptachlorodibenzofuran	1,4,9-HpCDF	55673-89-7
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	OCDF	39001-02-0

Individual dioxins are assessed using a toxic equivalency factor (“TEF”), which is an estimate of the relative toxicity of the compounds to 2,3,7,8-tetrachlorodibenzo-p-dioxin (“TCDD”). These converted concentrations are then added together to determine the “toxic equivalence concentration” (“TEQ”) of the dioxin compounds as a whole.

d. “Future Response Costs” shall mean all costs, including direct and indirect costs, that the United States incurs in reviewing or developing plans, reports and other items pursuant to this Settlement Agreement, verifying the Work, or otherwise implementing, overseeing, or enforcing this Settlement Agreement on or after the Effective Date.

e. “Interest” shall mean interest at the rate specified for interest on investments of the U.S. EPA Hazardous Substance Superfund established by 26 U.S.C. § 9507, compounded annually on October 1 of each year, in accordance with 42 U.S.C. § 9607(a). The applicable rate of interest shall be the rate in effect at the time the interest accrues. The rate of interest is subject to change on October 1 of each year.

f. “National Contingency Plan” or “NCP” shall mean the National Oil and Hazardous Substances Pollution Contingency Plan promulgated pursuant to Section 105 of CERCLA, 42 U.S.C. § 9605, codified at 40 C.F.R. Part 300, and any amendments thereto.

g. “Settlement Agreement” shall mean this Administrative Settlement Agreement and Order on Consent and all appendices attached hereto (listed in Section XXIX). In the event of conflict between this Settlement Agreement and any appendix, this Settlement Agreement shall control.

h. “Parties” shall mean U.S. EPA and Respondent.

i. “Performance Based” means the method for implementing this interim response action removal work, based, not on numerical cleanup criteria, but on locations, volumes, boundaries, or specific actions within the Reach, as described in the Work Plan

j. “RCRA” shall mean the Solid Waste Disposal Act, as amended, 42 U.S.C. §§ 6901, *et seq.* (also known as the Resource Conservation and Recovery Act).

k. “Respondent” shall mean The Dow Chemical Company, a Delaware corporation.

l. “Site” shall mean Reach D of the Tittabawassee River, located in the vicinity of an historic, 1,200 foot-long, water discharge flume containing approximately 14,000 cubic yards of dioxin-contaminated bottom deposits and sediments, together with any area in proximity to Reach D that is necessary for implementing the removal action, including, for purposes of the

Reach D removal action only, Respondent's sediment dewatering area (and the 9,000-foot dredge slurry pipe to the de-watering area). The area of the Site where the Performance Based sediment removal Work will occur is generally bounded by the Dow revetment groundwater interception system ("RGIS") sheet piling along the northeast bank of the Tittabawassee River and a line of old sheet piling constructed in the 1930s-1940s and varying from 5 to 40 feet distant from the east bank, as well as contamination that may have migrated immediately beyond the historic sheet piling along the upstream and downstream portions of Reach D, and all located within The Dow Chemical Company Midland Plant property with an address of 1000 East Main Street, 1790 Building, Midland Michigan, 48667 (the "Midland Plant"), and depicted generally on the map attached as Attachment A.

m. "State" shall mean the State of Michigan.

n. "U.S. EPA" shall mean the United States Environmental Protection Agency and any of its successor departments or agencies.

o. "Waste Material" shall mean 1) any "hazardous substance" under Section 101(14) of CERCLA, 42 U.S.C. § 9601(14); 2) any pollutant or contaminant under Section 101(33) of CERCLA, 42 U.S.C. § 9601(33); 3) any "solid waste" under Section 1004(27) of RCRA, 42 U.S.C. § 6903(27); and 4) any "hazardous material" under Michigan Administrative Code R 299.9203.

p. "Work" shall mean all activities Respondent is required to perform under this Settlement Agreement, except those activities required by Section XI (Retention of Records).

IV. FINDINGS OF FACT

9. Based on available information, including the Administrative Record in this matter, U.S. EPA hereby finds that:

a. The Site includes an area commonly referred to as Reach D of the Tittabawassee River. Reach D is located at, and in the vicinity of, an historic, 1,200 foot-long, water discharge flume and contains approximately 14,000 cubic yards of dioxin-contaminated bottom deposits and sediments. The Site is located within the Midland Plant. The Site is the location where Respondent owns and operates (and has owned and operated) a chemical manufacturing plant and is the location where Respondent has disposed of hazardous substances, pollutants, or contaminants. The Site is depicted generally on the map attached as Attachment A.

b. The Dow Chemical Company is a Delaware corporation and its registered agent is The Corporation Trust Company with an address of Corporation Trust Center, 1209 Orange Street, Wilmington, Delaware.

c. The Midland Plant began operations in 1897. The Midland Plant covers approximately 1,900 acres. The majority of the Midland Plant is located on the east side of the Tittabawassee River and South of the City of Midland.

d. The Tittabawassee River is a tributary to the Saginaw River, draining 2,600 square miles of land in the Saginaw River watershed. The Tittabawassee River flows south and east for a distance of approximately 80 miles to its confluence with the Shiawassee River approximately 22 miles southeast of Midland. Upstream of the Midland Plant, the Tittabawassee River flow is regulated by the Secord, Smallwood, Edenville, and Sanford dams. The current operation of the hydroelectric station at Sanford results in water releases from Sanford Dam during peak electricity usage periods to provide peaking power to Consumer's Energy. Sanford Lake has limited flood storage capacity due to a narrow range of permitted lake levels. The Dow Dam is located adjacent to the Dow Plant. Below the Dow Dam, the river flow is free flowing to its confluence with the Shiawassee and Saginaw Rivers. Tittabawassee River flow and water level fluctuate daily in response to releases from the Sanford Dam. The average and 100-year flood discharge for the Tittabawassee River based on data from 1937 to 1984 are approximately 1,700 cubic feet per second ("cfs") and 45,000 cfs, respectively. The relatively large ratio between the 100-year flood discharge and the long-term average discharge (26.5) indicates that the river is "flashy," or has a flow regime that is characterized by highly variable flows with a rapid rate of change.

e. The average monthly discharge from 1937 to 2003 for the Tittabawassee River 2,000 feet downstream of the Dow Dam ranged from approximately 600 cfs (in August) to 3,900 cfs (in March), with an average of 1,700 cfs. Discharge is typically highest in March and April during spring snowmelt and runoff. The maximum recorded historical crest of the Tittabawassee River occurred in 1986. A large storm in September 1986 produced up to 14 inches of rain in 12 hours. The discharge of the river near the Dow Dam reached nearly 40,000 cfs, and the river stage was 10 feet above flood stage at its crest (Deedler, Undated). Flows greater than 20,000 cfs have occurred in 22 of the 95 years between 1910 and 2004, with flows greater than 30,000 cfs occurring in 1912, 1916, 1946, 1948, and 1986. In March 2004, the river discharge reached approximately 24,000 cfs.

f. Portions of the Tittabawassee River floodplain are periodically inundated by floodwaters.

g. The Saginaw River is located within the Saginaw Bay and River watershed and drains 6,300 square miles of land. It is formed by the confluence of the Tittabawassee River and the Shiawassee River just south of Saginaw, Michigan. The river itself is relatively short, with only 22.3 miles of length. Most of the Saginaw River flow originates in its major tributaries with 39 percent of flow contributed by the Tittabawassee River, 11 percent of flow contributed by the Shiawassee River, 20 percent of flow contributed by the Flint River, 14 percent of flow contributed by the Cass River and 16 percent of flow contributed by other sources. Most of the rivers in the watershed, including the Cass and Flint Rivers, indirectly discharge into the Saginaw River. The Flint River discharges into the Shiawassee River approximately six miles upstream

of the confluence of the Tittabawassee and Shiawassee Rivers. The Cass River also discharges into the Shiawassee River, approximately five miles downstream of the Flint River and about one mile upstream of the Tittabawassee/Shiawassee/Saginaw confluence.

h. The Saginaw River flows through Saginaw, Michigan and from there to Bay City, where the river discharges into Saginaw Bay. Saginaw Bay water surface elevations and seiche effects (oscillations in water surface elevations caused by meteorological events) can affect Saginaw River water levels and flow rates for its entire length. The Saginaw River discharges into Lake Huron.

i. Sheet piling has been used to stabilize the banks of the Tittabawassee River along numerous stretches within the Midland Plant area and in several downstream locations. This type of bank stabilization increases channel velocity in the immediate area during flood stage by restricting the cross-sectional area of the river and, depending on the local cross-section, may increase downstream flood elevations and erosive forces by increasing the flows and velocities of water that can no longer be stored on the overbank above the stabilized banks.

j. Initially, the Midland Plant operations involved extracting brine from groundwater pumped from production wells ranging in depth from 1,300 to 5,000 feet below groundwater surface. Over the time of its operation, the Midland Plant has produced over 1,000 different organic and inorganic chemicals. These chemicals include the manufacture of 24 chlorophenolic compounds since the 1930s.

k. In the very early history of the Midland Plant, wastes were discharged directly into the Tittabawassee River and, sometime later, wastes were stored and treated in ponds. Other wastes were disposed of at the Midland Plant either on land or by burning. Over time, changes in waste management practices included installation and operation of a modern wastewater treatment plant as well as use of incinerators instead of open burning. Changes in the waste water treatment plant and subsequent incorporation of pollution controls into both the operations of and emissions from the incinerators have reduced or eliminated releases and emissions from the Midland Plant.

l. Elevated dioxin and furan levels in and along the Tittabawassee River appear to be primarily attributable to brine electrolysis for chlorine manufacturing, and associated waste management practices for the period at the Midland Plant. Prior to the construction of wastewater storage ponds in the 1920s, waste from manufacturing processes were discharged directly to the Tittabawassee River. Flooding of the Midland Plant property resulted in discharges to the Tittabawassee River of stored brines and untreated or partially treated process wastewaters. The primary source of furans and dioxins from the Midland Plant to the Tittabawassee River is believed to be historic releases of aqueous wastes. The chlorine manufacturing process was the likely source of comparatively high furan TEQ readings in and along the Tittabawassee River. Dioxins and furans would have been discharged directly to the Tittabawassee River. Dioxins and furans found in more recent sediments are also believed to be related to chlorophenol production that began in the mid-1930s.

m. The historic water discharge flume was, at one time, connected to an outfall at the Midland Plant.

n. Pursuant to Section 3006 of the Resource Conservation and Recovery Act (“RCRA”), 42 U.S.C. § 6926, the Administrator of U.S. EPA may authorize a State to administer the RCRA hazardous waste program in lieu of the federal program when the Administrator finds that the State program meets certain conditions. Any violation of regulations promulgated pursuant to Subtitle C (Sections 3001-3023 of RCRA, 42 U.S.C. §§ 6921-6939e) or of any state provision authorized pursuant to Section 3006 of RCRA, constitutes a violation of RCRA, subject to the assessment of civil penalties and issuance of compliance orders as provided in Section 3008 of RCRA, 42 U.S.C. § 6928. Pursuant to Section 3006(b) of RCRA, 42 U.S.C. § 6926(b), the Administrator of U.S. EPA granted the State of Michigan final authorization to administer a state hazardous waste program in lieu of the federal government’s base RCRA program effective October 30, 1986. 51 Fed. Reg. 36804 (October 16, 1986). The U.S. EPA granted Michigan final authorization to administer certain HSWA and additional RCRA requirements effective January 23, 1990, 54 Fed. Reg. 48608 (November 24, 1989); June 24, 1991, 56 Fed. Reg. 18517 (April 23, 1991); November 30, 1993, 58 Fed. Reg. 51244 (October 1, 1993); April 8, 1996, 61 Fed. Reg. 4742 (February 8, 1996); December 28, 1998, 63 FR 57912 (October 29, 1998) (stayed and corrected effective June 1, 1999, 64 Fed. Reg. 10111 (March 2, 1999)); and, July 31, 2002, 67 FR 49617 (July 31, 2002). The U.S. EPA authorized Michigan regulations are codified at Michigan Part 111 Administrative Rules 299.9101 *et seq.* See also 40 C.F.R. § 272.1151 *et seq.*

o. The Michigan Department of Environmental Quality (“MDEQ”) issued to Respondent its current RCRA Hazardous Waste Management Facility Operating license for the Midland Plant, with an effective date of June 12, 2003, and an expiration date of June 12, 2013 (the “License”). Under its License, Respondent has been conducting corrective action work. As part of the RCRA corrective action work, Respondent prepared and submitted on December 29, 2005, a Remedial Investigation (“RI”) Work Plan (“RIWP”) for the area consisting of river channels and floodplains of the Tittabawassee River. On March 2, 2006, the MDEQ notified Respondent that the RIWP was substantively deficient and Dow was required to submit a completely revised RIWP. On July 7, 2006, Respondent submitted a GeoMorph Sampling and Analysis Plan for the Upper Tittabawassee River (“UTR SAP”). On December 1, 2007, Respondent submitted a completely revised RIWP to the MDEQ for review. The RIWP is under active review by the MDEQ. On July 12, 2006, the MDEQ approved on a pilot basis, the UTR SAP for the upper 6.5 miles of the Tittabawassee River. On February 1, 2007, Respondent submitted the UTR Pilot Site Characterization Report. On May 3, 2007, the MDEQ approved the UTR Pilot Site Characterization Report with conditions and removed pilot site status from the GeoMorph process. Once approved and implemented, the RIWP will meet the requirements of Michigan’s Natural Resources and Environmental Protection Act (“NREPA”), 1994 PA 451 [Act 451], as amended, Parts 111 (Hazardous Waste Management) and 201 (Environmental Remediation), and RCRA regulations and standards of practice.

p. Sampling was conducted under the pilot GeoMorph UTR SAP as part of the remedial investigation process. The sampling was conducted to identify areas contaminated with dioxins and furans, and other contaminants of concern, including chlorobenzene.

q. The pilot GeoMorph sampling plan included sampling conducted at the Site. Sampling within Reach D establishes dioxin sediment contamination levels of up to 69,000 parts per trillion (“ppt”) dioxin, and other contaminants, including chlorobenzene at levels of up to 950 parts per million (“ppm”).

r. Sampling conducted as part of the RIWP strongly suggests that the dioxin/furan contamination at the Site and in the Tittabawassee River adjacent to and downstream of Dow is associated with the Dow Midland plant. Soil samples collected upstream of Midland did not contain elevated levels of dioxins or furans. Dioxin and furan concentrations from these sample locations are consistent with statewide background concentrations. Sampling within tributaries to the Tittabawassee River have failed to identify any significant sources of dioxins or furans. No significant sources of dioxins or furans are known within the City of Midland other than Dow. Dioxin/furan congener profile charts for Tittabawassee River sediments and floodplain soils downstream of the Dow Midland facility are similar amongst themselves and very different from sample locations upstream of the Dow Midland facility.

s. In October 2003, MDEQ completed its “Tittabawassee River Aquatic Ecological Risk Assessment,” and Dow responded to that document on December 19, 2003. In April 2004, MDEQ completed its “Tittabawassee River Floodplain Screening-level Ecological Risk Assessment.” On July 30, 2004, U.S. EPA issued its “(1) Health Risk Analysis of Tittabawassee Fish with Dioxin and (2) Recommendations for Risk Evaluation.”

t. In the “Tittabawassee River Aquatic Ecological Risk Assessment,” risks to birds and mammals from consuming fish from the Tittabawassee River below Midland were evaluated using a streamlined approach that included site-specific contaminant data and modeling related to TCDD (fish tissue and bird egg concentrations) and data from the scientific literature.

u. The main conclusion of the “Tittabawassee River Aquatic Ecological Risk Assessment” is that the possibility of unacceptable risks to aquatic receptors, as well as avian and mammalian piscivores in the Tittabawassee River floodplain, due to sediment contamination by dioxin cannot reasonably be discounted.

v. In the “Tittabawassee River Floodplain Screening-level Ecological Risk Assessment” risks to six species of birds and mammals from consuming soils and invertebrate, mammalian, and avian prey from the floodplain of the Tittabawassee River downriver of Midland were evaluated using a screening level ecological risk assessment. This analysis was based on empirical soil PCDD/PCDF concentrations and bioaccumulation, toxicological, and ecological data from the scientific literature. The question addressed by this ecological risk assessment was whether an unacceptable risk to ecological receptors in the Tittabawassee River floodplain could be reasonably discounted.

w. The main conclusion of the “Tittabawassee River Floodplain Screening-level Ecological Risk Assessment” is that the possibility of unacceptable risks to terrestrial receptors in the Tittabawassee River floodplain due to soil contamination by dioxin cannot reasonably be discounted. Indeed, the relatively high hazard index (“HI”) values obtained may be an indication that it may be more likely than not that risk actually pertains in the assessment area. Further site-specific studies are needed before any such risks can be confirmed or rejected.

x. In the “(1) Health Risk Analysis of Tittabawassee Fish with Dioxin and (2) Recommendations for Risk Evaluation,” U.S. EPA evaluated the risks to humans from consuming fish from the Tittabawassee River. Tittabawassee River Fish data collected by DEQ in 2003 and made available to U.S. EPA in June 2004, was analyzed to assess risks to fish consumers. The conclusion was that dioxins in river fish present unacceptable risks to public health.

y. Although the Site is within the Midland Plant property boundary, access to the Site is unrestricted to people approaching the site from the Tittabawassee River. Wildlife in the area also has unrestricted access. The Site may also be subject to flooding and erosion. This is particularly true during high stream flow events. This may result in the spread of dioxin contamination to other locations within the flood plain, as well as to downstream locations. This may also result in further contamination of fish and invertebrates within the river.

z. Dioxins, furans, and chlorobenzenes are listed as hazardous constituents in the Resource Conservation and Recovery Act (RCRA) Appendix VIII to 40 CFR 261; and Part 111 , Hazardous Waste Management, of Michigan’s Natural Resources and Environmental Protection Act, 1994 PA 451, as amended, Michigan Compiled Laws (“MCL”) 324.101 et seq. (“NREPA”).

V. CONCLUSIONS OF LAW AND DETERMINATIONS

10. Based on the Findings of Fact set forth above, and the Administrative Record supporting this removal action, U.S. EPA has determined that:

a. The Reach D of the Tittabawassee River Site is a “facility” as defined by Section 101(9) of CERCLA, 42 U.S.C. § 9601(9).

b. The contamination found at the Site, as identified in the Findings of Fact above, includes a “hazardous substance” as defined by Section 101(14) of CERCLA, 42 U.S.C. § 9601(14).

c. Respondent is a “person” as defined by Section 101(21) of CERCLA, 42 U.S.C. § 9601(21).