**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**
REGION 5
77 W. JACKSON BOULEVARD
CHICAGO, ILLINOIS 60604-3590



**MEMORANDUM**

**SUBJECT:** ENFORCEMENT ACTION MEMORANDUM – Request for Approval of Action Memorandum for Non-Time Critical Removal Action at the Tittabawassee River Floodplain of the Tittabawassee River, Saginaw River & Bay Site, Michigan (Site ID #B5KF)

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**TO:** Richard C. Karl, Director
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## I. PURPOSE

The purpose of this memorandum is to request approval of this Action Memorandum for a Non-Time Critical Removal Action (NTCRA) to address contaminated soil in the Floodplain of the Tittabawassee River of the Tittabawassee River, Saginaw River & Bay Site, Michigan (TRSR&B Site). For the purposes of this Action Memorandum: "Work" is defined in Section V below; "Cleanup Numbers" or "TEQ Cleanup Numbers" shall mean the site-specific numeric dioxin TEQ human direct contact criteria established herein; "Floodplain" shall mean the 8-year floodplain of the Tittabawassee River, which includes land adjacent to the Tittabawassee River that generally experiences flooding at least once every 8 years when the river water levels rise and encroach on or inundate the land; and "Site" shall mean the Floodplain, nearby areas where dioxins from the Floodplain have come to be located at levels that exceed applicable Cleanup Numbers, and other nearby areas required to do the Work, including any approved disposal areas at The Dow Chemical Company (Dow) Midland Plant. The Floodplain begins downstream of the Midland Plant and extends approximately 21 miles on both sides of the river to the confluence of the Tittabawassee and Shiawassee Rivers. The general location of the Floodplain is depicted in Attachment A to this Action Memorandum.

This NTCRA will mitigate actual or potential threats to public health, welfare, and the environment presented by the presence of an uncontrolled release or threat of release of hazardous substances, pollutants, or contaminants, as identified by the presence of elevated levels of polychlorinated dibenzo-p-dioxins (dioxins) and/or polychlorinated dibenzofurans (furans) from Floodplain soil. More specifically, the Site poses a risk due to actual or potential exposure to nearby human populations, animals or the food chain from hazardous substances or pollutants or contaminants; and actual or potential contamination of sensitive ecosystems. Hazardous substances or pollutants or contaminants have or may have come to be located at the Site from Dow's Midland Plant property, with an address of 1000 East Main Street, 1790 Building, Midland, Michigan, 48667.

Portions of the Floodplain contain elevated levels of dioxins (primarily furans). Dioxin concentrations in this Action Memorandum will generally be discussed as toxic equivalency (TEQ) – a calculation summing the relative toxicity of the congeners as compared to 2,3,7,8-tetrachlorodibenzo-p-dioxin. This Action Memorandum establishes site-specific numeric TEQ Cleanup Numbers for Floodplain soil based on human direct contact (i.e., incidental ingestion and dermal absorption) exposure pathways at the Site. The Floodplain includes approximately 4,500 acres and portions of more than 700 property parcels. There will be a property-by-property comparison to the Cleanup Numbers to establish which properties within the Site need Work. If dioxin levels in surface soil at a property parcel are higher than the appropriate site-specific Cleanup Number(s), Work shall be required.

The specific property parcels within the Site that require Work will be identified by the United States Environmental Protection Agency (U.S. EPA), in consultation with the Michigan Department of Environmental Quality (MDEQ), through amendments of this Action Memorandum. The removal action activities to be performed within those parcels are based on the nature of each property parcel's use or uses. The proposed response options generally include: Maintained Residential Areas exceeding 250 parts per trillion (ppt) TEQ shall be excavated, any generated material disposed of at an approved location, backfilled with clean soil, and the area revegetated; and Other Land Use Areas exceeding 2,000 ppt TEQ shall be either excavated, backfilled and replanted, or covered with clean material, as approved by U.S. EPA, after working with the property owner.

U.S. EPA and Dow entered into an Administrative Settlement Agreement and Order on Consent (Floodplain AOC), pursuant to which Dow will perform the removal action described herein with U.S. EPA oversight.

This action will be conducted in accordance with Section 104(a)(1) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. § 9604(a)(1), and 40 C.F.R. § 300.415 (*Removal Action*) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) to abate or eliminate the threats posed to public health and/or the environment. This action is anticipated to require at least six construction seasons to implement. Floodplain construction work is expected to begin in 2015.

## II. SITE CONDITIONS AND BACKGROUND

CERCLIS ID#: MID980994354
Category: Non-Time Critical Removal Action

### A. Physical Location and Description

The TRSR&B Site, as defined in the Administrative Settlement Agreement and Order on Consent for Remedial Investigation, Feasibility Study and/or Engineering Evaluation and Cost Analysis, and Response Design, CERCLA Docket No. V-W-10-C-942, with an effective date of January 21, 2010, (2010 AOC) is the area located in and along the Tittabawassee River and its floodplains, starting upstream of the Midland Plant, and extending downstream to, and including, the Saginaw River and its floodplains, and Saginaw Bay, and any other areas in or proximate to the Tittabawassee River and its floodplains, the Saginaw River and its floodplains, and Saginaw Bay where hazardous substances, pollutants, or contaminants from the Midland Plant have or may have come to be located.

The TRSR&B Site starts at the Tittabawassee and Chippewa confluence, at a local landmark, the Tridge. Operable Unit 1 (OU 1) of the TRSR&B Site includes the Tittabawassee River and the upper Saginaw River. The Tittabawassee River has been divided into seven segments of about 3 to 4 miles each. In-channel sediment and riverbank soil removal response actions have been selected for Segments 1 and 2. Segment 1 consists of a 3.1 mile stretch of the Tittabawassee River that transects the Dow Midland plant. Segment 2 is the stretch of the Tittabawassee River beginning immediately downstream of Segment 1 and extending approximately 4.1 miles.

The Floodplain is a sub-area within the TRSR&B Site and OU 1. The Floodplain includes about 4,500 acres, begins adjacent to Segment 2 approximately 3.1 miles downstream of the confluence of the Chippewa and Tittabawassee Rivers and extends on both sides of the river approximately 21 miles to the confluence of the Tittabawassee and Shiawassee Rivers. There are portions of more than 700 property parcels in the Floodplain. Estimated current land use in the Floodplain includes undeveloped properties or areas that seem to be little used, typically forested (~54%), active agriculture (~18%), the Shiawassee National Wildlife Refuge (~16%), maintained residential areas (~ 5%), commercial (~4%), and public parks (~3%). Human access to the Site is available to people living, working or playing on the Floodplain. Wildlife in the area also has access to the Site.

About 76% of the Floodplain is in a natural condition. These areas provide significant ecological, physical, and geomorphological functions. The Floodplain has several ecologically important areas that provide unique habitat that promote wildlife diversity, including riparian zones, wetlands, and forested and unforested areas, as well as aquatic features such as ponds. Riparian zones and wetlands help to dissipate energy from flood events, stabilizing soil erosion and protecting property. During and after floods, sediment deposition and water filtration occurs in the wetlands, riparian zones, and extended floodplain, which are important hydrological functions delivering ecological benefits. Wetlands and riparian zones within the Floodplain are also important sites of energy and nutrient flux to and from the river, helping to promote biological productivity of aquatic and terrestrial food webs.

## B. Background

The Midland Plant began operations in 1897 and eventually grew to be a 1,900 acre facility. One major historical process used at the Midland Plant was the chloralkali process, which used electric current to extract chemicals from brine. 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.

Early in the history of the Midland Plant, liquid wastes were discharged directly into the Tittabawassee River and, sometime later, wastes were stored and partially treated in settling ponds prior to discharge to the river. Historically, flooding of the Midland Plant property may have resulted in discharges of stored brines and untreated or partially treated process wastewaters to the Tittabawassee River. Much of the Floodplain TEQ is believed to have been released in the early 1900s in the form of furan-contaminated graphitic particles that came from breakdown of the carbon anodes used in the chloralkali process. Once released to the river, the graphitic particles mixed with the sediment and deposited in levees that form the riverbanks. Frequent flooding resulted in deposition of contaminated sediment in the Floodplain. Over time, changes in waste management practices included the installation and operation of a modern wastewater treatment plant. Changes in the wastewater treatment plant and subsequent incorporation of pollution controls into both the operations of, and emissions from, the incinerators have reduced or eliminated non-permitted releases and emissions from the Midland Plant.

Dioxins and furans are listed as hazardous constituents in Appendix VIII to Part 261 of Title 40 of the Code of Federal Regulations, 40 C.F.R. pt. 261 app. VIII, and Part 111 of Natural Resources and Environmental Protection Act (NREPA), Mich. Comp. Laws §§ 324.11101-324.11153, and as hazardous substances in Part 201 of NREPA, Mich. Comp. Laws §§ 324.20101-324.20142.

MDEQ issued to Dow its current Resource Conservation and Recovery Act (RCRA) Hazardous Waste Management Facility Operating License for the Midland Plant, with an effective date of June 12, 2003 (License). The License is currently under review by MDEQ for renewal and remains in effect until reissued or denied by MDEQ. Under its License, Dow had been conducting corrective action work including characterization of the Tittabawassee River. Dow continues to conduct corrective action work under the License on the plant site and off-site in the City of Midland. Corrective action work also is identified in the January 19, 2005 Framework for an Agreement between the State of Michigan and the Dow Chemical Company.

U.S. EPA's and MDEQ's understanding of potential hazardous substances in Floodplain soil is based on various sampling, analysis, and studies regarding dioxin/furans and other contaminants in the Tittabawassee River, the Saginaw River, and the Saginaw Bay. The sampling, analysis, studies, and orders relied on by U.S. EPA and MDEQ include, but are not limited to, those listed in the Administrative Record index, Attachment C to the Floodplain AOC.

In December 2008, negotiations with Dow began for a more comprehensive approach to addressing contamination related to Dow in the rivers and Bay. On January 14, 2010, using

CERCLA authority, U.S. EPA signed the 2010 AOC with MDEQ and Dow, requiring Dow to perform investigations, develop and design cleanup options, selected by U.S. EPA for, amongst others, areas such as the Floodplain. The 2010 AOC became effective on January 21, 2010, and work under the 2010 AOC is ongoing.

The 2010 AOC established a comprehensive site-wide management approach for the TRSR&B Site. The site-wide management approach includes developing a set of prioritized actions intended to reduce exposure to and/or transport of contaminated sediment, riverbanks and floodplain soil for the purposes of helping to reduce risks to acceptable levels for human health and ecological receptors. Later residual risk assessments, informed by the long-term monitoring plans initiated in concert with these actions, will be used to assess the need for further actions at the site. In any case, a final Record of Decision(s) will be issued for OU 1. This Floodplain Action Memorandum is part of the larger site-wide management plan. This Floodplain Action Memorandum selects response actions for addressing human direct contact exposure pathways at the Site. Implementation will occur in an upstream to downstream sequence, concurrent with adjacent in-channel and riverbank activities.

### C. Environmental Justice Analysis

An Environmental Justice (EJ) analysis for the site was conducted. Screening of the Floodplain and surrounding area used Region 5's EJ Screen Tool (which applies the interim version of the national EJ Strategic Enforcement Assessment Tool). Region 5 has reviewed environmental and demographic data for the area in and around the Floodplain, and determined there is a low potential for EJ concerns at the Site.

### D. Risk Assessments, Cleanup Numbers, Health Consultations, and Advisories

#### 1. Risk Assessments

Extensive data has been collected at the TRSR&B Site, particularly since 2006. The 2010 AOC and associated Statement of Work (2010 SOW) set forth requirements that human health and ecological risk assessments be conducted. Those risk assessments are not yet complete, and will be conducted in accordance with the requirements and schedule of Tasks 10 and 13 of the 2010 AOC. In particular, for OU 1 the risk assessments will be conducted after response actions have been implemented, to assess residual risk. U.S. EPA currently anticipates that the Task 10 post-construction risk assessments for portions of OU 1 will be conducted before all of the Floodplain Work is complete.

The *Tittabawassee River Floodplain Response Proposal* (Floodplain EE/CA), dated May 30, 2014, and approved by U.S. EPA with modifications on August 6, 2014 for purposes of public comment, presented detailed information obtained during a series of site investigations conducted by Dow and others. A brief summary of the findings is included in Section II.E, below. These investigations largely focused on dioxins and furans, but a subset of samples was assessed for secondary constituents of interest (SCOIs). The Floodplain EE/CA summarizes the nature and extent of TEQ in Site soil, and evaluates the bases for response actions resulting from potential human direct contact exposure to Floodplain soil TEQ. Neither a baseline human

health nor an ecological risk assessment was conducted as part of the Floodplain EE/CA, but Floodplain conditions were evaluated compared to NCP removal criteria (40 C.F.R § 300.415(b)(2)).

### 2. Site-Specific TEQ Cleanup Numbers

Relatively new information regarding prenatal and postnatal health effects attributed to dioxin exposure and changes in risk assessment practices resulted in the necessity to more closely consider the potential for non-cancer adverse effects in developing dioxin Preliminary Remediation Goals (PRGs). Based on this information, U.S. EPA developed a dioxin oral Reference Dose (RfD) that was finalized in February 2012. Screening values calculated using this RfD and U.S. EPA non-adjusted (default) exposure factors are 50 ppt TEQ for residential soil and 730 ppt TEQ for commercial/industrial soil. U.S. EPA has an expectation that the Regions often will prefer site-specific data that can be used to adjust these values using site-specific exposure factors instead of the default exposure factors.

Because site-specific exposure data is available, U.S. EPA and MDEQ calculated site-specific dioxin PRGs for a variety of human direct contact Floodplain soil exposure scenarios. The calculations followed standard U.S. EPA and MDEQ algorithms and used a combination of both standard default and site-specific input parameters. Potential PRGs were calculated to assess both non-cancer risks to meet a Hazard Quotient of 1 and cancer risks to meet U.S. EPA and MDEQ ranges. Based on these calculations, U.S. EPA and MDEQ proposed two site-specific human direct contact PRGs for the Floodplain soil: 1) 250 ppt TEQ for Maintained Residential Areas; and 2) 2,000 ppt TEQ for Other Land Use Areas. The PRGs are based on the most sensitive receptor and direct contact exposure scenario within each land use, in both cases the young child resident. Thus, the PRGs are protective for all other human direct contact receptors and exposure scenarios. The PRG development, including a detailed discussion of site-specific exposure factors, is presented in U.S. EPA's technical document *Site-Specific Preliminary Remediation Goals (Cleanup Goals) For Tittabawassee River Floodplain Soil* (http://www.epa.gov/region5/cleanup/dowchemical/pdfs/dowchemical-floodplain-cleanup-goals-development-techdoc-201408.pdf).

U.S. EPA took public comment on the proposed Floodplain cleanup plan, including the PRGs. U.S. EPA received and responded to comments on the PRGs (see Attachment B). In this Action Memorandum, U.S. EPA, in consultation with MDEQ, is finalizing the PRGs of 250 ppt TEQ for Maintained Residential Areas and 2,000 ppt TEQ for Other Land Use Areas as the site-specific numeric TEQ Cleanup Numbers for human direct contact with Floodplain soil.

As discussed in the Responsiveness Summary, Attachment B to this Action Memorandum, some commenters felt that there should be a process for making exceptions to the Cleanup Numbers in ecologically important areas that have little chance of use by the most sensitive receptors. U.S. EPA recognizes that there may be limited instances where property uses in the Floodplain do not fit the exposure scenarios considered in developing the PRGs. Therefore, this Action Memorandum is providing the flexibility for U.S. EPA, in its sole discretion, after consultation with MDEQ, to conduct a property-specific exposure evaluation, with the possibility that there could be a property-specific direct contact TEQ cleanup number developed through an

amendment of this Action Memorandum that results in the preservation of habitats and ecosystems determined by U.S. EPA to be of exceptional quality. Among the factors that U.S. EPA will consider are: consistency with the exposure assumptions used to develop the site-specific criteria; the importance of the existing habitat/ecosystem; how remote the area is; the likelihood of human access; likely future use; and other relevant factors. If any such property-specific TEQ cleanup number is developed, it will be done so consistently with the NCP, and will address non-cancer risks to meet a Hazard Quotient of 1 and cancer risks to meet U.S. EPA and MDEQ acceptable ranges. Any U.S. EPA dioxin consultation policy in effect at the time will be followed by the Region before any property-specific TEQ cleanup number is finalized.

The Cleanup Numbers are not based on potential exposure from eating animals or animal products raised or caught on the floodplain, potential ecological risks, or potential exposures and/or risks from SCOIs. U.S. EPA, in consultation with MDEQ, will continue to evaluate those potential exposures and/or risks, and identify separate response actions, as appropriate.

### 3. Health Consultations

EPA and MDEQ work with health agencies such as the Agency for Toxic Substances and Disease Registry (ATSDR) and Michigan Department of Community Health (MDCH) to understand potential health effects to people from environmental contamination. ATSDR and MDCH have completed a number of health consultations for the TRSR&B Site, including:

- 8/12/04 Health Consultation, Tittabawassee River Floodplain Dioxin Contamination, Tittabawassee River, Midland, Midland County, Michigan
- 4/29/05 Petitioned Health Consultation, Dioxins in Wild Game Taken from the Tittabawassee River Floodplain South of Midland, Midland and Saginaw Counties, Michigan
- 11/1/07 A Pilot Exposure Investigation Report: Dioxin Exposure in Adults Living in the Tittabawassee River Floodplain
- 2/4/08 Health Consultation, Evaluation of Saginaw River Dioxin Exposures and Health Risks, Saginaw River, City of Saginaw, Saginaw County, Michigan
- 8/19/09 Health Consultation, Dioxin Contamination on Residential Property in the Tittabawassee River Floodplain, Saginaw County, Michigan

All of the health consultations listed above can be found at http://www.atsdr.cdc.gov/HAC/PHA/HCPHA.asp?State=MI .

### 4. Advisories

The State of Michigan has issued fish consumption advisories for dioxins, PCBs, and mercury for the Tittabawassee and Saginaw Rivers and Saginaw Bay. These advisories are posted at multiple locations throughout the watershed. The advisories can be found online at http://www.michigan.gov/documents/mdch/EAT_SAFE_FISH_IN_THE_SAGINAW_BAY_AREA_WEB_356929_7.pdf

The State of Michigan has issued a public Health Advisory for Consuming Wild Game from the Tittabawassee River Flood Plain due to dioxin contamination. The wild game advisory can be found online at
http://www.michigan.gov/documents/mdch/Eat_Safe_Wild_Game_277942_7.pdf

The State of Michigan's latest advisories are summarized in *Dioxins and Furans and Your Health along the Tittabawassee and Saginaw Rivers.* This brochure is found at
http://www.michigan.gov/documents/mdch/Dioxin_Exposure_and_Health_Final_420292_7.pdf

**E. Site Assessments**

U.S. EPA's and MDEQ's understanding of hazardous substances in soil at the Site is based on various sampling, analysis, and studies regarding dioxin/furans and other contaminants, in the Tittabawassee River, the Saginaw River, and the Saginaw Bay. The sampling, analysis, studies, and orders relied on by U.S. EPA and MDEQ include, but are not limited to the documents listed in Attachment C to the Floodplain AOC. In particular, the Floodplain EE/CA summarizes Site conditions.

Geomorphic features in the Floodplain are the result of local hydrological conditions, fluvial processes, human-induced alterations, and variations in floodplain elevations. The identification of geomorphic features helps to delineate depositional areas that are likely to contain TEQ-impacted soils. More than 10,000 soil samples have been analyzed for TEQ from more than 1,800 core locations at the Site. TEQ sampling was designed to try to characterize the different geomorphic units in the Floodplain, as well as general contaminant distribution both vertically and horizontally. The sampling was conducted using a "step out" procedure to bound more highly contaminated surface samples.

Floodplain soil dioxin levels range from none detected up into tens of thousands of ppt TEQ. The majority of the Floodplain is characterized by surface average concentration (SAC) values less than 1,000 ppt TEQ. Areas with SACs greater than 5,000 ppt TEQ represent approximately 1% of the total Floodplain and are generally confined to small isolated locations. Average surface TEQ levels are generally lower with increasing distance from the river. This is consistent with our understanding of contaminant transport processes within the Floodplain; areas closer to the river are likely to be flooded more frequently, with more deposition of river sediment in those areas. In Segments 4-7, Floodplain TEQ levels tend to decrease from upstream to downstream. Additional variables affecting Floodplain TEQ distribution include geomorphic unit and sample depth. Because the Floodplain is very complex, data will have to be carefully evaluated during design of response actions and additional data may be needed.

Focus on the 8-year floodplain is a result of the data distribution. TEQ samples were collected outside of the 8-year floodplain boundary, but within the 100-year floodplain. The average level of the surface soil samples located outside of the 8-year floodplain is 20 ppt TEQ, the median is 13 ppt TEQ, and the 95% upper confidence limit is 26 ppt TEQ. These levels are below U.S. EPA's screening values. The 8-year floodplain boundary was delineated using aerial photographs taken during the March 2004 flood event. In a few cases, TEQ levels in surface samples outside of the 8-year floodplain boundary that are elevated may reflect slight

inaccuracies with the 8-year boundary line or relocated soil. These instances will be considered when evaluating Floodplain areas that warrant response actions.

Sampling for SCOIs – more than 220 other chemicals or chemical families – was done at a subset of the core locations. The criteria used to identify Floodplain samples for SCOI analyses were intended to bias samples to locations with a higher potential for elevated SCOI concentrations, and included samples collected from soil depositional areas, samples with atypical dioxin/furan congener patterns, and visual or olfactory characteristics in soil observed during coring. As discussed above, SCOIs will be considered further by U.S. EPA and MDEQ.

Certain areas of dioxin/furan contamination in the Floodplain have been addressed previously by a combination of CERCLA removal actions and RCRA interim response actions (IRAs) which involved soil removal and capping, as described in Section II.H.2 of this Action Memorandum.

## F. NPL Listing Status

The TRSR&B Site, including the Floodplain, is not listed on the National Priorities List (NPL). The TRSR&B Site is being addressed under the Superfund alternative (SA) approach, which uses the same investigation and cleanup process and standards for sites listed on the NPL. The SA approach is an alternative to listing a site on the NPL; it is not an alternative to Superfund or the Superfund process.

Threshold eligibility criteria for using the SA approach are: site contaminants are significant enough that the site would be eligible for listing on the NPL (i.e., the site would have a Hazard Ranking Score $\geq$ 28.5); a long-term response (i.e., a remedial action) is anticipated at the site; and there is a willing, capable PRP who will negotiate and sign an agreement with EPA to perform the investigation and cleanup.

## G. Maps, Pictures and Other Graphic Representations

A figure showing the general location of the Floodplain is included as Attachment A to this Action Memorandum.

## H. Other Actions to Date

### 1. Previous CERCLA Actions at the TRSR&B Site

In order to implement response actions at the TRSR&B Site, U.S. EPA and Dow have entered into numerous separate AOCs under the authority of Sections 104, 106(a), 107, and 122 of CERCLA.

a. On July 12, 2007, U.S. EPA and Dow entered into an AOC for a CERCLA time critical removal to dredge and dispose of a sediment deposit at Reach D adjacent to Dow's Midland plant. U.S. EPA provided Dow with notification of the completion of this AOC on October 15, 2008.

b. On July 12, 2007, U.S. EPA and Dow entered into an AOC for a CERCLA time critical removal at Reaches J/K to remove and dispose of contaminated riverbank soil, cap a contaminated upland area, and fence off a contaminated wetland area. U.S. EPA provided Dow with notification of the completion of this AOC on May 2, 2008.

c. On July 12, 2007, U.S. EPA and Dow entered into an AOC for a CERCLA time critical removal to dredge and dispose of a sediment deposit at Reach O. U.S. EPA provided Dow with notification of the completion of this AOC on April 10, 2008.

d. On November 15, 2007, U.S. EPA and Dow entered into an AOC for a CERCLA time critical removal to dredge and dispose of a sediment deposit near Wickes Park in the Saginaw River. U.S. EPA provided Dow with notification of the completion of this AOC on August 4, 2008.

e. On July 15, 2008, U.S. EPA and Dow entered into an AOC for a CERCLA time critical removal to remove and dispose of floodplain soil around residential properties at Riverside Boulevard and clean the inside of occupied homes. U.S. EPA provided Dow with notification of the completion of this AOC on February 1, 2010.

f. On February 27, 2009, U.S. EPA and Dow entered into an AOC for a CERCLA time critical removal to remove and dispose of floodplain soil at West Michigan Park and conduct soil removal and/or barrier controls at adjacent residential properties. U.S. EPA provided Dow with notification of the completion of this AOC on September 11, 2012.

g. On May 26, 2011, U.S. EPA and Dow entered into an AOC for a CERCLA non-time critical removal action to provide interim exposure controls at eligible floodplain properties. The work under this AOC is ongoing.

h. On July 8, 2011, U.S. EPA and Dow entered into an AOC for a CERCLA non-time critical removal action to remove a small eroding island and cap adjacent sediment in Reach MM. U.S. EPA provided Dow with notification of the completion of this AOC on July 12, 2012.

i. On November 1, 2011, U.S. EPA and Dow entered into an AOC for a CERCLA non-time critical removal action to remove and destroy dense non-aqueous phase liquids from the Tittabawassee River and install hydraulic control barriers and caps at Sediment Management Areas (SMAs) in Segment 1. The work under this AOC is ongoing.

j. On November 21, 2013, U.S. EPA and Dow entered into an AOC for a CERCLA non-time critical removal action to address sediment and riverbank soil

contaminated with dioxins and furans within Segment 2 of the TRSR&B Site. The work under this AOC is ongoing.

Three of the AOCs (from July 12, 2007, July 15, 2008 and February 27, 2009) pertain to removals previously conducted within the Floodplain, as further described in Section II.H.2 in this Action Memorandum. The AOCs from May 26, 2011, November 1, 2011 and November 21, 2013 are current actions and are further described in Section II.H.3 in this Action Memorandum.

**2. Previous Actions Within the Floodplain**

Three of the CERCLA time-critical removal actions discussed above in Section II.H.1 and IRAs under the License have occurred within the Floodplain. These previous actions include:

a. Exposure Control IRAs

In 2005, IRAs were initiated under MDEQ oversight on residential properties flooded during the March 2004 flood event. At that time, Floodplain characterizations were not complete and conservative response actions were implemented on properties both inside and outside the 8-year floodplain. The work completed at residential properties included installing barriers such as land covers for exposed soil areas, replacing soil in gardens and flower beds, raising the elevation of gardens and flower beds to reduce flooding frequency, and house cleaning. Almost 1,000 property owners were contacted, and over 500 owners accepted various responses actions. Today, post-flood response activities are conducted at residential properties, upon request, to restore previously installed barrier controls, if necessary.

b. Public Park/Boat Launch IRAs

Response actions also began in 2005 at public parks along the Tittabawassee River including Freeland Festival Park, Imerman Park, West Michigan Park, Center Road Boat Launch, and Caldwell Boat Launch. At Freeland Festival Park, some IRAs included covering exposed soil with topsoil and vegetation which included a demarcation layer beneath the soil cover to distinguish clean, cover material from native soil, installing portable hand wash stations, and installing a stone wall along the riverbank to restrict bank access and to direct users to a newly constructed fishing dock. At Imerman Park, some IRAs included placing riprap along the bank slope, installing geotextile material, installing new sidewalks throughout the park, fencing along part of the pavilion area, and placing woodchips on exposed areas of trails. Additionally, the dog park was moved out of the frequently flooded area and a cross country warm up area/roller hockey rink was constructed to limit contact with soils. Interim response actions at public parks and boat launches continue today, including cleaning hard surfaces that accumulate sediment during flood events and conducting repairs to previously installed barrier controls, if necessary.

c. Reach J/K

In 2007, under a July 12, 2007 AOC, Dow conducted response actions in the floodplain on the northeast side of the river near Reach J/K. In addition to bank removal, a soil barrier was placed

on approximately 2.3 acres of the floodplain that contained elevated levels of TEQ. Following placement, the soil barrier area was covered with top soil and seeded with appropriate vegetation. A 4.4 acre wetland area was also included in the response action. An 8-ft high chain link fence and signage was installed to control access to the area.

d. Riverside Boulevard

In 2008, under the July 15, 2008 AOC, Dow, conducted permanent early response actions at properties near Riverside Boulevard where the residential structures reside within the 8-year floodplain. Work at these areas included removing surface soil, placing a marker layer, and replacing the removed material with clean soil. Additionally, the gravel road and driveways were replaced with pavement. In addition, horizontal surfaces, upholstery, and air ducts were cleaned in occupied homes at these residential properties.

e. West Michigan Park

In 2009, under the February 27, 2009 AOC, Dow conducted permanent early response actions at West Michigan Park, which included removing and replacing soil, planting trees and vegetation, and installing new playground equipment. Work also was performed at a nearby condominium complex and residential properties within the 8-year floodplain.

### 3. Current Actions

Pursuant to the May 26, 2011 AOC between U.S. EPA and Dow, work is being conducted at the Tittabawassee River, Saginaw River & Bay site to address potential near-term human exposures at eligible properties in the floodplain through interim exposure controls (Task 1 of the 2010 AOC). Interim exposure controls were placed at many floodplain properties, primarily in 2011 and 2012. A monitoring and maintenance plan is under development. The work required by this NTCRA is ongoing.

Segment-by-segment work is being conducted through development of response options in an upstream-to-downstream fashion for in-channel sediment and riverbanks. Pursuant to the November 1, 2011 AOC, cleanup of SMAs in Segment 1 started in 2012 and is largely complete, except for system optimization and long-term operations. Pursuant to the November 21, 2013 AOC, cleanup of SMAs and Bank Management Areas (BMAs) in Segment 2 started in 2014 and construction of the remaining BMA work is expected to be complete in 2015. Additional BMAs may be identified in Segment 2 as monitoring is implemented. The work required by these NTCRAs is ongoing.

## I. Tribal, State and Local Authorities' Role

### 1. State and Local Actions to Date

Dow's current License for the Midland Plant was issued by MDEQ with an effective date of June 12, 2003. The License is currently under review by MDEQ for renewal and remains in effect until reissued or denied by MDEQ. Under its License and the January 19, 2005 *Framework for*

*an Agreement between the State of Michigan and The Dow Chemical Company*, Dow conducted corrective action work including characterization of the Tittabawassee River and implementation of IRAs. U.S. EPA has partnered with MDEQ, as described under the 2010 AOC, to continue to undertake CERCLA activities at the TRSR&B Site. The CERCLA actions are intended to also meet Dow's RCRA corrective action requirements for the TRSR&B Site.

Local authorities own and manage public use land in the Floodplain, including parks, potential future parks, and boat launches. As described in Section II.H.2 of this Action Memorandum, local authorities have participated in IRAs at public use lands.

Both State and local authorities have a role in managing Floodplain use unrelated to the Site contamination. State controls are in place that limit construction and development, to ensure that activities in floodplains do not impede the floodway and do not increase flood conditions upstream. In addition, local controls include restrictions on development in the Floodplain, typically requiring special permits for construction of most structures within the 100-year floodplain within their jurisdictions and flood insurance requirements. Several local authorities also have environmental resource, conservation and/or greenbelt controls on the Floodplain.

**2. Potential for Continued State/Local Response**

U.S. EPA anticipates a continuing partnership with MDEQ as outlined in the 2010 AOC. Additionally, U.S. EPA anticipates continued coordination with local authorities.

**3. Tribal Role**

U.S. EPA held a government-to-government consultation with the Saginaw Chippewa Indian Tribe of Michigan prior to issuance of the proposed cleanup plan for the Site, so that U.S. EPA could hear and understand the Tribe's concerns and perspectives regarding the cleanup proposal. U.S. EPA responded to concerns raised by the Tribe during the consultation session, in particular concerns about the presence and/or use of native plants of Tribal significance and the potential unearthing of remains and/or culturally significant sites. U.S. EPA will continue to work with the Saginaw Chippewa Indian Tribe of Michigan on a government-to-government basis.

## III. THREATS TO PUBLIC HEALTH OR WELFARE OR THE ENVIRONMENT, AND STATUTORY AND REGULATORY AUTHORITIES

U.S. EPA has currently identified conditions present at the Site that constitute a threat to public health, welfare, or the environment based upon the factors set forth in Section 300.415(b)(2) of the NCP, 40 C.F.R. § 300.415(b)(2). As discussed in Section II.D above, U.S. EPA, in consultation with MDEQ, will continue to evaluate other potential exposures and/or risks from the Site, and may identify separate response actions, as appropriate. The NCP factors forming the bases of this response action include, but are not limited to, the following:

**A. <u>Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances, pollutants or contaminants.</u>**

This factor is present at the Site due to the existence of Floodplain surface soil contaminated with dioxins/furans at levels that may contribute to unacceptable risks in humans from direct contact exposure (i.e., incidental ingestion and dermal absorption).

**B. Actual or potential contamination of sensitive ecosystems.**

This factor may be present at the Site due to high levels of surface soil contamination in sensitive Floodplain ecosystems such as wetlands.

## IV. ENDANGERMENT DETERMINATION

Given the conditions at the Site, the nature of the hazardous substance there, and the potential exposure pathways described above, the actual or threatened release of contaminants from the Site, if not addressed by implementing the response actions selected in this Action Memorandum, may present an imminent and substantial endangerment to public health, or welfare, or the environment.

## V. PROPOSED REMOVAL ACTION ACTIVITIES AND ESTIMATED COSTS

### A. Proposed Removal Action Activities

#### 1. Proposed Removal Action Description

The required response actions in the Floodplain will, at a minimum, include the following tasks (collectively, the Work):

In accordance with paragraph 19 of the Floodplain AOC, develop and implement a Site Health and Safety Plan. In accordance with paragraph 18 of the Floodplain AOC, develop and implement a multi-phase Work Plan. The actions to be described in the Work Plan and design documents generally include, but are not limited to, the following:

a. In accordance with the General Design and Implementation Work Plan and segment-specific work plans, conduct property-by-property evaluations to identify Floodplain property parcels that require Work. If dioxin levels in surface soil at a property parcel are higher than the appropriate site-specific Cleanup Number (based on current land use), Work shall be required. The following site-specific Cleanup Numbers shall be used:

   i. Maintained Residential Areas exceeding 250 ppt TEQ. This applies to Floodplain portions of homeowners' properties that are clearly maintained for typical backyard uses, such as lawns, play areas, gardens, etc.

   ii. Other Land Use Areas exceeding 2,000 ppt TEQ. This applies to Floodplain portions of farms, parks, commercial properties, unmaintained parts of residential properties, and the Shiawassee National Wildlife Refuge.

b. For Floodplain property parcels requiring Work, as identified by amendments to this Action Memorandum, develop a property-specific design, after an opportunity for input from each property owner. The removal action activities developed in each property-specific design shall consist of one or more of the following responses selected in this Action Memorandum for the Site:

   i. Maintained Residential Areas: Clear and prepare the area; excavate soil to the design depth; place a marker layer (if needed); backfill excavated areas with clean fill and/or topsoil to the design grade (generally the original grade, with topsoil as the surface lift); and restore the property per the property-specific design.

   ii. Other Land Use Areas: Clear and prepare the area. As approved by U.S. EPA in the property-specific design, either: (a) Excavate soil to the design depth; place a marker layer (if needed); backfill excavated areas with clean fill and/or topsoil to the design grade; and restore the property per the property-specific design. Or, (b) Place a cover of clean material in accordance with the design specifications (typically clean soil with vegetation on top). Or, (c) A combination of soil removal and soil cover.

c. Implement the Work at each property parcel in accordance with the approved property-specific design.

d. Develop temporary staging areas and access to the Site to meet project requirements. Such areas may include, but are not limited to, equipment decontamination, mobilization and demobilization, worker access, and exclusion zones.

e. Transport and dispose of all soil, waste and materials removed from the Site as a result of implementing the Work at approved locations, which may include off-site disposal at a local landfill and/or on-site disposal at an approved location at Dow's Midland plant.

f. Conduct monitoring during the construction phase of the Work in accordance with the Work Plan.

g. Remove and restore the temporary access, mobilization and staging areas.

h. Document completion of the Work at each property in accordance with the reporting requirements of Paragraphs 22 and 23 of the Floodplain AOC.

i. Conduct monitoring and maintenance of the Work in accordance with the post-removal site control requirements of Paragraph 21 of the Floodplain AOC.

### 2. Contribution to Remedial Performance

The removal action implemented at the Site will address actual or potential short-term and/or long-term risks by reducing exposure to contaminated soil. In accordance with Section 300.415(d) of the NCP, U.S. EPA expects that this removal action shall, to the extent practicable, contribute to the efficient performance of any anticipated long-term remedial action with respect to the release concerned.

### 3. Analysis of Selected Response Actions

U.S. EPA has selected the proposed actions in this NTCRA based on careful consideration of multiple factors, including the EE/CA Approval Memorandum, the Floodplain EE/CA, public comments as evaluated in the Responsiveness Summary found at Attachment B, and other information in the Administrative Record.

U.S. EPA guidance establishes criteria for the evaluation of removal responses. Therefore, the response actions in this NTCRA were evaluated relative to effectiveness, implementability, and cost criteria. Additionally, as required by the 2010 AOC, the Floodplain EE/CA further evaluated the potential response alternatives against the nine evaluation criteria established for remedial responses in Section 300.430(e)(9)(iii) of the NCP. The discussion below highlights the most relevant criteria for the selected alternatives. U.S. EPA, in consultation with MDEQ, has selected the removal responses discussed above because these options provide the best balance of the evaluation criteria:

**Effectiveness:** The selected response actions are expected to help protect human health and the environment, meet the cleanup objectives and comply with laws and regulations.

- The cleanups will have some short-term impacts such as truck traffic, noise or air pollution. Both options will require extensive soil movement. Soil cover will require about 60 to 120 truckloads per acre to bring in the clean cover material. Soil removal and disposal will require about 120 to 240 truckloads per acre to truck out contaminated soil and bring in clean backfill. Short-term effects will be managed by planning and construction practices.
- The cleanups will require most existing vegetation to be cleared away in the work areas. Removing trees, shrubs and plants can have short- and long-term impacts on the ecosystem. Although areas will typically be replanted, forests and mature wetlands may require decades to return to their pre-construction condition. Grassy areas will be easier to restore.
- Worker safety concerns involve working around and operating construction equipment, managing large amounts of contaminated soil and clearing vegetation. Extensive outdoor work may also expose workers to allergens or irritants, or extreme weather conditions. Additionally, potential safety concerns for property owners, residents, and any other property visitors must be considered. These concerns will be managed by appropriate health and safety and operational plans.
- All of the selected response actions are expected to be effective in limiting human direct contact exposures in the long term. Clean covers provide an immediate benefit by safely isolating the contamination. Covers must be monitored and may need maintenance to make

sure they are reliable in the long term. Removal will be effective in the long term because it permanently removes contaminated soil from the floodplain.

**Implementability:** The selected response actions can be carried out. Similar actions have been done successfully in the Floodplain. All equipment, personnel and material necessary to implement the alternatives should be locally available.

- Implementing soil removal is expected to be easier in Maintained Residential Areas because the existing vegetation will be much easier to remove and replace.
- There may be seasonal restrictions that limit when and how work can be done. For example, trucks may be restricted on certain roads at times, or work may be limited by the breeding season of eagles.
- Implementing a clean cover may be difficult on steep slopes or in areas where it may cause excess flooding.
- Agreements from owners will be obtained before conducting work on their property.

**Cost:** U.S. EPA's estimated present worth cost for the Floodplain Work is $10 million. Placing a clean cover is estimated to cost between $17,000 and $30,000 per acre. Removing and disposing of soil is estimated to cost between $33,000 and $49,000 per acre. The ranges are preliminary and reflect different costs when working in areas with heavy forests compared to grassy areas, different excavation and cover thicknesses, and other factors. Project costs will be refined as assessments are completed.

### 4. Engineering Evaluation/Cost Analysis (EE/CA) and Public Comment

Task 8 of the 2010 AOC sets forth requirements to develop and submit segment-specific response proposals. Under this order, as it deems appropriate, U.S. EPA, in consultation with MDEQ, may direct the use of U.S. EPA's removal and/or remedial program authorities under CERCLA, and Dow shall submit either an EE/CA or a Feasibility Study consistent with the 2010 SOW requirements. Based on a review of U.S. EPA's guidance, the NCP, and conditions in the Floodplain, U.S. EPA, in consultation with MDEQ, determined that Dow should submit an EE/CA for the Floodplain. This was documented in an EE/CA Approval Memorandum issued by U.S. EPA, dated July 10, 2013. Dow submitted the final Floodplain EE/CA dated May 30, 2014. U.S. EPA, in consultation with MDEQ, approved the Floodplain EE/CA on August 6, 2014 with modifications, for purposes of public comment.

Because many properties in the Floodplain are affected by the cleanup decision, U.S. EPA conducted enhanced, early public involvement. Throughout 2013, U.S. EPA held about 20 interactive small group sessions and 5 one-on-one meetings to understand the community's interest(s) in the Floodplain and to obtain early feedback on cleanup approaches and their trade-offs. To support this early community engagement, a number of materials were prepared. U.S. EPA created an addendum to the *Community Involvement Plan* that specifically addresses the Floodplain outreach. The preliminary cleanup options and their tradeoffs are discussed in a document called the *Tittabawassee River Floodplain Soil Alternatives Array*. U.S. EPA distributed a fact sheet called *Floodplain Cleanup is Planned; EPA Wants Your Input* to more

than 700 floodplain property owners and other stakeholders. This early feedback allowed the community's concerns to be reflected in U.S. EPA's final proposal.

The Floodplain EE/CA included proposed alternatives to address soil contamination at the Site. On or about August 8, 2014, U.S. EPA, in consultation with MDEQ, released a fact sheet titled *EPA Proposes Cleanup Plan for Tittabawassee River Floodplain Soil*. This fact sheet was placed on the website and mailed to about 1,300 people. It describes the Floodplain EE/CA and U.S. EPA's recommended response actions and sought public comment on the Floodplain EE/CA, pursuant to the NCP requirements. To assist the public in its review, U.S. EPA also issued: *Cleanup Numbers Developed for Tittabawassee River Floodplain* – a short fact sheet describing the PRGs; *Site-Specific Preliminary Remediation Goals (Cleanup Goals) For Tittabawassee River Floodplain Soil* – a long technical memorandum describing development of the PRGs; and *Tittabawassee River Floodplain Soil Cleanup Frequently Asked Questions*.

U.S. EPA expected that the public would want more than the normal 30-day public comment period and therefore provided in advance a 30-day extension to the public comment period. The public comment period ran from August 15 through October 14, 2014. U.S. EPA held four informal meetings for Floodplain property owners to explain the cleanup proposal and the comment process. These meetings were held on August 27 and September 9, 11, and 17. U.S. EPA also met with the owners/managers of all public use Floodplain areas, including parks, boat launches, and the Shiawassee National Wildlife Refuge. U.S. EPA also presented the proposed options to the Saginaw Tittabawassee Rivers Contamination Community Advisory Group (CAG) on September 15. U.S. EPA, with the assistance of MDEQ, held a public meeting regarding the proposed response actions on September 24, 2014, at Freeland High School in Freeland, Michigan.

U.S. EPA received written comments during the public comment period. In total, written comments were received from ten different individuals, the Natural Resource Trustees, MDEQ, the Lone Tree Council, the CAG, Dow, and a group of environmental organizations. There was also an opportunity to make verbal comments at the public meeting, and one person made verbal comments at that meeting. U.S. EPA carefully evaluated the comments and developed a Responsiveness Summary, found herein as Attachment B. Copies of all the comments received are included in the Administrative Record for the Site.

### 5. Applicable or Relevant and Appropriate Requirements (ARARs)

In accordance with 40 C.F.R. § 300.415(j), all on-site actions required pursuant to this Action Memorandum shall, to the extent practicable, as determined by U.S. EPA, considering the exigencies of the situation, attain ARARs under federal environmental or state environmental or facility siting laws. In accordance with Section 121(e) of CERCLA , 42 U.S.C. § 6921(e), and 40 C.F.R. § 300.400(e), no federal, state or local permits will be required for on-site response actions conducted as part of this removal action. Following is a summary of potential ARARs and to be considered guidance (TBCs) that were identified in the Floodplain EE/CA, approved by U.S. EPA with modifications:

a. Federal

**Potential Federal Action-Specific Requirements or TBCs**

Resource Conservation and Recovery Act – Subtitles C and D and Land Disposal Restrictions
Endangered Species Act
Bald and Golden Eagle Protection Act

**Potential Federal Location-Specific Requirements or TBCs**

Protection of Wildlife (National Wildlife Refuge System)
Floodplain and Wetland Regulations and Executive Orders 11988 and 11990
Clean Water Act – Section 404
National Historic Preservation Act
Migratory Bird Treaty Act
Archeological and Historic Preservation Act
American Indian Religious Freedom Act
Archeological Resources Protection Act
Native American Graves Protection and Repatriation Act

b. State

**Potential State Chemical-Specific Requirements or TBCs**

Michigan Natural Resources and Environmental Protection Act – Part 201

**Potential State Action-Specific Requirements or TBCs**

Michigan Natural Resources and Environmental Protection Act – Part 31
Michigan Natural Resources and Environmental Protection Act – Part 55
Michigan Natural Resources and Environmental Protection Act – Part 91
Michigan Natural Resources and Environmental Protection Act – Part 111
Michigan Natural Resources and Environmental Protection Act – Part 115
Michigan Natural Resources and Environmental Protection Act – Part 121
Michigan Natural Resources and Environmental Protection Act – Part 201
Michigan Natural Resources and Environmental Protection Act – Part 365
Michigan Natural Resources and Environmental Protection Act – Part 413
Michigan Administrative Code Rule 901(a)

**Potential State Location-Specific Requirements or TBCs**

Michigan Natural Resources and Environmental Protection Act – Part 301
Michigan Natural Resources and Environmental Protection Act – Part 303

### B. Project Schedule

Upon the effective date of the Floodplain AOC, Dow will start to develop a Work Plan. The Work Plan will contain a specific schedule for implementation of the Work. U.S. EPA anticipates that Work will begin in 2015 adjacent to Segment 2. This action is anticipated to require at least six construction seasons to implement, and likely longer.

### C. Estimated Costs

Because more than 700 property parcels will need evaluations to determine if cleanup is needed, it is not possible to establish the total Floodplain cleanup cost at this time. U.S. EPA's current estimated cost for the required Work at the Floodplain is $10 million. Project costs will be refined as property-specific cleanup plans are developed. The estimated costs include labor, equipment, materials used during installation, and operation and maintenance. Monitoring and maintenance costs were estimated for a 30-year time period. The cost estimates were developed based on a review of previous Dow project data, similar projects completed at other sites, initial input from prospective Dow contractors, and an extrapolation by U.S. EPA of unit costs to the expected work scope. Consistent with U.S. EPA guidance, the cost estimates for each alternative are anticipated to be accurate within the range of -30 to +50 percent. A future discount rate of 7 percent was used for the present worth calculations of post-construction monitoring costs, as specified by U.S. EPA guidance.

## VI. EXPECTED CHANGE IN THE SITUATION SHOULD ACTION BE DELAYED OR NOT TAKEN

Continued risk to public health or the environment will result if this response action is delayed or not taken. Delayed action increases the chance that people could be exposed to contaminated Floodplain soil or ecological exposures could increase.

## VII. OUTSTANDING POLICY ISSUES

U.S. EPA's guidance (OSWER 9360.0-40P) states: *"For non-time-critical removal actions where the cost of the selected removal action could exceed $6 million, the Region must consult with the Director of OERR prior to signing the EE/CA Approval Memorandum (or its equivalent). This consultation requirement applies both to fund-lead actions and those actions to be performed by PRPs."* Region 5 anticipated that the cost of the NTCRA for the Floodplain could exceed $6,000,000. As such, consultation between Region 5 and U.S. EPA Headquarters was conducted prior to the execution of the EE/CA Approval Memorandum. A draft of the EE/CA Approval Memorandum was sent to Headquarters on March 28, 2013. Conference calls between the Region and Headquarters to discuss use of NTCRA authorities for the Floodplain were held on May 2 and June 24, 2013. All substantive comments raised by Headquarters were addressed in the final EE/CA Approval Memorandum dated July 10, 2013.

According to Directive 9360.0-19, from the Office of Solid Waste and Emergency Response (OSWER), March 3, 1989, U.S. EPA Headquarters consultation must occur prior to conducting removal actions at sites that are not listed on the NPL where taking that removal action may be

nationally significant or precedent-setting. That Directive at Section I.3 identifies as nationally significant or precedent-setting *"[r]emoval actions at sites involving any form of dioxin when it is one of the principal contaminants of concern."* Further, the OSWER memorandum dated December 13, 1996, titled "Headquarters Consultation for Dioxin Sites," requests that the Regions consult with Headquarters where remediation goals are to be developed for dioxin in soil. Dioxins (primarily furans) are the principal contaminants of concern in Floodplain soil. As such, prior to public comment on the NTCRA, Region 5 consulted with Headquarters on the proposed Floodplain response action, including development of the site-specific PRGs for dioxin TEQ in Floodplain soil.

## VIII. ENFORCEMENT

This action is being undertaken pursuant to the Floodplain AOC between U.S. EPA and Dow. An enforcement addendum to this Action Memorandum details the enforcement strategy at the TRSR&B Site, Michigan.

## IX. RECOMMENDATION

This decision document represents the selected removal action for the Floodplain located within the TRSR&B Site, Michigan. It was developed in accordance with CERCLA as amended, and is not inconsistent with the NCP. This decision is based upon the Administrative Record for the Floodplain, an index of which is Attachment C to the Floodplain AOC.

Conditions in the Floodplain meet the criteria of Section 300.415(b) of the NCP for a removal action, and I recommend your approval of the proposed removal action. Region 5 expects that the potentially responsible party will perform the removal action under the oversight of the RPM/OSC. You may indicate your decision by signing below.

APPROVE _____ DATE: 1/8/2015
for Director, Superfund Division

DISAPPROVE _____ DATE: _____
Director, Superfund Division

Enforcement Addendum

Attachments:

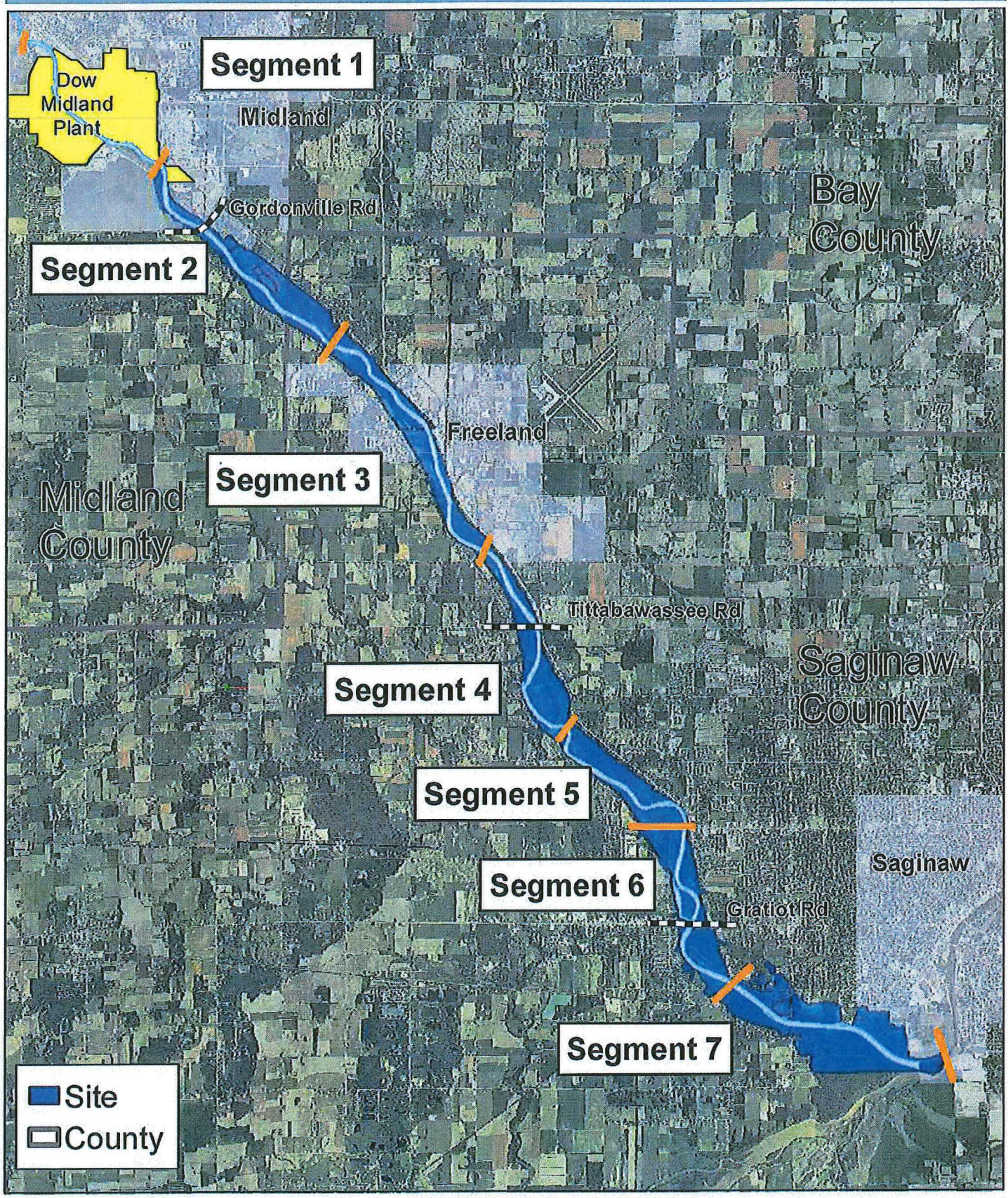
A. General Floodplain Location Map
B. Responsiveness Summary

cc: J. Tanaka, T. Prendiville, M. Logan, D. Russell, J. El-Zein, J. Cahn, C. Garypie – U.S. EPA Region 5
D. Turner, U.S. EPA Headquarters
A. Taylor, MDEQ, w/o Enf. Addendum
P. Synk, Michigan Department of Attorney General, w/o Enf. Addendum
L. Nelson, U.S. DOI, w/o Enf. Addendum
L. Williams, FWS, w/o Enf. Addendum

# ATTACHMENT A

## General Floodplain Location Map

**Tittabawassee River, Saginaw River & Bay Site**
**Midland, Saginaw, and Bay Counties in Michigan**




Attachment A Site
Tittabawassee River 8-Year Floodplain

# ATTACHMENT B

## Responsiveness Summary

**Tittabawassee River Floodplain of the**
**Tittabawassee River, Saginaw River & Bay Site**
**Midland, Saginaw, and Bay Counties in Michigan**

# RESPONSIVENESS SUMMARY

## Non-Time Critical Removal Action for the Floodplain of the Tittabawassee River of the Tittabawassee River, Saginaw River & Bay Site

This Responsiveness Summary provides a summary of the public comments that the United States Environmental Protection Agency (EPA) received regarding a proposed non-time critical removal action for dioxin-contaminated floodplain soil along the Tittabawassee River and the *Tittabawassee River Floodplain Response Proposal,* dated May 30, 2014 (Floodplain EE/CA) at the Tittabawassee River, Saginaw River & Bay Site (TRSR&B Site). This Responsiveness Summary also provides EPA's responses to those comments, developed in consultation with the Michigan Department of Environmental Quality (MDEQ).

For the purposes of this Responsiveness Summary: Dioxin concentrations will generally be discussed as toxic equivalency (TEQ) – a calculation summing the relative toxicity of the congeners as compared to 2,3,7,8-tetrachlorodibenzo-p-dioxin; "Work" is defined in Section V of the Action Memorandum; "Cleanup Numbers" or "TEQ Cleanup Numbers" shall mean the site-specific numeric dioxin TEQ human direct contact criteria established in the Action Memorandum; "Floodplain" shall mean the 8-year floodplain of the Tittabawassee River; and "Site" shall mean the Floodplain, portions of Floodplain properties that extend beyond the 8-year floodplain where dioxins from the Floodplain have come to be located at levels that exceed the Cleanup Numbers, and other nearby areas required to do the Work, including any approved disposal areas at The Dow Chemical Company (Dow) Midland Plant. The Floodplain begins adjacent to Segment 2 approximately 3.1 miles downstream of the confluence of the Chippewa and Tittabawassee Rivers and extends approximately 21 miles to the confluence of the Tittabawassee and Shiawassee Rivers.

## I. Outcome of Review of Public Comments and State Consultation

After carefully reviewing and considering the public comments submitted during the public comment period, EPA, in consultation with MDEQ, has signed an Action Memorandum selecting response actions for the Site. The Preliminary Remediation Goals (PRGs) have been finalized in the Action Memorandum as the Cleanup Numbers for human direct contact with Floodplain soil. The Floodplain includes approximately 4,500 acres and more than 700 property parcels. There will be a property-by-property comparison to the Cleanup Numbers to establish which properties within the Site need a cleanup. The selected response actions for Floodplain property parcels that need cleanup work are unchanged from EPA's recommended alternatives.

State and community acceptance are "modifying" criteria – criteria that EPA uses to reevaluate the balance between alternatives prior to selection of the final response actions. After evaluating public comments and consulting with MDEQ, one minor change was made to EPA's proposed options. Some commenters felt that there should be a process for making exceptions to the Cleanup Numbers in ecologically important areas that have little chance of use by the most sensitive human receptors. Therefore, the Action Memorandum provides the flexibility for EPA to conduct a property-specific exposure evaluation, with the possibility that there could be a

property-specific direct contact TEQ cleanup number developed through an amendment of the Action Memorandum that results in the preservation of habitats and ecosystems determined by EPA to be of exceptional quality.

EPA, after consultation with MDEQ, has negotiated an Administrative Settlement Agreement and Order on Consent (Floodplain AOC) with Dow, requiring Dow to implement the selected response actions. A copy of the Floodplain AOC, Action Memorandum, and this Responsiveness Summary (which is Attachment C to the Action Memorandum) can be found at http://www.epa.gov/region5/sites/dowchemical/index.htm.

## II. Background and Community Involvement

Dioxins (primarily furans) and other contaminants are found in the Tittabawassee and Saginaw Rivers and their floodplains, and in Saginaw Bay from past waste disposal practices at Dow's plant in Midland, Michigan. Negotiations with Dow began in December 2008 for a comprehensive approach to addressing contamination related to Dow on the floodplains and in the rivers and Bay. On January 14, 2010, EPA signed an Administrative Settlement Agreement and Order on Consent (2010 AOC) with MDEQ and Dow, requiring Dow to perform investigations, develop cleanup options, and design cleanup options selected by EPA, in consultation with MDEQ, for the TRSR&B Site using Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) authority. The 2010 AOC (No. V-W-10-C-942) became effective on January 21, 2010, and work under the 2010 AOC is ongoing.

The 2010 AOC and associated Statement of Work (2010 SOW), Attachment A to the 2010 AOC, set forth requirements for Dow to develop and submit response proposals. For each response proposal, EPA, in consultation with MDEQ, may direct the use of EPA's removal and/or remedial program authorities under CERCLA, and Dow is required to submit either a Feasibility Study or an EE/CA consistent with the 2010 SOW requirements. Based on a review of EPA's guidance, the National Contingency Plan (NCP), and conditions in the Floodplain, EPA, in consultation with MDEQ, determined that Dow should submit an EE/CA for the Floodplain. This was documented in an EE/CA Approval Memorandum issued by EPA and dated July 10, 2013. Dow submitted the final Floodplain EE/CA dated May 30, 2014. On August 6, 2014, EPA, in consultation with MDEQ, approved the Floodplain EE/CA with modifications, for the purposes of public comment.

Because many properties in the Floodplain are affected by the cleanup decision, EPA conducted enhanced, early public involvement. Throughout 2013, EPA held about 20 interactive small group sessions and 5 one-on-one meetings to understand the community's values about the Floodplain and to obtain early feedback on cleanup approaches and their trade-offs. To support this early community engagement, a number of materials were prepared. EPA created an addendum to the *Community Involvement Plan* that specifically addresses the Floodplain outreach. The preliminary cleanup options and their tradeoffs are discussed in a document called the *Tittabawassee River Floodplain Soil Alternatives Array*. EPA distributed a fact sheet called *Floodplain Cleanup is Planned; EPA Wants Your Input* to more than 700 Floodplain property owners and other stakeholders. This early feedback allowed the community's concerns to be reflected in EPA's final proposal.

The Floodplain EE/CA included proposed alternatives to address soil contamination in the Floodplain. On or about August 8, 2014, EPA, in consultation with MDEQ, released a fact sheet titled *EPA Proposes Cleanup Plan for Tittabawassee River Floodplain Soil*. This fact sheet was placed on the website, announced via listserve to about 250 recipients, and mailed to about 1,500 people. It describes the Floodplain EE/CA and EPA's recommended response actions and sought public comment on the Floodplain EE/CA, pursuant to the NCP requirements. To assist the public in its review, EPA also issued: *Cleanup Numbers Developed for Tittabawassee River Floodplain* – a short fact sheet describing the PRGs; *Site-Specific Preliminary Remediation Goals (Cleanup Goals) For Tittabawassee River Floodplain Soil* – a long technical memorandum describing development of the PRGs (Technical Support Document); and *Tittabawassee River Floodplain Soil Cleanup Frequently Asked Questions*.

EPA expected that the public would want more than the normal 30-day public comment period and therefore provided in advance a 30-day extension to the public comment period. The public comment period ran from August 15 through October 14, 2014. EPA held four informal meetings for Floodplain property owners to explain the cleanup proposal and the comment process. These meetings were held on August 27 and September 9, 11, and 17, 2014. EPA also met with the owners/managers of all public use areas, including parks, boat launches, and the Shiawassee National Wildlife Refuge. EPA also presented the proposed options to the Saginaw Tittabawassee Rivers Contamination Community Advisory Group (CAG) and a small group of the public on September 15, 2014. EPA, with the participation of MDEQ, held a public meeting regarding the proposed response actions on September 24, 2014, at Freeland High School in Freeland, Michigan.

## III. Comments and Responses

EPA received written comments during the public comment period. In total, comments were received from ten different individuals, the Natural Resource Trustees, MDEQ, Environmental Stewardship Concepts on behalf of the Lone Tree Council, the CAG, Dow, and a letter co-signed by a group of environmental organizations. There was also an opportunity to make verbal comments at the public meeting, and one person made verbal comments at that meeting. Copies of all the comments received (including the verbal comments reflected in the transcript of the public meeting) are included in the Administrative Record for the Site.

This Responsiveness Summary does not repeat verbatim each individual comment. Rather, the comments are summarized and grouped by category with respect to the type of issue raised. The comments fell within several different categories: remedy options; basis for action and conceptual site model; Cleanup Numbers; communication; remedy implementation; property use; recontamination and flooding; dioxins and health; specific information requests, and miscellaneous comments. The remainder of this Responsiveness Summary contains a summary of the comments received (grouped by category) and EPA's responses to those comments, in consultation with MDEQ.

## A. REMEDY OPTIONS

1. *Two commenters supported EPA's proposed cleanup plan. One commenter felt that EPA was doing a good job to resolve the problem.*

EPA and MDEQ acknowledge these comments.

2. *Two commenters wanted different remedies to be selected.*
   a. *One commenter indicated that nothing should be done because natural processes will reduce the dioxin levels and natural recovery is the best option because it minimizes cost, pollution caused by implementation, and destruction of natural habits and scenery.*

   Monitored natural attenuation (MNA) is a process that involves leaving contaminated soil in place and allowing existing natural processes to reduce the bioavailability or toxicity of the contaminants. MNA was discussed in Section 5.5 of the Floodplain EE/CA. MNA was not carried forward as an alternative because the timeframe necessary for MNA to be successful, as compared to the timeline for achieving site goals through other technologies, makes MNA less feasible as an alternative. Also, it is unclear whether it would be reliable in all areas. While MNA has many of the positive values cited by the commenter, EPA and MDEQ do not believe it will protect human health fast enough.

   b. *One wants all contaminated soil (including below the PRG) to be removed. He stated that a cover should never be an option.*

   EPA and MDEQ believe that the final selected response actions achieve the best balance of EPA's evaluation criteria. EPA does not have a policy or goal to completely eliminate environmental contamination. The March 8, 1990 Preamble to the NCP specifically states, "CERCLA does not require the complete elimination of risk or of all known or anticipated adverse effects, i.e. remedies under CERCLA are not required to entirely eliminate potential exposure to carcinogens." EPA's policy is to ensure that actual or potential risks from exposure to site-related environmental contaminants fall within an acceptable risk range, based on protective evaluations. EPA and MDEQ believe that the Cleanup Numbers are protective for people who might contact Floodplain soil. A soil cover is being retained as an option for circumstances where that may be the preferred response given area-specific circumstances.

3. *One commenter expressed concerns with the soil cover option. They stated that digging or farming would disturb a cover, and that permanent restrictions would be needed.*

EPA agrees that any area over which a cover is placed will need long-term restrictions and monitoring to help protect the integrity of the cover. EPA anticipates that those areas will receive proprietary institutional controls. EPA's factsheet and other materials clearly stated that a clean cover would not be suitable in areas with active agriculture.

4. *One commenter felt that he and his family and other homeowners should be provided relocation, and the houses torn down.*

EPA responded several times in the past to similar comments from individuals requesting relocation. A very detailed response can be found at comment # 13 in the Responsiveness Summary for Interim Actions for High-Use Floodplain Areas at the TRSR&B Site found as Attachment D to the Action Memorandum at http://epa.gov/region5/cleanup/dowchemical/pdfs/dowchemical_actionmemo_20110526.pdf .

In summary, EPA's preference is to address the actual or potential risks posed by contamination by using well-designed methods of cleanup which allow people to remain safely in their homes and businesses. Because of CERCLA's preference for cleanup, EPA does not routinely consider relocation as a component of a response. There are specific criteria that must be met for either temporary or permanent relocation. EPA does not believe that the properties in the Floodplain meet these criteria. However, if new information becomes available that indicates relocation should be reconsidered, EPA will reassess properties in the Site to evaluate whether relocations may be required in the future.

5. *The same commenter stated that if relocation were not possible, he wants his property to be landscaped to be protected from a 500 year flood.*

Federal, State and local laws and regulations would prohibit such flood proofing landscaping alterations to property in the Tittabawassee floodplain. However, EPA will evaluate TEQ concentrations on the commenter's property to determine if any action is warranted pursuant to this Action Memorandum.

## B. BASIS FOR ACTION AND CONCEPTUAL SITE MODEL

6. *MDEQ commented that the PRGs were developed to be protective for direct human contact (i.e., incidental soil ingestion and dermal contact) and were not developed to be protective for the consumption of animal products raised or produced on Floodplain soils. They propose reliable land use controls, monitoring, and continued education and outreach to ensure that animal products such as livestock and chicken eggs are not produced or consumed from the Floodplain.*

EPA agrees with MDEQ that the PRGs/Cleanup Numbers were not developed to be protective for the consumption of animal products raised or produced on Floodplain soils. The Action Memorandum and Floodplain AOC explicitly state this and recognize that EPA, in consultation with MDEQ, will continue to evaluate those potential exposures and/or risks, and identify separate response actions, as appropriate. Based on observations made at numerous Floodplain properties, this potential pathway does not appear to be currently typical on the Floodplain. EPA, MDEQ and Dow have agreed to set up a process to systematically inventory the properties along the river to determine the number and types (if any) of livestock/ poultry/ poultry product land uses there may be in the Floodplain to target early actions in the short term (if needed) and further address this pathway as appropriate, if needed in the long term.

7. *The CAG and two other commenters expressed concerns that the Floodplain cleanup and the PRGs only address human direct contact exposure and do not address agricultural impacts*

*and bioaccumulation in produce and meat. They commented that this needs to be addressed in a more robust way.*

The 2010 AOC established a comprehensive site-wide management approach for the TRSR&B Site. The site-wide management approach includes developing a set of prioritized actions intended to reduce exposure to and/or transport of contaminated sediment, riverbanks and floodplain soil. Later residual risk assessments, informed by the long-term monitoring plans initiated in concert with these actions, will be used to assess the need for further actions at the site. Using the results of that risk assessment EPA will issue a final Record of Decision(s) for the Floodplain which will address all complete exposure pathways. The Floodplain Action Memorandum is part of the larger site-wide management plan. It selects response actions for addressing human direct contact exposure pathways at the Site. Under Task 10 of the 2010 AOC, DOW will complete a post-construction residual risk assessment after response actions have been implemented. If warranted, EPA will propose and select additional response actions, in consultation with MDEQ.

EPA and MDEQ are working closely with the Michigan Department of Agriculture and Rural Development (MDARD). In or around 2011, at the request of MDEQ, MDARD conducted an observation survey of the Tittabawassee River floodplain and did not find evidence of commercial livestock operations in the floodplain. MDARD has tested produce and found that dioxins are not taken up into the plants typically grown in the floodplain (corn, soybeans and wheat). Dioxins can be found on dirt clinging to produce, but can be removed by washing and/or peeling. As appropriate, EPA will further evaluate these (and other) potential pathways in the post-construction residual risk assessment.

8. *The Trustees agree with EPA that Secondary Constituents of Interest (SCOIs) need to be thoroughly evaluated as part of Task 10 Risk Assessment, or sooner, before the Agencies can determine that the Tittabawassee Floodplain response work is complete. MDEQ stated "The MDEQ strongly recommends that SCOIs that exceed cleanup criteria be addressed at the same time as dioxin so that the potential to have to revisit sites where remedial actions have already been implemented is reduced." MDEQ also commented that additional SCOI data may be needed to support final remedial decisions, and that it could be collected, at least in part, during Floodplain design and implementation. Another commenter asked to what extent the plan would address SCOIs, and whether Dow's liability for those contaminants would be resolved by this cleanup.*

The PRGs/Cleanup Numbers were not developed based on SCOIs in Floodplain soils. The Action Memorandum and Floodplain AOC explicitly state this and recognize that EPA, in consultation with MDEQ, will continue to evaluate those potential exposures and/or risks, and identify separate response actions, as appropriate. EPA agrees with MDEQ that we would like to minimize revisiting properties. However, although some SCOIs exceed MDEQ generic criteria, EPA not yet determined if there is a NCP basis for action for SCOIs in Floodplain soil. These potential pathways will be further evaluated in the Task 10 post-construction risk assessment, or sooner, if appropriate. EPA will work with MDEQ and Dow to see if SCOI data gaps (if any) can be filled during the Floodplain design and implementation. Dow would have ongoing liability for unacceptable risks from Site-related contaminants, including SCOIs.

9. *The Trustees recognize that the current response action in the Floodplain is based on human direct contact of dioxin-contaminated soil. They commented that, in the future, an Ecological Risk Assessment (ERA) must be conducted that evaluates ecological receptors for both dioxins and SCOIs. The Trustees welcome the opportunity to discuss the ERA data and process with Dow and the Agencies at the appropriate time in the response activity schedule. Another commenter asked to what extent the plan would address ecological risks.*

As noted by the Trustees, the current response actions do not address ecological risk. However, exposures to ecological receptors will be reduced in Floodplain areas that receive work based on the Cleanup Numbers. The 2010 AOC sets forth requirements that an ERA will be conducted, but after response actions have been implemented, to assess residual risk. EPA and MDEQ welcome the opportunity to receive Trustee input on the future ERA.

10. *The Trustees commented that the Conceptual Site Model and/or the Remedial Action Objectives may need to be modified in the future, depending on the outcome of the ERA and/or other assessments.*

EPA and MDEQ agree that the Conceptual Site Model and/or the Remedial Action Objectives may need to be modified in the future, depending on the outcome of future assessments.

11. *One commenter was concerned about the dioxin being left in place and asked if the Agencies have authority to require additional cleanup based on the Post-Response Residual Risk Assessment. They asked about Dow's ongoing liability.*

Yes, EPA and MDEQ have authorities to require additional response actions at the Site, if there are actual or potential unacceptable risks. Dow would have ongoing liability for unacceptable risks from Site-related contaminants.

12. *MDEQ and the Trustees believe that the potential significance of erosion of Floodplain soils and associated TEQ back into the river or relocation from one Floodplain area to another has not been determined and that this potential contaminant transport mechanism should continue to be assessed. MDEQ submitted a video showing flooding and overland flow in Imerman Park. MDEQ suggested that land management (e.g., buffer strips along agricultural fields) may be needed to limit the erosion of contaminated soils back into the river.*

As stated in EPA's August 6, 2014 letter to Dow, the conclusions regarding the potential significance for erosion of Floodplain soils (and associated TEQ) back into the river or relocated from one Floodplain area to another, will continue to be assessed. If it is determined that erosion of Floodplain soil may be contributing to an unacceptable risk, EPA will propose and select additional response actions, as needed (including land management, if appropriate).

13. *One commenter was concerned that only the Tittabawassee River Floodplain was being addressed, and stated that the Saginaw River and Bay also need to be addressed.*

The Saginaw River and Saginaw Bay are parts of the TRSR&B Site and EPA will evaluate them, in consultation with MDEQ, under the 2010 AOC. EPA will propose response actions for those areas, as needed. The 2010 AOC established a comprehensive site-wide management approach for the TRSR&B Site. The site-wide management approach includes developing a set of prioritized actions intended to reduce exposure to and/or transport of contaminated sediment, riverbanks and floodplain soil for the purposes of helping to reduce risks to acceptable levels for human health and ecological receptors. Currently, Dow, under EPA supervision, is conducting work in an upstream to downstream sequence. As more of the Tittabawassee River work is complete, attention will shift downstream to Saginaw River and Bay.

**C. CLEANUP NUMBERS**

*14. MDEQ participated in the development of the site-specific PRGs and supports their use on the Floodplain in coordination with reliable land use controls and monitoring to ensure that the use of these cleanup criteria remain consistent with the exposure assumptions that went into their development.*

EPA greatly appreciates MDEQ's participation in the development of the PRGs, which EPA finalized in the Action Memorandum as the Cleanup Numbers. Regarding exposure assumptions, as noted in the Technical Support Document, there may be a very few property uses that do not fit the exposures considered in developing the PRGs. For these properties, a property specific evaluation may be necessary. EPA and MDEQ will address these on a case-by-case basis. The Floodplain AOC requires Dow to develop (among other requirements) a monitoring plan that will evaluate future land use and an Institutional Control Implementation and Assurance Plan (ICIAP) that will address land use controls. EPA looks forward to continued collaboration with MDEQ.

*15. One commenter supported EPA's proposed Cleanup Numbers.*

EPA and MDEQ acknowledge this comment.

*16. The CAG is generally supportive of the dual land-use approach proposed by EPA. However, the individual CAG members are not in full agreement over the specific Cleanup Numbers, but they all agree that they want full protectiveness in places of maximum exposure. They stated that the site-specific Cleanup Numbers appear to be consistent with other numbers being used on the larger cleanup, the CAG understands how site-specific factors were applied to arrive at the proposed levels, but acknowledges that the environmental community believes that EPA's 50 parts per trillion (ppt) screening level should be used.*

EPA and MDEQ acknowledge the comment on dual land use. Since the CAG is a group that represents the broad spectrum of opinions in the community, EPA understands why the CAG is not in full agreement over the specific Cleanup Numbers. EPA and MDEQ believe that the Cleanup Numbers are protective for people who might contact Floodplain soil, including places of maximum exposure. Because there are valid site-specific exposure values, use of EPA's 50 ppt screening level is not required or appropriate. The proposed PRGs/Cleanup Numbers are being selected in the Action Memorandum.

*17. Two commenters objected to EPA's proposed cleanup plan because they felt the PRGs are not stringent enough. They stated that because of the uncertainties with the risk assessment process at this site, the most conservative default settings should be used and that it has not been demonstrated that site-specific adjustments are appropriate. The following are specific comments on why they believe the PRGs are not stringent enough.*

It is EPA's policy to use valid site-specific exposure data, when available and EPA and MDEQ believe that was appropriately done here. EPA and MDEQ believe that the Cleanup Numbers are protective for people who come in contact with Floodplain soil. Therefore, EPA has not modified the PRGs as a result of these comments, and finalized them in the Action Memorandum as the Cleanup Numbers.

*a. They compared the PRGs to other numbers and felt that the site-specific PRGs are "weaker."*

For the proposed cleanup plan for the Floodplain, EPA developed health protective PRG values based on the use of valid site-specific information and conditions unique to the Floodplain as explained in detail in the Technical Support Document. This procedure is consistent with the way the Superfund program develops PRG values at all sites. EPA assumes that the "other numbers" mentioned by the commenter refer to remediation goals and/or PRG values for dioxin contamination derived for locations other than the Tittabawassee River Floodplain. EPA does not believe that the health protection provided by the PRG values developed for the Floodplain is weaker merely because the numerical values are different from those developed for another location. EPA does not believe it is valid to cite the conditions that exist at other locations and extrapolate those conditions to the Floodplain.

*b. They felt that the relative bioavailability (RBA) exposure parameter should not be changed from EPA's default of 100%. They stated that EPA had only limited RBA data and that EPA concluded that there would be no national adjustment to RBA. They also stated that since EPA had no preferred animal model, that animal data should not be averaged, and one commented that no animal model should be used, since all are known to be inadequate in representing human physiology. Finally, they felt that because the RBA studies were done by Dow, they should not be used.*

EPA (2010)[1] concluded that the available information indicated that the RBA of dioxins/ furans for soil ingestion is less than 100%, but there was insufficient information available to determine a national default adjustment to replace the current default of 100% or to supplant the use of site-specific values. EPA clearly confirmed its position that the use of site-specific RBA information for dioxins and furans is a valid factor to consider during the development of PRG values. http://epa.gov/superfund/health/contaminants/dioxin/dioxinsoil.html

[1] EPA (2010) *Final Report: Bioavailability of Dioxins and Dioxin-like Compounds in Soil.* Office of Superfund Remediation and Technology Innovation, Environmental Response Team – West; Las Vegas, NV. http://www.epa.gov/superfund/health/contaminants/dioxin/pdfs/Final_dioxin_RBA_Report_12_20_10.pdf

EPA (2010) indicated that there is not a preferred animal model for dioxin and furan RBA based on the current information available, but did not conclude that there should be no animal models used to develop site-specific RBAs. For the Tittabawassee River Floodplain, RBA data was available for two animal models, rat and swine. Since there is not a preferred animal model, average values from the two animal models were used to develop the Floodplain PRGs.

Although the studies were contractually paid for by Dow, the RBA study designs and results were reviewed by an independent science advisory panel with oversight from the MDEQ. (The study documents are available at: http://www.michigan.gov/deq/0,1607,7-135-3312_4118_4240-193506--,00.html) The Superfund program requires the responsible party(ies) for a site to propose and fund data collection necessary for decisions by EPA or the authorized state agency, with oversight and approval of the work by the authorized agency.

c. *One commenter stated that other EPA default exposure values should not be changed because changing the defaults decreases the overall protectiveness. These exposure parameters include: exposed skin surface area; dermal absorption fraction; and increased worker body weight*

When conducting risk assessments including assessments to develop PRGs, EPA applies "default" or "generic" numerical values to exposure parameters when site-specific parameter data are not available or when a site-specific exposure situation has not yet been defined. If reliable site-specific data become available or if a localized exposure situation can be defined, then EPA will modify the default exposure parameter value to reflect the specific information. In addition, for parameters that cannot be assigned site-specific values, EPA conducts periodic reviews of newly published scientific data to determine if a default parameter value should be modified by replacement with a new updated value. For the Floodplain PRG assessment, EPA determined (in consultation with MDEQ) that a few exposure parameter values should be modified:

Exposed skin surface area - EPA determined that values used to estimate this parameter for the various exposure groups (e.g., young children, adolescents, teenagers, adults) should reflect the local situation taking into account which body parts would be expected to present exposed skin surfaces under the climate conditions and activity practices expected in the Floodplain areas. EPA calculated the skin surface area values by following the published guidance protocol as explained in detail in Appendix A of the Technical Support Document (*Site-specific Preliminary Remediation Goals for Tittabawassee River Floodplain Soil*; August 2014).

Dermal absorption fraction - Dermal absorption refers to the translocation of a substance across the skin to the point where it is introduced into the circulation. This is a chemical-specific parameter which is estimated quantitatively by an efficiency value which is dependent on the nature of the chemical, the ability of the chemical to desorb from the soil matrix, and the ability of the chemical to penetrate the soil barrier layers. For dermal

absorption efficiency of dioxin-like constituents represented by TCDD, EPA originally evaluated the available scientific literature studies from the 1992 time frame to estimate a dermal absorption efficiency value of 3% for low organic carbon soils. Since that time, EPA performed and published its own updated studies on TCDD dermal absorption efficiency (2008). As a result of those studies, an updated absorption efficiency value of 2% is recommended for the type of soils encountered in the Floodplain (Technical Support Document; Section 2.4.5). In practice, the modification of the dermal absorption efficiency from 3% to 2% has a minimal effect on the calculation of PRG values.

Increased worker body weight - EPA has reviewed the published studies and other available information on body weight and the relationship between age and body weight in order to provide recommendations for incorporating values for this parameter into risk assessments. This comment apparently refers to the assignment of an updated body weight value of 81.8 kg for an adult worker instead of the earlier "default" value of 70 kg (Technical Support Document; Table 2). The updated value reflects EPA's review of the most recent published data on adult body weight (Exposure Factors Handbook, 2011). It should be noted that the key PRG values developed for the Floodplain (i.e., 250 ppt for Residential Maintained Areas; and 2000 ppt for Other Land Uses) are based on the young child as being the most sensitive receptor for soil exposure. Therefore, the modification of the adult body weight does not impact the remediation goal selected for the site.

d. *They felt the inhalation pathway should be included, particularly when considering farmers.*

This comment apparently refers to the possibility that an inhalation pathway for dioxin in soil could occur from inhalation of dioxin-like constituents volatilized from soil or via inhalation of air-borne soil particulates containing dioxin-like constituents. EPA conducted a modeling exercise to evaluate whether inhalation of dioxin-like constituents from soil could be a significant exposure pathway that should be factored into the development of PRG values. The results of the analysis determined that the inhalation pathway would be a very minor contributor to total exposure dose compared to the exposure contributed from the combination of soil ingestion and dermal absorption. The quantitative analysis showed that inhalation exposure to dioxin (particulates and vapor) is expected to be low (< 2.4%) compared to the combination of oral and dermal absorbed doses. This modeling was documented in Attachment 1 to EPA's *Public Review Draft, Draft Recommended Interim Preliminary Remediation Goals for Dioxin in Soil at CERCLA and RCRA Sites* issued for public comment in December 2009[2]. In that document, EPA scientists concluded that inhalation exposure would not be included for the draft recommended interim PRGs, because at present, there is no available inhalation unit risk value for dioxin that has been derived in accordance with current guidance for inhalation risk assessment, and risks due to inhalation of particulates and vapors are expected to be minimal.

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[2] EPA's "Public Review Draft, Draft Recommended Interim Preliminary Remediation Goals for Dioxin in Soil at CERCLA and RCRA Sites"
http://www.epa.gov/superfund/policy/remedy/pdfs/Interim_Soil_Dioxin_PRG_Guidance_12-30-09.pdf

e. *They believe that the use of 260 days of outdoor exposure underestimates exposure, because of potential climate change.*

Executive Order 13653 of November 1, 2013 directs Federal Agencies to integrate consideration of climate change in managing lands and waters (FedCenter 2013)[3]. The Order calls for "adaptive learning, in which experiences serve as opportunities to inform and adjust future actions." The Superfund program is consistent with the concept of adaptive learning. At this time, the effect of climate change on the exposure frequency for the Tittabawassee River Floodplain is unclear. The outdoor exposure frequency used for the PRGs is a high end value assuming exposure on all days without frozen soils or snow cover and does not consider days that the floodplain is inundated during a flooding event. The proposed Floodplain cleanup plan is a non-time critical removal action. In the future, EPA will make a remedial decision(s) for the Floodplain and climate change will be considered, as needed, as a component of that decision process. Superfund also requires a Five-Year Review when hazardous substances remain on a site above levels which permit unrestricted use and unlimited exposure, during which the continued protectiveness of remedies is evaluated. If there is significant climate change in the Floodplain that calls into question the site-specific exposure frequency, it will be evaluated in a Five-Year Review.

f. *They commented "A young child, up to 6 years old, could very likely play within the 8-year floodplain in unmaintained areas adjacent to the river. Assuming that a child will not frequent these areas is not a valid assumption, is not supported by any data and is certainly not protective of human health."*

The site-specific evaluation of property use in the Floodplain assumed that a young child (up to 6 years old) could visit within unmaintained areas of a residential property. It is possible that the unmaintained area could include a strip of land adjacent to the River. The evaluation assumed that a young child could visit an unmaintained area on 7% of the 260 days per year when outdoor direct contact exposure to soil could be expected. For those unmaintained areas, the protective PRG value is 2000 ppt. If, on the other hand, a residential property has a maintained area that extends all the way down to the river bank, then the applicable PRG value is also 250 ppt for the part of the river bank that is residential maintained. Surveys will be performed to determine which portions of individual residential properties are maintained or unmaintained.

g. *One commented that any residential land use area, whether "maintained" or "unmaintained" should be held to the same cleanup level.*

As described in the Technical Support Document, the use of residential land in the Floodplain was evaluated. Current residential properties located in the Floodplain appear to have two readily definable categories or types of use that result in a distinctly different potential for frequency of use and, therefore, distinctly different potential for soil exposure. The Maintained Residential Areas are those associated with frequent activity because they

[3] FedCenter (2013 *Executive Order 13653, Preparing the United States for the impacts of Climate Change.* https://www.fedcenter.gov/Articles/index.cfm?id=24801&pge_id=1854

are open spaces available for activities such as gardening or recreational activity. This is the use type for which the sensitive young child receptor (i.e., age 1 to 6 years) is expected to experience the highest frequency and opportunity for direct soil contact exposure. (Potential exposure to the young child is the basis for the health protective PRG values derived for the Floodplain.) The Unmaintained Residential Areas are those portions clearly **not** maintained for frequent residential activity, and are consistently characterized by woodlots, brush, wetlands and other areas not subject to regular mowing or other maintenance. The potential for visits (in terms of number of outdoor days per year) by the sensitive young child to those areas is clearly less than the maintained areas. Consequently, it is valid to develop two distinct PRG values which are both health protective based on the known uses of residential property in the Floodplain.

h. *They felt that there are too many subcategories for the land use category "Other Land Uses" to adequately create a protective PRG. One commenter felt that human contact with soil on a farm is frequent.*

Maintained Residential Land was recognized as the primary situation for which a protective PRG value would be needed because of direct soil contact by young children. Then, other land uses were evaluated to identify the likely types of human activities and expected frequency for human visitation. A number of likely land use types or "categories" were identified as explained in the Technical Support Document. Then the PRG values were calculated for those land categories taking into account which subgroups could visit those sites (i.e., young child, adolescent, teenager, adult). The results showed that the PRG value was lowest for a young child visiting Unmaintained Residential Land (2000 ppt). Consequently, the PRG value for Unmaintained Residential Land is also a protective PRG value to apply for all Other Land Use categories. Contact with soil on a farm could occur, and that situation was evaluated as potential exposure to an adult agricultural worker. As explained above, the Other Land Use PRG value based on potential soil contact by a young child is also protective for an adult farm worker.

i. *They felt that the already present body burden of dioxins from other exposures (particularly food) should be considered when calculating the PRGs.*

Superfund risk assessment is an analysis of the potential adverse health effects (current or future) caused by hazardous substance releases from a facility in the absence of any actions to control or mitigate these releases (i.e., under an assumption of no action). The primary goal of the CERCLA program is to protect human health and the environment from current and potential threats posed by uncontrolled releases of hazardous substances, pollutants, and contaminants. In some cases, the same hazardous substance, pollutant, and contaminant associated with a release is also a background constituent, e.g., a body burden from other sources that are not uncontrolled releases, such as food (*Role of Background in the CERCLA Cleanup Program*, OSWER 9285.6-07P, April 2002).

The PRGs that EPA developed are based on a non-cancer Reference Dose (RfD) developed from studies of human exposures to TCDD alone. At the time of those studies, the human subjects had exposures to other dioxin-like chemicals that are greater than the body burdens

of dioxin-like chemicals of more contemporary people living in the U.S., Michigan, and the Tittabawassee River Floodplain. The greater body burdens for people in the studies used to establish the RfD to non-TCDD dioxins and furans that were not considered in the dose-response evaluation for the RfD would offset typical dietary exposures that occur today. See the attached Table 1 below for comparisons.

*j. One commenter said "The non-cancer RfD is based on the oil gavage control in rats and the dough-ball control in the swine which are simply 50% and 80% of the soil fed doses given to the non-control animals. Creating these values from faulty methodology and ignoring the current non-cancer RfD is unprotective."*

EPA disagrees with the commenter that our methodology was faulty and that our values are unprotective. EPA did not ignore the non-cancer RfD in setting our Cleanup Numbers.

The non-cancer RfD is based on human data with bioavailability as measured from TCDD in oil. To develop an appropriate RBA for application with the RfD, the soil bioavailability needs to be measured relative to oil. The RBA values for the PRGs are calculated by dividing the fraction of the administered dose retained in the tissues of the soil-feed animals by the fraction of the administered dose retained in the tissues of the oil gavage animals.

The 50% and 80% of the soil feed doses mentioned were the oil gavage concentrations compared to the soil-feed concentrations used for the follow-up bioavailability study in the rats for the Floodplain soil. This approach was not necessary for the swine data. The approach using different percentages of the soil dose in the oil gavage was necessary for the rat data based on the initial pilot study results. These pilot study results showed that there was greater enzyme induction and hepatic retention in the oil gavage animals as compared to the soil-feed animals. This enzyme induction and hepatic retention may have resulted in increased metabolism/elimination of dioxins/furans in the gavage animals that would cause an overestimation of soil RBA.

To address these problems, the follow-up study used three gavage doses (20%, 50% and 80%) to flank the potential soil-feed uptakes to minimize differences in elimination rates between the two groups. The enzyme induction and hepatic retention for the soil feed animal group was between the 50% and 80% oil gavage groups. The differences between the 50% and 80% oil gavage groups for TEQ adjusted RBAs was minimal (58-60%). Only the 2,3,7,8-TCDF congener appeared to have increased metabolism/elimination from enzyme induction in the oil gavage rats from the pilot study that overestimated the soil RBA.

*k. One said that cancer, instead of non-cancer health effects, should be the driver behind the PRGs.*

Based on the regulations that apply to Superfund site remediation and long-standing EPA policy, PRG values selected for a site need to take into consideration protection for both non-cancer and cancer health endpoints. PRG values are selected to provide protection against cancer effects by applying EPA's target risk range of one in ten thousand to one in one million for a potentially exposed individual, and to provide adequate protection against non-

cancer effects based on a Hazard Index[4] of 1. For the goal of applying the best current science as the basis for its cleanup actions, EPA announced that the Agency will use the final non-cancer RfD for TCDD to address cleanup projects under Superfund: (http://www.epa.gov/superfund/health/contaminants/dioxin/dioxinsoil.html).

The TCDD non-cancer RfD applies to the development of site-specific PRGs. EPA first applied the RfD to develop appropriate PRGs for the Floodplain because it specifically addresses potential exposure to the young child as the most sensitive subgroup. The PRG value of 250 ppt for residential maintained property was determined to be protective for non-cancer effects. EPA performed a separate evaluation for estimating cancer risk for multiple subgroups, and determined that the 250 ppt value also falls within the required cancer risk range. Similarly the PRG value of 2000 ppt for unmaintained property was determined to be protective for non-cancer effect, and also falls within the required cancer risk range.

18. *Two commenters stated that the PRGs are not protective of ecological receptors or the ecosystem.*

See the response to comment 9, above. The current response actions do not address ecological risk. However, EPA will conduct an ERA as part of the on-going site investigation to assess residual risk. If warranted, EPA will develop additional PRGs and/or response for ecological receptors.

19. *One commenter was concerned that the maintained residential PRG will only apply to 5% of the Floodplain, while the other "less protective" PRG will apply to 95% of the area.*

The PRGs were developed based on the likely exposures that could come from different land uses, not on the proportion of the Floodplain to which they would apply. Under the Floodplain AOC, Dow will submit a plan for periodic monitoring of the Site to ensure that future land use is consistent with the site-specific TEQ Cleanup Number(s) used to determine if work was needed at that property parcel. In the future if an Other Land Use Area changes to Maintained Residential Area, Dow and EPA will re-evaluate the property parcel against the 250 ppt site-specific Cleanup Number to determine if any additional work is necessary.

20. *Dow agrees with the Agency's approach of using site-specific Cleanup Numbers for determining if remedy is necessary.*

EPA and MDEQ acknowledge this comment.

21. *Dow believes many of the assumptions that went into determining the cleanup numbers are conservative and that there are scientifically supportable alternative values for input parameters that would have yielded alternative PRGs that are also protective. They stated "The PRG values are calculated values based on an extensive set of assumptions about long term behaviors, bioavailability, and soil concentrations that reflect both conservative default*

[4] A Hazard Index is the ratio of the site-related exposure compared to an exposure level that is safe for non-cancer effects.

*values and conservative site-specific assumptions." Dow specifically mentioned the following factors as those which could be subjects for scientifically supportable alternative values: TEQ in Maintained Soil Outside the 8-Year Floodplain; Skin Surface Area; Oral Bioavailability; Soil and Dust Ingestion; and Outdoor Days per Year.*

EPA recognizes Dow's assertion that the Cleanup Numbers (PRGs) selected by EPA are based on generally conservative input assumptions that includes a mix of average and high end exposure assumptions for evaluating health risk. Scientifically based alternative input values could result in alternative PRGs which may also be considered health protective. When developing the selected PRG values, EPA considered a number of input assumptions which could be based on appropriate site-specific information. In consultation with MDEQ, EPA determined that site-specific information was valid and supportable for the following input factors: a) local climate conditions to estimate outdoor soil exposure days and indoor only dust exposure days; b) dioxin concentration levels in dust are lower than in Floodplain soil and a conservative value could be assigned to the dust dioxin level; c) a relative bioavailability value could be selected to account for the fraction (i.e., percentage) of dioxin in Floodplain soil that could be absorbed into the human body (the bioavailability value selected was based on the EPA and MDEQ review of tests Dow conducted in lab animals using Floodplain soil); and d) private property and other land in the Floodplain is used in different ways including property maintained for residential use, residential property that is unmaintained, and natural or work areas (e.g., parks and farmland). EPA determined that it was appropriate to assign specific exposure frequencies to those areas during the process of calculating PRG values. Consequently, EPA believes that it made a thorough evaluation of site-specific information that could be applied to the development of PRGs for the Floodplain.

22. *Dow commented that "the EPA-calculated PRGs clearly reflect goals for soil levels that are highly conservative, since even current conditions have not led to detectable elevations in blood dioxin levels in adult residents." They cited the University of Michigan Dioxin Exposure Study (UMDES) blood levels of dioxins measured in more than 251 adult residents in the floodplain and more than 440 adult residents in the areas surrounding the floodplain as well as in the City of Midland. They said that the UMDES found no significant increases in blood dioxin levels related to soil concentrations were observed in these adults. They also cited consistent blood level results in other studies of populations residing on or near soils with elevated dioxin levels*

The EPA and MDEQ recognize that the UMDES provides valuable information on soil, dust, and blood dioxin, furan and coplanar polychlorinated biphenyl concentrations. Please see EPA's review of the UMDES study (EPA 2009)[5].

However, the relationship between blood dioxin levels and soil concentrations is based on statistical modeling using population-weighted sample results. This modeling is influenced overwhelmingly by the control groups (Jackson/Calhoun 70% and other Midland/Saginaw 28.5%) with large populations. The floodplain population was significantly smaller providing

[5] EPA (2009) *Review of the University of Michigan Dioxin Exposure Study.* U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-09/117, 2009. http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=214244

less than 1% influence on the population weighted model results. No analyses of these relationships were conducted with unweighted samples. In addition, for the dataset used for the statistical modeling, any missing data other than blood data was estimated. For the floodplain house perimeter, floodplain, and soil contact locations, soil samples were missing for 19-47% of these datasets, so estimated values were used for the modeling.

23. *Because of the exposure assumptions that went into the PRG and the desire to minimize impacts in areas of valuable habitat, several commenters suggested that there should be flexibility in the application of the 2,000 ppt Other Land Use PRG. The CAG stated "The community as a whole views the loss of trees as a significant mitigating factor in applying strict cleanup levels ..." and "... there needs to be a clear approach and criteria for making exceptions. For example, there are many large stands of trees that could be placed in a permanent easement and that have little or no chance of use by the most sensitive receptors." Dow and another commenter felt that many areas of the floodplain (e.g., wetlands or areas remote from residential properties) are essentially inaccessible to residents for direct contact on a regular basis and that protection of habitat should be considered for these areas, rather than the strict application of the 2,000 ppt PRG.*

EPA and MDEQ recognize that there may be limited instances where property uses in the Floodplain do not fit the exposure scenarios considered in developing the PRGs. Therefore, the Action Memorandum for the Floodplain provides the flexibility for EPA, after consultation with MDEQ, to conduct a property-specific exposure evaluation, with the possibility that there could be a property-specific direct contact TEQ cleanup number that results in the preservation of habitats and ecosystems determined by EPA to be of exceptional quality. Among the factors that EPA will consider are: consistency with the exposure assumptions used to develop the site-specific criteria; the importance of the existing habitat/ecosystem; how remote the area is; the likelihood of human access; likely future use; and other relevant factors. If any such property-specific TEQ cleanup number is developed, it will be done so consistent with the NCP, and will address non-cancer risks to meet a Hazard Quotient of 1 and cancer risks to meet EPA and MDEQ acceptable ranges.

24. *One commenter questioned whether the 2,000 ppt PRG for non-maintained is reasonable for families that often use these areas to fish, camp or walk. The commenter also works with youth groups, and wants to make sure that people who use the Floodplain are safe.*

EPA recognizes that non-maintained areas may present a potential soil contact point for persons who live along or visit the Floodplain, but those areas are not visited on a daily basis. To develop the PRG for non-maintained land, EPA assumed that the sensitive young child who lives along the Floodplain would also visit these areas, and a reasonable number of visitation days was assigned. Older children, teens and adults would be expected to spend more time than the young child in non-maintained areas, however these receptors are not as sensitive as the young child. Consequently, the PRG value calculated for health protection for a young child is also protective for other groups including older children and adults, who are expected to use non-maintained areas more frequently. The cleanup numbers are protective for using non-maintained areas for activities like fishing, camping or walking.

*25. One commenter felt that the Site will never be clean.*

EPA is currently regulating the site under CERCLA which provides enforcement authority to provide for human health and environmental protection from the site hazardous substances. While this complex and large site may take many years to attain these protectiveness goals, EPA is committed to seeing this site cleanup to completion.

## D. COMMUNICATION

*26. The CAG is concerned about the overall public understanding of the cleanup approach and the perceptions and information needs of affected landowners.*

EPA has already conducted extensive community outreach on the Floodplain cleanup, particularly with the property owners (see Section II, above). EPA is very aware that extensive outreach is needed on an ongoing basis throughout the cleanup. EPA will work with Dow and MDEQ to enhance public understanding and meet the community's information needs. Additionally, as we have in the past, EPA may request a CAG sub-committee to work with EPA on community engagement plans and materials.

*27. The CAG believes that EPA needs to more clearly explain how the PRGs were developed, how they compare with other numbers, and the reasons for the differences.*

EPA, in consultation with MDEQ, created *Cleanup Numbers Developed for Tittabawassee River Floodplain* – a short fact sheet describing the PRGs, and the Technical Support Document – a long technical memorandum describing development of the PRGs. EPA believes that these documents, combined with the responses herein, provide much of the information that the CAG is requesting. However, during implementation of the cleanup, if EPA finds that additional information on the Cleanup Numbers is needed by the public, EPA will develop that information.

*28. The CAG believes that a consistent and transparent approach to identify which soils must be removed is essential and communicating this approach up-front will be important to public understanding and participation in the cleanup.*

EPA and MDEQ agree. Under the Floodplain AOC, Dow will develop a General Design and Implementation Work Plan that will include sampling strategies and decision rules for cleanup determinations. As details are developed, EPA will communicate that information to the CAG and public.

*29. The CAG is concerned that there may be significant landowner refusal in having their properties cleaned. The CAG believes that people need to understand the full ramifications of what they are signing, and may need to have significantly more information than is available, including information on the rights of property owners and the potential for future modifications to and uses of their properties.*

EPA is also concerned that there may be owners that refuse to have their properties cleaned up. EPA has stated that we do not intend to require a cleanup on a property if the owner objects.

EPA will provide property owners detailed information on the work planned for their properties and owners will have input on those plans. Through that input we hope to deal with any reservations and EPA will work very closely with owners to reconcile any concerns.

30. *The CAG commented that new buyers will need to be informed of the restrictions on their properties, and ongoing monitoring and enforcement of these controls will be required. Another commenter asked how property restrictions would be communicated and enforced, and how that would be funded, since working closely with landowners seems to be a perpetual necessity.*

EPA agrees the future buyers of Floodplain property will need information on any restrictions that may be associated with the property. As mentioned above, the Floodplain AOC requires Dow to develop a monitoring plan that will evaluate future land use and an ICIAP that will address land use controls. These plans will address long-term communication, monitoring and enforcement of property controls. Dow will be responsible to implement the plans, with oversight by the Agencies.

31. *The CAG asked that EPA provide more information on institutional controls, what they are, how they are applied, and the ramifications for landowners. They are concerned about consistency and making sure that landowners understand ramifications.*

EPA will provide more information to the CAG on institutional controls and how land use restrictions will be communicated to the public.

32. *One commenter asked what actions would occur to educate people about game consumption advisories.*

Since about 2005, Dow has been implementing Communication Interim Response Actions (IRAs) under a plan approved by MDEQ. Among other things, the Communication IRAs require Dow to reproduce and distribute copies of informational materials authored by MDEQ and the Michigan Department of Community Health (MDCH). These materials are provided to numerous public use locations such as libraries and government offices in the area, and include information about game consumption advisories. Additionally, EPA provides direct grant funding to MDCH to allow MDCH and local partners to provide education and information to the public about consumption advisories. A major focus of the grant targets providing information and education to sensitive populations and those more likely to be exposed.

## E. REMEDY IMPLEMENTATION

33. *MDEQ offered to work with EPA and Dow to develop a robust implementation plan for the application of the site-specific Cleanup Numbers with the goal of minimizing the impact of the activities on affected property owners while getting necessary cleanup work done. In particular, MDEQ wants to adequately address the uncertainty in the application of these Cleanup Numbers in the determination of what properties, or portions of properties, require remedy.*

EPA looks forward to an ongoing coordination with MDEQ on the Floodplain cleanup. EPA anticipates that there are "lessons learned" from the dioxin soil cleanup in the City of Midland conducted by Dow and overseen by MDEQ that may be useful. MDEQ will have an opportunity for input on all of the design plans, including decision rules related to the Cleanup Numbers.

*34. MDARD consulted with MDEQ in the review of EPA's proposed remedy and recommends that additional data be generated and evaluated for agricultural activities and products.*

Consistent with the 2010 AOC, EPA will work with MDEQ and Dow to evaluate what data is needed for the Task 10 post-construction risk assessment. If data gaps exist, EPA will work with MDEQ and Dow to fill those gaps. EPA expects MDEQ to continue to coordinate with MDARD on this issue.

*35. The Trustees commented that they would like to continue to work with the Agencies and Dow to get information on current conditions, prior to the implementation of cleanups.*

EPA anticipates an ongoing opportunity for the Trustees' participation in the Floodplain cleanup.

*36. The Trustees recognize the challenge of balancing the risk of leaving some contamination in place with the damage caused by destruction of Floodplain forest and wooded banks under some response scenarios, and want to continue to work with the Agencies and Dow to minimize, to the extent practicable, both risk and damage to the environment.*

EPA and MDEQ recognize the tradeoffs that may occur in natural areas of the Floodplain as a result of cleanup. As discussed above in the response to comment 23, the Action Memorandum for the Floodplain provides the flexibility for EPA to potentially develop property-specific numbers, on a case-by-case basis, in ecologically important areas that have little chance of use by the most sensitive receptors. EPA and MDEQ welcome the opportunity to work with the Trustees to minimize, to the extent practicable, both risk and damage to the environment.

*37. The CAG and another commenter commented that they are concerned about the ability to maintain the remedy over time and ensure that future changes to property do not present harm to human health. They want to ensure the transparency, effectiveness, and reasonableness of monitoring, maintenance, and institutional controls, and asked:*

*a. Who will perform the monitoring, how frequently, and how will it be enforced?*

Dow will conduct the monitoring, with oversight by the Agencies. The Floodplain AOC requires Dow to develop and implement several plans that establish requirements, including monitoring after the physical cleanup of properties is complete. Those plans are not currently available, but will be developed on an approved schedule. So, specific details such as frequency of monitoring are not available at this time. As plans are developed, additional information will be shared with the CAG and public. The terms of the Floodplain AOC allow EPA to enforce these requirements.

b. *How will monitoring be conducted post flood events to ensure that EPA assumptions are accurate?*

The approach to post-flood monitoring throughout the Floodplain has not yet been determined. The Floodplain AOC requires Dow to develop and implement a "plan for periodic monitoring of the Site to assess post-flood conditions and potential recontamination." At other Floodplain locations where cleanup has been done, Dow has taken surface soil samples from specified locations after spring flood events. So far, recontamination has not been a concern. However, hydrodynamic conditions vary throughout the Floodplain, and additional monitoring is expected. It is also expected that upstream river sediments and banks will receive response actions before the downstream Floodplain areas. This will minimize the potential for recontamination of the Floodplain.

c. *Who will manage the long-term use of property, and be responsible for information and enforcement during property ownership changes?*

Please see the response to comment 30, above.

38. *A significant concern of the CAG is the wholesale removal of trees and other vegetation to implement the remedy. The CAG hopes that a significant effort will be made to ensure that the largest and oldest trees can be saved whenever possible. They stated "In cases where significant soil is removed, the soil backfill used to ensure long-term revegetation should be of a quality consistent to what is removed, and the vegetation itself should provide consistent aesthetic appeal. For example, removing a mature forest and replacing it with grass is simply not acceptable."*

EPA and MDEQ are very aware that the CAG and the community are concerned with large scale removal of trees, vegetation and habitat. To the extent possible, design planning will try to minimize these impacts. However, most plants and trees in the work areas will probably need to be removed. The project team will work with owners to see if specific trees or ornamental features can be left in place. Soil backfill will be suitable for replanting. The project team will work with each owner to come up with an acceptable plan to restore vegetation when the cleanup is complete.

39. *The CAG and another commenter raised questions about use of a clean cover on private property and the implications for homeowners on their property. They commented that it seems that clean covers would significantly restrict use of property, ability to garden, build and conduct other activities; and that these restrictions need to be clearly articulated for landowners. They asked how the restrictions would be communicated and enforced, and who would be charged with the task. They asked for an explanation of how clean cover areas are monitored and maintained. They also asked for an explanation of the landowner responsibilities with regard to maintenance.*

Please see the response to comment 3, above. EPA agrees that any area over which a cover is placed would need long-term restrictions on the use of that part of the property. EPA's selected remedy does not provide for clean covers on Maintained Residential Area. Covers could be

implemented in Other Land Use Areas, but EPA would only allow a cover to be used if the landowner understood and agreed to the long-term restrictions, monitoring and maintenance required. Dow will conduct the monitoring and maintenance, with oversight by the Agencies. Landowners are not expected to have responsibility for maintenance. However, they would be expected to exercise due care of the cover to avoid intentional damage. As discussed in the response to comment 37.a, details on monitoring plans are not yet developed. They will be shared as they become available.

*40. One commenter felt that Dow should continue to do maintenance on the IRAs on their property every year after flooding.*

It is EPA's intent that Dow will continue to perform maintenance on Floodplain IRAs until either a cleanup is completed or EPA determines that no cleanup is needed. For the IRAs currently in place, maintenance may not be required on a yearly basis – the condition of the IRA will determine the frequency of maintenance.

*41. Some commenters are concerned that the focus is on the 8-year floodplain, rather than the 100-year floodplain or the areas flooded in 1986.*

The focus on the 8-year floodplain is a result of the data distribution from the extensive soil sampling that has been conducted to date. TEQ samples were collected outside of the 8-year floodplain boundary, but within the 100-year floodplain. The average level of the surface soil samples located outside of the 8-year floodplain is 20 ppt TEQ, the median is 13 ppt TEQ, and the 95% upper confidence limit is 26 ppt TEQ. These levels are below U.S. EPA's screening values. The 8-year floodplain boundary was delineated using aerial photographs taken during the March 2004 flood event. In a few cases, TEQ levels in surface samples outside of the 8-year floodplain boundary that are elevated may reflect slight inaccuracies with the 8-year boundary line or relocated soil. These instances will be considered when evaluating Floodplain areas that warrant response actions.

*42. One commenter asked why isn't all contaminated soil going to Dow's hazardous waste landfill, where the company is already responsible for ongoing monitoring and maintenance?*

The final location for disposal of soil removed from the Floodplain has not been determined, and could ultimately include multiple disposal sites. Disposal locations will be finalized as design plans are developed. Possible disposal locations include local landfills or at an approved location(s) at Dow's Midland plant. If soils are disposed at Dow's Midland plant, Dow will be responsible for long-term monitoring and maintenance. Local landfills will also have long-term monitoring and maintenance obligations.

## F. PROPERTY USE

*43. The CAG expressed concerns over how land uses will ultimately be designated, how much control current and future landowners will have in designating their property use, and what rights will they have to future cleanup. Another commenter stated that residents should be able to change how they use their land, whether maintained or unmaintained.*

Current land use will be the basis for determining which Cleanup Number applies to a property. On some property parcels, both Cleanup Numbers may apply. EPA is not placing any limits on how owners use their land in the future. However, the project team may ask property owners for voluntary long-term agreements on the future use of particular Floodplain areas. For example, long-term agreements could keep land undeveloped and natural through conservation easements or other agreements. As discussed in the response to comment 19, above, if an Other Land Use Area changes to a Maintained Residential Area, Dow and EPA will re-evaluate the property parcel against the 250 ppt site-specific Cleanup Number to determine if any additional work is necessary.

*44. The CAG stated that regardless of land use designation, access to the waterfront will be an important issue. They want to ensure long-term access to the river and appropriate control over personal property. They want the CAG and the public to understand whether "other uses" allows for accessing the river, paths, boat docks, riverside recreational activities, etc.*

EPA and MDEQ agree that access to the waterfront is important. The Cleanup Numbers were developed to be protective for riverside activities such as paths, access areas, recreational uses, etc. EPA will work with MDEQ and Dow to ensure that owners know that these activities are allowed and safe. As discussed immediately above in the response to comment 43, EPA is not placing any limits on how owners use their land in the future.

*45. One commenter asked how he could use Floodplain areas that are not currently landscaped or developed. He asked if it is safe to clear an area for use as a yard or garden.*

If an owner clears an area to use as a yard or garden, that part of the property will be compared to the Maintained Residential Areas Cleanup Number to determine if a cleanup is needed. Until a property is cleaned up or EPA determines that no cleanup is needed, there are steps people can take to help limit their exposures. MDCH and MDEQ have guidelines to help reduce contact with Floodplain soil such as having play areas and gardens away from areas that flood frequently, washing up after contact with Floodplain soil and trying not to track Floodplain soil into the house. http://www.michigan.gov/mdch/0,1607,7-132-2945_5105_29181-113198--,00.html

*46. One commenter felt that the property owner should have control of the cleanup for their property.*

If a property needs a cleanup, owners will have an opportunity for input on their property-specific design and the schedule for the work. EPA does not intend to proceed with cleanups without the property owner's permission.

*47. One commenter said that more sampling is needed for the proposed nature preserve in Thomas Township to make sure what levels are there.*

EPA and MDEQ believe that more sampling will be needed in some cases, to determine whether a property needs a cleanup or to help delineate the cleanup boundary. No determination has been

made yet about whether the property in question will need more sampling. EPA will continue to work with Thomas Township on this issue.

*48. One commenter said that he was told not to use his yard, and that areas with previous IRAs have been flooded.*

EPA has not told owners not to use their yards. EPA has communicated to owners that MDCH and MDEQ have guidelines to help reduce exposures to Floodplain soil. (Please see the response to comment 45). For properties where IRAs have occurred, if they need monitoring or maintenance after flooding, owners can call Dow's hotline at 989-638-6100.

## G. RECONTAMINATION AND FLOODING

*49. One commenter asked if anything is being done in the river, so that cleanup is not needed every time it floods. Another commenter asked about potential recontamination of remediated areas, and what will done in the event of recontamination. MDEQ commented that ongoing monitoring will be necessary to ensure that if recontamination of remediated areas occurs, actions will be taken to address the recontaminated property.*

Recontamination after flooding is a potential, but is not expected to occur at levels that would require additional cleanup. The site strategy is generally following an upstream-to-downstream approach. Distinct sediment deposits and riverbank areas that may be sources of dioxins when they erode are being targeted for cleanup. These upstream river cleanups are expected before the downstream Floodplain cleanups. This upstream cleanup, combined with current management practices that control releases from Dow's facility, will help prevent recontamination. Dow is currently monitoring places with previous cleanups (for example, West Michigan Park and Riverside Boulevard) to assess the potential for recontamination. So far, it has not been a concern. However, if recontamination were to occur at levels exceeding the Cleanup Numbers, additional cleanup would be required. There will be a monitoring program in place to assess this.

*50. One commenter felt that there are opportunities for conservation and wetland protection. He suggested looking into partnerships with the U.S. Department of Agriculture and/or the Shiawassee National Wildlife Refuge to increase incentives for conservation.*

EPA agrees with this comment. As appropriate, EPA, MDEQ, and Dow will look for opportunities to partner with other entities. Although conservation is not an explicit goal of the selected response actions, lands in conservation agreements may help assure long-term future use of lands not cleaned to the Maintained Residential Areas Cleanup Number.

## H. DIOXINS AND HEALTH

*51. One commenter felt that EPA should monitor residents to see if there are statistically relevant health effects, and if not, take no action.*

EPA and MDEQ both have cleanup programs that are based on reduction of actual or potential risk. Both Agencies rely on their scientists, including toxicologists, to advise the cleanup programs on the potential risks and toxicity of environmental contaminants. EPA and MDEQ have concluded that dioxins may cause cancer or other health effects such as thyroid problems and reproductive issues, and at higher doses, skin problems and liver damage. Because both Agencies have conservative protection goals, neither Agency relies on measurable adverse public health effects before addressing potential unacceptable risks. The idea is to take action before measurable effects occur, if possible.

*52. One commenter who lives along the Floodplain and whose home uses a groundwater well is concerned that the water they drink and the dirt in their yard may cause health effects to their family.*

The Cleanup Numbers were developed to ensure that residents are safe when they contact soil in their yard. This commenters yard will be evaluated and either cleaned up, or the owner will be notified that no cleanup is needed. Until then, there are steps that can be taken to limit exposures. MDCH and MDEQ have guidelines to help reduce contact with floodplain soil such as having play areas and gardens away from areas that flood frequently, washing up after contact with floodplain soil and trying not to track floodplain soil into the house. Additionally, Dow, under EPA and MDEQ oversight, has taken steps to limit human exposure to dioxins in Tittabawassee River floodplain soil. EPA will contact this individual to discuss these steps. Regarding groundwater, see the response to comment 56, below. Groundwater from residences along the Floodplain has been tested and no site-related contaminants were detected at levels of concern.

*53. One commenter feels that the Site has adversely affected his health and the health of his family and others.*

As stated above, the Cleanup Numbers are conservative protection goals developed to ensure that residents will be safe when they contact soil in their yard. EPA and MDEQ are sorry the commenter and his family have health concerns.

EPA and MDEQ are not health agencies, but work with health agencies such as the Agency for Toxic Substances and Disease Registry (ATSDR) and MDCH to understand potential health effects to people from environmental contamination. The commenter has been provided contact information for MDCH and ATSDR so he can discuss his health concerns with them. It is extremely difficult to attribute health effects causation to environmental exposures. ATSDR and MDCH have completed a number of health consultations for the Site, including:

- 8/12/04 Health Consultation, Tittabawassee River Floodplain Dioxin Contamination, Tittabawassee River, Midland, Midland County, Michigan
- 4/29/05 Petitioned Health Consultation, Dioxins in Wild Game Taken from the Tittabawassee River Floodplain South of Midland, Midland and Saginaw Counties, Michigan
- 11/1/07 Exposure Investigation Report: Dioxin Exposure in Adults Living in the Tittabawassee River Floodplain

- 2/4/08 Health Consultation, Evaluation of Saginaw River Dioxin Exposures and Health Risks, Saginaw River, City of Saginaw, Saginaw County, Michigan
- 8/19/09 Health Consultation, Dioxin Contamination on Residential Property in the Tittabawassee River Floodplain, Saginaw County, Michigan

All of the health consultations listed above can be found at http://www.atsdr.cdc.gov/HAC/PHA/HCPHA.asp?State=MI .

*54. One commenter discussed that dioxin is persistent, bioaccumulative, and toxic at low levels of exposure. They discussed the cancer and non-cancer health effects of dioxin. They said "According to the EPA, existing background exposure to dioxin is already likely to result in an increased risk of cancer and is uncomfortably close to levels that can cause subtle adverse non-cancer effects in animals and humans. Any additional exposure clearly carries risks, particularly for people who may be vulnerable, or whose levels are close to those where health effects are seen."*

EPA and MDEQ consider dioxins and furans to be persistent, bioaccumulative compounds, with potential cancer and non-cancer health effects. Exposure to chemicals like dioxin can come from a variety of sources, such as food, as well as from the environment. Cleanup of the Floodplain is expected to reduce unacceptable risks from human direct contact with TEQ contaminated soil. The Cleanup Numbers were developed based on the most sensitive receptor – the young child resident. Please also see the response to comment 17.i, above.

## I. SPECIFIC INFORMATION REQUESTS

*55. One commenter asked that specific information be added to EPA's document Site-Specific Preliminary Remediation Goals (Cleanup Goals) For Tittabawassee River Floodplain Soil, dated August 2014:*

EPA does not plan to revise the PRG memorandum. However, most of the information requested is available in the administrative record.

*Requested revisions include:*

*a. A figure including the location of the dioxin sampling points along the river.*

This information can be found on Figures 3-1A through 3-1F of the Floodplain EE/CA.

*b. How many samples were analyzed for PCBs and test method(s) used.*

Analytical results are found in Appendix A of the Floodplain EE/CA. At least 685 samples were analyzed for PCBs by EPA analytical methods 3545, 3550B, and 8082. Most of these sample were done early in the investigation. Since PCBs were not detected at levels of concern, they were dropped as analytes.

c. *The document discussed some houses almost completely inside the Floodplain that have been cleaned up. The commenter wants to know what background levels are and how they were determined, and requested a figure depicting the location of these residences.*

Figures depicting houses almost completely in the Floodplain include 2-4F and 3-3A of the Floodplain EE/CA. Background dioxin levels in the State of Michigan are shown on the figure at http://www.michigan.gov/documents/deq/deq-whm-hwp-mi-soil-bkgd-dioxin-data_251085_7.PDF

d. *They felt that Figure 3 is an unprofessional depiction and asked, instead, for a scale map of the land use along the river, with insets to show an actual property and the potential land use designations found there.*

This figure has been very well received by other community members because it helps to explain some of the concepts in EPA's cleanup plan. Details on current estimated land use can be found on Figures 2-4A through 2-4F of the Floodplain EE/CA.

## J. MISCELLANEOUS COMMENTS

56. *One commenter lives along the Floodplain and uses groundwater. She is concerned that the groundwater is contaminated and wants Dow to provide hook ups to public water.*

The vast majority of businesses and residences located within and adjacent to the Tittabawassee River Floodplain are serviced by municipal drinking water supplies. However, some residences continue to acquire potable water from groundwater. Because dioxins do not dissolve easily in water (i.e., they are hydrophobic), dioxins would not be expected in groundwater at concentrations of concern. Groundwater from residences along the Floodplain has been tested by the Saginaw County Health Department and MDEQ and no site-related contaminants were detected at levels of concern. Because of these results, no response actions are warranted. Details on the sampling and the results can be found at http://www.michigan.gov/documents/deq/deq-whm-hwp-dow-TR-FINALPHASEIIREPORTSOIL6-24-2003_251811_7.pdf and http://www.michigan.gov/documents/deq/deq-whm-hwp-dow-TR-Soils-Appendix-D_251859_7.pdf

57. *One commenter stated that the riverbanks need to be stabilized to keep them from falling into the river. He said that the only way to fix the river is to cement the banks and river bottom.*

EPA and MDEQ agree that eroding banks releasing contaminants into the river is a concern that must be evaluated and addressed, as needed. These evaluations of contaminant transport risks and response actions are being conducted under the 2010 AOC. One of EPA's main goals for the Tittabawassee River cleanup is to reduce the spread of contaminated riverbank soil to keep dioxin levels low in the river. This helps to prevent dioxin from building up in fish. EPA has identified and will continue to identify priority riverbank areas called Bank Management Areas or BMAs for cleanup. More than a mile of riverbanks have been cleaned up, and more areas will

be targeted in the future. Most recently, three BMAs in Segment 2 were stabilized. Although stabilization techniques are being implemented at some riverbank areas, and cover of river sediment has been implemented and will continue to be considered for some river sediment, cementing over the entire river and riverbanks is unlikely to be an appropriate final action. Not all sediments or riverbank will require response actions, and cementing is not an appropriate stabilization technique for this environmental setting.

*58. One commenter felt that Dow should pay property owners "for this mess."*

EPA does not have an opinion as to whether people should be compensated because that is outside of EPA's regulatory jurisdiction. EPA is responsible for making sure that environmental laws and regulations are implemented and followed. Questions regarding whether compensation for damages related to contamination are appropriate are typically answered in the context of court actions not involving EPA.

*59. One commenter believes that Dow is continuing to release contaminants to the Tittabawassee River.*

At this time, the State regulates discharge from the Dow Midland Plant to the Tittabawassee River by permit, with strict, protective discharge limits and monitoring requirements. Prior to any discharge, water from the Midland facility goes through a tertiary wastewater treatment plant.

*60. One commenter felt that the TRSR&B Site should be listed on the National Priorities List (NPL) and was concerned that using the Superfund Alternative approach may not be sufficient and felt that actions taken would be more robust and/or effective if the TRSR&B Site were on the NPL.*

In a letter to the TRSR&B Site community dated May 26, 2009, EPA Administrator Lisa P. Jackson addressed the issue of NPL listing of the TRSR&B Site. She stated:

> I have carefully considered whether this site should be listed on the CERCLA National Priorities List and have decided that this step would cause further delay if pursued now. I am ready, however, to seek NPL listing if Dow at any time does not comply with requirements that EPA deems necessary for protection of public health and the environment. I will insist on including as part of our agreement with Dow a commitment that Dow not challenge EPA's right to pursue NPL listing if we decide it is needed in the future.
>
> Although we will not list the site on the NPL at this time, the actions we require of Dow under CERCLA will be based on well-established tools that EPA uses for all CERCLA cleanups. These tools will impose enforceable obligations on Dow – backed up by a range of penalties and sanctions – with minimal opportunities for time-consuming appeals to resolve disputes. While our preference is to use these tools on a negotiated basis, we will not hesitate to use them unilaterally if required. We also will undertake the work ourselves at Dow's expense if there is continued non-compliance with EPA

directives. These strong enforcement tools will assure progress here after a history of delay in accomplishing significant cleanup.

While NPL listing would have the potential benefit of allowing EPA to spend taxpayer dollars on remedial action, I do not now believe that EPA will need to fund the remedy at this site. We fully expect Dow to provide that funding. Remedy selection would proceed in the same way as it would for any NPL cleanup, with EPA issuing a Record of Decision, after public input, setting the terms and conditions for cleanup. In addition, a CERCLA Order would not terminate RCRA Corrective Action obligations.

Table 1. Comparison of RfD TCDD and TEQ Blood Levels to Recent US and Michigan Populations

| | Blood Concentrations (ppt, lipid adjusted) | | | | |
|---|---|---|---|---|---|
| | Average TCDD | Range TCDD | Average TEQ DFcP | 95%tile | Range TEQ DFcP |
| RfD Adult Seveso Female Average of a subset of Pregnant Mothers from Baccarelli et al, 2008 | 18.9 | 1.4-309.5 | 44.8* | | 11.6-330.4* |
| US Females 20-39 years NHANES 2001-2002 from Patterson et al, 2008 | | ~<2.7 | | 27.7# | |
| US Adults NHANES 2001-2002 from Lorber et al, 2009 and Patterson et al, 2008 | | ~<5.6 | 17.2-21.7# | 56.1# | |
| Tittabawassee River Floodplain Adults 18-29 years from UM DES, 2008 | 0.5 | <0.6-1.2 | 6.6# | 11.53# | 4.7-11.5# |
| Tittabawassee River Floodplain Adults 30-44 years from UM DES, 2008 | 1.4 | <0.6-4.1 | 16.6# | 26.5# | 7.4-38# |
| Highest Category Michigan Adults 18-29 years from UM DES, 2008 | 0.9 | <0.6-3.1 | 9.1# | 17.8# | 4.1-17.8# |
| Highest Category Michigan Adults 30-44 years from UM DES, 2008 | 1.6 | <0.7-8.1 | 19.6# | 63.8# | 4.9-63.8# |
| RfD Child Seveso TCDD only from Moccarelli | 210 | | | | |
| RfD Child Pooled Serum from females 0-12 years in Seveso reference area from Eskanazi et al, 2004 | | 33.4-47.6 | | 113.6-119.5@ | |
| No Child comparison values available for US or Michigan populations | | | | | |

* TEQ based on 24 dioxins, furan and coplanar PCBs

# TEQ based on 29 dioxins, furan and coplanar PCBs

@ TEQ based on 26 dioxins, furan and coplanar PCBs