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U.S. EPA National Center for Environmental Assessment Review of the University of Michigan Dioxin Exposure Study

In May 2009, U.S. EPA Administrator Lisa P. Jackson issued *EPA's Science Plan for Activities Related to Dioxins in the Environment* (<http://www.epa.gov/dioxin/scienceplan>). Included in the plan was a commitment by the Agency to review a dioxin exposure study conducted by the University of Michigan. The objectives of EPA's review were to comment on the design, implementation and results of the study and the relevance of its findings to EPA's mission.

About the University of Michigan Dioxin Exposure Study

The UMDES is one of the largest studies of dioxin exposure ever conducted. This study was conducted in response to community concerns that dioxin compounds from the Dow Chemical Company had contaminated the city and surrounding areas. The University of Michigan received financial support for the study from Dow through an unrestricted grant.

The UMDES included 946 adult participants (695 in the Midland area and 251 from a reference area 100 miles south of Midland). Blood, soil and household dust samples were collected from study participants, and an extensive questionnaire was used to collect demographic and life style information. The goal of the study was to understand the levels of dioxin, furan and PCB measured in blood and the factors that explain variation in these levels. It is important to note that the UMDES addresses exposure only. No information was collected on health status or outcomes.

To date, the UMDES has yielded twenty journal articles that have been published or accepted for publication in the scientific literature and more than one hundred presentations at scientific conferences. The University of Michigan has provided access to the study protocol, publications and presentations at <http://www.sph.umich.edu/dioxin/index.html>.

Summary of EPA's Review of the UMDES

In conducting this evaluation, EPA reviewed the study protocol, an August 2006 report published on the UMDES Web site, and several of the peer-reviewed publications. Additionally, EPA contacted several individuals knowledgeable about the study, including experts from the University of Michigan, Michigan Department of Health, EPA's Region 5, and members of the UMDES Science Advisory Panel.

Comments about the Study

The UMDES was well suited to identify patterns of blood dioxin, furan and PCB levels among adults. The data provide reliable estimates of the overall distributions of dioxin concentrations in blood, soil and dust in the Midland area. As has been found in other studies, higher blood levels were associated with several demographic factors, such as increased age and being overweight. Other findings include:

- Properties in the Midland area tend to have higher soil dioxin concentrations than properties in the reference area.
- People living in the Midland area tend to have higher blood dioxin levels than people living in the reference area.
- Household dust from the Midland plume area contains higher dioxin levels than household dust from the other study areas.
- People who lived in the Midland area from 1960-1979 tend to have higher serum dioxin levels.
- People who worked at Dow from 1940-1959 tend to have higher serum dioxin levels.

- People who consume fish (whether store-bought, sport-caught, or from a restaurant) tend to have higher serum dioxin levels.

There were, however, several significant limitations of this study.

- The study did not include children. Children generally have higher exposures to contaminants due to activities that increase contact with and ingestion of soils and dusts.
- The study may not have included a sufficient number of properties with highly contaminated soils. Soil exposure is generally a very small contributor to an individual's total level of dioxin (food is typically the largest contributor). However, when individuals live on high dioxin soils and, further, engage in high exposure activities such as gardening or raising animals for food, their exposure levels can become high and their blood levels elevated.
- It is uncertain how well the study represented individuals participating in other activities that could lead to elevated dioxin exposures, such as consuming local fish or game with elevated dioxin levels.

Overall, the University of Michigan Dioxin Exposure Study (UMDES) has produced a credible and valuable source of data on dioxin levels in adults in the Midland, Michigan area. However, there are limitations to the study that need to be understood. The UMDES does not appear to be relevant to EPA's risk management mission. For example, the study does not provide sufficient information to inform the development of preliminary remediation goals for soil, which are set using national default exposure and toxicity values and not site-specific data. In addition, for risk-based decision-making, EPA often focuses on highly exposed and/or sensitive subpopulations. The UMDES did not target such subpopulations. From a risk assessment perspective, this is a significant drawback.