

Attachment F

Response to Public Comment Summary

Responsiveness Summary

MDCH provided an initial 60-day comment period that was extended an additional 30 days at the request of several commenters. The comment period closed on June 14, 2002. Comments received after June 14, 2002 will not be addressed here.

Some commenters expressed concerns related to comments made by other individuals, companies, or organizations. These comments are not germane to the Public Health Consultation and will not be addressed further here.

Where possible, several related comments have been combined to reduce redundancy.

Several commenters provided journal articles, research papers, and other reference materials and the MDCH thanks the contributors for this information. Several commenters also provided historical background information concerning previous studies of dioxin contamination in the city of Midland, contamination in media other than soil, or other contaminants of concern in Midland. MDCH thanks the contributors and will retain this information in our files for use in developing a comprehensive Public Health Assessment for the city of Midland.

Dioxins are a group of chlorinated chemicals with similar structures and chemical properties including chlorinated dioxins, furans, and some polychlorinated biphenyls. For simplicity, this group of chemicals is referred to here collectively as "dioxins." Where analytical concentrations are reported in this discussion, the term total dioxin TEQ will be used. Please see the text of the consultation for an explanation of the TEQ approach for reporting dioxin concentrations in the environment.

Comment: The MDEQ "residential cleanup criterion" is not relevant to MDCH's analysis, which should be based on the ATSDR action level of 1ppb. The MDEQ generic 90ppt cleanup criterion is invalid as a matter of law because it has not been properly promulgated or calculated and is being re-evaluated. Therefore, MDCH should delete all references to the MDEQ "cleanup criterion" and should analyze soil samples only in the context of the relevant action level of 1ppb. At a minimum, should MDCH insist on maintaining a reference to the 90ppt proposed standard, MDCH should describe it more accurately as a "proposed generic residential soil direct contact criterion."

Response: The MDEQ residential soil direct contact criterion is legally promulgated within the Administrative Rules for Part 201, Environmental Remediation, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended. It should also be noted that the ATSDR screening level of 50 ppt must also be considered when assessing the public health hazard posed by dioxin contamination in soil. MDCH considers all relevant environmental standards and criteria when assessing public health risks.

Comment: Site Specific Assessment – MDCH failed to mention a comprehensive site-specific assessment of the Midland area that concluded that a soil criterion of 1.48 ppb dioxin in residential soils would be fully protective of human health in Midland. The assessment,

performed by a leading expert on dioxin, determined that a soil criterion of 1.48 ppb PCDD/F TEQ would be fully protective of public health in Midland, based upon site-specific considerations. The methods used in that report are consistent with ATSDR's guidelines. Moreover, criterion was developed pursuant to, and is consistent with, the Michigan Natural Resources and Environmental Protection Act. Given that extensive soil sampling has already been conducted and not a single residential sample even approaches the ATSDR action level, let alone the site-specific soil criterion, no further-site specific evaluation is necessary to determine that dioxin in Midland soil does not present any apparent public health hazard. MDCH should amend the above-quoted statement to reflect the findings of the assessment.

Pursuant to ATSDR guidance, the only action that is appropriate where, as here, the ATSDR screening level but not the ATSDR action level has been exceeded is the performance of a site-specific exposure assessment. An assessment taking into account the site-specific exposure factors typically employed by ATSDR for this purpose has already been conducted for Midland. Because a scientifically sound site-specific assessment has already been conducted for Midland and extensive sampling has shown that residential soils do not exceed the ATSDR action level or the site-specific criterion, no further action is necessary.

Response: A report entitled "Calculation of a Site-specific Soil Criterion for Midland, Michigan" was prepared by Exponent for the Dow Chemical Company. This document was submitted to the MDEQ on April 9, 2002—several weeks after the MDCH draft health consultation was released on March 4, 2002, therefore, a discussion of the assessment contained in this document could not have been included in the Draft Health Consultation. The site-specific criterion and supporting documentation was reviewed by MDEQ and MDCH staff and deficiencies in the assessment were noted in a memo dated September 9, 2002 from the MDEQ Toxics Steering Group Dioxin Subcommittee to then MDEQ Deputy Director Arthur Nash. The 12-page memo details the regulatory and scientific deficiencies noted in the approach taken by Exponent in the development of the proposed site-specific criterion. Based on the noted deficiencies in the assessment, a lower site-specific criterion of 831 ppt was proposed in the draft Corrective Action Consent Order for the Dow Chemical Company dated November 6, 2002. This Consent Order was withdrawn on December 27, 2003 and no further proposal for a site-specific criterion or a site-specific risk assessment has been submitted to any state agency. Therefore, the consultation cannot consider or reference a site-specific criterion developed for the city of Midland.

Comment: The report fails to mention that a bioavailability study was conducted last year and is currently under review.

Response: The study referred to was, in fact, an *in vitro* (i.e., in glass) bioaccessability laboratory study intended to approximate the bioaccessability of dioxin in soil in living animals. *In vitro* studies are not conducted in living animals and it is not known as yet whether this study will adequately mimic the dioxin availability in whole animals. In March of 2002, the bioaccessability study was undergoing review by the Michigan Department of Environmental Quality. It has since been determined that further study in live animals (*in vivo*) is needed to validate the results of the previous *in vitro* study. The

results of the *in vivo* study cannot be incorporated into the consultation process until they have undergone review, and are determined to be adequate to represent the availability of dioxin in Midland soil. At the time of this writing, all bioaccessibility studies are on hold pending resolution of regulatory issues associated with the Dow Correction Action requirements in the city of Midland.

Comment: The relevant standard for the Dow plant site is the EPA preliminary remediation goal for industrial sites, which is 5-20 ppb.

Response: The relevant and applicable standard for the Dow plant site is the legally promulgated MDEQ Industrial soil direct contact criterion of 990 ppt (i.e., 0.99 ppb). Table 1 has been revised accordingly in the consultation.

Comment: The maximum concentration at the Corporate Center was 513 ppt TEQ, not 583 ppt.

Response: The concentration reported by Dow at the Corporate Center sampling location with the highest detected concentration was 476 ppt TEQ. A duplicate sample taken at the same location showed 614 ppt TEQ. The average of these two concentrations is 545. However, Dow reported these concentrations on a “wet weight” basis that must be adjusted for the percent of solids in the sample. The correct adjusted concentration detected at this location is 583.51 ppt TEQ. MDCH mistakenly rounded this value to 583, when it should have been rounded to 584. This error has been corrected in the consultation.

Comment: Given the levels of dioxin in TEQ in Midland soils, any exposure from soils is not consequential with respect to health effects. As Dow has discussed elsewhere, the maximum known concentration in the Midland community to which the general population may be exposed is 0.513 ppb. Thirty years of daily exposure to this maximum concentration in Midland would correspond to a daily intake of 0.069 picograms per kilogram per day (pg/Kg/day), or approximately 7% of the daily EPA estimated “background” intake. Thirty years of exposure to the average concentration (0.0999 ppb) yields an intake of 0.0135 pg/Kg/day, or about 1 percent of the overall daily dietary intake – which is consistent with the conclusion reached by EPA in the dioxin reassessment. In short, even if individuals were exposed on a daily basis for 30 years to the maximum PCDD/F TEQ concentration measured in Midland soils (a highly unlikely occurrence), the soil-related dose would be a tiny fraction of the “background” dose associated with the diet. MDEQ should revise this passage to reflect the facts regarding the percentage intake that Midland residents face as a result of exposure to the levels of dioxin in Midland soils. MDCH should acknowledge: (i) the relative exposure impact of the food supply compared with soils; (ii) the fact that the overwhelming majority of the dioxin intake of Midland residents is no different from that of any other U.S. resident since there is no commercial farming in Midland, and therefore, (iii) that there is no scientific basis to conclude that residential soil exposure at levels well below 1ppb will have any health effect on Midland residents.

Response: As previously stated, the maximum detected concentration of dioxins on the Dow Corporate Center was 584 ppt. MDEQ and MDCH toxicologists have developed calculations to determine the contribution of exposure to dioxins at varying soil

concentrations to daily intake rates. Using national average dioxin concentrations in various foods coupled with intake levels provided in the U.S. EPA Exposure Factors Handbook, and assuming soil concentrations of 10 ppt, total average adult exposures to dioxins from all sources would equal 0.61 pg/Kg-day. Soil exposures would constitute 0.6 percent of that total. However, exposure to soil dioxin TEQ concentrations of 584 ppt will result in a daily dioxin intake of 0.21 pg/Kg-day from soil alone, or 26% of the total daily intake of 0.80 pg/Kg-day from all sources combined including diet. This estimate assumes that residents in Midland are exposed to dioxins in their diet at average concentrations for the United States and that 50% of the dioxins in soil will be absorbed into the body. If, however, consumption of locally caught fish containing 2.4 ppt TEQ is assumed, total daily intake rises to 1.24 pg/Kg-d and the relative contribution of soil exposure drops to 17%. If this same fish-eating average adult were exposed to dioxins in soil at concentrations of 1,000 ppt, the total daily intake rises to 1.4 pg/Kg-day with the contribution of soil exposures again rising to 26% of the total. These calculations do not support the position that exposure to dioxin-contaminated soils in Midland constitutes only a "tiny fraction" of diet-associated exposures. Further, these estimated daily intake rates for average adults exceed the ATSDR minimal risk level (MRL) of 1 pg/Kg-day indicating the need for further site-specific evaluation.

Comment: The "Report" contains conflicting comments regarding dioxin levels in soils in the community. The "Report" states; "The results of several preliminary soil sampling studies indicate that dioxins have been detected in soil at two locations in the Midland community at concentrations greater than the ATSDR action level." Again the Report on pg 8, states, "Dioxin TEQ concentrations greater than 1,000 ppt have been detected at two locations in the Midland community...referencing the Plant perimeter and the Salzburg haul route." The Plant perimeter and the Salzburg haul routes should not be included as community samples because they are not residential areas. These samples are not located in residential areas, are highly localized, and have little or no bearing on residential exposure. Indeed, one of the two sample sites is located inside the Dow fence line and is inaccessible to the public. The other sample site, which was located along an industrial haul route, has since been remediated.

Response: The Dow plant site is located in the Midland community. The samples taken at the Northeast Perimeter of the Dow plant site were taken just within the fence line. Samples from this area were taken at either the base of the fence or within 10 feet of the fence. The 1998 sampling that was conducted in this area was in response to the elevated level of dioxin in soils in the traffic island at Saginaw and Bay City Roads. Three of the 11 samples from the Dow fence line exhibited concentrations of dioxins and furans near 1 ppb: NEPP-S-02 and its replicate (.930 and .473 ppb); NEPP-S-10 (.923 ppb); and adjacent sample NEPP-S-11 (1.07 ppb). In addition, it should be noted that samples NEPP-S-10 and NEPP-S-11 are located directly across Saginaw Road from the Corning Lane neighborhood. The chain link fence at the perimeter of the Dow facility does not provide a barrier to the movement of contaminants and there is no reason to think that the concentrations of dioxins and furans would be significantly different on the outside of the fence line vs. the inside of the fence line.

The Salzburg Road haul route is also located in the Midland community. This area is unrestricted to public access. Sixteen samples were taken on a 775-foot interval over a 2.6-mile length of this road. This relatively low frequency sampling identified several areas on the haul route with elevated concentrations. A dioxin level of 2.6 ppb (2600 ppt) found at one sampling location suggests that other areas of elevated concentrations may have been missed and further sampling and evaluation should be conducted.

Comment: We suggest educational materials be designed that are accurate, comprehensive, and informative for community members who must make choices about their behavior and living situations in an area with elevated levels of dioxin. Any educational materials must point out the limitations of current data collection in answering critical questions such as- has Midland or Saginaw residents' health been affected by exposure to dioxin.

Response: Comments noted.

Comment: We urge cooperative agreements between local and state public health officials in order that accurate statements are being provided to the community.

Response: Comment noted.

Comment: Why were the public meetings scheduled in Saginaw for May 1st and Midland for May 2nd cancelled for unknown reasons?

Response: MDCH had some difficulty identifying available and appropriate locations to hold public meetings. When suitable locations were identified, MDCH postponed the meetings for a few days to allow the public adequate notification time.

Comment: MDCH ignored the conclusion of the US EPA that current levels of dioxin do not pose an unacceptable public health risk (based on EPA's own testing).

Response: The EPA "Risk Assessment for Dioxin Contamination, Midland, Michigan" was released in March of 1988. MDCH reviewed the EPA risk assessment, however, scientific advancements in understanding the potential health risks of exposure to dioxin suggest that an updated risk assessment is necessary. For example, the EPA based its risk assessment only on detected concentrations of 2,3,7,8 tetrachlorodibenzo-p-dioxin (TCDD) and did not account for the dioxin-like toxicity of other dioxin and furan congeners detected in Midland soil samples. The MDEQ estimates that the levels of TCDD found by the EPA in the 1980's accounts for only one-third of the total dioxin like toxicity associated with dioxin TEQ concentrations in Midland soil.

Comment: How does dioxin biodegrade and at what rate? Do dioxins degenerate to furans? Is there any chance that the analytical process itself can cause dioxins to become furans?

Response: Dioxins degrade very slowly in the environment as a result of exposure to sunlight (photolysis) or by the action of microorganisms in the soil. The ability of a chemical to degrade is generally described in terms of the chemical half-life, or the time

it would take for one-half of the amount of chemical present to degrade. Estimates of the half-life of dioxins range from 9 to 15 years at the soil surface, to 25 to 100 years in subsurface soils. Some microorganisms are capable of removing chlorine atoms from dioxin and furan molecules, but the rate of degradation varies for each congener. It is possible that dechlorination by microorganisms could convert highly chlorinated and less toxic congeners to potentially more toxic compounds (ATSDR1998). Dioxins do not degenerate or degrade into furans, either in the environment or in the laboratory.

Comment: Dioxin congeners found downriver indicate dioxin-contaminated PCB's as the source.

Response: During the 2002 Phase II sampling in the flood plain of the Tittabawassee River, the MDEQ initially conducted PCB analysis on soil samples taken both upstream and downstream of Midland. PCBs were present in only very low concentrations at all locations and contributed very little to the total dioxin-like toxicity of the samples. Therefore, it does not appear likely that PCBs are a source of the dioxin contamination found either in Midland or in the flood plain of the Tittabawassee River. The Phase II data will be discussed in future public health assessment documents.

Comment: Is dioxin being released into the air from the Dow plant and at what rate? (Alternately, is this dioxin contamination historical or ongoing?)

Response: The dioxin contamination in soil in the city of Midland is primarily historical. In 2001, MDEQ issued a permit to Dow Chemical to install and operate a new hazardous waste incinerator under stringent conditions. State and federal standards required a maximum achievable degree of emission reductions for dioxins and a thorough multipathway risk assessment was performed as part of the permit application and review process. The risk assessment accounted for the existing locally elevated dioxin levels in soil and fish, as well as the incremental future impacts of emissions. The new permitted emission rate will result in a substantial reduction in dioxin emissions and impacts compared to the operation of the two previously existing incinerators. The multipathway risk assessment demonstrated that the additional potential exposures and risks associated with the new incinerator were acceptably low. The new incinerator is currently operational and early testing indicates that it will meet all emission standards specified in the permit.

Comment: The table below suggests the kinds of health effects likely to be experienced by residents of Midland and downriver areas exposed to elevated levels of dioxin. Data on these effects are generally not reliably collected or not collected at all (with the exception of genital malformations). Most would be impossible to measure at the clinical level and are only measurable at the population level. Yet they represent the most important risk to area residents.

Body Burden (ng/kg)	Species	Health effect
83	Human	Decreased testosterone
73	Rats	Genital malformations (female)
64	Rats	Decreased sperm count
54	Monkeys	Endometriosis
50	Rats	Immune suppression
42	Monkeys	Endometriosis
42	Monkeys	Object learning
28	Rats	Decrease in sperm counts
19	Monkeys	Learning disability
14	Human	Decreased testes size
14	Human	Altered glucose tolerance
10	Mice	Adult immune suppression
7	Mice	Increased susceptibility to virus
7	Monkeys	Altered immune response
10	Current background body burden nationally (It is not known whether Midland and Saginaw residents have body burdens above the national average, but it is certainly a strong possibility. In addition, the average masks considerable variation among individuals.)	

Response: Comment noted. MDCH will consider these potential effects if any health studies are conducted in the future.

Comment: Levels of dioxin in indoor dust must be considered as part of the health consultation. A German study of dioxin levels in dust near contaminated areas found significant levels of dioxin in indoor dust. It is important to consider dioxin-laden dust as an important source of exposure in the health consultation.

Response: MDCH agrees and is developing a protocol for indoor dust sampling.

Comment: If the EPA estimates over 94% of exposure to dioxins come from food, why is the MDCH not focusing its efforts on eating habits?

Response: The EPA estimates of dioxin exposure cited in the comment are based on the assumption that most people are exposed to dioxin in soil at levels of 1 to 10 ppt total dioxin TEQs. Under this scenario, soil dioxin accounts for less than one percent of a person's total dioxin exposure. However, if a person is exposed to soils with dioxin levels of 1,000 ppt total dioxin TEQ, their total exposure is increased and soil exposure accounts for about 37 percent of their total dioxin exposure.

While very low levels of dioxin in soil occur naturally as a result of forest fires and other types of combustion, most dioxin is released to the environment by human activity. Dioxin contamination is present in food because it is present in the environment. While the MDCH recommends that people eat a diet low in animal fat and follow the Michigan Fish Advisory to reduce dioxin exposures, it also advocates for environmental clean up to begin to reduce the amount of dioxin in these foods. Fish consumption advisories are in place for the Tittabawassee River. In addition, MDCH is working to complete a health consultation involving eggs from chickens raised on the Tittabawassee floodplain.

Comment: Dioxin at its worst is a very weak carcinogen and in all probability is not carcinogenic at all in humans (paraphrased quote from Dr. Vernon Houk circa 1990, the Assistant US Surgeon General and Director of the Center for Environmental Health and Injury Control, CDC).

Response: Dr. Houk's statements were made prior to the EPA's reassessment of the health effects of dioxin. Contrary to his opinions at the time, the EPA and the International Agency for Research in Cancer have since concluded that 2,3,7,8-TCDD is a human carcinogen. The EPA has concluded that the mixture of dioxin and furans typically found in the environment is a likely human carcinogen.

Comment: The report addresses only cancer and reproductive/teratogenic effects – what about other potential health effects? (e.g. endometriosis, diabetes, immune system, neurological and respiratory effects, endocrine disruption, etc.)

Response: Several other adverse health effects associated with dioxin exposure in humans or animals were addressed in the consultation including: chloracne, liver damage, alterations in glucose metabolism, changes in hormone levels, disruption of the endocrine system, weakening of the immune system, and birth defects. Please see the Toxicological Evaluation section on pages 6 and 7. We have insufficient data to evaluate the likelihood of specific toxicological effects at this site. The discussion in the text is provided for general information. It is not all inclusive. Other efforts, as suggested by the comment, have been reported in the literature.

Comment: Wildlife data must be considered in the health consultation, as often this data provides important information about extent of the contamination, historical trends, and potential health effects in humans. It is possible to conduct studies on wildlife that cannot be done on humans. Further, wildlife data include studies of subtle functional losses, immune system problems, etc, that are relevant to the human population, and that come from organisms living in the same environment and eating the same fish as humans in the watershed. The health consultation should include a thorough review of the literature for these purposes.

Response: Wildlife studies are currently being designed and, in some cases, are already underway. An aquatic eco-assessment was completed in September 2003 by an independent contractor for the MDEQ and a study report is pending. Additional studies may be conducted by the MDEQ, or by Dow with oversight by the MDEQ. The MDCH will report on these findings as appropriate in future public health assessment documents.