

A New Regulatory Framework for Control of Toxic Air Pollutants

**Prepared by:
Air Toxics Subcommittee**

**for the
Michigan Department of Environmental Quality
Air Advisory Group**

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PURPOSE OF THE REPORT

PURPOSE OF THE REPORT

This report was prepared by the Air Toxics Subcommittee of the Michigan Department of Environmental Quality's (MDEQ's) Air Quality Division (AQD) Air Advisory Group. The purposes of this report are:

1. to address issues of concern regarding toxic air pollution identified by the AQD Air Advisory Group;
2. to summarize points of view raised during deliberations, i.e., give readers a sense of the subcommittee's discussions; and
3. to present recommendations for revisions to Michigan's Air Toxics Program along with supporting rationale for those recommendations.

BACKGROUND AND ISSUES STATEMENT

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The Federal Clean Air Act (CAA) of 1970 included provisions for the U.S. Environmental Protection Agency (USEPA) to develop emission standards for hazardous air pollutants. Despite the usage of an extensive array of toxic air pollutants from a variety of sources throughout the country, the USEPA had only issued standards for a relative handful (seven) of air pollutants under the federal CAA. As a result, Michigan and many other states determined it was necessary to establish a state specific program to manage emissions of toxic air contaminants.

In the 1980s, the Michigan Air Pollution Control Commission directed that an advisory committee be formed to develop specific recommendations for a toxic air pollutant program. A committee was formed, met for over two years, and presented the Commission and the Michigan Department of Natural Resources with a proposed air toxics program. After much discussion and debate, rules were developed and eventually adopted by the Commission. The rules took effect in April 1992.

As with many legislative and regulatory initiatives, implementation results in a variety of experiences. These experiences often form the basis for modifications to programs. Such is the case with air toxics.

Several concerns have been raised regarding the content and implementation of Michigan's air toxics rules. These include, but are not limited to, the following:

1. the rule is not limited to a discrete list compounds;
2. conservative assumptions in the health impact analysis process;
3. delays in issuance of permits,
4. the time and process for determining screening levels; and
5. lack of control on existing sources.

While these concerns are not universally shared, they are the perspectives of a number of parties in the State of Michigan.

After the abolition of the Michigan Air Pollution Control Commission, the AQD formed an Air Advisory Group. A major function of this group is to provide AQD with feedback and advice on air quality policy related issues. After discussing these and other issues related to the air toxics program, the Air Advisory Group formed a subcommittee to assess the issues and formulate recommendations for their consideration. This is the subcommittee's report.

AIR TOXICS SUBCOMMITTEE CHARGE AND PROCESS

AIR TOXICS SUBCOMMITTEE CHARGE AND PROCESS

In its initial formation, the AQD Air Advisory Group identified air toxics as one of several key issues for review. The Advisory Group periodically discussed several issues related to implementation of Michigan's air toxics rules i.e. Rules 230-232. The Advisory Group determined it was appropriate to form a subcommittee to take a detailed look at several issues. Five of the key concerns put before the subcommittee were:

1. whether or not the application of Rule 230 should be based on a finite list of compounds,
2. an examination of the appropriateness of the conservative exposure assumptions used in implementation of the rule,
3. delays in issuance of permits,
4. reviewing the time and process for determining screening levels; and
5. lack of control on existing sources.

In the process of conducting its work, the subcommittee addressed each concern and issue identified by the Advisory Group. Each issue was analyzed by teams created by the subcommittee. Background and recommendations on each issue are provided in this report. More detailed, technical descriptions of certain issues are in the appendices.

The subcommittee includes representatives of the regulatory community, industry, environmental groups, and local government (See Appendix A). The subcommittee sought to work on a consensus basis.

The subcommittee addressed the issues by developing and evaluating alternatives to the existing rule. These alternatives were then evaluated against what the subcommittee identified it believes is the appropriate purpose of the state's air toxic regulation. The subcommittee decided the purpose of the regulation is:

To protect public health and the environment and facilitate sustainable economic growth and development considering workability of the rule, predictability of the standards, economic considerations, and ample margins of safety.

This statement embraces protection of public health and providing for predictability. The statement of purpose also embraces the concept of sustainable growth recognizing that all emissions cannot be eliminated.

The subcommittee recognizes the different values reflected in this purpose. Proposals aimed at improving provisions to protect public health and the environment are often viewed as lessening the goals of sustainable economic growth and providing predictability. Similarly, proposals to provide for sustainable growth and predictability of standards are often viewed as diminishing provisions to protect public health. The recommendations in this report were developed by the subcommittee considering all the values embodied in the rule purpose statement. Readers are encouraged to do the same.

RECOMMENDATIONS

RECOMMENDATIONS

We request the Advisory Group and the State of Michigan concur with the following recommendations. These recommendations address each of the concerns outlined in the Background and Issues Section. The recommendations form the basis for revisions to Michigan's Air Toxics rules and their administration. The recommendations are based on the experience and judgment of subcommittee members, and are consistent with the principles of toxicology and risk management. (Detailed background on each of the recommendations is provided later in the report.)

ISSUE: Should Rule 230 Be Based On A Finite List Of Compounds?

1. The definition of a Toxic Air Contaminant (TAC) should not change.
2. Best Available Control Technology for Toxics (T-BACT) should continue to be applied to all processes emitting TACs as currently required in Rule 230(1)(a).
3. Rule 230 should not be based on a finite list of compounds. Rather, compliance with Rule 230(1)(b) should be determined as follows:

Tier 1: TAC emissions are exempt from Rule 230 (1)(b) if they do not exceed 10 lbs/month and the maximum hourly emission rate does not exceed 0.14 lbs/hour (after applicable T-BACT). This small quantity emission level does not apply to TACs that are carcinogenic as defined in Rule 103(c) or those that have been determined to be of high concern by AQD (e.g., mercury and the 26 compounds with an Initial Threshold Screening Level (ITSL) less than 0.1 $\mu\text{g}/\text{m}^3$).

Tier 2: For TACs that have a screening level, the conditions of Rule 230(1)(b) are satisfied if the emission rate does not exceed the emission levels derived from the equations in Table 1.

Tier 3: Rule 230(1)(b) is satisfied if TAC emissions do not exceed the rate determined by application of the Ambient Impact Ratio (AIR) Screening Matrix following the procedures in Appendix D.

Tier 4: All other TAC emissions are subject to current modeling requirements specified in Rule 230 (10).

4. To be sure we are meeting the goal of protecting public health and to address concerns about emission from existing sources, the subcommittee recommends that the State of Michigan undertake a study in conjunction with USEPA and Wayne County Department of Environment. The study should determine the quality, quantity and nature of toxic air contaminants in a heavily impacted area such as southwest Detroit to determine the existence of any hot spots or areas of pollutants of concern.

ISSUE: Appropriateness of Exposure Assumptions and Other Assumptions Used in the Health Screening Analysis

5. Rule 230(1)(b) should be modified to include specific provisions for use of an industrial exposure scenario. Specifically, screening levels for carcinogenic chemicals should be adjusted by a factor of 10. A mechanism should be identified (e.g., a permit condition) whereby a company would periodically confirm that the land-use had not changed.

Adjustments for other, more complex scenarios such as consideration of commercial land-use should be dealt with on a case-by-case basis under Rule 230(6).

6. The default value for the ITSL should be changed from 0.04 to 0.1 $\mu\text{g}/\text{m}^3$ on an annual average basis.
7. The AQD should provide guidance in some form (e.g., operational memos) to address the following:
 - a. clarify how and when multi-media risk assessments should be done pursuant to Rule 230(3); and
 - b. clarify how an adjustment to the screening criteria might be supported based on a commercial exposure scenario applied on a case-by-case basis under Rule 230(6).
8. AQD should commit time and resources to addressing the following:
 - a. The AQD should address the issues related to use of the industrial scenario for noncarcinogens and develop adjusted criteria on an ongoing basis as appropriate.
 - b. As USEPA develops clearer guidance on how to address exposure to children, the AQD should consider changes to Rule 230 as appropriate.

ISSUE: Should the AQD Provide a List of Chemicals for which the Toxics Review is Only Partially Completed?

9. The AQD should maintain a list of chemicals for which a screening level review was only partially completed. The list will contain the chemical name, the Chemical Abstracts Service (CAS) number, and a brief statement as to why only a partial review was performed (e.g., permit application was withdrawn, low ambient impact, only reviewed for carcinogenicity data, other). The listing of partially reviewed chemicals can be made available in the same manner as the list of screening levels and should be periodically updated.
10. The "Reference Checklist" (see Appendix G) to the July 6, 1995 AQD document "Procedures for Developing Screening Levels" should be revised slightly so that the edition of the reference material, or date of review of the reference material is

noted. This will allow interested parties to determine whether any additional information has become available since the reference was checked.

ISSUE: Should the AQD Provide a List of Chemicals which are Currently Under Review for Development of a Screening Level?

11. The AQD should revise the list of chemicals for which screening levels have been developed to also list the chemicals which are currently under review. The list will contain the chemical name, the CAS number, the screening level (if it exists) or, in the alternative, the statement "In Progress." The list of chemicals under review can be made available in the same manner as the list of screening levels.

ISSUE: Development of a Screening Level Outside of Permit Review Process

12. The AQD should pursue development of a procedure to allow requests for screening levels to be initiated prior to the request being made by the permit engineer during the review of the application. Because of the potential for overburdening of staff resources, AQD should consider a pilot program prior to full scale implementation of any new changes. These requests should not be allowed to slow the permit related requests. Companies seeking development of a screening level prior to submission of the permit should submit relevant data available to them which will aid AQD staff in setting a screening level. The type of information needed is outlined in the AQD document, "Procedures for Developing Screening Levels," dated July 6, 1995.
13. The AQD should develop a policy of how these requests will be prioritized for review, especially in relation to screening level requests for in-house permit applications.

ISSUE: Should Applicants be Required or Allowed to Propose a New or Revised Screening Level?

14. The AQD should issue a brief policy or memo clarifying the Agency's open position regarding submission of toxicological information and proposals for screening levels by permit applicants. The policy should specifically clarify that such information is welcome to be submitted, but is not required.
15. This position should be communicated to attendees at appropriate programs, such as training by MDEQ Environmental Assistance Division (EAD) and conferences, such as those sponsored by the Air and Waste Management Association.
16. Business representatives on the AQD Air Advisory Group should report this policy back to their respective organizations (e.g., Michigan Manufacturers Association (MMA), Chamber of Commerce, Michigan Chemical Council, etc.)

ISSUE: How to Define the Best Available Data (or Information) in Developing Screening Levels

17. The definitions, references and guidelines for determining best available data appearing in the rules and "Procedures for Developing Screening Levels" are the most appropriate currently available. Agreement on a single set of detailed decision criteria for determining best available data (or information) may well be beyond general scientific consensus and is not feasible.
18. Additional helpful "criteria for assessing the quality of individual animal toxicity studies" can be found in USEPA guidance, "Methods for Development of Inhalation Reference Doses." This should be referenced in future memoranda put out by AQD.

ISSUE: Should Mutagenicity Data be Used to Establish Uncertainty Factors for the Development of Screening Levels?

19. There is no scientifically justifiable methodology for developing uncertainty factors based on mutagenicity data. We are unaware of any precedent for using such data in this manner. Therefore, the subcommittee recommends mutagenicity data not be used to establish uncertainty factors for the purpose of developing screening levels.

ISSUE: Conformance of Michigan's Program with the Federal Clean Air Act

20. Rule 230 should be amended as follows to be consistent with Act 451.
 - a. A system should be developed to insure that the Rule 336.1230(4) exemption incorporates all promulgated emission standards under Section 112(d).
 - b. Rule 336.230(4)(b)(1) should be amended to include technology determinations made pursuant to CAA Sections 112(g) and 112(j).
 - c. Rule 230 should exempt other toxic air pollutants that are volatile organic compounds (VOCs) and particulate matter if the standard promulgated under Section 112(d) or the determination made under Section 112(g) or 112(j) control similar compounds.
21. Michigan's Air Use Permit Technical Manual (June 1996) should be updated. The update should clarify that if a source meets the requirements of a promulgated Section 112(d) emission standard for hazardous air pollutants or a technology determination made pursuant to either Section 112(g) or 112(j), the source would be exempt from Rule 230 technology requirements (T-BACT) for all air contaminants regulated under the CAA. The exemption would also include a categorical exemption for VOCs and particulate matter if CAA Sections 112(d), 112(g) or 112(j) control similar compounds which are also VOCs and particulate matter.

22. Michigan should proactively engage in the Federal rule development process (e.g. Section 112(f) "Standard to Protect Health and the Environment") in an effort to influence the outcome of the final rules based on experiences Michigan has gained from implementing a risk based air toxics program.

**ISSUES AND BASIS FOR SUBCOMMITTEE
RECOMMENDATIONS**

ISSUES AND BASIS FOR SUBCOMMITTEE RECOMMENDATIONS

ISSUE: Should Rule 230 Be Based On A Finite List Of Compounds?

The subcommittee devoted numerous meetings to discussing the pros and cons of incorporating a finite list of compounds into Rule 230. This would be a significantly different approach than the one used in the current rule which presupposes that all compounds (except for approximately 40) are TACs. To address this issue, the subcommittee developed and debated several alternatives to use as a basis for a regulatory program. These included:

- retaining the status quo,
- basing application of the rule on a relatively long list of compounds,
- basing application of the rule on a shorter list of compounds and providing the AQD with greater authority in the rule to address unlisted compounds,
- basing application of the rule on a limited list of compounds for new sources but taking a more aggressive approach in reducing emissions from existing sources, and
- shifting the focus away from the "list issue" toward basing the need for health assessments on some de minimis value based on either toxicity, rate of emissions, or both.

Appendix B includes a brief description of several of these options with a list of pros and cons considered by the subcommittee. **The pros and cons do not represent any consensus of the subcommittee. They simply represent a list of perspectives that different members put on the table regarding the various options. In fact, certain issues that may be considered a pro by one person may well be considered a con by another.**

Perspectives on Whether or Not to List

The core of the debate about whether to incorporate a list to Rule 230 centers on values that often are in conflict. From the perspective of many, a list is needed to provide for workability, ease of administration, certainty, and the proper allocation of resources. While others do not dispute the desirability of achieving those values, there is another perspective that these values are being achieved and limiting the rule to a list of compounds compromises the ability of the regulatory agency to provide for adequate protection of public health.

In general, permit applicants are of the opinion that application of T-BACT to all pollutants coupled with an impact analysis for emissions of certain compounds based on some de minimis criteria was appropriate. Some feel that such an approach would be more consistent with the regulations of some other states and still provide for the protection of public health.

In general, regulatory agencies and others are of the opinion that in order to protect public health, it is necessary to have the ability to limit the impact from emissions of compounds whether or not they appear on a list. Some feel comparison to other states' programs is not very helpful. Some states do not have air toxics rules, and those that do, have widely ranging applicability provisions.

Many felt the lists being proposed encompassed most of the emissions from the majority of sources in the state. Such a finite list would only benefit more specialized industry and considerable effort on both sides would be expended debating which compounds should be on or off the list. When we tried to develop a list, several difficulties were apparent, such as:

- determining which pollutants belong on the list,
- how to deal with unlisted pollutants, and
- determining a de minimis level of emissions.

The subcommittee determined that the issue of whether or not there should be a list of compounds in the rule and the de minimis concept are inextricably linked. If there were an exhaustive list of compounds, or if there was no list, a larger de minimis quantity would be more appropriate. If the list was relatively short, a smaller de minimis quantity would be more appropriate.

Out of this discussion, the group determined that an acceptable method of protecting human health while providing flexibility was to make use of a tiered system in determining how much permit review is necessary. We evolved a proposal to establish criteria to use in a screening process of determining whether or not detailed ambient impact analysis would be necessary for a particular pollutant. Specifically, the subcommittee developed a tiered approach to determine the following:

First, whether or not anything other than the T-BACT provisions of Rule 230 need to be considered, and

Second, what level of detailed analysis is required to satisfy the health impact analysis provisions of Rule 230(1)(b).

A four-tiered approach has been developed. This approach is designed to focus resources of the agency and applicants and responds to many of the concerns that the subcommittee was asked to address.

For the first tier, the subcommittee developed a small quantity exemption level for Rule 230(1)(b) applicability (10 lbs/month with a maximum hourly emission of 0.14 lbs/hour). This is accompanied by a list of compounds which do not qualify for the exemption. These are compounds that meet the definition of a carcinogen in Rule 103(c) and those noncarcinogens that have been determined to be of high concern by AQD (e.g., mercury and the 26 compounds that have an ITSL below $0.1 \mu\text{g}/\text{m}^3$).

For the second tier, emission levels are determined acceptable if:

- a) there is a screening level for the TAC, and
- b) the emissions do not exceed the emission rate for the specific averaging time in the following table:

Table 1: Tier 2 Approach for Determining Acceptable Emission Rates for Rule 230(1)(b)

SL* (ITSL or IRSL) Averaging Time	Monthly Emission Rate (lbs/mo)	24 Hour Emission Rate (lbs/24 hr)	1 Hour Max Emission Rate (lbs/hr)
annual	SL X 40		SL X 0.54
24 hours		SL X 0.12	SL X 0.05
8 hours			SL X 0.02
1 hour			SL X 0.001

*All screening levels (SLs) are in units of $\mu\text{g}/\text{m}^3$. For simplicity, the units in the equations are not included here, but they are discussed in Appendix C.

Thus, the greater the screening level, the greater the acceptable emission rate.

For the third tier, the subcommittee determined that the acceptable emission level should be a function of both the toxicity of the substance and the rate of emissions, and the physical characteristics (stack height, building height, distance to property line, etc.) of the proposed process. The acceptable emission level for a less toxic substance such as acetone could be orders of magnitude higher than for a substance like 1,3-butadiene. The subcommittee and the Dispersion Modeling Procedures (DiMoP) subcommittee developed an AIR matrix for determining acceptable emission rates based on the ratio of emissions to the ITSL or Initial Risk Screening Level (IRSL) (see Appendix C). The acceptable emission rate varies with stack parameters, building height, distance to secured property line, and the screening level and averaging time.

A detailed explanation of the derivation of the these first 3 tiers is in Appendix C.

For the fourth tier, the impact analysis is conducted in the same fashion as currently required in Rule 230(10), except that the dilution matrix would be replaced by the AIR matrix.

The anticipated outcome of these changes is that sources with emissions of compounds which are acceptable according to tiers 1-3 will only undergo T-BACT review. Sources which emit what are determined to be significant quantities of more toxic compounds

will receive more extensive dispersion modeling and impact analysis. Figures 1 and 2 show the existing and proposed process for implementation of Rule 230.

In summary, the issue of whether or not to base the rule on a finite list is addressed by this tiered approach. These changes will help streamline the permitting process by focusing the efforts of the Department and the regulated community on emissions of greatest concern. **This approach also provides an incentive to industry to minimize emissions of more toxic compounds so as to fall below threshold quantities.**

Recommendations

In response to whether or not the state's air toxics program should be based on a finite list, the subcommittee recommends the following:

1. The definition of a TAC should not change.
2. T-BACT should continue to be applied to all processes emitting TACs as currently required in Rule 230(1)(a).
3. Rule 230 should not be based on a finite list of compounds. Rather, compliance with Rule 230(1)(b) should be determined as follows:

Tier 1: TAC emissions are exempt from 230(1)(b) if they do not exceed 10 lbs/month and the maximum hourly emission rate does not exceed 0.14 lbs/hour (after applicable T-BACT). This small quantity emission level does not apply to TACs that are carcinogenic as defined in Rule 103(c) or those that have been determined to be of high concern by AQD (e.g., mercury and the 26 compounds with an ITSL less than 0.1 $\mu\text{g}/\text{m}^3$).

Tier 2: For TACs that have a screening level, the conditions of 230(1)(b) are satisfied if the emission rate does not exceed the emission levels derived from the equations in Table 1.

Tier 3: Rule 230(1)(b) is satisfied if TAC emissions do not exceed the rate determined by application of the AIR Screening Matrix following the procedures in Appendix D.

Tier 4: All other TAC emissions are subject to current modeling requirements specified in Rule 230(10).

4. To be sure we are meeting the goal of protecting public health and to address concerns about emission from existing sources, the subcommittee recommends that the State of Michigan undertake a study in conjunction with USEPA and Wayne County Department of Environment. The study should determine the quality, quantity and nature of toxic air contaminants in a heavily impacted area

such as southwest Detroit to determine the existence of any hot spots or areas of pollutants of concern.

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ISSUE: Appropriateness of Exposure Assumptions and Other Assumptions Used in the Health Screening Analysis

Background

Some feel the State of Michigan's air toxics regulations (Michigan's program) combine a series of conservative assumptions that compound and lead to permit requirements more restrictive than necessary to protect public health. The focus of the subcommittee's efforts was to enhance understanding of the process, clearly identify any significant drivers, if possible, then recommend any changes that would increase flexibility in the process while continuing to protect public health. Appendix E contains a detailed description of the approach taken to evaluate conservative assumptions. A summary follows.

The toxics permitting process is complex and is impacted by many different factors. The subcommittee identified, listed, and characterized individual items that impact the process. The group then qualitatively classified each according to the degree of conservatism (from low-end to worst case) they contribute to the process. Items were organized into five groups or categories for clarity: emissions characterization, ambient impact modeling, holistic or real-world issues, exposure scenario assumptions, and dose-response assessment and screening level development. The details of the analysis are provided in Appendix E.

Review of the overall range of conservative and nonconservative assumptions did not indicate a preponderance of conservatism in the program. However, some key aspects did stand out as areas in need of adjustment.

Due to time and resource constraints, the subcommittee was unable to address these items in a way that would characterize the weight or impact each item would be expected to have on the entire process relative to other items (e.g., conduct a sensitivity analysis). **It is not valid to add up the number of low-end (not considered to be conservative) versus worst-case (considered to be very conservative) contributors and have a sense of the conservatism in the overall process.** Comments on the relative importance of any item, as provided in Appendix E, reflects the best judgment of the subcommittee.

Based on the initial evaluation of the assumptions, procedures and methodologies influencing Michigan's permitting process, the following topics were addressed:

- I. The potential for incorporating appropriate exposure factors in the development and application of screening levels. The possibility of adjusting screening levels for use as criteria in assessing impacts in industrial and commercial areas was discussed.

- II. Alternatives for developing a new default (trace) level for chemicals lacking in toxicity data.
- III. Areas where the AQD should develop guidance to facilitate the use of alternative approaches in the rules were identified.
- IV. Areas where future efforts and resources should be committed were identified.

Each area is discussed separately below. Recommendations are summarized at the end of the section.

I. Incorporation of appropriate exposure factors in the development and application of screening levels.

Background

Concerns have been raised regarding the appropriateness of certain conservative exposure assumptions in the calculation of a risk-based screening level. This is particularly important when applied to potential exposures at all locations beyond the secured property line.

The following provides the regulated community with options that are more appropriate under certain conditions. Appropriately applied, public health will not be compromised and the approach selectively addresses the worst case end of the items identified in several categories (e.g., point of compliance, length of time over which exposure occurs).

Industrial Land-Use Scenario

Under the current rules, the point of maximum impact at or beyond a secured property line is defined as the point of compliance. Predicted ambient impacts (PAIs) are compared to the appropriate chemical specific screening level [ITSL, IRSL, Secondary Risk Screening Level (SRSL)] to determine acceptability. The subcommittee sought to allow flexibility in the point of compliance by allowing for adjustment of the screening level based on changes in anticipated length of time over which exposure occurs (hours per day, days per year, number of years).

Screening levels are currently developed to protect the general public (adults, children, and sensitive subpopulations) even if exposures are assumed to be continuous over a lifetime of exposure. The subcommittee evaluated the possibility of developing alternative screening levels based on current land-use in the area surrounding the proposed process.

The approach will still be protective of human health. People do not live in industrial areas and are expected to be there only a portion of the day and a portion of the week.

They will be exposed for a shorter amount of time and therefore the estimated dose attributed to a source would be less than if the impact were in a residential area.

For those permit applicants who choose to use this approach, modeling would need to be done to develop a PAI for each sector (e.g., determine where land-use is industrial) and an adjusted screening level would be applied where appropriate. A mechanism would need to be identified (e.g., a permit condition) whereby a company would periodically confirm that the land-use had not changed.

This will provide more flexibility for emissions which have their maximum impact on large unfenced properties owned by the same company, and impacts in industrial parks and other areas where clearly the health of the community will not be impacted.

Adjustment of IRSLs & SRSLs Based on Exposure Factors for Industrial Exposure Scenarios

Cancer risk-based screening levels are based on an assumed continuous lifetime of exposure. Implicit in this approach is an assumed exposure of 365 days per year (with a ventilation rate of 20 m³/d), for a full lifetime (70 years). These assumptions are recognized as conservative (but not unreasonably so) for residential exposure scenarios. However, they are overly conservative for areas with no reasonable potential for use as residential properties, due to industrial land use or other circumstances.

There is potential to remedy this situation by replacing certain exposure factors with more appropriate ones based on non-residential human exposure potential in the area impacted by a facility's emissions. The range of alternative approaches for implementing a change are governed by three key questions.

1. Which alternative exposure scenarios to address?

There is potentially a wide array of scenarios which could be considered for alternative exposure factors for IRSL/SRSL calculations. These include not only industrial but also commercial land-use classifications (as in Environmental Response Division (ERD) Part 201 program), water bodies, parks, etc. Since the greatest concern presently is with the industrial land-use areas, and the other scenarios would significantly increase the complexity, the group proposed to address only the industrial land-use areas presently. Still, the other non-residential impacted areas may be evaluated differently on a case-by-case basis under Subrule 230(6).

2. Who should apply the alternative exposure factors for ambient impact assessment: AQD vs. applicant?

If less conservative exposure factors are to be applied, essentially resulting in higher IRSLs and SRSLs for industrial areas, there will be a need to model the

predicted ambient impacts in these areas as well as the most impacted residential areas to ensure that the impacts there are acceptable. If this assessment were to be performed by AQD for all permit applications involving carcinogen emissions, the ambient impact modeling required would be a significant burden. Therefore, it is proposed that the permit applicant have the burden of the demonstration. The demonstration would be reviewed by AQD permit engineers and modelers.

3. Are rules revisions necessary?

Alternative demonstrations of the public health protectiveness of emissions are currently allowed under Subrule 230(6). However, it is proposed that the adjustments to IRSLS and SRSLS, based on alternative exposure factors for impacts to industrial areas, be provided via a rule revision. The intention of this approach is to enable the applicant to perform the adjustments without entering into the complexities of a Subrule 230(6) demonstration.

Basis for Recommended Adjustment

An ambient air impact in an area which is exclusively industrial in use, should be considered acceptable under Rule 230 if the concentrations of carcinogens are as much as 10 times higher than the applicable IRSLS and SRSLS. The 10-fold adjustment is derived as follows in Table 2:

Table 2: Industrial and Residential Exposure Factors

Land Use	Lifetime (L)	Exposure Duration (ED)	Exposure Frequency (EF)	Inhalation Rate (IR)
industrial	25,550d (70 yr)	21 yr	245 d/yr	10 m ³ /d
residential	25,550d (70 yr)	70 yr	365 d/yr	20 m ³ /d

It should be noted that the cancer risks associated with such exposures are not any different than the acceptable target cancer risk levels in Rules 230-231. Rather, the acceptable air concentrations associated with those target cancer risks are higher due to the exposure factors adjustments.

The adjustment of IRSLs and SRSLs for residential applications to those for industrial applications is calculated from the ratio of the residential:industrial exposure equations, which are each set up as:

$$\frac{ED \times EF \times IR}{L}$$

Solving this calculation for residential and industrial exposure gives a residential:industrial ratio of 20:2, or a 10-fold higher exposure for residential. Therefore, the industrial exposure scenario may have 10-fold higher ambient impact of carcinogen emissions while still being associated with the same 10^{-6} (IRSL) and 10^{-5} (SRSL) risk levels.

The L, ED, EF, and IR values for industrial scenarios are consistent with those used by ERD for the derivation of dermal and inhalation cleanup criteria (see ERD operational memorandum #14, and Part 201 Generic Soil Inhalation Criteria for Ambient Air: Technical Support Document). According to the ERD operational memo, the chosen exposure duration of 21 years represents a 90th percentile value, while the 95th percentile is 25 years. The exposure frequency of 245 days per year is based on a 5 day/week work schedule, with 3 weeks per year of leave time. The IR of $10 \text{ m}^3/\text{d}$ for occupational exposures is a standard default utilized by USEPA and OSHA. It is based on the assumption that a worker engaged in moderate activity will respire more heavily while working than during light activity and resting portions of the day.

The assumed lifetime of 70 years is a standard assumption, and for cancer risk assessment the total lifetime dose is assumed to be the appropriate metric for risk quantitation. The appropriateness of this assumption becomes more questionable as exposure duration decreases significantly.

The issues surrounding the adjustment of screening levels protective of noncarcinogenic effects will be addressed at a later date. This is briefly discussed in the section addressing areas where future efforts and resources should be committed.

II. Alternatives for developing a new default (trace) level for chemicals lacking in toxicity data.

Background

Basis for Current Default Value

When no toxicological data are available to determine an ITSL, the ITSL is set at the default value of $0.04 \text{ ug}/\text{m}^3$. This value was first developed in 1981 by the Special Air Advisory Committee convened by the AQD. The default value was determined using an oral LD_{50} of $5 \text{ mg}/\text{kg}$ in the algorithm for deriving an ITSL from an LD_{50} . The LD_{50} of $5 \text{ mg}/\text{kg}$ was selected by first searching the 1978 version of the Registry of Toxic Effects of Chemical Substances (RTECS) for oral LD_{50} values. A total of 10,417 citations were identified, and the 5th percentile ranked (from smallest to largest) LD_{50} was $5 \text{ mg}/\text{kg}$.

Re-evaluation of the Default Value in 1995

In 1995, staff of the AQD re-evaluated the basis of the default value. As part of this work, staff investigated the possibility of using inhalation LC₅₀s as opposed to oral LD₅₀s for determination of the default value. The rationale for this approach was that although the available data set for inhalation LC₅₀s was much smaller than oral LD₅₀s, the route of exposure was much more appropriate.

A search of the 1995 RTECS database resulted in 526 LC₅₀ values, representing 483 chemicals. The 5th percentile ranked (smallest to largest) LC₅₀ was 45 mg/m³. An evaluation of the database showed the data were not normally distributed. The resulting ITSL using the algorithm for an inhalation LC₅₀ was 0.9 ug/m³.

Following completion of this work, staff requested a recommendation from the Scientific Advisory Panel (appointed pursuant to Rule 230) on whether the use of the inhalation LC₅₀ database resulted in a more scientifically appropriate default value than use of the oral LD₅₀ database. During consideration of this issue, the Panel requested that AQD staff also analyze the existing database of ITSLs to determine a potential default value. For this analysis, all existing ITSLs, excluding those based on the default value, were converted to annual averaging times by dividing the ITSL by the following conversion factors from the Rule 230 dilution factor matrix in Table 3:

Table 3: Averaging Time Conversion Factors

Averaging Time	Factor
24 hour	10
8 hour	18
1 hour	75

After converting the ITSL to "annualized" values, it was found that the 5th percentile ranked (smallest to largest) ITSL was 0.03 ug/m³. A similar analysis was also done for the set of ITSLs that were based only on an annual averaging time (excluding those with shorter averaging times). For this database, the 5th percentile ranked value was 0.06 ug/m³. The Panel concluded that there seemed to be no convincing data to change the current default of 0.04 ug/m³ at that time. It should be noted that at a later date (see below) it was discovered that a few ITSLs based on the default value had been left in this database, and the correct 5th percentile value should have been 0.3 - 0.4 ug/m³.

Re-evaluation of the Default Value in 1996

The Air Toxics Subcommittee of the AQD Air Advisory Group began a review of the air toxics rules (Rules 230-232) in early 1996. As part of this work, the default value was again re-evaluated.

It was discovered that in the 1995 analysis of existing ITSLs, a few ITSLs based on the default value had inadvertently been included in the database. Because of this, and the fact that a large number of ITSLs had been developed since the work in 1995, it was decided to re-analyze the existing ITSL database.

Since averaging times for an ITSL may vary from 1 hour to an annual basis, it is difficult to directly compare screening levels with different averaging times. For this reason, three different methods were used to evaluate the existing ITSL database. These three methods are described in more detail below.

Method 1

In this method, all currently established ITSLs that were based on an annual averaging time, excluding all ITSLs based on the default value (0.04 ug/m^3), were ranked from lowest to highest value. The ITSL values ranged from 0.01 to 6000 ug/m^3 . The 10th percentile ranked value was 1.5 ug/m^3 , and the 5th percentile ranked value was 0.3 ug/m^3 . Based upon this analysis, the current default value would be represented by a percentile ranking of 1.2 - 1.8. There were three ITSLs less than 0.04 ug/m^3 , which ranged in value from 0.01 - 0.03 ug/m^3 .

The advantage of this database is that all ITSLs are based on the same averaging time. Therefore, the issue of different averaging times and appropriate conversion factors does not have to be considered. However, this database excludes all the chemicals with averaging times shorter than an annual period, including those chemicals in which the ITSL is based on a Reference Concentration (RfC), Reference Dose (RfD), or occupational exposure limit (ACGIH TLV or NIOSH REL). In general, the hazards from these chemicals are better characterized, there is more health effects data on these chemicals, and the chemicals are used in greater volume. Thus, by using this database, ITSLs based on the best data and with the least uncertainty are not included, nor are the high volume use chemicals.

Method 2

In this method, all currently available ITSLs regardless of averaging time (excluding all ITSLs based on the default value) were ranked from lowest to highest value. Prior to ranking the values, any ITSL not based on an annual averaging time was adjusted to an annual averaging time by dividing by the factors listed in Table 3 above.

The adjusted ITSL values ranged from 0.001 - 8000 ug/m^3 . The 10th percentile ranked value was 0.13 ug/m^3 , and the 5th percentile ranked value was 0.03 ug/m^3 . Based upon this analysis, the current default value would be represented by a percentile ranking of 6 - 6.4. There were 23 ITSLs (adjusted values) lower than 0.04 ug/m^3 , ranging from 0.001 - 0.03 ug/m^3 .

The advantage of this database is it includes the greatest number of ITSLs, especially those ITSLs based on the best data and the high volume use chemicals. The disadvantage of this database is that ITSLs with an averaging time period less than annual, have to be converted to an annual basis. This process can add some uncertainty due to questions regarding the appropriate factor to use to make this conversion.

Method 3

In this method, all currently available ITSLs, regardless of averaging time, but excluding all ITSLs based on the default value were ranked from lowest to highest value. No adjustment to the ITSL was made based on the averaging time.

The ITSLs ranged from 0.01 - 80,000 $\mu\text{g}/\text{m}^3$. The 10th percentile ranked value was 1 $\mu\text{g}/\text{m}^3$, and the 5th percentile ranked value was 0.2 $\mu\text{g}/\text{m}^3$. Based upon this analysis, the current default value would be represented by a percentile ranking of 1.8 - 2.3.

The advantage of this database is that like Method 2, it includes the greatest number of ITSLs, especially those based on the best data and the high volume use chemicals. The disadvantage of this database is that it is not appropriate to directly compare ITSLs with different averaging times.

Table 4 below provides a summary of the 5th and 10th percentile ranked ITSLs, based on the above three methods.

Table 4: 5th and 10th Percentile ITSLs

Method	5th Percentile ITSL ($\mu\text{g}/\text{m}^3$)	10th Percentile ITSL ($\mu\text{g}/\text{m}^3$)
1	0.3	1.5
2	0.03	0.13
3	0.2	1.0

Basis For The Recommendation

After considering all the available information, the subcommittee recommends that the default value for the ITSL be changed from 0.04 to 0.1 $\mu\text{g}/\text{m}^3$ on an annual average basis.

The subcommittee agrees with the earlier review done in 1995 by the Scientific Advisory Panel that new data and re-analysis of this information does not provide a compelling basis for changing the default value. However, the subcommittee believes that these data and analyses can support a range of values for the default value.

In evaluating this information, the subcommittee tended to feel that Method 2 was better supported than the other methods when weighing advantages/disadvantages. However, no one set of data or methodology could be justified as the best approach

based only on scientific reasons. Rather than selecting a single approach for justifying a default value, the subcommittee believes the data as a whole can support the selection of 0.1 ug/m^3 . The following considerations form the basis for this recommendation:

- A value of 0.1 ug/m^3 corresponds to the 2.4, 6.7, and 3.3 percentile ranked ITSLs, respectively for Methods 1, 2 and 3. The percentile rank range of 2.4 - 6.7 encompasses the 5th percentile value historically used in determining the default value.
- The value of 0.1 ug/m^3 is between the 5th and 10th percentile ranked values for Method 2. Both the 5th and 10th percentiles are used in risk assessment to represent conservative estimates.
- A value of 0.1 ug/m^3 is within the range of ITSLs ($0.04 - 0.9 \text{ ug/m}^3$) that would be determined from the 5th percentile ranked LD_{50} and LC_{50} .
- The uncertainty in all of the methodologies indicates that the precision should be reasonably presented as no better than an order of magnitude.

III. Areas where the AQD should develop guidance to facilitate the use of alternative approaches in the rules.

Background

Currently, there are existing options in the rules that allow for alternate approaches for demonstrating the acceptability of PAIs. The AQD has not provided guidance on how these may be used. Following are options discussed by the subcommittee:

- Rule 230, Subrule 6 provides for an exemption from the standard approach to developing screening levels and allows for a case-by-case analysis that shows that the new or modified process will not cause or contribute to a violation of Rule 901.
- Rule 230, Subrule 7(c) provides for the use of an alternative cancer risk assessment methodology that can be shown to be appropriate on biological grounds and supported by scientific data.
- Rule 230, Subrule 8(b) provides for the use of an alternative methodology to assess noncarcinogenic health effects that can be demonstrated to be more appropriate on biological grounds and supported by scientific data.
- Rule 230, Subrule 3 provides for the use of multi-media risk assessments as an alternative. This rule allows the AQD to consider indirect routes of exposure in

determining the adequacy of the screening levels to protect public health or the environment.

IV. Areas where future efforts and resources should be committed.

There are certain areas where there are ongoing efforts by other agencies (e.g., USEPA, academia, the regulated community) which may result in changes in the way toxics should be regulated in Michigan. The AQD should commit to following these issues and incorporating the changes as appropriate.

The issues surrounding the use of alternative exposure assumptions based on land-use (industrial scenario) for non-carcinogens need to be addressed. The issues include chemical-by-chemical identification of the effects associated with exposure to a chemical (e.g., teratogenicity), the critical effect, and the likelihood of the occurrence of acute effects when criteria are adjusted. There are ongoing efforts by USEPA, certain state governments and other agencies to develop short-term/acute criteria. These efforts may provide criteria that can be used for shorter averaging times (e.g., 1 hour) in conjunction with chronic criteria, when appropriate.

USEPA has mounted an ongoing effort to address special issues that are important to assessing exposure and sensitivity issues in children. The AQD should continue to follow the activities and developments for this issue.

The subcommittee identified a large number of assumptions (see Appendix E) that might factor into the risk assessment process associated with Rule 230. Given the time and resource constraints, the subcommittee focused its discussions on those issues that tended towards either worst case or low end with regards to the degree of conservatism, and that were likely to be significant factors in the risk assessment. Based on this evaluation, the subcommittee recommends the following:

Recommendations

5. Rule 230(1)(b) should be modified to include specific provisions for use of an industrial exposure scenario. Specifically, screening levels for carcinogenic chemicals should be adjusted by a factor of 10. A mechanism should be identified (e.g., a permit condition) whereby a company would periodically confirm that the land-use had not changed.

Other, more complex scenarios such as consideration of commercial land-use should be dealt with on a case-by-case basis under Rule 230(6).

6. The subcommittee recommends that the default value for the ITSL be changed from 0.04 to 0.1 $\mu\text{g}/\text{m}^3$ on an annual average basis.
7. The subcommittee recommends that AQD provide guidance in some form (e.g., operational memos) to address the following:
 - a. clarify how and when multi-media risk assessments should be done pursuant to Rule 230(3); and
 - b. clarify how an adjustment to the screening criteria might be supported based on a commercial exposure scenario applied on a case-by-case basis under Rule 230(6).
8. AQD should commit time and resources to addressing the following:
 - a. The AQD should address the issues related to use of the industrial scenario for noncarcinogens and develop adjusted criteria on an ongoing basis as appropriate.
 - b. As USEPA develops clearer guidance on how to address exposure to children, the AQD should consider changes to Rule 230 as appropriate.

ISSUE: Should the AQD Provide A List Of Chemicals for Which the Toxics Review Is Only Partially Completed?

Background

There are a number of chemicals submitted to the AQD for which the review is not completed. The review of the chemical is completed partially for a number of reasons. Two common reasons are the permit application is withdrawn by the applicant, or the ambient impact of the chemical is calculated to be so low that professional judgment of the toxicologist dictates that the ambient impact is below a level of concern.

It is important to note that in cases where only a partial review is completed because the ambient impact is below a level of concern, the ambient impact approved for the permit does not become a screening level for that chemical. The only time that a screening level is set for a chemical is when a complete review of the data has been performed.

Two methods of conveying information on the partially reviewed chemicals were discussed. The information could be obtained via a telephone call to the AQD, or the information could be disseminated periodically by the AQD in a list format similar to the list of screening levels.

Applicants will be able to determine the status of a chemical that they may potentially use. This will help applicants to more accurately predict the length of time necessary for a permit review. This may also prompt applicants to "gap fill" information which has not yet been reviewed according to the "Reference Checklist" in the July 6, 1995 AQD document "Procedures for Developing Screening Levels."

If a company wishes to inquire further about the partial review of a chemical, the AQD can be contacted. Additional information that can be requested includes, the "Reference Checklist" (Appendix G) and a copy of the information gathered.

Note: The AQD will not review their files to determine which chemicals were only partially reviewed in the past. The list will be developed based on reviews that are ongoing after the implementation date of this recommendation.

Recommendation

9. The AQD should maintain a list of chemicals for which a screening level review was only partially completed. The list will contain the chemical name, the CAS number, and a brief statement as to why only a partial review was performed (e.g., permit application was withdrawn, low ambient impact, only reviewed for carcinogenicity data, other). The listing of partially reviewed chemicals can be made available in the same manner as the list of screening levels and should be periodically updated.

10. The "Reference Checklist" (see Appendix G) in the July 6, 1995 AQD document "Procedures for Developing Screening Levels" should be revised slightly so that the edition of the reference material, or date of review of the reference material is noted. This will allow interested parties to determine whether any additional information has become available since the reference was checked.

ISSUE: Should The AQD Provide a List of Chemicals Which Are Currently Under Review for Development of a Screening Level?**Background**

During discussions of whether a list of chemicals whose review was not completed should be listed, the work group found that there was another category of chemicals that applicants are interested in: those that are currently under review by the AQD. We felt that it could help applicants make informed determinations regarding the time required for a permit review with toxics concerns.

Two methods of conveying information on the chemicals whose reviews are in progress were discussed. The information could be obtained via a telephone call to the AQD, or the information could be added to the list of screening levels.

(Note: The subcommittee discussed the fact that this list will be updated at the same time as the screening level list (every two months) and that industry should be aware that unless the list was updated very recently, there may be chemicals under review that do not appear on the list. It is hoped that eventually, as technology and knowledge of the Internet increases, there may be some type of direct link and "real time" update of the information.)

Applicants will be able to determine the status of a chemical that they may potentially use. This will help applicants to more accurately predict the length of time necessary for a permit review. This may also prompt applicants to "gap fill" information which has not yet been reviewed according to the "Reference Checklist" (Appendix G).

Recommendation

11. The AQD should revise the list of chemicals for which screening levels have been developed to also list the chemicals which are currently under review. The list will contain the chemical name, the CAS number, the screening level (if it exists) or, in the alternative, the statement "In Progress." Since the list of chemicals with screening levels is an existing list with a distribution process already in place, the distribution process will not be revised.

ISSUE: Development Of A Screening Level Outside Of The Permit Review Process

Background

Historically compounds have been reviewed, and ITSLs or IRSLs set, as part of the review of a permit application. The request for the development of a screening level is usually initiated by the permit engineer during the evaluation of the application for technical completeness.

As the business environment becomes more competitive, the regulated community needs a very rapid permit approval system. If companies could submit compounds for assessment prior to permit applications being sent, it would aid in the design of the process and emission control equipment. It would also speed up the permit review process because the ITSLs or IRSLs for the compounds would be established prior to receipt of the application.

There has also been a recent change proposed to Rule 290 which allows for an exemption of an emission unit based on the ITSL or IRSL of the compounds emitted from the unit. For companies to use this exemption properly, they will need to know the ITSL or IRSL of compounds emitted from the unit. While companies may determine the screening level themselves for using this exemption, some companies may not have the technical staff to do so. Others may desire the assurance of utilizing an AQD derived screening level.

This change could be done as a simple statement of policy as to whether or not it is allowed. A detailed description of the informational requirements from the applicant would be developed with an informational format for the information. The AQD could set a policy stating what the informational requirements are and how the requests will be prioritized with the current permit work load.

By establishing the ITSL or IRSL earlier in the design of the process, there will be less back and forth discussion between the AQD engineer and the company. This would also ensure that a company could work with the AQD in establishing ITSLs and IRSLs for an exempt Rule 290 source.

The practice of setting ITSLs or IRSLs could also invite abuse by companies asking for ITSLs or IRSLs on many compounds without firm plans to install a process. Typically, only a small number of projects make it from the lab to full scale production. If a company were to request an ITSL or IRSL for every compound they look at in the lab, a serious backlog would be created.

Recommendation

12. The AQD should pursue development of a procedure to allow requests for screening levels to be initiated prior to the request being made by the permit engineer during the review of the application. Because of the potential for overburdening of staff resources, the AQD should consider a pilot program prior to full scale implementation of any new changes. These requests should not be allowed to slow the permit related requests. Companies seeking development of a screening level prior to submission of the permit should submit relevant data available to them which will aid AQD staff in setting a screening level. The type of information needed is outlined in the AQD document, "Procedures for Developing Screening Levels", dated July 6, 1995.
13. The AQD should develop a policy of how these requests will be prioritized for review, especially in relation to screening level requests for in-house permit applications.

ISSUE: Should Applicants be Required or Allowed To Propose a New or Revised Screening Level?**Background**

Some representatives stated that the AQD should allow companies to submit relevant data or possibly even proposals for ITSLs and IRSLS. This would help speed up the AQD's development of screening levels and thereby also speed up the permit process. Further, others have suggested that companies submitting permits for substances that do not have screening levels be required to submit relevant data and proposals for screening levels. This would reduce the workload on the state and thereby conserve public resources expended in the permit process.

Some companies, particularly those involved in developing and using new chemicals and chemical feedstocks, are interested in being able to provide data to support the development of screening levels. In some cases, these companies have relevant and valuable information regarding acceptable levels of exposure to these chemicals. The AQD has, and will continue to, accept such information under advisement when determining screening levels. Because it is currently acceptable for applicants to submit such data, the AQD has no reason, need, nor plans to change that policy.

Requiring the permit applicant to provide data or a proposed screening level would not be a practical or efficient solution for either industry or the agency. First, the information needed to set an ITSL or IRSLS is very technical, toxicological data. Knowing what data to gather and then proposing a screening level requires the knowledge and judgment of trained and educated toxicologists.

Second, the majority of companies in the state do not have such trained individuals on staff. It would be exceedingly costly and impractical for most companies, particularly small business, to retain such assistance. Further, unless the toxicologists hired by the company were very familiar with the state AQD's program and policies, AQD staff would be forced to spend an inordinate amount of time working with company-hired toxicologists to train them and educate them on the specific procedures used in setting screening levels.

Third, given the subjective professional judgment often required in the process, there is no guarantee that external toxicologists would arrive at the same standard that the State would generate for a screening level. Indeed, it would likely take more time for staff to train the outside toxicologists and then review their submittals, than it would take for staff to simply to do the work internally.

In conclusion, forcing companies to submit data or develop proposals for ITSLs and IRSLS would be inefficient and impractical and would likely not lead to any significant programmatic improvements in the AQD.

However, recognizing that some companies conduct extensive research into various chemicals and processes, the AQD has, and will continue to, encourage companies to submit applicable raw data and other relevant toxicological information that they may have regarding such compounds.

AQD should communicate to interested companies that they are willing to receive proposals for screening level limits and other relevant data and toxicological information which would aid in setting screening levels, but that such information is by no means required from permit applicants.

In light of the apparent concern and misunderstanding over AQD's policy for accepting information under Rule 230, the AQD should make a concerted effort to clearly communicate their policy with the business community.

Recommendations

14. AQD should issue a brief policy or memo clarifying the Agency's open position regarding submission of toxicological information and proposals for screening levels by permit applicants. The policy should specifically clarify that such information is welcome to be submitted, but is not required.
15. This position should be communicated to attendees at appropriate programs, such as training by MDEQ EAD and conferences, such as those sponsored by the Air and Waste Management Association.
16. Business representatives on the AQD Air Advisory Group should report this policy back to their respective organizations (e.g., MMA, Chamber of Commerce, Michigan Chemical Council, etc.)

ISSUE: How to Define the Best Available Data (or Information) in Developing Screening Levels

Background

Michigan's air toxic rules require the use of best available data in developing screening levels. The subcommittee was asked to look at clarifying the meaning of "best available data."

USEPA RfC, or RfD and Cancer Slope Factors (CSF) are preferentially employed to determine screening levels. If these are not available, workplace exposure standards may be utilized. If this information is not available, a literature review must be performed to determine the most appropriate data upon which to develop a screening level.

The AQD has prepared a "Reference Checklist" of typical sources of information for literature reviews, which was published in the July 6, 1995 AQD document, "Procedures for Developing Screening Levels." The Reference Checklist contains both online data bases and "hardcopy" reference sources (see Appendix G).

When reviewing the literature, the applicant must find the most appropriate data or "best available information" upon which to develop a screening level. The Air Toxics Rule [R 336.1102 Definitions; B. (4/17/92)] broadly defines "best available information" as follows:

"...data which serves as the basis for a risk assessment. Such information may be taken from the scientific literature or the integrated risk information system database maintained by the United States Environmental Protection Agency or from other databases, as appropriate. The term includes other pertinent studies or reports containing data which the department finds to be of adequate quality for use in the risk assessment." [emphasis added]

Determining what is "best available information" is usually not an easy task. Frequently, the reviewer may only find a few studies (and sometimes only one) to evaluate. At this point, the reviewer must consider toxicological parameters in determining the "quality" of each study. The term, "quality", is further interpreted in the July 6, 1995 AQD memorandum, which states the following:

"In evaluating the quality [emphasis added] of the study, the toxicologists consider many things, such as purity of substance tested, physical form of the substance, vehicle used for administration of dose, volume of material administered, housings and feeding conditions of animals, the number of dose groups, spacing of dose groups, number of animals per dose group, dose levels, exposure duration, duration of study, observation periods, effects evaluated and reported, and statistical analyses performed. Guidelines have been developed

by EPA that outline toxicological testing protocols that are acceptable for testing requirements under the Toxic Substances Control Act (TSCA) and the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). Likewise, the Organization for Economic Co-operation and Development (OECD) has developed guidelines that provide a framework for each toxicity test which is sufficiently well defined to enable it to be carried out in a similar manner in different countries and to produce results that will be fully acceptable to various regulatory bodies. Toxicity tests meeting these guidelines would generally be considered good quality tests, however, often much of the available data falls short of these guidelines. In these cases, the toxicologist must use professional judgment in evaluating the quality of an individual study and interpreting the significance of the overall data base."

After having followed such guidelines and professional judgment, a single study may be chosen for screening level development. If no study is deemed of sufficient quality, the default screening level of 0.04 ug/m^3 is applied.

Incorporation of additional guidance references in subsequent AQD memoranda would require minimal effort and facilitate better understanding of relevant parameters to assess study quality in developing screening levels.

Recommendation

17. The definitions, references and guidelines for determining best available data appearing in the rules and the "Procedures for Developing Screening Levels" are the most appropriate currently available. Agreement on a single set of detailed decision criteria for determining best available data (or information) may well be beyond general scientific consensus and is not feasible.
18. Additional helpful "criteria for assessing the quality of individual animal toxicity studies" can be found in USEPA guidance, "Methods for Development of Inhalation Reference Doses." This should be referenced in future memoranda put out by AQD.

ISSUE: Should Mutagenicity Data be Used to Establish Uncertainty Factors for the Development of Screening Levels?

Background

Should mutagenicity data should be used to establish the uncertainty factors used in developing screening levels? If so, how this should be done?

These questions were raised by the regulated community with the comment that two different uncertainty factors should be used depending on whether or not there was positive mutagenicity data. Currently, mutagenicity data is not used to establish the uncertainty factors used in the air toxic rules for the development of screening levels.

In general, uncertainty factors are used to account for the uncertainty in extrapolating from experimental data conditions to an estimate of a concentration safe for the assumed human scenario. Uncertainty factors in the rules are used to account for the following extrapolations: 1) data on effects of average healthy humans to sensitive individuals; 2) animal data to humans; 3) acute or subchronic studies to chronic duration; 4) Lowest observable adverse effect level (LOAEL) to the no observable adverse effect level (NOAEL); 5) oral to inhalation exposure.

A change in the use of uncertainty factors would require a rule change. Currently, the rules provide for use of specific uncertainty factors that are not based on the results of mutagenicity data. These uncertainty factors are specified in Rule 232 directly, or indirectly by using RfC to develop screening levels. The USEPA methodology for deriving RfCs provides guidance on use of uncertainty factors which does not incorporate the results of mutagenicity data.

Several options were considered.

- The uncertainty factors could be changed to include a factor for positive mutagenicity data. The magnitude of this factor could vary and would be subject to discussion.
- Do not change the uncertainty factors to account for positive mutagenicity data. One impact of this change would be to make the rule more complex. There is a large number of assays that measure different mutagenic endpoints, including such things as gene mutations, chromosomal effects, and DNA damage. Interpretation of mutagenicity data, especially when mixed results (positive and negative data) are seen, is not always clear cut.

Recommendation

19. There is no scientifically justifiable methodology for developing uncertainty factors based on mutagenicity data. We are unaware of any precedent for using such data in this manner. Therefore, the subcommittee recommends mutagenicity data not be used to establish uncertainty factors for the purpose of developing screening levels.

ISSUE: Conformance Of Michigan's Program With The Federal Clean Air Act

Background

Under the requirements of the 1990 CAA the USEPA is required to develop a series of federal rules related to air toxics:

- Section 112(d) Emission Standards (Maximum Achievable Control Technology (MACT))
- Section 112(f) Standard to Protect Health and the Environment
- Section 112(g) Reconstruction and Construction
- Section 112(j) Hammer Provisions.

To date, Michigan has addressed the issue of consistency between the State's air toxics rules and federal air toxic rules by including exemption language in the Michigan Air Pollution Control Rules 336.1230 (Rule 230) and Act 451 (Appendix F). These provide qualified exemptions from State technology based and health based requirements if equivalent federal rules are in place.

The exemptions are contingent on promulgation of specific federal emission and residual risk standards. Currently, however, the exemptions provided under Act 451 are more comprehensive than the exemptions defined under Rule 230. To avoid confusion and provide for consistency, Michigan should amend Rule 230 to be consistent with Act 451.

Michigan Act 451, Section 324.5508, provides a more comprehensive exemption from technology based requirements than Rule 230 because the exemption includes all toxic air contaminants regulated under the CAA for which MACT standards have been promulgated under Section 112(d), as well as control technology determinations made pursuant to Sections 112(g) and 112(j). The Rule 230 exemption is limited to 112(d) standards promulgated by February 28, 1991. (Act 451 of 1994, as amended, Natural Resources and Environmental Protection Act, Article II Pollution Control, Chapter 1: Point Source Pollution Control Air Resources Protection and Air Pollution Control Rules, Rule 336.230 (4)(b)(1)) Control technology determinations made pursuant to Sections 112(g) and 112(j) are not addressed in Rule 230.

Michigan Act 451, Section 324.5508, also includes a categorical exemption for VOCs and particulate matter if Sections 112(d), 112(g) or 112(j) control similar compounds which are also VOCs and particulate matter. The Rule 230 exemption is limited to hazardous air pollutants listed in Title III, Section 112(b) of the CAA. VOC and particulate matter exemptions are limited to sources meeting BACT or Lowest Achievable Emission Rate (LAER) requirements.

Michigan Act 451, Section 324.5508, also exempts sources from Rule 230 health based screening level requirements. This only applies if standards have been promulgated

specific to that source category under CAA Section 112(f) "Standard to Protect Health and the Environment" (a.k.a. residual risk standards). These Section 112(f) standards are statutorily required to be promulgated eight years after promulgation of each CAA Section 112(d) emission standard. Section 112(d) emission standards are promulgated for each source category defined under CAA Section 112(c) based on a ten year phased in schedule. The majority of the Section 112(d) emission standards should be finalized by the year 2003.

The USEPA is currently in the process of developing the structure for the Section 112(f) standards. The required work product is behind schedule.

Michigan has experience implementing both a technology and risk based air toxics program. The committee developing the structure for the 112(f) standards would benefit from Michigan's knowledge base. Proactive involvement by Michigan would benefit both the USEPA and the state of Michigan. Participating in the federal rulemaking process would help address concerns raised by Michigan's stakeholders regarding integrating Section 112(f) and Rule 230's risk based requirements (e.g. development of screening levels, modeling criteria, etc.) and possible variations in stringency.

MDEQ has submitted a request for delegation of the Federal air toxic program pursuant to Section 112(l) of the CAA. USEPA Region V responded May 14, 1996 with a memorandum of agreement (MOA) between the MDEQ and USEPA. The MOA (Appendix F) outlines MDEQ's and USEPA's responsibilities regarding information exchange and delegation of both existing and future standards. To date the MOA has not been finalized.

In summary, Michigan has already taken steps to achieve conformance between the federal and state program by including exemption language in both Michigan Rule 230 and Michigan Act 451. However, as written, the exemptions for Act 451 are more comprehensive exemptions than Rule 230. This could cause potential confusion for a permittee who may depend on the rules for guidance and not be aware of the more extensive exemptions found in Act 451. Therefore, recommendations are being made to clarify the rule language.

Recommendations

20. Rule 230 should be amended as follows to be consistent with Act 451.
 - a. A system should be developed to insure that the Rule 336.1230(4) exemption incorporates all promulgated emission standards under Section 112(d).
 - b. Rule 336.230(4)(b)(1) should be amended to include technology determinations made pursuant to CAA Sections 112(g) and 112(j).
 - c. Rule 230 should exempt other toxic air pollutants that are VOCs and particulate matter if the standard promulgated under Section 112(d) or the determination made under Section 112(g) or 112(j) control similar compounds.

21. Michigan's Air Use Permit Technical Manual (June 1996) should be updated. The update should clarify that if a source meets the requirements of a promulgated Section 112(d) emission standard for hazardous air pollutants or a technology determination made pursuant to either Section 112(g) or 112(j), the source would be exempt from Rule 230 technology requirements (T-BACT) for all air contaminants regulated under the CAA. The exemption would also include a categorical exemption for VOCs and particulate matter if CAA Sections 112(d), 112(g) or 112(j) control similar compounds which are also VOCs and particulate matter.
22. Michigan should proactively engage in the Federal rule development process (e.g. Section 112(f) "Standard to Protect Health and the Environment") in an effort to influence the outcome of the final rules based on experiences Michigan has gained from implementing a risk based air toxics program.

APPENDIX A

AIR TOXICS SUBCOMMITTEE MEMBERS

APPENDIX A: AIR TOXICS SUBCOMMITTEE MEMBERS

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APPENDIX B

SUMMARY OF PROS AND CONS OF USING A FINITE LIST

APPENDIX B: SUMMARY OF PROS AND CONS OF USING A FINITE LIST

Issue	Option #1 Status Quo	Option #2 Limited List - add & delete	Option #3 Limited list & existing sources	Option #4 Define list with threshold for applicability	Option #5 Finite list below x tons - infinite list above x tons	Option #6 Infinite list for new sources - finite list for existing	Option #7 Status Quo - change definition of TAC	Option Y
Maximizes protection of public health -example-	X					X		
Protects public health in more highly impacted areas faster than would be accomplished with the federal and state programs.	X					X		
Unlimited list ensures that all chemicals are properly regulated.	X					X		
Provides greatest incentive to reformulate or use compounds that have been well tested and have low toxicity.	X					X		
Engenders the greatest public trust.	X					X		
Approach for developing screening levels is well established and efficient for AQD toxicologists to administer.	X					X		
Provides greatest assurance that additional controls will not be needed after permit is issued due to unevaluated compounds later found to be problematic.	X					X		
Would provide industry with more certainty prior to the permitting process.		X	X	X	X		X	
Limited lists would provide incentive for sources to reformulate prior to the permitting process - result would expedite reductions of certain chemicals of concern in MI and the Great Lakes region.		X	X	X	X		X	
Focusing on a finite list of chemicals could present opportunity for expediting permits.		X	X	X	X		X	
MDEQ resources could be prioritized by focusing on chemicals of concern.		X	X	X	X		X	

Issue	Option #1 Status Quo	Option #2 Limited List - add & delete	Option #3 Limited list & existing sources	Option #4 Define list with threshold for applicability	Option #5 Finite list below x tons - infinite list above x tons	Option #6 Infinite list for new sources - finite list for existing	Option #7 Status Quo - change definition of TAC	Option Y
Limited lists would provide a beneficial economic impact by having sources stay in MI and attracting new sources to MI.		X	X	X				
Other states have worked off finite lists.		X	X	X				
Would be more stringent that the federal programs.	X			X	X	X	X	
A process could be developed to add new pollutants of concern.		X	X		X	X	X	
Provides for more of the focus on sustainable development.		X	X	X	X		X	
Provides an opportunity for using risk management to address air toxic issues considering ecosystem (multimedia) impacts.		X	X	X	X		X	
Would be consistent with approach taken in water quality permitting and in Part 201.			X					
Focuses efforts of the regulators and regulated community on compounds with a known health impact, the listed compounds and emissions of larger quantities.		X	X	X	X		X	
In many cases the installation of RACT, BACT or T-BACT is sufficient to meet the maximum ambient impact for emissions of low tonnages. The impact analysis is of no environmental impact.					X			
There is an incentive created for the source to control emission of any unlisted compound to less than 10 tons per year.					X			
The agency inspector can focus their attention on the sources with the higher potential to harm the environment.		X	X	X	X		X	

Issue	Option #1 Status Quo	Option #2 Limited List - add & delete	Option #3 Limited list & existing sources	Option #4 Define list with threshold for applicability	Option #5 Finite list below x tons - infinite list above x tons	Option #6 Infinite list for new sources - finite list for existing	Option #7 Status Quo - change definition of TAC	Option Y
Would reduce the challenges brought to MDEQ questioning them on their information, calculations etc.		X	X	X	X		X	
Eliminates difficulty of establishing an appropriate list considering tremendous number of substances being used or produced in MI, and the varying toxicity of these substances.	X			X		X	X	
Predictability and consistency of approach is greater than other approaches that would rely on case-by-case judgments for unlisted compounds.		X	X					
A known finite list would virtually eliminate the default 0.04 value.		X	X					
More environmental benefit would be achieved per dollar expended.		X	X	X	X		X	
Predictability resulting from a finite list would make MI more competitive.		X	X		X			
Provides opportunities for innovative use of emission trading concept to reduce impact of toxic emissions.			X					
Authority to regulate unlisted pollutants is provided in Rule 901.		X	X		X			
By regulating both new and existing sources the program would be based on a more holistic assessment of air quality.			X			X		
Allows for incremental progress in solving complex, existing problems related to air toxics.			X					
Finite list would be more extensive than Section 112 (Title III) under the CAA and therefore more comprehensive than the 189 Federal HAP list.		X	X		X			

APPENDIX C

DETAILED BACKGROUND ON DETERMINING ACCEPTABLE EMISSION LEVELS IN TIERS 1-3 OF THE APPROACH

APPENDIX C: DETAILED BACKGROUND ON DETERMINING ACCEPTABLE EMISSION LEVELS IN TIERS 1-3 OF THE APPROACH

This appendix describes the methodology used for establishing Tiers 1, 2, and 3 in the proposed toxics program.

Currently, the approach to Rule 230(1)(b) is as follows:

- Modeling (dilution factor matrix, or other).
- Determine the PAI.
- Compare the PAI to SLs to determine if Rule 230(1)(b) is met.

The Air Toxics Subcommittee recommends a different approach.

1. Tier 1: Compare the emission rate to a single "small quantity criteria"; if met, then Rule 230(1)(b) is satisfied. If not, then;
2. Tier 2: Compare the emission rate to screening level-based "small quantity criteria"; if met, then Rule 230(1)(b) is satisfied. If not, then;
3. Tier 3: Compare the emission rate to the acceptable emission rate, derived from the screening level and the use of the AIR matrix (Appendix D). The AIR relates the facility's dispersion characteristics (stack and building height, distance, etc.) to an acceptable emission rate. If met, then Rule 230(1)(b) is satisfied. If not, then;
4. Tier 4: Modeling is performed (e.g., SCREEN3 or ISC3) to determine if Rule 230(1)(b) is satisfied.

Explanation of Tier 1, Tier 2, and Tier 3

1. Small Quantity Criteria for Tier 1

Proposal: If a TAC does not meet the definition of a carcinogen in Rule 103(c), and has not been demonstrated by AQD to be a high concern noncarcinogenic chemical for the purposes of this provision [e.g., mercury, and the 26 chemicals with ITSLs lower than 0.1 ug/m^3 on an annual average adjusted basis], then a facility's emission of that TAC satisfies Rule 230(1)(b) if the emission rate is **10 pounds per month (with an hourly maximum of 0.14 lbs/hr)** or lower.

Basis: The emission rate of 10 lbs/mo was initially selected for consideration due to its appearance in the draft Rule 290 (which is currently applied via Rule 279), as a controlled emission rate of *total* noncarcinogenic non-VOC air contaminants (with ITSLs as low as 0.04 ug/m^3) which qualifies for an exemption from a permit to install requirement. In the present proposal, the

emission rate is coupled with an ambient impact of 0.1 ug/m^3 , which is being recommended as the new default ITSL, to provide a perspective on the acceptability of the dispersion characteristics of emissions (further details below). The hourly maximum of 0.14 lbs/hr is based on a peak that is 10-fold higher than the average $[(10 \text{ lbs/mo}) \times (1 \text{ month}/730 \text{ hrs}) \times 10 = 0.14 \text{ lbs/hr}]$. This is consistent with Rule 230(10).

Discussion: The Air Toxics Subcommittee has found that there are significant advantages to having a small quantity exclusion from any further ambient impact assessment. It is preferable that this exclusion not be dependent on some facility criteria, such as a minimum stack height or distance to fence line. Also, it is preferable that this exclusion not be dependent on the availability of a screening level.

We considered three optional amounts: 4, 10, or 20 lbs/month. We considered what facility scenarios would give poor dispersion, such that the 0.1 ug/m^3 concentration would be exceeded in ambient air, for each of these three optional emission rates. Attached Figure C-1 (in bold print) is the display of those facilities for the 10 lb/month option.

The Air Toxics Subcommittee selected the 10 lb/month option based on the consideration of several factors. These included the utility of the value, other aspects of the program that are protective (e.g., fence line receptors are assumed), and consideration of the emission scenarios that would have poor dispersion characteristics and the magnitude of the impact at those facilities. The scenarios noted in Figure C-1 could have an exceedance of the default ITSL of 0.1 ug/m^3 by a factor no greater than 16.

2. Small Quantity Criteria for Tier 2

Proposal: The conditions of Rule 230(1)(b) are satisfied if the emission rate does not exceed the averaging-time-specific levels derived from the equations in the following Table C-1.

Table C-1. Tier 2 Approach for Determining Acceptable Emission Rates for Rule 230(1)(b).

SL (ITSL or IRSL) Averaging Time	Monthly Emission Rate (lbs/mo)	24 Hour Emission Rate (lbs/24 hr)	1 Hour Max Emission Rate (lbs/hr)
annual	SL X 40		SL X 0.54
24 hrs		SL X 0.12	SL X 0.05
8 hrs			SL X 0.02
1 hr			SL X 0.001

*all screening levels (SLs) are in units of ug/m^3 . For simplicity, the units in the equations are not included here, but they are discussed in the following text.

Basis: As in Tier 1, these emission rates were derived from considerations including the range of dispersion characteristics associated with emissions. Attached Figure C-2 is an indication of the facilities (in bold print) that have poor dispersion such that the screening level might be exceeded under this provision. This is a more limited set of facilities than utilized for Tier 1 (Figure C-1, in bold print). The magnitude by which the screening level may be exceeded is a factor of 6 or less. Unlike in Tier 1, this Tier can only be utilized if a screening level is available. If a screening level is not available, and the substance is not a carcinogen, the default screening level of 0.1 ug/m^3 may be used.

Discussion: This Tier 2 approach is being proposed as a simple way of determining if Rule 230(1)(b) is satisfied for substances which have screening levels, but which do not qualify for Tier 1 due to the nature of the substance or the emission rate being greater than 10 lbs/mo. This Tier 2 option is a simpler demonstration than using the AIR matrix (Tier 3). As with Tier 1 we have constructed this approach with no minimum stack height or distance requirements so that it is simpler and more broadly applicable.

Derivation of the Table C-1 Equations

Most emission scenarios provide at least as much dispersion as the following model facility: a building height of 25', a stack height-to-building height ratio of 1.25 or less, and a distance of 100' to fenceline. Using the AIR matrix, this model facility provides an annual averaged hourly emission rate (AAHER-AIR) ambient impact ratio of $0.054 \text{ (lbs/hr)/(ug/m}^3\text{)}$ (from interpolation between the 20' and 30' building height values of 0.033 and 0.075). It should be noted that basing the Table C-1 equations on this model facility is not the most conservative approach, as there are some facility scenarios with poorer dispersion characteristics (Figure C-2, in bold print). However, the 10' building height scenarios are uncommon, and the difference between the dispersion provided by these and by the model facility is about 6-fold or less ($0.054/0.0085 = 6.4$).

The Tier 2 equations for annually averaged screening levels are derived as follows: The AAHER-AIR value of $0.054 \text{ (lbs/hr)/(ug/m}^3\text{)}$ is multiplied by 730 hrs/month, resulting in $40 \text{ (lbs/month)/(ug/m}^3\text{)}$. The maximum hourly emission rate is derived as $0.054 \text{ (lbs/hr)/(ug/m}^3\text{)} \times 10 = 0.54 \text{ (lbs/hr)/(ug/m}^3\text{)}$. The acceptability of a 10-fold difference between the average and the peak hourly emission rate is consistent with Rule 230(10).

The Tier 2 equations for 24 hour averaged screening levels are derived similarly to those described above for annual averaged screening levels, but with the averaging time conversion factor of 0.091 to convert the AAHER-AIR to a 24 hour acceptable average hourly rate (AHER-AIR). Therefore, the AHER-AIR is $0.054 \times 0.091 = 0.0049 \text{ (lbs/hr)/(ug/m}^3\text{)}$. The acceptable 24 hour emission rate is $24 \times 0.0049 = 0.12 \text{ (lbs/24 hr)/(ug/m}^3\text{)}$. The acceptable maximum hourly emission rate is $10 \times 0.0049 = 0.049$, rounded off to $0.05 \text{ (lb/hr)/(ug/m}^3\text{)}$.

The Tier 2 equations for 8 hour averaged screening levels is derived from the averaging time conversion factor of 0.046 to convert the AAHER-AIR to the 8 hour AHER-AIR. The AHER-AIR is $0.054 \times 0.046 = 0.0025$ (lb/hr)/(ug/m³). The acceptable 8 hour emission rate is $8 \times 0.0025 = 0.02$ (lbs/8 hrs)/(ug/m³). The acceptable maximum hourly emission rate is $10 \times 0.0025 = 0.025$, which could then be rounded up to 0.03 or rounded down to 0.02 (lbs/hr)/(ug/m³). Since the 8 hour acceptable emission rate is 0.02 lbs (per ug/m³), it only makes sense to set the maximum hourly emission rate at 0.02 rather than 0.03 (lbs/hr)/(ug/m³). Further, since the 8 hour and maximum 1 hour rates are the same, the proposal includes only the maximum 1 hour emission rate of 0.02 (lbs/hr)/(ug/m³).

The Tier 2 equation for 1 hour averaged screening levels is derived using the averaging time conversion factor of 0.02 to convert the AAHER-AIR to the 1 hour AHER-AIR. The acceptable hourly emission rate is $0.054 \times 0.02 = 0.00108$, rounded to 0.001 (lbs/hr)/(ug/m³).

3. Development of AIR Matrix for Tier 3

The Air Toxics Subcommittee asked the Dispersion Modeling Procedures Subcommittee (DiMoP) to consider whether the existing dilution matrix used in Rule 230 could be modified to facilitate simpler determinations of compliance with Rule 230(1)(b). The toxics subgroup was seeking a matrix where compliance with the modeling and health assessment provisions could be determined based on the toxicity of the TAC, the level of emissions and the physical characteristics of the planned process. The group decided that the most important factors to consider were distance to secured property line, stack height, and building height. First, the model itself was in need of review. The DiMoP subgroup was charged with reviewing the existing dilution matrix and determining how it could best be improved.

The DiMoP subgroup acknowledged that the existing dilution matrix was outdated, and in some areas conservative. The group decided the matrix could be improved by redeveloping it using the USEPA's SCREEN3 model.

Review of the Model

The SCREEN3 model is used as a quick screening tool to assess a range of wind speed and stability combinations in order to find the one which produces the maximum ground level concentration. SCREEN3 provides a maximum 1-hour average ground level concentration and a set of conversion factors to convert the 1-hour value to 3-hour, 8-hour, 24-hour, and annual averaged concentrations.

A comparison was made between the 1-hour ambient impacts produced by SCREEN3 and the results for 1-hour averaging times produced by the existing dilution matrix. SCREEN3 provided less conservative 1-hour concentrations. The factors used to convert 1-hour impacts to other averaging times were found not to compare well to both the existing dilution factor matrix and USEPA's Industrial Source Complex Short Term (ISCST) model which is used to conduct refined dispersion modeling. Thus, DiMoP decided to develop alternate averaging time conversion factors. The following describes the methodology

used for developing the alternate averaging time conversion factors to be used with SCREEN3 1-hr concentration for the development of a revised Rule 230 dilution matrix.

Step 1: ISCST3 MODELING

The ISCST3 refined dispersion model was used to calculate 1-hour, 8-hour, 24-hour, and annual maximum ambient concentrations for building heights (Hb) of 10, 20, 30, 40, and 50 feet, stack heights (Hs) of 1.25xHb, 1.75xHb, and 2.5xHb, for all 16 sets of meteorological data available for the various areas of the State. For each of the cases mentioned above, (a total of 240), the maximum 1-hour impact was divided by the 8-hour, 24-hour, and annual maximum impacts to determine these ratios.

Step 2: RESULTS PROCESSING

The maximum, minimum, and average of the ratios calculated in step 1 were determined for each of the 16 different meteorological stations and compared. The station which had the lowest average ratio was then selected as the basis for deriving the alternate conversion factors. This station was Sault Saint Marie.

Step 3: CONVERSION FACTOR DETERMINATION

A follow-up check was conducted using the above mentioned building, stack, and meteorological data to ensure that in none of the cases examined would a situation occur in which SCREEN3 would predict a lower maximum concentration than ISCST3. The final alternate SCREEN3 conversion factors meet this criteria and are listed below:

1-HR CONCENTRATION	ALTERNATE CONVERSION FACTOR	AVERAGING PERIOD
1-hr concentration	X 0.44	= 8-hr concentration
1-hr concentration	X 0.22	= 24-hr concentration
1-hr concentration	X 0.02	= annual concentration

Development of the AIR Matrix

An emission rate of 1 lb per hour was used with SCREEN3 to generate maximum 1-hour impacts. Also, impact at discrete locations of 25, 50, 75, 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1500, and 2000 feet were determined. The values in the AHER-AIR table were derived in the following way:

$$\frac{\text{AHER (1 lb/hour)}}{\text{Maximum Annual Impact (ug/m}^3\text{)}} = \text{Annual AHER-AIR Ratio}$$

The maximum impact was used as long as it fell outside the secured property line distance in the table. If the maximum impact occurred within the secured property line distance, then the impact at the next discrete receptor was used to generate the AHER-AIR for that discrete distance in the table.

The averaging time conversion factors above were used to generate conversion factors for going from Annual AHER-AIR's values to 1, 8, and 24 hour averaging time AHER-AIR values. This value multiplied by a TAC's screening level provides the pound per hour emission rate. When continuously emitted over the averaging time period, this emission rate will cause an estimated maximum ground level impact equal to the screening level. The permit engineer can use this lb/hr emission rate as a benchmark to compare lb/hr emission rates submitted in permit applications to see if a TAC's screening will be met. The AIR matrix and a step-by-step process with an example are in Appendix D.

FIGURE C-1: TIER 1 - FACILITIES WITH POOR DISPERSION CHARACTERISTICS (in bold print)
RULE 230 ANNUAL AVERAGED HOURLY EMISSION RATE (AHER) AMBIENT IMPACT RATIOS (AIRS) IN UNITS OF (lbs/hr) / (µg/m³)
for TOXIC AIR CONTAMINANTS (TACs) with ANNUAL AVERAGED SCREENING LEVELS

BLDG HT (ft) H ₁ /H ₂ Stack Height->	10			20			30			40			50		
	1.25	1.75	2.50	1.25	1.75	2.50	1.25	1.75	2.50	1.25	1.75	2.50	1.25	1.75	2.50
D	0.0085	0.022	0.159	0.032	0.084	0.679	0.075	0.220	1.603	0.152	0.421	2.941	0.263	0.736	4.630
I	0.0087	0.022	0.159	0.032	0.084	0.679	0.075	0.220	1.603	0.152	0.421	2.941	0.263	0.736	4.630
S	0.0096	0.022	0.159	0.032	0.084	0.679	0.075	0.220	1.603	0.152	0.421	2.941	0.263	0.736	4.630
T	0.011	0.023	0.159	0.033	0.084	0.679	0.075	0.220	1.603	0.152	0.421	2.941	0.263	0.736	4.630
A	0.020	0.040	0.159	0.042	0.084	0.679	0.082	0.220	1.603	0.157	0.421	2.941	0.266	0.736	4.630
N	0.030	0.053	0.178	0.059	0.113	0.679	0.099	0.221	1.603	0.174	0.421	2.941	0.282	0.736	4.630
C	0.040	0.065	0.171	0.077	0.140	0.679	0.126	0.268	1.603	0.200	0.421	2.941	0.312	0.736	4.630
E	0.051	0.077	0.189	0.094	0.164	0.679	0.153	0.318	1.603	0.243	0.505	2.941	0.351	0.743	4.630
F	0.063	0.091	0.222	0.112	0.188	0.746	0.181	0.368	1.603	0.287	0.588	2.941	0.409	0.838	4.630
F	0.075	0.104	0.241	0.130	0.211	0.812	0.208	0.413	1.603	0.328	0.664	2.941	0.468	0.951	4.717
T	0.089	0.119	0.257	0.148	0.235	0.768	0.235	0.459	1.608	0.370	0.740	2.941	0.528	1.064	4.803
	0.103	0.134	0.264	0.167	0.258	0.770	0.261	0.502	1.672	0.411	0.812	2.941	0.585	1.168	4.854
	0.119	0.151	0.272	0.187	0.282	0.800	0.289	0.545	1.786	0.452	0.883	2.959	0.644	1.276	4.950
	0.209	0.245	0.318	0.290	0.406	1.080	0.428	0.756	1.953	0.654	1.214	3.521	0.924	1.761	5.376
	0.311	0.350	0.383	0.408	0.539	1.256	0.573	0.965	2.304	0.861	1.534	3.731	1.205	2.222	5.862

BLDG HT (ft) H ₁ /H ₂ Stack Height->	60			70			80			90			100		
	1.25	1.75	2.50	1.25	1.75	2.50	1.25	1.75	2.50	1.25	1.75	2.50	1.25	1.75	2.50
D	0.412	1.114	6.098	0.606	1.656	8.621	0.839	2.242	8.333	1.126	3.049	13.514	1.458	3.876	14.286
I	0.412	1.114	6.098	0.606	1.656	8.621	0.839	2.242	8.333	1.126	3.049	13.514	1.458	3.876	14.286
S	0.412	1.114	6.098	0.606	1.656	8.621	0.839	2.242	8.333	1.126	3.049	13.514	1.458	3.876	14.286
T	0.412	1.114	6.098	0.606	1.656	8.621	0.839	2.242	8.333	1.126	3.049	13.514	1.458	3.876	14.286
A	0.413	1.114	6.098	0.606	1.656	8.621	0.839	2.242	8.333	1.126	3.049	13.514	1.458	3.876	14.286
N	0.426	1.114	6.098	0.614	1.656	8.621	0.845	2.242	8.333	1.129	3.049	13.514	1.458	3.876	14.286
C	0.455	1.114	6.098	0.641	1.656	8.621	0.868	2.242	8.333	1.147	3.049	13.514	1.475	3.876	14.286
E	0.498	1.114	6.098	0.683	1.656	8.621	0.909	2.242	8.333	1.185	3.049	13.514	1.506	3.876	14.286
F	0.545	1.114	6.098	0.741	1.656	8.621	0.967	2.242	8.333	1.244	3.049	13.514	1.563	3.876	14.286
F	0.625	1.269	6.250	0.808	1.672	8.621	1.040	2.242	8.333	1.316	3.049	13.514	1.634	3.876	14.286
T	0.705	1.429	6.410	0.901	1.825	8.621	1.111	2.242	8.333	1.404	3.049	13.514	1.730	3.876	14.286
	0.781	1.572	6.579	1.000	2.016	8.621	1.235	2.488	9.091	1.502	3.086	13.514	1.832	3.876	14.286
	0.861	1.724	6.849	1.101	2.203	9.091	1.359	2.732	10.000	1.634	3.289	13.514	1.931	3.876	14.286
	1.232	2.404	7.042	1.577	3.106	9.615	1.953	3.846	11.905	2.358	4.505	15.152	2.778	5.208	16.129
	1.603	3.049	7.353	2.041	3.968	9.615	2.525	4.808	12.821	3.049	5.618	16.129	3.597	6.494	18.519

APPENDIX D

**STEP-BY-STEP PROCEDURE FOR USING THE AIR
MATRIX (TIER 3)**

APPENDIX D: STEP-BY-STEP PROCEDURE FOR USING THE AIR MATRIX (TIER 3)

AHER= Averaged Hourly Emission Rate
 H_b = Influential Building Height, H_s = Discharging Stack Height

INTRODUCTION & EXAMPLE

The steps below are the procedure for using the Rule 230 Annual AHER-AIR table. The table contains annual AHER-AIR values based on various stack, building, and secured property line scenarios. The AHER-AIR value, when multiplied by a TAC's annual screening level, will yield the lb/hr emission rate that, when continuously emitted over the screening level's averaging time, will cause an estimated maximum ground level impact equal to the screening level.

Factors are provided to convert the Annual AHER-AIR values in the table to 1-hr, 8-hr, and 24-hr averaging times. The lb/hr emission rate derived from the table can be used as a benchmark to compare lb/hr emission rates submitted in permit applications to see if a TAC's screening will be met.

The following example illustrates how each of the steps in the procedure are used:

SCENARIO: PAINT BOOTH

Max lb/hr Toluene = 10.0 lbs/hr, Toluene Screening Level = 400 $\mu\text{g}/\text{m}^3$ (24-hr avg)

Paint Booth Bldg Ht = 30', Stack Ht = 38', Operating Schedule = 8 hrs/day

Adj Bldg #1 Ht = 40', Bldg #1 Location = 50' away from discharge stack

Adj Bldg #2 Ht = 40', Bldg # 2 Location = 210' away from discharge stack

Minimum Fence Line Distance from discharging stack = 500 ft

1. **ISOLATED STACKS:** If the discharging stack is not attached to a building, divide the stack height by 2.5. Use this value for the building height. (Not applicable in this example.)
2. **INFLUENTIAL BUILDING:** Identify all buildings (including those onsite and offsite) located within a distance of 5 times their height from the discharging stack. Determine the highest building height among them. This is the influential building.

If the influential building height is greater than the discharging stack height, use the building height of the discharging stack and the 1.25 H_s/H_b column (regardless of the actual stack height) to look up the appropriate Annual AHER-AIR value from the table.

Building #1 is located within 5 times its height ($5 \times 40' = 200'$) from the stack. Thus it must be considered. Building #2 is located farther than 5 times its height

($5 \times 40' = 200'$) from the stack so it doesn't need to be considered. The influential building would be the highest building out of the discharging stack building (30') and Building #1 (40').

Thus the influential building would be Building #1 at 40' high. Since the influential building height (Building #1 at 40') is higher than the discharging stack height of 38', this requires use of the 1.25 Hs/Hb column and the discharging building height of 30' to look up the appropriate annual AHER-AIR value from the table.

3. **MINIMUM SECURED PROPERTY LINE DISTANCE:** Determine the minimum distance from the discharging stack to the secured property line. If there is no secured property line, use the 25 ft distance row in the table. If the minimum distance to the secured property line falls between values listed in the table, use the next lowest value.

MINIMUM DISTANCE TO FENCE LINE = 500 FT

4. **STACK HEIGHT COLUMN:** Use the stack height column as follows:

If Hs is less than $1.25 \times H_b$, use the 1.25 Hs/Hb column. If Hs is between $1.25 \times H_b$ and $1.75 \times H_b$, use the 1.25 Hs/Hb column or interpolate between the 1.25 Hs/Hb and 1.75 Hs/Hb column.

If Hs is between $1.75 \times H_b$ and $2.5 \times H_b$, use the 1.75 Hs/Hb column or interpolate between the 1.75 Hs/Hb and 2.5 Hs/Hb column.

If Hs is greater than or equal to $2.5 \times H_b$, use the 2.5 Hs/Hb column.

Due to the provisions in step 2, this step has already been determined.

5. **ANNUAL AHER-AIR VALUE:** Based on the influential building height, discharging stack height, and the minimum distance to the secured property line, look up the appropriate Annual AHER-AIR value from the Table. For influential building heights between values in the table, use the next lowest value or interpolate.

The annual AHER-AIR value from the table for 1.25 Hs/Hb, building height = 30, and secured property line of 500' is 0.153 lbs/hr per ug/m^3 .

6. **ALTERNATE AVERAGING TIMES:** For TAC's with screening level averaging times other than annual, multiply the Annual AHER-AIR value in the table by the following conversion factors:

Conversion factors for TACs with short term screening levels:

Annual AHER-AIR [(lbs/hr/ug/m ³)]	=	ANNUAL AHER-AIR × 1.0
24-Hr AHER-AIR [(lbs/hr/ug/m ³)]	=	ANNUAL AHER-AIR × 0.091
8-Hr AHER-AIR [(lbs/hr/ug/m ³)]	=	ANNUAL AHER-AIR × 0.046
1-Hr AHER-AIR [(lbs/hr/ug/m ³)]	=	ANNUAL AHER-AIR × 0.02

Since toluene has a 24-hr screening level, the annual AHER-AIR from the table is converted to a 24-hr AHER-AIR value multiplying the table value of 0.153 lbs/hr by 0.091 which equals 0.014 (lb/hr/ug/m³).

7. **AHER CALCULATION:** Multiply the TAC's screening level in ug/m³ by the AHER-AIR value with the same averaging time basis. This yields the AHER that could be emitted over that averaging period without causing a maximum PAI greater than the screening level. If a source's maximum hourly emission rate is equal to or lower than the AHER calculated in this step, the screening level would be met.

If a source has intermittent emissions which are not allowed to be emitted continuously over the appropriate averaging time, the maximum hourly emission rate can be averaged over the appropriate averaging time provided the averaged hourly emission rate is not less than 10% of the maximum hourly emission rate.

To find the allowable 24-hr AHER for toluene, multiply the 24-hr AHER-AIR value from step 6 by the screening level which yields (0.014 lbs/hr/ug/m³ x 400 ug/m³ =) 5.6 lbs/hr. Since the max emission rate of 10 lbs/hr is higher than 24-hr AHER of 5.6 lbs/hr, the maximum predicted impact from the source would exceed the screening level assuming the maximum hourly emission rate was emitted 24 hours a day. However, since the emissions occur only for only 8 hours per day, the maximum hourly emission rate can be averaged as follows:

$$\text{MAX RATE} = \frac{10 \text{ lbs}}{\text{hour}} \times \frac{8 \text{ hrs/day}}{24 \text{ hrs/day}} = 3.33 \text{ lbs/hr* (24-hr averaged hourly emission rate)}$$

*a permit condition limiting operation to 8 hrs/day may be needed.

This amount of averaging would be allowed since the averaged lbs/hr rate is not less than 10% of the maximum lb/hr rate (i.e. 3.33 > .1x10 = 1). The averaged rate is 3.33 lbs/hr which is less than the AHER derived from the table of 5.6 lbs/hr, thus, the screening level would be met.

8. **MULTIPLE STACKS:** If a specific TAC emission is emitted from more than 1 stack, determine the AHER-AIR value for each individual stack and use the lowest value among them. Multiply this lowest AHER-AIR value by the TAC's screening level to determine the combined hourly emission rate. The total hourly emission rate from all stacks considered must be below this calculated combined emission rate. (Not applicable in this example.)

INTERPOLATION EXAMPLES (interpolation is optional)

Hb = Bldg Ht = 14', STACK Ht = 19.6' or 1.4 x Hb, NO SECURED PROPERTY LINE

The following illustrates interpolation of a building height and stack height with the building height interpolation being done first.

FROM THE AHER-AIR TABLE

Hs/Hb->	Hb=10'			Hb=20'		
	1.25	1.75	2.5	1.25	1.75	2.5
STACK HT->	<u>12.5'</u>	<u>17.5'</u>	<u>25'</u>	<u>25'</u>	<u>35'</u>	<u>50'</u>
AHER-AIR->	.0085	.022	.159	.032	0.084	.679

Perform the building height interpolation for the next lower Hs/Hb ratio in the table of 1.25

$$1.25 \text{ Hs/Hb, } 14' \text{ Bldg AHER-AIR VALUE} = \frac{(14' - 10')}{(20' - 10')} \times [.032 - .0085] + .0085 = .018$$

If slightly higher AHER-air value is needed, a stack height interpolation can be performed as follows:

The same building height interpolation as above will be needed for the next higher Hs/Hb ratio of 1.75 as follows:

$$1.75 \text{ Hs/Hb, } 14' \text{ Bldg AHER-AIR VALUE} = \frac{(14' - 10')}{(20' - 10')} \times [.084 - .022] + .022 = .1$$

Then, the 1.4x Hs/Hb stack height interpolation can be done as follows:

$$14' \text{ Bldg, } 1.4 \times \text{Hb AHER-AIR VALUE} = \frac{(1.4 - 1.25)}{(1.75 - 1.25)} \times [1 - .018] + .018 = .043 \text{ (lbs/hr/ug/m}^3\text{)}$$

INTERPOLATION EXAMPLES (interpolation is optional):

Hb = Bldg Ht = 14', STACK Ht = 19.6' or 1.4xHb, NO SECURED PROPERTY LINE

The following illustrates interpolation of a building height and stack height with the stack height interpolation being done first.

From the AHER-AIR table

Hs/Hb->	Hb=10'			Hb=20'		
	1.25	1.75	2.5	1.25	1.75	2.5
STACK HT->	<u>12.5'</u>	<u>17.5'</u>	<u>25'</u>	<u>25'</u>	<u>35'</u>	<u>50'</u>
AHER-AIR->	.0085	.022	.159	.032	0.084	.679

Perform the stack Ht interpolation for the next lower building height

$$10' \text{ Bldg, } 1.4 \times \text{Hb STACK AHER-AIR VALUE} = \frac{(1.4 - 1.25)}{(1.75 - 1.25)} \times [.022 - .0085] + .0085 = .0126$$

If slightly higher AHER-air value is needed, a building height interpolation can be performed as follows:

The same 1.4xHb stack height interpolation as above will be needed for the next higher building height of 20'

$$20' \text{ Bldg, 1.4xHb STACK AHER-AIR VALUE} = \frac{(1.4 - 1.25) \times [.084 - .032]}{(1.75 - 1.25)} + .084 = .1$$

then, the building height interpolation can be done as follows:

$$14' \text{ Bldg, 1.4xHb AHER-AIR VALUE} = \frac{(14 - 10) \times [.1 - .0126]}{(20 - 10)} + .0126 = .048 \text{ (lbs/hr/ug/m}^3\text{)}$$

FIGURE D-1: AMBIENT IMPACT RATIO (AIR) MATRIX
RULE 230 ANNUAL AVERAGED HOURLY EMISSION RATE (AHER) AMBIENT IMPACT RATIOS (AIRS) in UNITS of (lbs/hr) / (µg/m³)
for TOXIC AIR CONTAMINANTS (TACs) with ANNUAL AVERAGED SCREENING LEVELS

BLDG HT (ft) H _s / H _a Stack Height->	10						20						30						40						50					
	1.25		1.75		2.50		1.25		1.75		2.50		1.25		1.75		2.50		1.25		1.75		2.50		1.25		1.75		2.50	
	75.0	105.0	150.0	75.0	105.0	150.0	87.5	122.5	175.0	87.5	122.5	175.0	37.5	52.5	75.0	37.5	52.5	75.0	50.0	70.0	100.0	50.0	70.0	100.0	62.5	87.5	125.0	62.5	87.5	125.0
D 25	0.0085	0.022	0.159	0.032	0.084	0.679	0.075	0.220	1.603	0.075	0.220	1.603	0.075	0.220	1.603	0.152	0.421	2.941	0.152	0.421	2.941	0.152	0.421	2.941	0.263	0.736	4.630	0.263	0.736	4.630
I 50	0.0087	0.022	0.159	0.032	0.084	0.679	0.075	0.220	1.603	0.075	0.220	1.603	0.075	0.220	1.603	0.152	0.421	2.941	0.152	0.421	2.941	0.152	0.421	2.941	0.263	0.736	4.630	0.263	0.736	4.630
S 75	0.0096	0.022	0.159	0.032	0.084	0.679	0.075	0.220	1.603	0.075	0.220	1.603	0.075	0.220	1.603	0.152	0.421	2.941	0.152	0.421	2.941	0.152	0.421	2.941	0.263	0.736	4.630	0.263	0.736	4.630
T 100	0.011	0.023	0.159	0.033	0.084	0.679	0.075	0.220	1.603	0.075	0.220	1.603	0.075	0.220	1.603	0.152	0.421	2.941	0.152	0.421	2.941	0.152	0.421	2.941	0.263	0.736	4.630	0.263	0.736	4.630
A 200	0.020	0.040	0.159	0.042	0.084	0.679	0.082	0.220	1.603	0.082	0.220	1.603	0.082	0.220	1.603	0.157	0.421	2.941	0.157	0.421	2.941	0.157	0.421	2.941	0.266	0.736	4.630	0.266	0.736	4.630
N 300	0.030	0.053	0.178	0.059	0.113	0.679	0.099	0.221	1.603	0.099	0.221	1.603	0.099	0.221	1.603	0.174	0.421	2.941	0.174	0.421	2.941	0.174	0.421	2.941	0.282	0.736	4.630	0.282	0.736	4.630
C 400	0.040	0.065	0.171	0.077	0.140	0.679	0.126	0.268	1.603	0.126	0.268	1.603	0.126	0.268	1.603	0.200	0.421	2.941	0.200	0.421	2.941	0.200	0.421	2.941	0.312	0.736	4.630	0.312	0.736	4.630
E 500	0.051	0.077	0.189	0.094	0.164	0.679	0.153	0.318	1.603	0.153	0.318	1.603	0.153	0.318	1.603	0.243	0.505	2.941	0.243	0.505	2.941	0.243	0.505	2.941	0.351	0.743	4.630	0.351	0.743	4.630
N 600	0.063	0.091	0.222	0.112	0.188	0.746	0.181	0.368	1.603	0.181	0.368	1.603	0.181	0.368	1.603	0.287	0.588	2.941	0.287	0.588	2.941	0.287	0.588	2.941	0.409	0.838	4.630	0.409	0.838	4.630
F 700	0.075	0.104	0.241	0.130	0.211	0.812	0.208	0.413	1.603	0.208	0.413	1.603	0.208	0.413	1.603	0.328	0.664	2.941	0.328	0.664	2.941	0.328	0.664	2.941	0.468	0.951	4.717	0.468	0.951	4.717
T 800	0.089	0.119	0.257	0.148	0.235	0.768	0.235	0.459	1.608	0.235	0.459	1.608	0.235	0.459	1.608	0.370	0.740	2.941	0.370	0.740	2.941	0.370	0.740	2.941	0.528	1.064	4.803	0.528	1.064	4.803
I 900	0.103	0.134	0.264	0.167	0.258	0.770	0.261	0.502	1.672	0.261	0.502	1.672	0.261	0.502	1.672	0.411	0.812	2.941	0.411	0.812	2.941	0.411	0.812	2.941	0.585	1.168	4.854	0.585	1.168	4.854
S 1000	0.119	0.151	0.272	0.187	0.282	0.800	0.289	0.545	1.786	0.289	0.545	1.786	0.289	0.545	1.786	0.452	0.883	2.959	0.452	0.883	2.959	0.452	0.883	2.959	0.644	1.276	4.950	0.644	1.276	4.950
A 1500	0.209	0.245	0.318	0.290	0.406	1.080	0.428	0.756	1.953	0.428	0.756	1.953	0.428	0.756	1.953	0.654	1.214	3.521	0.654	1.214	3.521	0.654	1.214	3.521	0.924	1.761	5.376	0.924	1.761	5.376
N 2000	0.311	0.350	0.583	0.408	0.539	1.256	0.573	0.965	2.304	0.573	0.965	2.304	0.573	0.965	2.304	0.861	1.534	3.731	0.861	1.534	3.731	0.861	1.534	3.731	1.205	2.222	5.882	1.205	2.222	5.882

BLDG HT (ft) H _s / H _a Stack Height->	60						70						80						90						100					
	1.25		1.75		2.50		1.25		1.75		2.50		1.25		1.75		2.50		1.25		1.75		2.50		1.25		1.75		2.50	
	75.0	105.0	150.0	75.0	105.0	150.0	87.5	122.5	175.0	87.5	122.5	175.0	100.0	140.0	200.0	112.5	157.5	225.0	112.5	157.5	225.0	112.5	157.5	225.0	145.8	176.0	280.0	145.8	176.0	280.0
D 25	0.412	1.114	6.098	0.606	1.656	8.621	0.639	2.242	8.333	0.639	2.242	8.333	0.639	2.242	8.333	1.126	3.049	13.514	1.126	3.049	13.514	1.126	3.049	13.514	1.458	3.876	14.286	1.458	3.876	14.286
I 50	0.412	1.114	6.098	0.606	1.656	8.621	0.639	2.242	8.333	0.639	2.242	8.333	0.639	2.242	8.333	1.126	3.049	13.514	1.126	3.049	13.514	1.126	3.049	13.514	1.458	3.876	14.286	1.458	3.876	14.286
S 75	0.412	1.114	6.098	0.606	1.656	8.621	0.639	2.242	8.333	0.639	2.242	8.333	0.639	2.242	8.333	1.126	3.049	13.514	1.126	3.049	13.514	1.126	3.049	13.514	1.458	3.876	14.286	1.458	3.876	14.286
T 100	0.412	1.114	6.098	0.606	1.656	8.621	0.639	2.242	8.333	0.639	2.242	8.333	0.639	2.242	8.333	1.126	3.049	13.514	1.126	3.049	13.514	1.126	3.049	13.514	1.458	3.876	14.286	1.458	3.876	14.286
A 200	0.413	1.114	6.098	0.606	1.656	8.621	0.639	2.242	8.333	0.639	2.242	8.333	0.639	2.242	8.333	1.126	3.049	13.514	1.126	3.049	13.514	1.126	3.049	13.514	1.458	3.876	14.286	1.458	3.876	14.286
N 300	0.426	1.114	6.098	0.614	1.656	8.621	0.645	2.242	8.333	0.645	2.242	8.333	0.645	2.242	8.333	1.126	3.049	13.514	1.126	3.049	13.514	1.126	3.049	13.514	1.458	3.876	14.286	1.458	3.876	14.286
C 400	0.455	1.114	6.098	0.641	1.656	8.621	0.668	2.242	8.333	0.668	2.242	8.333	0.668	2.242	8.333	1.147	3.049	13.514	1.147	3.049	13.514	1.147	3.049	13.514	1.475	3.876	14.286	1.475	3.876	14.286
E 500	0.498	1.114	6.098	0.683	1.656	8.621	0.909	2.242	8.333	0.909	2.242	8.333	0.909	2.242	8.333	1.185	3.049	13.514	1.185	3.049	13.514	1.185	3.049	13.514	1.506	3.876	14.286	1.506	3.876	14.286
F 600	0.545	1.114	6.098	0.741	1.656	8.621	0.967	2.242	8.333	0.967	2.242	8.333	0.967	2.242	8.333	1.244	3.049	13.514	1.244	3.049	13.514	1.244	3.049	13.514	1.563	3.876	14.286	1.563	3.876	14.286
T 700	0.625	1.269	6.250	0.808	1.672	8.621	1.040	2.242	8.333	1.040	2.242	8.333	1.040	2.242	8.333	1.316	3.049	13.514	1.316	3.049	13.514	1.316	3.049	13.514	1.634	3.876	14.286	1.634	3.876	14.286
A 800	0.705	1.429	6.410	0.901	1.825	8.621	1.111	2.242	8.333	1.111	2.242	8.333	1.111	2.242	8.333	1.404	3.049	13.514	1.404	3.049	13.514	1.404	3.049	13.514	1.730	3.876	14.286	1.730	3.876	14.286
N 900	0.781	1.572	6.579	1.000	2.016	8.621	1.235	2.488	9.091	1.235	2.488	9.091	1.235	2.488	9.091	1.502	3.086	13.514	1.502	3.086	13.514	1.502	3.086	13.514	1.832	3.876	14.286	1.832	3.876	14.286
C 1000	0.861	1.724	6.849	1.101	2.203	9.091	1.359	2.732	10.000	1.359	2.732	10.000	1.359	2.732	10.000	1.634	3.289	13.514	1.634	3.289	13.514	1.634	3.289	13.514	1.931	3.876	14.286	1.931	3.876	14.286
F 1500	1.232	2.404	7.042	1.577	3.106	9.615	1.953	3.846	11.905	1.953	3.846	11.905	1.953	3.846	11.905	2.358	4.505	15.152	2.358	4.505	15.152	2.358	4.505	15.152	2.778	5.208	16.129	2.778	5.208	16.129
T 2000	1.603	3.049	7.353	2.041	3.968	9.615	2.625	4.808	12.821	2.625	4.808	12.821	2.625	4.808	12.821	3.049	5.618	16.129	3.049	5.618	16.129	3.049	5.618	16.129	3.597	6.494	18.519	3.597	6.494	18.519

APPENDIX E

**DOCUMENTATION OF APPROACH TO EVALUATING
CONSERVATIVE ASSUMPTIONS**

APPENDIX E: DOCUMENTATION OF APPROACH TO EVALUATING CONSERVATIVE ASSUMPTIONS

Conservative and Nonconservative Aspects of the Air Toxics Program

Process for Characterizing the Relative Level of Conservatism

The approach selected for attempting to characterize the relative degree of conservatism of the air toxics program was to first break the program down to discrete steps or elements. Next, there was a need for a method to characterize the elements evaluated, in terms of whether or not they would contribute toward more or less conservatism/restrictiveness of the air toxics program. This was problematic due to the diversity of the elements, and the many conditions and caveats associated with any such characterization.

The method chosen was to qualitatively characterize the elements, using a variation of the USEPA Science Policy Council (1995) guidance for risk characterization. The subcommittee considered developing a quantitative approach, but recognized that this would be a novel, difficult and time-consuming undertaking. The USEPA guidance provides a clear distinction between the intent of risk assessments to provide central tendency estimates, high-end estimates, bounding estimates, and worst-case estimates of exposure and risk. These terms can also be applied to individual parameters or approaches. Central tendency descriptors reflect central estimates of exposure or risk. In other words, if the variability of a parameter forms a distribution, then the central tendency value is taken from the mid-range of that distribution. High-end descriptors are plausible estimates of the upper end of a distribution (i.e., above the 90th percentile, but never above the end of the distribution). Bounding estimates are equal to or greater than the highest actual exposure or risk situation. A worst-case estimate refers to an event or condition (or combination of them) which produces the highest conceivable exposure or risk situation. Additionally, for our purposes, a descriptor of "low-end" is added, to accommodate the elements of the air toxics program assessment which are distinctly nonconservative. A "policy" label denotes those elements which are not classifiable as to the relative degree of conservatism, since they are risk policy based. Overall, the parameters are thus described on a continuum of terms intended to convey the relative degree of conservatism (restrictiveness) imparted to the air toxics program:

low-end <---- central tendency ---- high-end ---- bounding ----> worst case

Depending on the parameter being characterized, the above continuum may be interpreted to also indicate one or more of the following:

underestimate exposure or risk <-----> overestimate exposure or risk

nonconservative <-----> highly conservative

no/minimal margin of safety <-----> large margin of safety

Categories of Elements

The parameters, elements or approaches identified in the air toxics program may be separated into the following categories:

1. Emission characterization
2. Ambient impact modeling
- 3.. Holistic, real-world issues
4. Exposure scenario assumptions
5. Dose-response assessment, and screening level development

These categories contain the following elements, with the indicated characterization regarding the degree of conservatism/restrictiveness:

1. Emission characterization

1.a	MSDS: for constituents with a range, the upper end is assumed.	High-end
1.b	MSDS: not all ingredients are listed (trade secrets; <1% noncarcinogenic; <0.1% carcinogenic)	Low-end
1.c	Emission's stack and plume <i>chemistry/transformations</i> are not well characterized.	Varies
1.d	Upset conditions and malfunctions are not generally accounted for.	Low-end
1.e	Start-up and shut-down higher emission rates are not generally accounted for.	Low-end
1.f	Emissions averaging may underestimate acute exposures and risks.	Low-end
1.g	Modeling maximum hourly emission rate, or no less than 10% of maximum as the emission average, can overestimate chronic exposure/risk.	Central to High-end

2. Ambient impact modeling

2.a	Dispersion modeling of impacts via the dilution factor matrix is generally conservative.	High-end
2.b	Dispersion modeling of maximum 1-hr impacts via SCREEN3 is fairly accurate, but conversion to longer averaging times is conservative.	Central to High-end
2.c	Dispersion modeling of impacts via ISC3 is accurate.	Central

3. Holistic, real-world issues

3.a	A facility may have more than one emission source of the same compound, but each emission source is evaluated individually (except SRSLs).	Low-end
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3.b	Noncarcinogens in emissions are compared to ITSLs, without accounting for background sources of exposure (other facilities' emissions, other sources of exposure).	Low-end
3.c	Carcinogens in emissions are compared to IRSLs/SRSLs, without accounting for background sources of exposure (<i>incremental risk</i>).	Policy
3.d	Toxicological interactions of multiple chemical exposures (from the same emission, or background sources) are not generally assumed or accounted for (except PCDD/PCDF in an emission). <ol style="list-style-type: none"> 1. Additivity is not accounted for. 2. Synergism is not accounted for. 3. Antagonism is not accounted for. 	Varies Low-end Low-end High-end

4. Exposure scenario assumptions

4.a	Fence line (and beyond) location of receptor, regardless of actual conditions existing, for assessing long-term exposures.	Central to Worst-case
4.b	Fence line (and beyond) location of receptors, for assessing short-term exposures.	Central
4.c	Exposure frequency and duration. <ol style="list-style-type: none"> 1. ITSLs with averaging time of 24 hrs or less: continuous exposure for that time period, at that location. 2. ITSLs with annual averaging time: continuous exposure for a year or more, at that location 3. IRSLs/SRSLs (annual averaged): continuous exposure for a lifetime at that location. 	varies, depends on type of SL Central Central to Worst-case Worst-case
4.d	Deposition modeling, and indirect exposure pathways, are generally not assessed.	Low-end to Central
4.e	Chronic screening levels may not ensure protection from effects of acute exposure peaks.	Low-end
4.f	Adult's assumed body weight (70 kg) is fairly average.	Central
4.g	Adult's assumed ventilation rate (20 m ³ /d) is above average.	Central to High-end
4.h	Children ventilate at higher rates per body weight than adults, which may result in relatively higher internal doses; not accounted for.	Low-end

5. Dose-response assessment, and screening level development

5.a	Cancer risk low-dose extrapolation is generally assumed to be without a threshold, and a plausible upper bound is used.	High-end
5.b	Acceptable cancer risk level is 10 ⁶ (IRSL) or 10 ⁵ (SRSL).	Policy

5.c	ITSLs may be derived from RfDs and RfCs.	Central to Bounding
5.d	ITSLs derived from occupational limits employ a moderate uncertainty factors (UF).	Low-end to High-end
5.e	ITSLs derived from 7 day, LC ₅₀ , and LD ₅₀ studies employ more uncertainty factors to compensate for the poor database.	Varies
5.f	Default value of 0.04 $\mu\text{g}/\text{m}^3$ was established as a 5th percentile.	High-end
5.g	Chemicals without cancer bioassays are assumed noncarcinogenic; ITSLs or the default value thus applied <i>may</i> result in high cancer risk <i>if</i> carcinogenic.	Low-end
5.h	Incomplete toxic database limits the discovery of potentially critical noncancer effects of substances.	Low-end
5.i	Animal cancer bioassays generally utilize high exposures; findings may over-predict actual low-dose hazard and risk.	Central to Worst-case

The characterization of the above elements can also be displayed to demonstrate the overall distribution and variability:

Table E-1: Summary of the Relative Conservatism of the Elements of the Health Impact Analysis

CATEGORY AND ELEMENT	LOW-END	CENTRAL	HIGH-END	BOUNDING	WORST-CASE
1. Emission char.					
1.a			*		
1.b	*				
1.c (varies)					
1.d	*				
1.e	*				
1.f	*				
1.g		*	*		
2. Modeling					
2.a			*		
2.b		*	*		
2.c		*			
3. Holistic issues					
3.a	*				

CATEGORY AND ELEMENT	LOW-END	CENTRAL	HIGH-END	BOUNDING	WORST-CASE
3.b	*				
3.c (policy)					
3.d (varies)					
3.d.1	*				
3.d.2	*				
3.d.3			*		
4. Exposure					
4.a		*	*	*	*
4.b		*			
4.c (varies)					
4.c.1		*			
4.c.2		*	*	*	*
4.c.3					*
4.d	*	*			
4.e	*				
4.f		*			
4.g		*	*		
4.h	*				
5. SL derivation					
5.a			*		
5.b (policy)					
5.c		*	*	*	
5.d	*	*	*		
5.e (varies)					
5.f			*		
5.g	*				
5.h	*				
5.i		*	*	*	*

Narrative Discussion of the Elements

1. Emission Characterization

- 1.a. MSDS: for constituents with a range, the upper end is assumed. **High-end.** MSDSs often serve as the source of information on the types and quantities of constituents present in an emission. It is not uncommon for constituents to be listed in MSDSs with a range of possible concentrations in the product. In these cases, the high end of the range is generally utilized in estimating the level in an emission. This is a conservative assumption in many cases, but in some cases it will be accurate. Overall, this practice is likely to be a minor factor in relation to the overall characterization of emissions.
- 1.b. MSDS: not all ingredients are listed (trade secrets; <1% noncarcinogenic substances; <0.1% carcinogenic substances). **Low-end.** The use of MSDSs to characterize emission constituents and quantities can fail to include constituents which are present in the product but are not reported in the MSDS. Reasons for this include the nondisclosure of trade secret information, and the presence of constituents at levels below the reporting thresholds of 1% (for noncarcinogens) and 0.1% (for carcinogens). In other words, a noncarcinogen such as toluene may be present in a product, but is not required to be a listed ingredient unless the concentration is 10,000 ppm or greater. For a carcinogen such as benzene, the reporting threshold is 1,000 ppm. This can result in an underestimation of emission constituents, which may potentially result in exposures which are not evaluated for acceptability.
- 1.c. Emission's stack and plume *chemistry/transformations* are not well characterized. **Varies.** The use of emission factors for source types, or other sources of emission characterization, may fail to adequately account for complex chemical changes that may occur in the emission prior to release, or in the plume following release. Conceivably, these changes could result in more toxic compounds which are not accounted for, or degradation of substances to less toxic forms.
- 1.d. Upset conditions and malfunctions are not generally accounted for. **Low-end.** All equipment and processes are assumed to be properly operating at all times. Aberrantly high emissions due to malfunctions may cause increased risks of acute effects, and potentially for chronic effects.
- 1.e. Start-up and shut-down higher emission rates are not generally accounted for. **Low-end.** Short-term high emission rates during start-up or shut-down may result in increased risks of acute effects, and potentially for chronic effects.
- 1.f. Emissions averaging may underestimate acute exposures and risks. **Low-end.** For intermittent emissions, the average emission rate may be used for impact modeling if the average is not less than 10% of the maximum hourly rate

(Rule 230(10)). This averaging may be widely used for intermittent, batch-type process emissions. If the average is significantly less than 10% and the health effect of concern is chronic (e.g., cancer), use of the 10% limit for averaging may be a conservative measure in some cases. However, in some cases there may be insufficient protection from acute effects due to peak emissions coupled with adverse meteorological conditions. For example, if the appropriate averaging period for a substance (the ITSL averaging time) is annual, with emissions averaging the maximum hourly emission rate may be up to 10 times higher than the average emission rate. The meteorological conditions may result in a much higher impact over one hour than over one year (up to 50 times higher, according to a recent assessment by the dispersion modeling procedures (DiMoP subcommittee). Therefore, the potentially higher 1-hour emission rate coupled with the meteorological conditions can result in hourly ambient air concentrations of up to 500 times higher than the annually averaged impact. This potential for acute effects has not been accounted for in the air toxics permitting process, largely because of the unavailability of acute exposure criteria for most compounds.

- 1.g. Modeling the maximum hourly emission rate, or no less than 10% of maximum as the emission average, can overestimate chronic exposure/risk. **Central to High-end.**

Actual exposures may be significantly overestimated over the long-term, if impacts are modeled based on the maximum hourly emission rate. This is because actual operating conditions may not consistently be at the design capacity of the process equipment. If emissions averaging is used, chronic exposure may also be overestimated if the emission average is less than 10% of the maximum hourly and the 10% limit must be used per Rule 230 (10). To the extent that these approaches add conservatism in some applications of the rule, they are considered appropriate in order to ensure that dose-rate concerns of toxicants are accounted for, i.e., the appearance of toxic effects can be dependent on the dose-rate rather than just the long-term average.

2. Ambient impact modeling

- 2.a. Dispersion modeling of impacts via the dilution factor matrix is generally conservative. **High-end.**

The dilution factor matrix in Rule 230 is known to generally provide high estimates of impacts, as a first screen of emission's impacts on ambient air and to indicate the need for further modeling. The results of this analysis may provide impact estimates which are generally high, and sometimes significantly higher than, the impacts modeled with more sophisticated methods.

- 2.b. Dispersion modeling of maximum 1-hour impacts via SCREEN3 is fairly accurate, but conversion to longer averaging times is conservative. **Central to High-end.** An assessment of SCREEN3 by the DiMoP Subcommittee of the AQD Air Advisory Group determined that SCREEN3 provides estimates of maximum 1-hour impacts which are fairly accurate or slightly higher than estimates derived

via ISC3. The USEPA recommended conversion factors for estimating longer-term impacts (particularly annual) result in significantly higher impacts than those estimated via ISC3, for various emission scenarios using the meteorological data from the 16 stations for Michigan. The magnitude of the conservatism of SCREEN3 for estimating annual impacts is on the order of 3-fold or greater. The DiMoP Subcommittee is considering the use of Michigan-specific conversion factors in lieu of the USEPA recommended values. Given that the USEPA approach results in annual impact estimates which are conservative in comparison to Michigan-specific ISC3 modeling results, those annual estimates via SCREEN3 are best described as "High-end."

- 2.c. Dispersion modeling of impacts via ISC3 is accurate. **Central.**
The ISC3 dispersion model utilizes area-specific meteorological data and other source-specific information which is not used for SCREEN3 modeling. As a result, ISC3 provides fairly accurate estimates of impact, for all averaging times.

3. Holistic, real-world issues

- 3.a. A facility may have more than one emission source of the same compound, but each emission source is evaluated individually (except SRSLs). **Low-end.**
The ITSLs and IRSLs apply to incremental impacts of a permitted emission, regardless of whether there may be other emission sources of the same compound from the same facility that are also impacting the ambient air.

- 3.b. Noncarcinogens in emissions are compared to ITSLs, without accounting for background sources of exposure (other facilities' emissions, other sources of exposure). **Low-end.**

Other existing sources of exposure to a noncarcinogen are not accounted for in comparing an impact to an ITSL. Other existing sources may include emissions from other facilities' air emissions, exposures from the use of products, indoor air sources of air contaminants, or background exposures via non-air media. Accounting for other sources is a step that is referred to as the "relative source contribution," in the establishment of National Primary Drinking Water Regulations under the Safe Drinking Water Act, and in the establishment of ambient water quality standards for bioaccumulative substances under the Great Lakes Water Quality Guidance.

This issue is a realistic concern for those substances which have significant background sources of exposure leaving little or no "margin of exposure," and which have a well defined threshold for effect which may be exceeded by the incremental exposure from a facility's emissions. If the ITSL incorporates a significant margin of safety because of uncertainty in the location of the theoretical threshold, or the actual exposure scenario is overestimated by the assumed exposure conditions, then the incremental increase in exposure over background may have no health consequences.

- 3.c. Carcinogens in emissions are compared to IRSLs/SRSLs, without accounting for background sources of exposure (*incremental risk*). **Policy**

Public concern over cancer risks from air pollutants is generally focused on the total risk posed, not on the incremental risk posed by each of many carcinogenic air pollutants present in the air they breathe. However, the air toxics rules prescribe the acceptable level of incremental cancer risk for individual carcinogens in a permitted emission. This is done without regard for the number of carcinogens present in the emission, or the number of carcinogens present in background ambient air and the risk level which they represent. Rather than label this practice with the relative level of conservatism, it is more appropriate to describe this as a policy issue.

- 3.d. Toxicological interactions of multiple chemical exposures (from the same emission, or background sources) are not generally assumed or accounted for. **Varies.**

Rule 230(9)(a) directs that all PCDDs and PCDFs in an emission shall be treated additively via the relative potency approach. Rule 230(9)(b) states that, "If two or more hazardous substances are present *and known to result* in toxicological interaction, the interactive effects shall be considered in establishing initial threshold screening levels, initial risk screening levels, and secondary risk screening levels" (emphasis added). Further, Rule 230(3) also directs that additive or synergistic effects from other TACs can be considered in determining if a maximum allowable emission rate provides adequate protection. However, potential toxicological interactions are not generally accounted for in the air toxics program. The reason for this is that toxicological interactions are poorly understood, and there are countless possibilities of chemical mixture combinations. If in particular cases, staff are aware of a mixture in an emission which is "known to result in toxicological interaction" (as per Rule 230(9)(b)), adjustments to the allowable emission rate can be made accordingly. But, in general, the inability to account for the potential interactive effects is assumed to have a varied effect on the level of conservatism of the air toxics program. This means that the frequency of significant interactive effects is not known, and interactions which may occur may range from antagonism to synergism:

1. Additivity is not accounted for. **Low-end.**
2. Synergism is not accounted for. **Low-end.**
3. Antagonism is not accounted for. **High-end.**

4. Exposure scenario assumptions

- 4.a. Fence line (and beyond) location of receptors, regardless of actual conditions existing, for assessing long-term exposures. **Central to Worst-case.**
In the air toxics program, the point of compliance with screening levels is at a secured property line and beyond. This is consistent with the USEPA approach for evaluating the impacts of criteria pollutants. The modeled point of maximum ground level concentration (PAI) must be at or below the screening level, for the appropriate averaging time, without consideration of the actual or reasonably anticipated human exposure potential at that location. For human health concerns with long-term exposure (and annual averaging times), this approach is considered "central" for those scenarios which actually do have receptors in the

area of the PAI. However, other scenarios may preclude any reasonable anticipation of long-term human exposure at the PAI location. Examples of this include conditions which make the area uninhabitable on a constant and long-term basis, such as over waterways, or in industrial parks. For these situations, the modeled PAI may in some cases be significantly higher than the ambient air impacts in adjacent areas where it is feasible for receptors to be exposed on a long-term basis. Therefore, there are some instances for which the approach may be characterized as "worst-case."

One possible way of addressing the occurrence of "worst-case" assessments is to make greater utilization of the provisions of Rule 230(6). That subrule allows an exemption from the requirement of PAIs to meet screening levels, if it can be demonstrated that Rule 901 will not be violated. That demonstration may include, among other considerations, the "Actual exposure levels and durations" (Rule 230(6)(d)). Therefore, the present and foreseeable land use and receptor locations and occurrence periods would be relevant considerations in such a case-by-case demonstration.

4.b. Fence line (and beyond) location of receptors, for assessing short-term exposure. **Central.**

As in the discussion above under 4.a., the standard approach to impact assessment in the air toxics program may in some cases be a conservative step with regard to actual human short-term exposure potential at the PAI location. However, this is viewed as an overall "central" approach to exposure and risk characterization, because the screening level averaging times of 1, 8, and 24 hours can be considered to be reasonably attainable exposure periods in the preponderance of cases.

4.c. Exposure frequency and duration. **Varies, depends on type of screening level.**

1. ITSLs with averaging times of 24 hours or less: continuous exposure for that time period, at that location. **Central.**
2. ITSLs with annual averaging times: continuous exposure for a year or more, at that location. **Central to Worst-case.**
3. IRSLS/SRSLs (annually averaged): continuous exposure for a lifetime at that location. **Worst-case.**

These exposure assumptions result in a level of conservatism which varies from "central" to "worst-case", depending upon the screening level type and the averaging time, as listed below. Possible alternative assumptions to consider could be derived using a probabilistic approach, accounting for actual residence times in a home or within the same general area. That could provide conservative upper-bound values to replace the present maximum values. That type of approach has been used in other regulatory programs, such as in the setting of cleanup criteria for contaminated sites, in assessing fish consumption exposure for surface water criteria development, and in evaluating multi-pathway exposures and risks from air emissions.

4.d. Deposition modeling, and indirect exposure pathways, are generally not assessed. **Low-end to Central.**

The screening levels are derived to ensure protection of direct inhalation exposure only. If air contaminants are persistent in the environment and deposit to the ground, waterways or plant foliage, they may then be available for human exposure via the indirect pathways (soil ingestion, crop uptake, meat and dairy products, fish bioaccumulation, etc.). These indirect pathways are not normally evaluated for facility emissions regulated under the air toxics program, except for municipal waste combustors. Also, hazardous waste incinerators are commonly subjected to multi-pathway risk assessments under the auspices of the USEPA. By focusing on only the inhalation route of exposure and not evaluating the indirect pathways, the exposure potential may be significantly underestimated (i.e., Low-end) for relatively large sources of emission of some compounds which are highly bioaccumulative and/or persistent, particularly if there are local activities (e.g., farming, fishing) in the impacted area. For many substances (e.g., VOCs), the inhalation pathway of exposure is much more important than the indirect pathways, therefore the approach is "Central" for those cases.

- 4.e. Chronic screening levels may not ensure protection from effects of acute exposure peaks. **Low-end.**

Acute, subacute, and subchronic criteria are not generally developed for chemicals. The screening levels available may also be protective of shorter-term effects if the screening level concentration is not exceeded for any time period. However, with annual averaging times in particular, wide fluctuations in exposure levels can occur, including peak levels much higher than the annually averaged screening level. The peak levels of exposure are a result of two factors. First is the use of emission averaging to demonstrate compliance with annual screening levels, with maximum hourly emission rates that may be up to ten times higher than the average emission rate. The second factor is the variable meteorological conditions. Modeled ambient air impacts are substantially lower on an annual average basis than on a short-term basis due to varying meteorological conditions. For example, the averaging time conversion factors of Rule 230 include a 75-fold difference in the dilution factors between annual and hourly impacts. These two factors (higher short-term emission rates and higher ambient air impacts on the shorter term) may be compounding factors. This results in uncertainty that the application of the annually averaged screening levels are protective of short-term exposures and effects.

One possible response to this concern would be to develop both short-term and long-term screening levels for chemicals. This effort would be a difficult undertaking due to the present lack of appropriate acute exposure guidelines for the general public. An ongoing USEPA effort is anticipated to provide this information within a few years.

- 4.f. Adult's assumed body weight (70 kg) is fairly average. **Central.**
The USEPA Exposure Factors Handbook (August 1996 Science Advisory Board Review Draft; Volume I, page 7-8) recommends a mean body weight for males and females, ages 18 to 75, of 71.8 kg. This value is very close to the value of 70 kg which has traditionally been used in regulatory programs.

- 4.g. Adult's assumed ventilation rate (20 m³/d) is above average. **Central to High-end.**

The USEPA Exposure Factors Handbook (1996) recommends (for long-term exposures) mean inhalation rates of 11.3 m³/d and 15.2 m³/d for adult females and males respectively, based on an assessment of age groups and activity levels. Hourly inhalation rates are also recommended, for various types of activities. Study results are also presented which indicate that reasonably anticipated activities can result in inhalation rates of over 20 m³/d for men or women. Therefore, the standard assumption of 20 m³/d may be considered high-end for the overall population, but appears to be a central value for large subgroups of the adult population.

- 4.h. Children ventilate at higher rates per body weight than adults, which may result in relatively higher internal doses; not accounted for. **Low-end.**

As recommended in the USEPA Exposure Factors Handbook (1996), children less than one year in age inhale at a mean rate of 4.5 m³/d, and children ages 1-8 years inhale at a mean rate of 8.7 m³/d. When coupled with body weight data, the relatively higher inhalation rate among children suggests that their internal doses may be approximately 2 to 4 times higher than adults (assuming similar absorption rates). This differential is not accounted for in the air toxics program.

5. Dose-response assessment, and screening level development.

- 5.a. Cancer risk low-dose extrapolation is generally assumed to be without a threshold, and a plausible upper bound is used. **High-end.**

Unless mechanistic data are available to support the construction of a chemical-specific dose-response relationship extrapolation to low doses, default models are used to estimate potential risks at low doses. This process is designed to provide a "plausible upper bound". The attainment of a plausible upper bound is based upon the assumption of no threshold in the low-dose extrapolation, and the use of an upper confidence limit on the slope of the dose-response line, rather than the maximum likelihood estimate of that line. This approach can best be described as "high-end", or possibly, "bounding", since the process is generally intended to incorporate conservatism and to err on the side of protectiveness.

- 5.b. Acceptable cancer risk level is 10⁻⁶ (IRSL) or 10⁻⁵ (SRSL). **Policy.**
The rules specify the cancer risk levels which are considered acceptable risk levels under this program. Rather than characterizing the relative degree of conservatism of these risk levels, they may best be denoted as policy based.

- 5.c. ITSLs may be derived from RfCs and RfDs. **Central to Bounding.**
If an RfC or RfD is available, the ITSL may be based on it without additional uncertainty factors. Some RfCs and RfDs are based on a high certainty of the dose-response relationship and minimal uncertainty factors. Others employ a number of uncertainty factors to help ensure protectiveness in view of the gaps in our understanding of the chemical's hazards and effects on sensitive humans. Taken individually, the uncertainty factors each appear to be fairly appropriate

and protective (i.e., they are "central to high-end"). However, since multiple uncertainty factors may be combined, the resulting total uncertainty factor products may result in an overall range of RfCs and RfDs which could be best characterized as "central to bounding".

- 5.d. ITSLs derived from occupational limits employ a moderate uncertainty factor. **Low-end to High-end.**

Occupational limits are designed to be protective of serious adverse effects in healthy adult workers. They are utilized by various state's air programs to derive criteria levels, after incorporating an uncertainty factor in the range of 30 to 420, with various averaging times (USEPA, 1993, A Descriptive Guide to Risk Assessment Methodologies for Toxic Air Pollutants). Slight adverse effects do occur in otherwise healthy adults, with exposure to many substances within their occupational limits. Michigan's air toxics program uses a total uncertainty factor of 100 to adjust the occupational limit and derive an ITSL (with averaging times consistent with the occupational limit). The resulting ITSL is considered to be nonconservative or low-end in some cases, and conservative or high-end in other cases.

- 5.e. ITSLs derived from 7 day, LC₅₀, and LD₅₀ studies employ more uncertainty factors to compensate for the poor database. **Varies.**

These methods are not commonly used by other state's agencies. They are used so that regulatory criteria can be derived for compounds with extensive data gaps, rather than the chemical simply not being regulated, regulated at a default level, or being prohibited from discharge until further toxicological data are provided. Multiple uncertainty factors are used to account for uncertainty associated with data gaps. This approach helps ensure that exposures will not cause harm, for chemicals with poorly characterized toxicity. The wide variety of substances so regulated, with an assumed wide variety of inherent but poorly documented toxicity, results in a characterization of "varies" for this approach.

- 5.f. Default value of 0.04 $\mu\text{g}/\text{m}^3$ was established as a 5th percentile. **High-end.** Refer to this document's section entitled, "Determination of an Alternate Default Initial Threshold Screening Level."

- 5.g. Chemicals without cancer bioassays are assumed noncarcinogenic; ITSLs or the default value thus applied *may* result in high cancer risk *if* carcinogenic. **Low-end.**

The method for regulating a substance as a carcinogen requires evidence demonstrating the carcinogenic potential. In other words, there is no "reverse onus", and a substance is considered innocent until proven guilty. While this is the normal and traditional approach in regulatory agencies, it does lead to the concern that some as-yet undiscovered carcinogens may be under-regulated in emissions due to the lack of cancer bioassays and the lack of a requirement for studies to reveal this potential effect. Therefore, this is described as a "low-end", or under-conservative, regulatory approach.

- 5.h. Incomplete toxicological database limits the discovery of potentially critical noncancer effects of substances. **Low-end.**

The setting of protective ITSLs is dependent to some extent on knowing the critical noncancer effects of the compounds. A chemical may possess an inherent but undiscovered ability to cause a toxic effect at dose-rates significantly lower than other effect endpoints which have been investigated. For example, the more critical undiscovered effect may be on reproductive or developmental systems which were not the focus of experimental designs. The USEPA, in establishing RfCs and RfDs, evaluates the database completeness and may account for significant database gaps with the application of an additional uncertainty factor of up to 10. ITSLs based upon such RfCs and RfDs would therefore incorporate that uncertainty factor. But for all other ITSL derivation methods, the air toxics program does not utilize a minimum data set requirement and an additional uncertainty factor to account for data gaps similar to USEPA's approach. Therefore, the AQD approach may be considered "low-end".

- 5.i. Animal cancer bioassays generally utilize high exposures; findings may over-predict actual low-dose hazard and risk. **Central to Worst-case.**

Relatively high exposures (maximum tolerated doses) are commonly used in cancer bioassays to maximize the ability to find carcinogenic hazards in necessarily limited numbers of experimental animals. This practice raises concerns that the findings may not be applicable, qualitatively or quantitatively (by linear extrapolation), to low-dose risks. This is a very controversial area of cancer risk assessment which is recognized to probably result in a wide range of impacts on the conservatism of chemical risk assessments. This aspect of the program is difficult to characterize, but may be best represented by a "central to worst-case" descriptor range due to the large uncertainties and chemical-by-chemical variabilities involved.

APPENDIX F

**RELATIONSHIP OF STATE TOXICS PROGRAM TO
SECTION 112 OF THE FEDERAL CLEAN AIR ACT**

APPENDIX F: RELATIONSHIP OF STATE TOXICS PROGRAM TO SECTION 112 OF THE FEDERAL CLEAN AIR ACT

Michigan Rule 336.230(4): The provisions of subrule (1)(a) of this rule shall not apply to any of the following:

(b) Process or process equipment that only emits toxic air contaminants which are particulates, VOCs, or hazardous air pollutants as listed in Section 112(b) of the Clean Air Act as amended, 42, U.S.C. 1401 et seq and is in compliance with all of the following:

- (1) BACT or LAER requirements for particulates and VOC, or **emission standards for hazardous air pollutants promulgated by February 28 1991** (emphasis added) pursuant to Section 112(d) of the Clean Air Act as amended, 42 U.S.C. 1401 et seq.

Michigan Act 451, Section 324.5508: "Section 112" defined; source, process or process equipment not subject to best available control technology for toxics requirements or health based screening level requirements.

Sec. 5508. (1) As used in this Section, "Section 112" means Section 112 of Part A of Title 1 of the Clean Air Act, 84 Stat 1685, 42 U.S.C. 7412.

- (2) A new, modified, or existing source, process, or process equipment for which standards have been promulgated under Section 112(d) for which a control technology determination has been made pursuant to Section 112(g) or 112(j) is not subject to the best available control technology for toxics (T-BACT) requirements of rules promulgated under this part for any of the following:
- (a) The hazardous air pollutants listed in Section 112(b)
 - (b) Other toxic air contaminants that are volatile organic compounds, if the standard promulgated under Section 112(d) or the determination made under Section 112(g) or 112(j) controls similar compounds that are also volatile organic compounds.
 - (c) Other toxic air contaminants that are particulate matter, if the standard promulgated under Section 112(d) or the determination made under Section 112(g) or 112(j) controls similar compounds that are also particulate matter.
 - (d) Other toxic air contaminants that are similar to the compounds controlled by the standard promulgated under Section 112(d) or controlled by the determination made under Section 112(g) or 112(j).
- (3) A new, modified or existing source, process or process equipment for which standards have been promulgated under Section 112(f) is not subject to the health based screening level requirements in rules promulgated under the part for the hazardous air pollutants listed in Section 112(b).



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

MAY 14 1996

AIR QUALITY DIVISION

MAY 08 1996

REPLY TO THE ATTENTION OF.

(AR-18J)

Dennis Drake, Chief
Air Quality Division
Michigan Department of Environmental Quality
P.O. Box 30260
Lansing, Michigan 48909

Dear Mr. Drake: *Dennis*

As you know, the United States Environmental Protection Agency (USEPA) is in the process of approving Michigan's request for delegation of the Federal air toxic program pursuant to Section 112(1) of the Clean Air Act, as amended. We anticipate rulemaking on the request in a Spring 1996 Federal Register notice. To facilitate Federal delegation of authority to implement and enforce standards promulgated by USEPA, our respective staffs have been working together for many months to develop a memorandum of agreement (MOA) between the Michigan Department of Environmental Quality (MDEQ) and USEPA. This MOA outlines MDEQ's and USEPA's responsibilities regarding information exchange and delegation of both existing and future standards.

I believe that this MOA will be a valuable tool for coordinating MDEQ's and USEPA's Section 112 responsibilities. In addition, I believe that it will facilitate communication between our agencies by establishing a new framework for continuing our cooperative working relationship.

Enclosed are two copies of the document that have been signed by me. If you agree with the provisions in the MOA, please sign the documents, and send one back to me for our records. If you have any questions regarding the MOA, please call me at (312)353-2212. I would like to thank the MDEQ staff for all of their hard work and cooperation during the development of this MOA.

Sincerely yours,

David Kee, Director
Air and Radiation Division

Enclosures

cc: Jerry Avery
Michigan Department of Environmental Quality

MEMORANDUM OF AGREEMENT
BETWEEN
THE MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
AND THE U.S. ENVIRONMENTAL PROTECTION AGENCY, REGION 5
REGARDING
SECTION 112, CLEAN AIR ACT IMPLEMENTATION

INTRODUCTION

The purpose of this Memorandum of Agreement (MOA) is to provide for a procedure to facilitate delegation by the United States Environmental Protection Agency (USEPA) to the Michigan Department of Environmental Quality (MDEQ) of authority to implement and enforce standards promulgated by USEPA under Section 112 of the Clean Air Act. This MOA sets forth specific expectations and responsibilities of MDEQ and USEPA and describes a formal procedure for cooperative information sharing between them. Both MDEQ and USEPA recognize that timely delegation of Section 112 responsibilities is vital to implementation of the Section 112 program, affirm their commitment to an effective State/USEPA partnership, and agree to review this MOA as the need arises.

SCOPE

MDEQ has requested, and USEPA intends to grant, delegation of responsibilities for implementation and enforcement of emission standards and other requirements promulgated under Section 112. MDEQ has not requested and at this time does not intend to request delegation of the accidental release program under Section 112(r) or of responsibilities relating to the radionuclide standard. This MOA addresses only those provisions and responsibilities for which MDEQ has requested delegation.

BACKGROUND

Section 112 requires USEPA to develop National Emissions Standards for Hazardous Air Pollutants (NESHAPs). Section 112(1) authorizes the USEPA Administrator to delegate the authority for the implementation and enforcement of standards promulgated under Section 112 to any State which applies for such delegation and which can demonstrate that it has in place a program which meets the criteria set forth in Section 112(1) and its implementing regulations at 40 CFR § 63.91 through § 63.96. The Administrator has redelegated the authority to approve State programs to the Regional Administrators.

MDEQ has submitted to USEPA, Region 5, and seeks approval of its program for implementation and enforcement of emission standards and other requirements for air pollutants subject to Section 112 (Section 112 standards). MDEQ has demonstrated that it has in place appropriate mechanisms for implementing and enforcing Section 112 standards with respect to both part 70 and non-part

70 sources in accord with this MOA, and that its program is in compliance with the regulations at 40 CFR § 63.91 through § 63.96.

Region 5 will approve MDEQ's Section 112 program in a 1996 Federal Register rulemaking pursuant to Section 112(1) at which time the authority to implement existing Section 112 standards for both part 70 and non-part 70 sources will be delegated to MDEQ. Authority to enforce Section 112 standards applicable to non-part 70 sources will be delegated to MDEQ upon incorporation of such standards by reference into the State air quality regulations. MDEQ will enforce Section 112 standards applicable to part 70 sources by including such Section 112 standards in State operating permits when they are issued or updated. Authority to implement and enforce future Section 112 standards will be delegated to MDEQ in accordance with this MOA.

POLICY STATEMENT

MDEQ and USEPA hereby agree to establish a process for delegation of responsibilities under Section 112(1). MDEQ and USEPA will presume delegation of all Section 112 standards as promulgated by USEPA unless MDEQ notifies USEPA otherwise as specified in this agreement. Both MDEQ and USEPA recognize that MDEQ's ability to implement and enforce a Section 112 standard in a timely manner will depend largely upon its having access to information regarding such standard prior to the final promulgation of such standard. The delegation process should therefore be an interactive, information-sharing process which should begin prior to promulgation by USEPA of the Section 112 standard to be delegated.

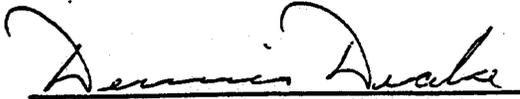
MDEQ shall implement Section 112 standards pursuant to this MOA through the part 70 and the new source review permit programs. Pursuant to Mich. Comp. Laws § 324.5506(6) (1994), MDEQ has the authority to include Section 112 requirements in operating permits. MDEQ shall include applicable Section 112 requirements in part 70 permits for existing sources and in new source review permits for new sources.

MDEQ and USEPA agree to implement the following procedures:

- I. Prior to final promulgation of a Section 112 standard, USEPA shall provide MDEQ with any information it has regarding Michigan sources that may be subject to such standard.
- II. Following final promulgation by USEPA of a Section 112 standard:
 - A. USEPA shall provide MDEQ with blank notification forms and other supporting resources.

- B. USEPA shall provide MDEQ with access to the applicable MACT database.
 - C. USEPA shall coordinate the sharing of guidance, outreach and other materials developed by USEPA and by other Region 5 States to implement the standard.
 - D. *Implementation Authority.* USEPA shall, by letter, delegate to MDEQ the authority to implement each Section 112 standard as promulgated unless MDEQ notifies USEPA differently, within 45 days of USEPA's final promulgation of the standard.
 - E. *Enforcement Authority.* As expeditiously as practicable and, if possible, within 12 months of the promulgation by USEPA of a Section 112 standard which is applicable to non-part 70 sources, MDEQ shall incorporate such standard by reference into the State air quality regulations. Upon completion of such regulatory action, MDEQ shall submit to USEPA proof of incorporation by reference. USEPA shall respond with a letter delegating enforcement authority to the MDEQ with respect to the standard or standards so incorporated.
- III. MDEQ shall be responsible for implementing and enforcing Section 112 standards in Michigan. Such implementation and enforcement shall include, as appropriate:
- A. Distribution of initial notification forms to potentially affected sources;
 - B. Receiving initial notifications and compliance certifications from affected sources;
 - C. Issuing or revising part 70 and new source review permits for affected sources as needed to include Section 112 standards;
 - D. Assuring compliance through implementation of the part 70 and new source review permit programs for those affected sources required to obtain permits.
- IV. Until MDEQ obtains the authority necessary to enforce Section 112 standards, USEPA shall initiate enforcement action when enforcement is in the best interest of the State, the general public, or USEPA, or when delayed enforcement would impose an undue level of risk on the general public and/or the environment. USEPA at all times retains its authority to enforce all provisions of Section 112 standards and requirements.

The above agreement is effective when signed and may be modified upon agreement by MDEQ and USEPA. Nothing in this agreement shall be construed to restrict in any way the authority of either USEPA or MDEQ to fulfill its responsibilities under State or Federal law.



Dennis Drake, Chief
Air Quality Division



David Kee, Director
Air and Radiation Division

Date: 5/16/96

Date: 5/8/96

APPENDIX G
REFERENCE CHECK LIST

APPENDIX G

REFERENCE CHECK LIST

Chemical Name _____

CAS No. _____

<u>Reference</u>	<u>Name</u>	<u>Date</u>
EPB Chemical Criteria Database	_____	_____
INTERIM Database	_____	_____
AQD Chemical Files	_____	_____
IRIS	_____	_____
HEAST (if nothing in IRIS)	_____	_____
ACGIH TLV*	_____	_____
NIOSH REL	_____	_____
RTECs*	_____	_____
EPB Library	_____	_____
NTP Management Status Report	_____	_____
IARC Monographs	_____	_____
CAS ONLINE	_____	_____
NLM/TOXLINE	_____	_____
EPBCCD or INTERIM Entries	_____	_____
Memos to chemical file	_____	_____

If other secondary reference and/or reviews necessary, check:

CESARS database	_____	_____
<u>Handbook of Environmental Data on Organic Chemicals</u>	_____	_____
<u>Patty's Industrial Hygiene and Toxicology</u>	_____	_____
<u>Merck Index</u>	_____	_____
<u>Condensed Chemical Dictionary</u>	_____	_____

Comments/Other References:

* If an ITSL can be determined from an RfC, RfD, or OEL; and data indicates potential carcinogenic effects, do a full review of the literature

APPENDIX H

LIST OF ACRONYMS AND DEFINITIONS

APPENDIX H: LIST OF ACRONYMS AND DEFINITIONS

<u>Acronym</u>	<u>Definition</u>
ACGIH	American Conference of Governmental Industrial Hygienists
AIR	Ambient Impact Ratio
AQD	Air Quality Division
BACT	Best Available Control Technology
CAA	Clean Air Act
CAS	Chemical Abstract Service
CSF	Cancer Slope Factor
DiMoP	Dispersion Modeling Procedures
DNA	Deoxyribonucleic Acid
EAD	Environmental Assistance Division
ED	Exposure Duration
EF	Exposure Frequency
ERD	Environmental Response Division
FIFRA	Federal Insecticide, Fungicide and Rodenticide Act
HAPs	Hazardous Air Pollutants
IR	Inhalation Rate
IRSL	Initial Risk Screening Level
ITSL	Initial Threshold Screening Level
L	Lifetime
LAER	Lowest Achievable Emission Rate
LC ₅₀	Lethal Concentration to 50% of exposed animals
LD ₅₀	Lethal Dose to 50% of exposed animals
LOAEL	Lowest Observable Adverse Effect Level
MACT	Maximum Achievable Control Technology
MDEQ	Michigan Department of Environmental Quality
MI	Michigan
MMA	Michigan Manufacturers Association
MOA	Memorandum of Agreement
NIOSH	National Insititue for Occupational Safety and Helath
NOAEL	No Observable Adverse Effect Level
OECD	Organization for Economic Co-operation and Development
OSHA	Occupational Safety and Health Administration
PAI	Predicted Ambient Impact
REL	Recommended Exposure Level
RfC	Reference Concentration
RfD	Reference Dose
RTECS	Registry of Toxic Effects of Chemical Substances
SL	Screening Level
SRSL	Secondary Risk Screening Level
TAC	Toxic Air Contaminant
T-BACT	Best Available Control Technology for Toxics
TLV	Threshold Limit Value
TSCA	Toxic Substances Control Act
USEPA	U. S. Environmental Protection Agency
VOC	Volatile Organic Compound