DETROIT AIR TOXICS INITIATIVE
RISK ASSESSMENT REPORT

TECHNICAL SUMMARY

November 2005

Introduction

Figure 1: DATI Report

The "Detroit Air Toxics Initiative (DATI) Risk Assessment Report" (**Figure 1**) has been prepared to provide a better understanding of which air toxics contribute the most to potential health risks in the Detroit area. The DATI report completes the first component of the DATI project. This document provides a Technical Summary of the DATI report.

DATI is a project initiated by the Michigan Department of Environmental Quality's (MDEQ's) Air Quality Division (AQD) and funded by a grant from the U.S. Environmental Protection Agency's (USEPA) Fiscal Year 2003 Community Assistance and Risk Reduction Initiative. This project includes two components, one to assess the health risks from exposure to air toxics in the Detroit area, and the other to fund projects to help reduce identified risks.

A Stakeholder Group is assisting the MDEQ with the DATI project. The Stakeholder Group consists of representatives from environmental and community groups, government, industry, and universities. The purpose of the Stakeholder Group is to review and comment on draft reports, help communicate the findings to others, and recommend potential risk reduction efforts in Detroit with funding provided by the USEPA grant.

The DATI Risk Assessment Report evaluates "air toxics" in the Detroit area, including air pollutants such as benzene, formaldehyde, chromium, manganese, and others. Air toxics are a group of air pollutants different from the USEPA's "criteria pollutants", such as lead, particulate matter, and ozone. Criteria pollutants were not evaluated in the DATI project. Air toxics do not have national air quality standards as the criteria pollutants do, but they may still pose significant public health concerns depending on their air concentrations. The DATI report evaluates these concerns for the Detroit area.

Background

The DATI Risk Assessment Report is the first of its kind in Michigan. It provides a risk characterization for air toxics, based on air concentrations monitored in the Detroit area. A total of 224 air toxics were monitored at seven sites in the Detroit area during 2001 and 2002. More limited monitoring was also done at Ypsilanti and Houghton Lake for comparison.

Figure 2: Detroit Area Monitoring Site Locations

The DATI monitoring sites in the Detroit area, shown in **Figure 2**, were at Allen Park, Dearborn, South Delray, North Delray, Southfield, River Rouge, and Northeast Detroit. These sites are believed to have air toxics levels attributable to a variety of sources (vehicles, businesses, and industries) that are both local and distant. Not all pollutants were sampled at all sites, and some pollutants were sampled more or less frequently from one site to the next. For instance, certain pollutants at the Northeast Detroit site were sampled every hour, whereas other sites had sampling every 6 or every 12 days. The pollutants that were measured and the sampling frequency varied by site due to study design and budgetary constraints. A complete list of all pollutants monitored, sampling frequency by site, and the levels measured, can be found in the full DATI Risk Assessment Report.

Methods

The DATI Risk Assessment Report provides estimates of health risks based on the exposures that people may have from breathing the measured levels in the air over time. It did not include an evaluation of air pollutants that may deposit to the ground or to lakes, which (for some pollutants such as mercury) could lead to additional exposure from soil, water, or food. Health risks for both cancer and non-cancer effects were evaluated.

Exposure levels for determining lifetime cancer risks were based on the monitored levels averaged over a year (the annual average). These exposure levels were used to estimate the risk of cancer per million people exposed to each carcinogenic air pollutant separately and in total. The inhalation cancer risk estimates in DATI are based only on exposure to outdoor air toxics and should not be confused with overall cancer rates.

Selection of the acceptable level of cancer risk resulting from pollution is a matter of public policy, and has not been established for air toxics in ambient air. This makes it difficult to interpret the acceptability of the cancer risk estimates in the DATI report. For comparison purposes, some USEPA and MDEQ regulatory programs regard a cancer risk of 1 in one million as acceptably small and not a health concern when determining if the emission from an individual source is allowable.

Potential non-cancer effects were evaluated for both short term (acute) exposure, and long term (chronic) exposure. Chronic non-cancer health effects were evaluated by comparing the annual average concentration to health reference levels developed by MDEQ or USEPA. The chronic health reference levels are exposure levels that do not pose significant hazards of non-cancer health effects. Long term exposure to levels below the health reference levels are assumed to produce no harmful effects. Exposures above these levels do not necessarily mean that harmful

effects will occur, but depending on the exposure level, length of time, and sensitivity of individuals, there is some potential for adverse effects. That concern increases as the exposure level increases. Similarly, acute non-cancer health effects were evaluated by comparing the highest one-hour or 24-hour monitored level to short term health reference levels.

Results

Based on the DATI data, the MDEQ has derived upper bound cancer risk estimates from breathing the monitored air toxics in the Detroit area, and compared monitored levels to non-cancer health reference levels and to levels monitored in other cities. This evaluation represents a "snapshot" in time, and does not necessarily reflect past or future risks or concerns from exposure to air toxics. Some of the most important findings include:

1. The ambient air levels of 12 chemicals were associated with increased cancer risks of 1 in one million or higher at one or more monitoring site. These 12 chemicals and their highest estimated risk at any one site are shown in **Table 1**:

Table 1: Chemicals and Associated Increased Cancer Risks

INCREASED LIFETIME CANCER RISK	CHEMICALS
100 to 400 in one million	methylene chloride naphthalene benzene
10 to 100 in one million	acrylonitrile formaldehyde 1,4-dichlorobenzene arsenic
1 to 10 in one million	carbon tetrachloride 1,3-butadiene acetaldehyde cadmium nickel

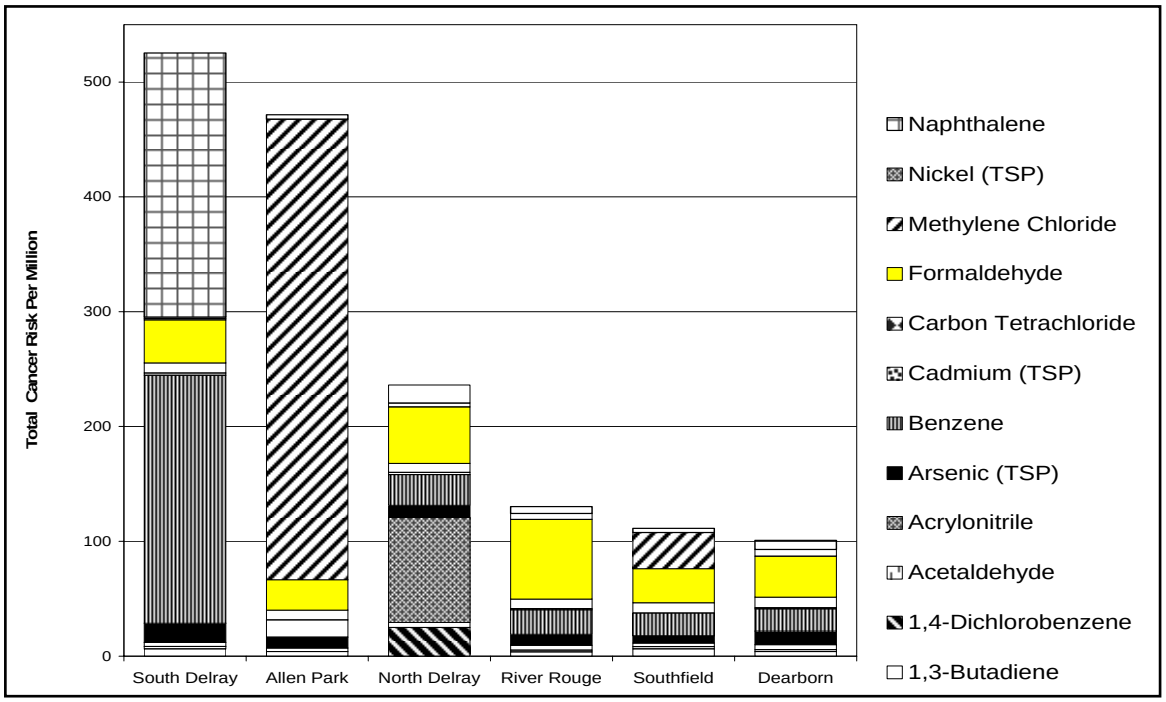
2. Total risks for the above 12 carcinogens added together varied across the Detroit area sites by a factor of 5 or less as shown in the following **Table 2** and **Figure 3**:

Table 2: Total Cancer Risk By Monitoring Site

MONITORING SITE	TOTAL CANCER RISK (PER MILLION)
South Delray	525
Allen Park	472
North Delray	236
River Rouge	130
Southfield	111
Dearborn	101
Northeast Detroit	52 *
Ypsilanti	35 *
Houghton Lake	27 *

*The Northeast Detroit, Ypsilanti, and Houghton Lake sites monitored for a more limited set of air toxics (volatile organic compounds were not measured), and therefore the total air toxics cancer risks for those sites should not be directly compared to the total air toxics cancer risks for the other sites.

Figure 3: Additive Cancer Risk by Site*



* The estimates of cancer risk should not be viewed as actual cancer cases resulting from air pollution, but as upper bound estimates based on lifetime exposure. These risk estimates are based on 2001-2002 monitoring data. NOTE: The unusually high levels of methylene chloride at Allen Park, along with naphthalene and benzene at South Delray during the 2001-2002 monitoring period have not persisted in subsequent monitoring.

It should be noted that the relatively unimpacted, more remote Houghton Lake site had a cancer risk estimate of 27 in one million, even though the monitoring at that site included a limited set of air toxics. This agrees with USEPA's nationwide studies indicating that some carcinogenic air toxics are present virtually everywhere, at levels well above a 1 in one million risk level.

3. The specific carcinogenic pollutants that contribute the most to total cancer risk and the size of this contribution varies by site, as shown in **Figure 3** above. In particular, the assessment found relatively high levels of methylene chloride at Allen Park, benzene and naphthalene at South Delray, and acrylonitrile at North Delray. As noted in **Figure 3**, the unusually high levels of methylene chloride at Allen Park and naphthalene and benzene at South Delray during the monitoring period (2001-2002) have not persisted in subsequent monitoring.

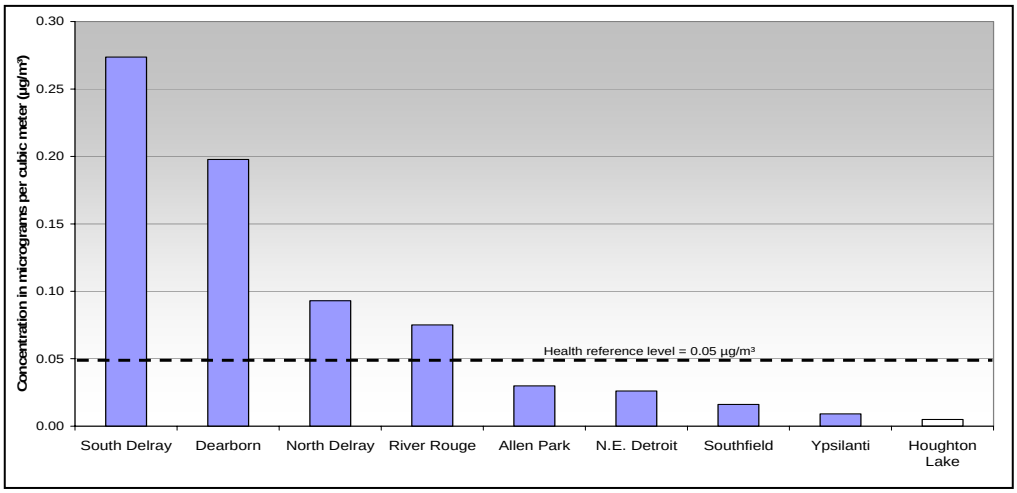
4. Diesel particulate matter (DPM) was also identified as a compound of concern for the Detroit area due to potential carcinogenic effects. The risks from DPM were not included in the estimates shown in **Table 2** and **Figure 3** because of the limited number of sites with monitoring data, and the uncertainty associated with determining DPM concentrations and estimating risks.

5. Non-cancer health reference levels have not been established for many of the monitored pollutants. Therefore, non-cancer hazard assessments could not be completed for such pollutants.

6. For those pollutants with chronic non-cancer health reference levels, only manganese and naphthalene were found at levels above the health reference levels.

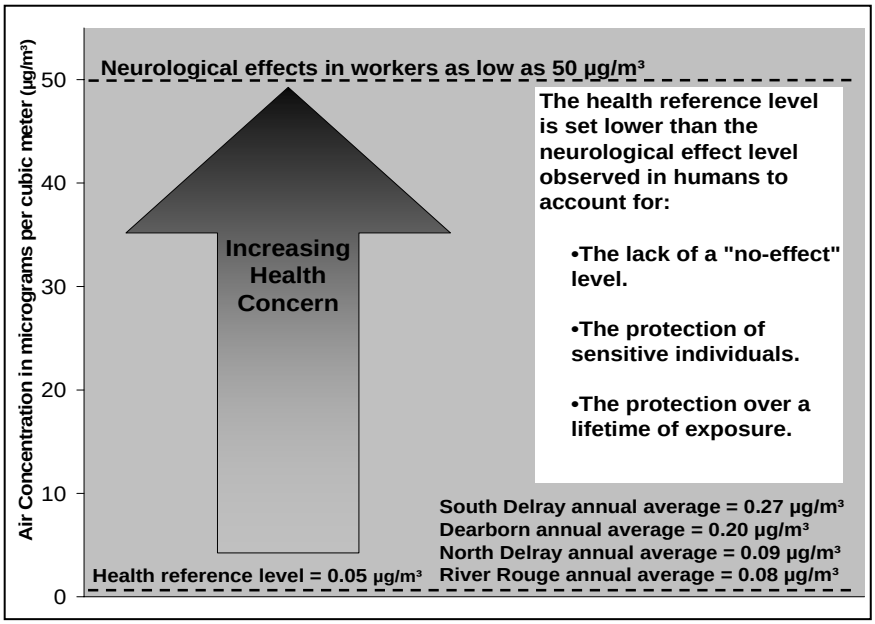
7. The annual average concentrations of manganese exceeded the chronic non-cancer health reference level at four sites: South Delray, North Delray, Dearborn, and River Rouge. These monitored levels were about two to five times higher than the health reference level, depending on the site. **Figure 4** shows the manganese level at each site in comparison to the health reference level.

Figure 4: Annual Average Manganese Air Concentrations



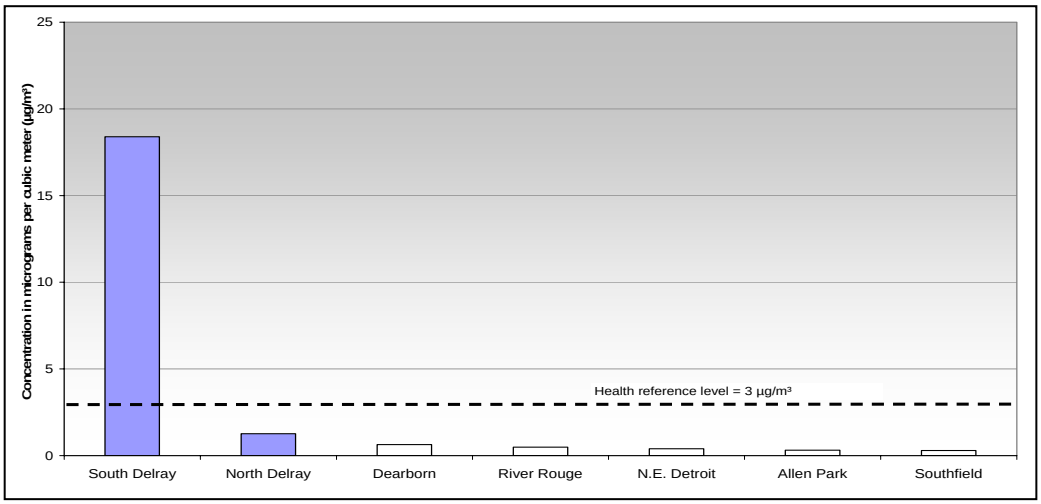
Inhalation of manganese at high enough concentrations causes effects to the nervous system. The health reference level is set far enough below the harmful level to help ensure the protection of all people. The highest manganese levels observed in the Detroit area are a cause for concern because they are higher than the health reference level, although they are still below the levels at which effects have been observed in scientific studies (see **Figure 5**).

Figure 5: Manganese Harmful Effect Level and Measured Levels Exceeding the Health Reference Level



8. The annual average concentration of naphthalene exceeded the chronic non-cancer health reference level at only one site. That site was South Delray, where the monitored level was about six times higher than the health reference level. **Figure 6** shows the naphthalene levels at each site in comparison to the health reference level.

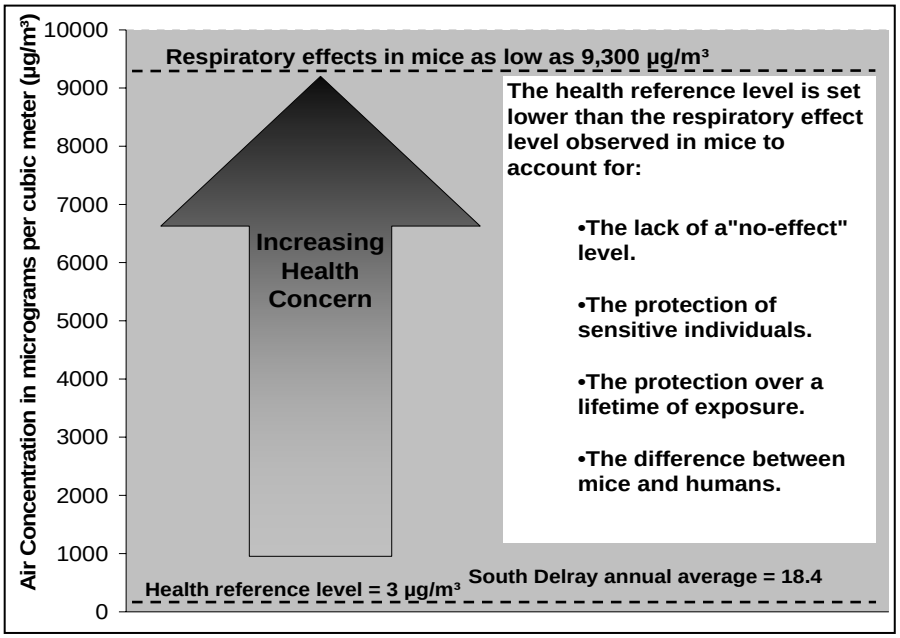
Figure 6: Annual Average Naphthalene Air Concentrations*



* NOTE: The unusually high levels of naphthalene at South Delray during the 2001-2002 monitoring period have not persisted in more recent monitoring.

Inhalation of naphthalene at high enough concentrations causes effects to the respiratory system. As with manganese, the health reference level for naphthalene is set far enough below the harmful level in order to help ensure the protection of all people. The highest levels of naphthalene observed in the Detroit area in 2001-2002 pose a concern because they were higher than the health reference level, although they were still below the levels at which effects have been observed in scientific studies (see **Figure 7**).

Figure 7: Naphthalene Harmful Effect Level and Measured Levels Exceeding the Health Reference Level



This concern is increased because there is a potential that exposures to naphthalene at the highest monitored levels could potentially have interactive effects with other air pollutants which also can affect the respiratory system (such as ozone, particulate matter, diesel exhaust, and acrolein). More recent limited monitoring indicates that the high levels of naphthalene in 2001-2002 have not persisted.

9. With regard to acute non-cancer health effects, only methylene chloride had any monitored levels higher than the acute health reference level. A total of three 24-hour monitored levels of methylene chloride exceeded the acute health reference level by a factor of 6 or less at Allen Park during the period of April 2001 to April 2002. However, further monitoring later in 2002 and in 2003 at the same location showed levels below the health reference level. The only other pollutant that had any monitored levels approaching the acute health reference level was benzene. The single highest 24-hour monitored level of benzene at South Delray was approximately the same as the health reference level; all other levels at South Delray and other sites were lower.

10. Measurements of hexavalent chromium (the carcinogenic form of chromium) were found to constitute only 1% to 2.4% of the measured total chromium. Based on that finding, chromium and hexavalent chromium levels do not appear to pose a significant public health risk in Detroit.

11. The Detroit-area monitoring data were compared to the findings of other air toxics monitoring initiatives for other cities in the U.S. The comparison indicates that:

    a) the pollutants creating the greatest risks vary across the cities studied;
    b) the high levels of methylene chloride, benzene, and manganese noted above are generally relatively high in comparison to the other cities;
    c) some studies reported higher levels of the compounds of greatest concern in Detroit, some were comparable, and others were lower; and,
    d) there was a lot of variability in the levels of some of the compounds of concern across the Detroit-area sites, while other cities had more consistency across sites.

12. Acrolein, which was not sampled and analyzed as part of the intensive one-year monitoring study conducted by the MDEQ, was identified as a compound that could pose potentially significant inhalation risks. This finding was based upon preliminary monitoring data at one site in Detroit from an ongoing USEPA study, as well as modeled impacts from another USEPA study.

Continuing Activities

- The MDEQ will use money from the USEPA grant to fund a risk reduction project based upon the results of the risk assessment study, current monitoring data, and input by the DATI Stakeholder Group.

- The MDEQ will pursue working with the DATI Stakeholder Group to develop an overall strategy to reduce risks from air toxics.

- The MDEQ is continuing to monitor air toxics in the Detroit area in response to the DATI findings. This monitoring will determine whether the levels of air toxics have changed since the DATI monitoring in 2001 and 2002.

- The MDEQ is developing plans to address the high levels of fine particulate matter and ozone in the Detroit area. These plans may also result in reductions in air toxics found in particulates such as manganese, or other air toxics that are volatile organic compounds and contribute to ozone formation.

Conclusions

The risk assessment for the DATI started with monitoring data for over 200 chemicals. From this list of chemicals, fifteen compounds were identified as contributing the most to potential health risks in the Detroit area. These fifteen included the twelve carcinogenic chemicals listed in **Table 1**, manganese, diesel particulate matter, and acrolein.

The DATI Risk Assessment Report provides very useful information, but it should be noted that risk estimates in this study represent a “snapshot” in time, and do not reflect risks from past or future exposures to air toxics. Furthermore, there are uncertainties in the estimation of exposure levels, and with the limited information available on potential health effects of air toxics alone and in combination with other air pollutants. Nevertheless, the study helps identify those air toxics of greatest concern in the Detroit area, and is useful for prioritizing future risk reduction efforts.