Air Permit Reviewer Reference Guide

APDG 5874

Modeling and Effects Review Applicability (MERA)

Air Permits Division

Texas Commission on Environmental Quality

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Introduction

The Texas Commission on Environmental Quality (TCEQ) regulates air quality in the state of Texas through the Texas Clean Air Act (TCAA), located in Chapter 382 of the Texas Health and Safety Code and rules, including those in Title 30 Texas Administrative Code (TAC) Chapter 116.

The TCEQ staff conducts a preconstruction technical review during the air permitting process. This review ensures that the operation of a proposed facility will comply with all the rules of the TCEQ and intent of the TCAA, and not cause or contribute to a condition of air pollution. A review of an air permit application involves an assessment of human health and welfare effects related to emissions from production and planned maintenance, startup, and shutdown (MSS) activities.

The human health and welfare effects are evaluated for applications with new and/or modified sources of air contaminants, as well as in permitting actions involving retrospective reviews or previously unevaluated emissions. Contaminants for which state air quality standards or National Ambient Air Quality Standards (NAAQS) exist are evaluated using a comparison between predicted concentrations and the standards. The evaluation procedures for these contaminants are covered in detail in the TCEQ Air Quality Modeling Guidelines – APDG 6232. If there are no state or national ambient air quality standards for a contaminant, it is evaluated through the TCEQ's Modeling and Effects Review Applicability (MERA) process. During the course of the MERA process, the scope of air dispersion modeling and effects review is determined.

While this document provides a general process and defines minimum considerations for agency staff's air quality impacts analysis, this document is not regulatory and does not limit the permit reviewer's ability to require the applicant to provide additional information. In addition, the permit reviewer and Air Permits Division (APD) management have the discretion to perform an effects review outside of the MERA process.

The MERA process begins with Step 0, which informs the user of the general procedures and practices to be followed throughout the MERA process. Steps 1 through 7 detail the criteria used to evaluate the health effects of an air contaminant. The initial steps in the MERA process are designed to be simple and conservative. As one progresses through the process, the steps require more detail and result in a more refined (less conservative) analysis. Site-wide air dispersion modeling is conducted at Step 7; and those results are evaluated using the Toxicology Effects Evaluation Procedure in Appendix D. If a contaminant, evaluated on a chemical species by chemical species basis, meets the criteria of a step, the review of human health and welfare effects is complete. A chemical species is said to "fall out" of the MERA process at this step, and the MERA document will direct the user to Step 8 to document the evaluation. If a contaminant does not meet the criteria of a step, the document will direct the user to the appropriate next step. It is acceptable to skip steps in the MERA process and proceed directly to more detailed steps.

This document replaces Modeling and Effects Review Applicability, APDG 5874, July 2009.

Summary of Significant Changes

Revision Date	Description of Changes
February 2018	Improve ease of use and clarity, removed infrequently used steps, and revised multi-point equation in previous Step 5. Chemical species for which there is not an ESL may be exempted from a MERA evaluation.
July 2009	Provided additional clarity pertaining to unevaluated and MSS emissions and added Appendix D, Toxicology Effects Evaluation Procedure.
August 2008	Updated requirements for APWL Constituents, added criteria for planned MSS and unevaluated emissions and added the term "permit-wide," established magnitude and frequency criteria for planned MSS emissions.
October 2001	Removed special interest constituents, and replaced with Air Pollutant Watch List, corrected multi-point equation in Step 5, and added information about single property line designations.
August 1998	Updated flowchart, added requirements for constituents of special interest, and added effects evaluation procedures and updated the format.
July 1993	Original MERA Guidance Document

How to Determine the Scope of Modeling and Effects Review for Air Permits

Step 0: Applicability and Procedures

MERA Evaluation Applicability

A MERA evaluation must be conducted for all chemical species whose short-term or long-term allowable emission rate will increase from any emission point number (EPN) through the project. The change in an allowable emission rate is calculated as the difference between the proposed maximum allowable emission rate and the currently permitted maximum allowable emission rate. Throughout the remainder of this document "allowable emission rates" will be referred to as "emission rates" or "emissions."

The following are exempt from a MERA evaluation:

- All chemical species for which there is a state air quality standard or NAAQS, other than particulate matter species that have an Effects Screening Level (ESL) published by the TCEQ Toxicology Division. The ESL database will reference the NAAQS in place of an ESL if a MERA evaluation is not required for a particulate matter species.
- The "Air Quality Modeling Guidelines" document (APDG 6232) provides the process for evaluating chemical species for which there is a state air quality standard or NAAQS.
- Facilities and chemical species listed on the Toxicology Emissions Screening List (see Appendix B).
- Chemical species for which there is not a current ESL listed in the Toxicity Factor Database, accessed through the Texas Air Monitoring Information System (TAMIS) database via the Toxicology ESL summary and detail reports. While no effects review is required, such chemical species must satisfy the BACT and other requirements. In addition, the permit reviewer and APD management have the discretion to perform an effects review outside of the MERA process. This exemption does not apply to chemical species being authorized under chemical flexibility permit provisions.

General Procedures

The following applies to the health effects review described in the MERA process, unless otherwise specified:

- The MERA evaluation must be conducted for each chemical species individually (except in cases where the Toxicology Division has developed an ESL for a blend such as gasoline), and must include all EPNs in the project with an increasing allowable emission rate of that chemical species.
- A short-term impacts evaluation must be conducted for all chemical species with an increase in short-term emissions.
- A long-term impacts evaluation must be conducted for chemical species with an increase in long-term emissions under the following conditions:
    - for all chemical species with a long-term ESL that is less than 10 percent of the short-term ESL or;
    - if a chemical species does not have an assigned short-term ESL, but does have an assigned long-term ESL; or

- if previous impacts were approved based on a limited frequency of exceedances.

For other cases, a long-term impacts is not required unless requested by the permit reviewer.

- The input of a screening model is an emission rate in mass per unit of time and the output is a maximum 1-hr ground level concentration (GLC_{max}), in units of micrograms per cubic meter (µg/m3). Therefore, if a long-term impacts evaluation is necessary and screen modeling is used, an annual GLC_{max} must be calculated by multiplying:
  - an annual unit impact multiplier, and
  - an emission rate representative of the annual emission increase associated with the 1-hr GLC_{max}.

  For SCREEN3, the annual unit impact multiplier is determined by multiplying the hourly unit impact multiplier by 0.08, which is an annual conversion factor that accounts for the variation in meteorological conditions throughout the year. For AERSCREEN the annual unit impact multiplier is determined by multiplying the hourly unit impact multiplier by the annual conversion factor 0.1. An annual conversion factor is not needed if a refined model that can calculate an annual GLC_{max} is used.

  To determine the emission rate representative of the annual emissions increase, convert the ton-per-year increase in emissions to a pound-per-hour rate using 8760 hours per year and 2000 pounds per ton.

  As an example, an emission source has an hourly unit impact multiplier of 100 $\mu g/m^3$, generated using SCREEN3, and an annual emission rate of 40 tpy. The annual emission rate is converted to an hourly rate as shown below:

  40 tpy x 2000 lb/ton / 8760 hours/year = 9.134 lb/hr

  The maximum 1-hr ground level concentration is multiplied by 0.08 to yield an annual unit impact multiplier:

  100 $\mu g/m^3$ x 0.08 = 8 $\mu g/m^3$

  The annual GLC_{max} is then calculated by multiplying that annual unit impact multiplier and that emission rate representative of the annual emissions:

  8 $\mu g/m^3$ x 9.134 pph = 73.1 $\mu g/m^3$

- ESLs should be determined from the Toxicity Factor Database, accessed through the TAMIS database. Instructions for using the database can be found on the Toxicology Division's website. If a chemical species does not have an assigned ESL, it may be exempted from a MERA effects evaluation, unless an evaluation is requested by the permit reviewer. However, for certain chemical species, such as chemicals to be approved under chemical flexibility permit provisions or proprietary mixtures, a new ESL may be requested from the Toxicology Division. In addition, a default ESL of 2 $\mu g/m^3$ may be used for a species with an unknown ESL.
- Unless otherwise stated, each step in the MERA evaluation must include all emissions associated with the project, including:
  - MSS emissions that will be authorized under Permits By Rule (PBRs).
  - Emissions from PBRs and Standard Permits (SPs) that are being consolidated by incorporation into the permit.

- Chemical species on the Air Pollutant Watch List (APWL) are subject to the requirements detailed in the "Permit Application Guidance for Companies Located in an Air Pollutant Watch List Area" guidance document, and must also be evaluated using the MERA. Also, a case-by-case analysis not relying on the steps of the MERA may be required for any specific situation as deemed appropriate by the permit reviewer and APD management.
- A retrospective MERA evaluation may be required for corrections in representations or emission calculations.This determination will be made on a case-by-case basis.
- All refined modeling should be conducted in accordance with direction from APD staff and the "Air Quality Modeling Guidelines" document (APDG 6232). A pre-modeling meeting or teleconference with the applicant, permit reviewer and modeling team is recommended before refined modeling is performed.

Step 1: No Net Increase

- Sum the proposed emission increases and decreases from each EPN to determine the net change in emissions.

Step 1: Is the net change in emissions less than or equal to zero?

- **If "Yes"** → Conduct a qualitative analysis to determine if the project will result in an increase in the GLC_{max} at the property line. The qualitative analysis should include factors affecting the GLC_{max} such as distance from the property line and the type of source (point, area, or volume). Submit the analysis as requested by the permit reviewer.

  Does the qualitative analysis indicate that the GLC_{max} will increase?

  - **If "No" → The MERA is complete. Proceed to Step 8 for documentation.**
  - **If "Yes" → Step 2.**
- **If "No" → Step 2.**

Step 2: De Minimis Increase

- Sum the short-term emission increases from each EPN to obtain the total short-term project increase. Do not include emission rate decreases from any EPN.
  - Include any unevaluated emissions such as emissions from PBRs, SPs, or any other authorization.
  - If MSS and production emissions occur simultaneously, add the MSS and production emissions into one emission rate. Otherwise, calculate separate rates.

Step 2: Is the long-term ESL ≥ 10 % of the short-term ESL?

AND

Are total short-term project increases less than the appropriate de minimis levels below?

If MSS and production emissions occur simultaneously, evaluate the combined emission rates against the production de minimis levels. Otherwise, evaluate MSS and production emissions separately against their respective de minimis levels.

Short-term ESL ($\mu g/m^3$)	Production Emissions Increase (lb/hr)	MSS Emissions Increase (lb/hr)
2 ≤ ESL < 500	≤ 0.04	≤ 0.1
500 ≤ ESL < 3500	≤ 0.1	
3500 ≤ ESL	≤ 0.4	≤0.4

- **If "Yes" → The MERA is complete. Proceed to Step 8 for documentation.**
- **If "No" → Step 3.**

Step 3: 10% of ESL Evaluation

- Evaluate emission increases in this step. Do not include emission decreases.
- For each EPN (EPN_i), obtain the unit impact multiplier (X_i), using either the Screening Tables found in Appendix C or an approved EPA model.
- Use the following equation to conservatively predict impacts from the project:

$$GLC_{max} = \sum_{i=1}^{n} (X_i * \mathrm{ER}_i)$$

where:

GLC_{max} = The maximum off-property ground level concentration for the appropriate averaging time of the chemical species emitted from all emission points in the impacts evaluation, in $\mu g/m^3$.

X_i = The unit impact multiplier obtained from the Screening Tables in Appendix C or an approved EPA Model for EPN_i, in $\mu g/m^3$ per lb/hr.

ER_i = The project emission rate increase of the chemical species being evaluated, from EPN_i in lb/hr.

n = The total number of emission points.

Step 3: Is the following inequality true?

$$GLC_{max} \leq 0.1 * ESL$$

where:

ESL = The effects screening level for the appropriate averaging time, in $\mu g/m^3$ for the chemical species being evaluated.

- **If "Yes" → Step 8. The MERA is complete.**
- **If "No" → Step 4.**

Example:

EPN	Emission Rate Increase (lb/hr)	ESL ($\mu g/m^3$)	Distance (feet)	Height (feet)	X Value ($\mu g/m^3$ / lb/hr)
1	3	20,000	1000	10	252
2	10	20,000	4000	20	50

$$\sum_{i=1}^{n}(X_i * ER_i) \leq 0.1 * ESL$$

$$(X_1 * ER_1) + (X_2 * ER_2) \leq 0.1 * ESL$$

$$\left(252\frac{\mu g/m^3}{lb/hr} * 3\frac{lb}{hr}\right) + \left(50\frac{\mu g/m^3}{lb/hr} * 10\frac{lb}{hr}\right) \leq 0.1 * 20{,}000\frac{\mu g}{m^3}$$

$$756\frac{\mu g}{m^3} + 500\frac{\mu g}{m^3} \leq 2{,}000\frac{\mu g}{m^3}$$

$$1{,}256\ \frac{\mu g}{m^3} \leq 2{,}000\frac{\mu g}{m^3}$$

In this example, the chemical species evaluated falls out at Step 3 because the increase in total ground level concentration is less than 10% of the ESL.

Step 4: Project-wide Modeling

- Model the MSS and production emissions for the project. Determine a GLC_{max} for production emissions and a GLC_{max} for MSS emissions.
- Model the MSS and production emissions for the project combined with all new and increased emissions since the most recent sitewide modeling. Determine a GLC_{max} for production emissions and a GLC_{max} for MSS emissions.
- Do not include emission decreases.
- Historical modeling records may be used to determine GLC_{max} values for this step.

Step 4: Will the following thresholds be met at the location of the GLC_{max}?

Planned MSS Only	Production Only
GLC_{max} ≤50% ESL for the project and all new and increased planned MSS emissions since the most recent site-wide modeling **AND** GLC_{max} ≤25% ESL for the project	GLC_{max} ≤25% ESL for the project and all new and increased production emissions since the most recent site-wide modeling **AND** GLC_{max} ≤10% ESL for the project

- **If "Yes" for both Production and Planned MSS → Step 8. The MERA is complete.**
- **If "Yes" for Production and "No" for Planned MSS → The MERA is complete for production emissions. MSS emission must be evaluated in Step 5.**
- **If "No" for Production → Step 6.**

Step 5: MSS Evaluation

Step 5A: Is the chemical species one of the following?

- Acrolein
- Acrylonitrile
- Benzene
- Bromine
- 1,3-butadiene
- Carbon disulfide
- Chlorine
- Chloroform
- Epichlorohydrin
- Fluorine
- Formaldehyde
- Hydrochloric acid (HC)
- Hydrofluoric acid (HF)
- Hydrazine
- Mercaptans
- Methyl bromide
- Methylenediphenyl diisocyanate (MDI)
- Phosgene
- Phosphine
- Styrene (odor)
- Toluene diisocyanate (TDI)
- Any chemical species with a short-term ESL < 2 $\mu g/m^3$

➢ **If "Yes" → Step 6.**

➢ **If "No" → Step 5B.**

Step 5B: Will the planned MSS emissions meet all of the following thresholds for the corresponding column as shown below?

Ground Level Concentration ($\mu g/m^3$)	Exceedances per Year (λ)
$GLC_{max} \geq 1 \times ESL$	$\lambda \leq 24$
$GLC_{max} \geq 2 \times ESL$	$\lambda \leq 12$
$GLC_{max} \geq 4 \times ESL$	$\lambda \leq 6$
$GLC_{max} \geq 10 \times ESL$	$\lambda = 1$
$GLC_{max} > 20 \times ESL$	$\lambda = 0$

➢ **If "Yes" → The MERA is complete for the MSS emissions.**

➢ **If "No" → Step 6.**

Step 6: Ratio Test

- Sum the emission increases from the project to obtain the total project increase, including planned MSS and production increases. Do not include any emission decreases.
- Sum the currently authorized emissions and all previously unevaluated emission from all emission points on the site, along with the new and increased emissions from the project to obtain the proposed site-wide emissions.

Step 6: Is the following inequality true?

$$\frac{GLC_{max}}{ESL} \leq \frac{ER_P}{ER_S}$$

where:

GLC_{max} = The maximum ground level concentration for the appropriate averaging time, in $\mu g/m^3$.
ESL = The effects screening level for the appropriate averaging time, in $\mu g/m^3$.
ER_P = The project increase, in lb/hr or tpy.
ER_S = The proposed site-wide emissions, in lb/hr or tpy.

- **If "No" → Step 7.**
- **If "Yes" → Step 8. The MERA is complete.**

Step 7: Site-wide Modeling.

- Conduct site-wide modeling in accordance with ADMT guidance; or
- Update site-wide modeling from a recently approved project to include the project increase and any previously unevaluated emissions; or
- Submit monitoring data per ADMT guidance and demonstrate that the monitoring data are representative of near worst-case impacts and should be used instead of site-wide modeling. Contact the permit reviewer to arrange a meeting to discuss currently available monitoring data or to receive guidance for, and approval of, a strategy to collect monitoring data.
- Site-wide modeling applies to emissions from all emission points on properties identified in single property-line designations between multiple owners.

TCEQ staff will evaluate the modeling analysis to determine if it is appropriate to proceed to Step 8.

Step 8: Documentation

- Document the MERA evaluation and provide all supporting information. The appropriate TCEQ staff will review and evaluate the impacts analysis.

Appendix A: Glossary

Please note that there are often differences in term usage and term definitions between the state and federal regulatory agencies. However, when conducting a MERA evaluation with this document, please refer to the following definitions.

air contaminant—Particulate matter, radioactive materials, dust fumes, gas, mist, smoke, vapor, or odor, including any combination of those items, produced by processes other than natural (Texas Health and Safety Code (THSC) §382.003).

air dispersion model—A model of the dispersion and transport of contaminants in the atmosphere, used to estimate the ground level concentration resulting from the emission of a contaminant, as further described in the "Air Quality Modeling Guidelines" document (APDG 6232).

air pollution—The presence in the atmosphere of one or more air contaminants in such concentration and of such duration that are or tend to be injurious to or to adversely affect human health or welfare, animal life, vegetation, or property, or interfere with the normal use and enjoyment of animal life, vegetation, or property (THSC §382.003).

ambient air—The portion of the atmosphere, external to buildings, to which the general public has access (30 Texas Administrative Code (TAC) § 101.1). For purposes of the MERA, ambient air is all air outside the property line.

Air Pollutant Watch List (APWL)—A list of geographic areas for which ambient air quality monitoring data indicates persistent, elevated concentrations of toxic air contaminants. The list and its accompanying programs aim to reduce emissions of APWL contaminants by engaging stakeholders, notifying the public, and requiring additional scrutiny for air permit applications that propose increases of an APWL contaminant in an APWL area. This list was established and is maintained by the TCEQ in compliance with the Texas Health and Safety Code, Title 5, Subtitle C, Chapter 382.

authorization—A mechanism to allow the release of emissions of constituents into ambient air. Typical authorizations are PBRs, SPs, and case-by-case NSR Permits.

chemical species—An individual air contaminant with a specific effects screening level.

criteria pollutant—A pollutant for which a NAAQS has been defined.

Emission Point Number (EPN)—A unique identifier for a point of emission release into the ambient air.

Effects Screening Level (ESL)—Screening levels used in TCEQ's air permitting process to evaluate the predicted impacts of air dispersion modeling. They are used to evaluate the potential for effects to occur as a result of exposure to concentrations of contaminants in the air. ESLs are based on data concerning health effects, the potential for odors to be a nuisance, and effects on vegetation. They are not ambient air standards. If predicted airborne levels of a constituent do not exceed the screening level, adverse health or welfare effects are not expected. If predicted ambient levels of constituents in air exceed the screening levels, it does not necessarily indicate a problem but rather triggers a review in more depth.

facility—A discrete or identifiable structure, device, item, equipment, or enclosure that constitutes or contains a stationary source, including appurtenances other than emission control equipment. A mine, quarry, well test, or road is not considered to be a facility (THSC §382.003 and 30 TAC §116.10).

Ground Level Concentration (GLC)—The ground level concentration of a constituent in micrograms per cubic meter (µg/m3) as predicted by modeling or measured by monitoring.

GLC_{max}—Maximum off-property ground level concentration for the appropriate averaging time of the chemical species emitted from all emission points in the impacts evaluation, in $\mu g/m^3$.

GLC_{ni}— Maximum non-industrial off-property ground level concentration for the appropriate averaging time of the chemical species emitted from all emission points in the impacts evaluation, in $\mu g/m^3$.

long-term—An annual averaging period.

National Ambient Air Quality Standards (NAAQS)—Levels of air quality to protect the public health and welfare (40 Code of Federal Regulations (CFR) §50.2). Primary standards are set to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly from the effects of "criteria air pollutants" and certain non-criteria pollutants. Secondary standards are set to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings.

non-industrial receptor—A receptor type such as residential, recreational, commercial, business, agricultural, or a school, hospital, day-care center, or church. In addition, receptors in un-zoned or undeveloped areas are considered non-industrial. A receptor is a location where the public could be exposed to an air constituent in the ambient air.

refined modeling—An air dispersion model with refined input parameters including hourly meteorological data, multiple facilities, and facility locations. Ground level concentrations are determined across a receptor grid and are more representative of actual concentrations than those obtained from screen modeling.

screen modeling—A simple air dispersion model with limited input parameters that yields a conservative estimate of the ground level concentration for a single facility as a function of distance from the facility.

short term—A one-hour averaging period.

site—The total of all stationary sources located on one or more contiguous or adjacent properties, which are under common control of the same person (or persons under common control) (30 TAC § 122.10).

site-wide modeling—Modeling (refined or screening) of emissions from all emission points and areas on a contiguous property or at a site. Site-wide modeling includes all sources authorized under 30 TAC Chapters 106 and 116. Note that de minimis emissions under 30 TAC § 116.119 are not included for site-wide modeling demonstrations.

source—A point of origin of air contaminants, whether privately or publicly owned or operated (30 TAC § 116.10).

unit impact multiplier—An EPN specific factor derived by running a dispersion model with a unit emission rate of 1.0 lb/hr or 1.0 g/sec. The unit impact multiplier can be multiplied by the emission rate to determine the ground level concentration resulting from those emissions.

Appendix B: Toxicology Emissions Screening List

Emissions from the following facilities have been reviewed for health effects and are not expected to cause adverse health effects. These do not require additional review through the MERA process.

- Odor and particulate emissions from agricultural, food processing, or animal feeding or handling facilities.
- Emissions of particulates from abrasive blast cleaning provided they do not contain any of the following:
  - asbestos;
  - metals and metal compounds with an ESL of less than 50 µg/m3 that are in a concentration of greater than 2.0%; or
  - crystalline silica at greater than or equal to 1 percent (weight) of the total particulate weight.
- Emissions of particulate matter, except for metals, metal compounds, silica, from controlled surface coating operations. Controlled surface coating operations are those that capture and abate particulate matter with a water wash or dry filter system (at least 98% removal efficiency) and vent through an elevated stack with no obstruction to vertical flow.
- Emissions of particulate matter from rock crushers, concrete batch plants and soil stabilization plants.
- Emissions from boilers, engines, or other combustion units fueled only by pipeline-quality natural gas as well as emissions from the combustion of natural gas in control devices.
- Emissions from flares, heaters, thermal oxidizers, and other combustion devices burning gases only from onshore crude oil and natural gas processing plants, with the exception of emissions from glycol dehydrators and amine units.
- Emissions of volatile organic compounds from emergency diesel engines.
- Emissions of freons that have ESLs greater than 15,000 µg/m3 from any facility.
- Emissions of the following gases, which have been classified as simple asphyxiates, from any facility.
  - argon
  - carbon dioxide
  - ethane
  - helium
  - hydrogen
  - methane
  - neon
  - nitrogen
  - propane
  - propylene

Appendix C: Screening Tables

The screening tables are used to determine a conservative estimate of the ground level concentration of a chemical species from an emission point. These tables provide conservative unit impact multipliers for a particular emission point based upon the source's stack height and distance from the nearest property line. The following instructions apply to the selection and use of Tables 1 through 4:

- Utilize linear interpolation between height and distance parameters in the tables to determine a more accurate unit impact multiplier, if desired. Extrapolation with heights or distances greater than the values listed in the tables is not allowed.
- Assume that daytime hours are between 6 a.m. and 6 p.m.
- Determine if the source will be downwashed. Downwash is a term used to represent the potential effects of a structure on the dispersion of emissions from a source. If the source is downwashed, use Table 1 or 3; if the source is not downwashed, use Table 2 or 4. A source is downwashed if each of the three conditions below is satisfied.
    1. The source is characterized as a point source. Downwash does not apply to sources characterized as area or volume sources.
    2. The stack height of the source is less than the good engineering practice stack height (H_g). H_g is defined as the greater of:
        i. 65 meters, measured from the ground-level elevation at the base of the stack;
        ii. For stacks in existence on January 12, 1979 and the owner or operator had obtained all applicable permits or approvals required under 40 CFR parts 51 and 52:

            $H_g = 2.5H$

            where:

            H = structure height;

        iii. For all other stacks

            $H_g = H + 1.5L$

            where:

            L = the lesser of the structure height or maximum projected width (the width as seen from the source looking towards the nearest property line) of the structure; and
    3. The structure is sufficiently close to the stack, as defined when

        $D \leq 5L$,

        where:

        D = the distance between the structure and the stack.

If the source is located near more than one structure, determine downwash applicability with the structure whose dimensions result in the highest GEP stack height. This structure will cause the greatest downwash effects. Downwash may be applicable even in cases where the building is not between the source and the nearest property line.

Table 1. Downwash for All Hours ($\mu g/m^3$ per 1 lb/hr)

Distance from the Property Line (feet)	Stack Height (feet)																				
	3	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200
50	2965	2363	2260	1005	596	362	251	185	141	112	90	75	63	54	46	40	35	31	28	25	23
100	2024	1719	1003	708	596	362	251	185	141	112	90	75	63	54	46	40	35	31	28	25	23
150	1338	1195	822	708	596	342	251	185	141	112	90	75	63	54	46	40	35	31	28	25	23
200	950	873	708	708	559	342	218	185	141	112	90	75	63	54	46	40	35	31	28	25	23
250	800	743	617	617	512	321	213	149	112	112	90	75	63	54	46	40	35	31	28	25	23
300	720	670	550	550	454	300	205	145	107	80	75	75	63	54	46	40	35	31	28	25	23
400	593	557	460	460	354	246	184	133	100	77	61	48	46	46	46	40	35	31	28	25	23
500	502	473	397	397	292	203	151	118	92	72	58	47	38	32	31	31	31	31	28	25	23
600	430	408	350	350	248	173	129	101	81	67	54	44	37	31	26	22	19	17	14	13	11
700	373	357	313	313	216	151	112	88	71	59	50	41	35	29	25	22	19	16	14	13	11
800	330	315	282	282	192	134	100	78	63	52	44	38	33	28	24	21	18	16	14	12	11
900	293	280	255	255	173	121	90	70	57	47	40	34	30	26	23	20	17	15	14	12	11
1000	262	252	233	233	157	110	82	64	52	43	36	31	27	24	21	19	17	15	13	12	11
1500	172	167	157	157	107	77	58	45	36	30	25	22	19	17	15	12	12	11	9.9	9.3	8.7
2000	122	120	117	117	80	58	44	35	28	23	20	17	15	13	11	10	9.2	8.4	7.8	7.3	6.8
2500	93	92	90	90	64	47	36	28	23	19	16	14	12	11	9.4	8.4	7.6	6.9	6.4	6	5.6
3000	75	73	72	72	52	39	30	24	20	16	14	12	10	9	8	7.1	6.4	5.8	5.5	5.1	4.8
4000	50	50	50	50	37	29	23	18	15	13	11	9.1	7.9	7	6.2	5.5	5	4.5	4.2	4	3.7
5000	37	37	37	37	29	23	18	15	12	10	8.7	7.5	6.5	5.7	5.1	4.5	4.1	3.7	3.4	3.2	3

Table 2. No Downwash for All Hours ($\mu g/m^3$ per 1 lb/hr)

Distance from the Property Line (feet)	Stack Height (feet)																				
	3	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200
50	23773	2787	725	323	175	107	72	51	38	30	24	19	16	13	11	9.8	8.5	7.5	6.6	5.9	5.2
100	19785	2233	697	323	175	107	72	51	38	30	24	19	16	13	11	9.8	8.5	7.5	6.6	5.9	5.2
150	12608	1942	550	310	175	107	72	51	38	30	24	19	16	13	11	9.8	8.5	7.5	6.6	5.9	5.2
200	8458	1942	482	275	166	107	72	51	38	30	24	19	16	13	11	9.8	8.5	7.5	6.6	5.9	5.2
250	6040	1837	482	243	155	100	72	51	38	30	24	19	16	13	11	9.8	8.5	7.5	6.6	5.9	5.2
300	4531	1837	453	243	132	96	67	48	38	30	24	19	16	13	11	9.8	8.5	7.5	6.6	5.9	5.2
400	2838	1613	448	203	128	76	60	46	35	30	24	19	16	13	11	9.8	8.8	7.5	6.6	5.9	5.2
500	1958	1322	422	195	114	76	49	40	33	27	21	17	16	13	11	9.8	8.5	7.5	6.6	5.9	5.2
600	1440	1075	417	188	105	70	49	36	28	24	20	17	14	12	11	9.8	8.5	7.5	6.6	5.9	5.2
700	1110	885	417	188	105	64	48	36	27	21	18	16	14	12	9.9	8.7	7.9	7.5	6.6	5.9	5.2
800	888	738	402	180	100	64	44	36	27	21	17	14	13	11	9.8	8.5	7.4	6.6	6.1	5.6	5.2
900	728	625	377	170	95	64	43	33	27	21	17	14	12	10	9.3	8.3	7.3	6.5	5.7	5.2	4.8
1000	610	535	348	170	95	62	43	30	25	21	17	14	11	9.7	8.6	7.8	7	6.3	5.7	5	4.6
1500	308	287	228	157	83	52	36	29	22	17	17	14	11	9.6	8.3	7.1	6.1	5.5	5	4.6	4.2
2000	188	182	157	123	79	45	32	23	20	16	13	11	8.9	8.2	7.4	6.8	6.1	5.5	4.9	4.4	3.9
2500	130	127	113	97	68	44	27	21	16	14	12	10	8.8	7.3	6.2	5.7	5.3	4.9	4.6	4.2	3.9
3000	98	95	88	77	57	40	27	19	15	12	11	10	8.3	7.2	6.2	5.3	4.4	4.2	3.9	3.7	3.5
4000	62	62	58	53	42	31	23	17	12	10	8.4	7.4	6.7	6.1	5.5	4.9	4.4	3.8	3.4	2.9	2.6
5000	45	43	42	38	32	25	19	15	11	8.3	7.2	6.2	5.4	5	4.6	4.2	3.8	3.5	3.2	2.8	2.6

Table 3. Downwash for Daytime ($\mu g/m^3$ per 1 lb/hr)

Distance from the Property Line (feet)	Stack Height (feet)																				
	3	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200
50	2965	2363	2260	1005	565	362	251	185	141	112	90	75	63	54	46	40	35	31	28	25	23
100	2024	1719	1003	565	565	362	251	185	141	112	90	75	63	54	46	40	35	31	28	25	23
150	1338	1195	822	353	320	251	251	185	141	112	90	75	63	54	46	40	35	31	28	25	23
200	950	873	665	352	300	201	185	185	141	112	90	75	63	54	46	40	35	31	28	25	23
250	700	655	532	335	275	189	135	112	112	112	90	75	63	54	46	40	35	31	28	25	23
300	563	532	437	312	247	176	129	97	76	75	75	75	63	54	46	40	35	31	28	25	23
400	392	373	322	263	195	147	116	90	71	57	48	46	46	46	46	40	35	31	28	25	23
500	290	280	247	220	160	122	97	80	65	54	45	38	32	31	31	31	31	31	28	25	23
600	225	218	197	183	134	104	84	69	58	50	42	36	31	27	23	20	18	16	14	13	11
700	185	180	165	155	115	91	73	61	52	44	39	33	29	25	22	20	17	16	14	13	11
800	152	148	138	133	100	80	65	54	46	40	35	31	28	24	21	19	17	15	14	12	11
900	128	125	117	117	88	71	58	49	42	36	32	28	25	23	20	18	16	15	13	12	11
1000	110	108	102	102	77	63	53	44	38	33	29	26	23	21	19	17	16	14	13	12	11
1500	58	58	57	57	47	40	34	30	26	23	20	18	16	15	14	12	11	11	9.9	9.3	8.7
2000	37	37	37	37	31	27	24	21	19	17	15	14	13	12	11	9.7	9	8.3	7.8	7.3	6.8
2500	27	27	27	27	23	20	19	17	15	14	12	11	10	9.4	8.6	8	7.4	6.9	6.4	6	5.6
3000	20	20	20	20	18	16	15	14	12	11	10	9.3	8.6	7.9	7.3	6.7	6.3	5.8	5.5	5.1	4.8
4000	13	13	13	13	12	11	10	9.4	8.7	8	7.4	6.8	6.3	5.9	5.5	5.1	4.8	4.5	4.2	4	3.7
5000	9.3	9.3	9.3	9.3	8.6	8	7.5	7	6.5	6.1	5.7	5.3	4.9	4.6	4.3	4.1	3.8	3.6	3.4	3.2	3

Table 4. No Downwash for Daytime ($\mu g/m^3$ per 1 lb/hr)

Distance from the Property Line (feet)	Stack Height (feet)																				
	3	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200
50	18738	2787	725	323	175	107	72	51	38	30	24	19	16	13	11	9.8	8.5	7.5	6.6	5.9	5.2
100	7657	1902	697	323	175	107	72	51	38	30	24	19	16	13	11	9.8	8.5	7.5	6.6	5.9	5.2
150	3983	1542	550	310	175	107	72	51	38	30	24	19	16	13	11	9.8	8.5	7.5	6.6	5.9	5.2
200	2445	1542	478	275	166	107	72	51	38	30	24	19	16	13	11	9.8	8.5	7.5	6.6	5.9	5.2
250	1662	1215	453	217	155	100	72	51	38	30	24	19	16	13	11	9.8	8.5	7.5	6.6	5.9	5.2
300	1207	962	453	212	132	96	67	48	38	30	24	19	16	13	11	9.8	8.5	7.5	6.6	5.9	5.2
400	727	633	402	195	116	75	60	46	35	30	24	19	16	13	11	9.8	8.5	7.5	6.6	5.9	5.2
500	488	445	327	195	105	73	49	40	33	27	21	17	16	13	11	9.8	8.5	7.5	6.6	5.9	5.2
600	353	330	263	182	105	68	49	36	28	24	20	17	14	12	11	9.8	8.5	7.5	6.6	5.9	5.2
700	268	255	215	162	105	64	48	36	27	21	18	16	14	12	9.9	8.7	7.9	7.5	6.6	5.9	5.2
800	212	203	177	142	100	64	44	36	27	21	17	14	13	11	9.8	8.5	7.4	6.6	6.1	5.6	5.2
900	172	167	148	123	92	64	43	33	27	21	17	14	12	10	9.3	8.3	7.3	6.5	5.7	5.2	4.8
1000	142	138	127	108	84	62	43	30	25	21	17	14	11	9.7	8.6	7.8	7.0	6.3	5.7	5.0	4.6
1500	70	70	67	62	53	45	36	29	22	17	17	14	11	9.6	8.3	7.1	6.1	5.5	5.0	4.6	4.2
2000	43	43	42	40	36	31	27	23	20	16	13	11	8.9	8.2	7.4	6.8	6.1	5.5	4.9	4.4	3.9
2500	30	28	28	28	25	23	21	19	16	14	12	10	8.8	7.3	6.2	5.7	5.3	4.9	4.6	4.2	3.9
3000	22	22	22	20	19	18	16	15	13	12	11	10	8.3	7.2	6.2	5.3	4.4	4.2	3.9	3.7	3.5
4000	14	14	13	13	12	12	11	10	9.4	8.7	8.0	7.4	6.7	6.1	5.5	4.9	4.4	3.8	3.4	2.9	2.6
5000	9.5	9.5	9.3	9.3	8.9	8.4	7.9	7.5	7.1	6.6	6.2	5.8	5.4	5.0	4.6	4.2	3.8	3.5	3.2	2.8	2.6

Appendix D: Toxicology Effects Evaluation Procedure

A three-tiered approach is used to evaluate the health and welfare effects of chemical species that undergo site-wide modeling. A GLCmax based on the project emission increase rather than site-wide emissions cannot be evaluated under these criteria. These tiers should be used to evaluate both short-term and long-term GLCmax values. In describing the results of an effects evaluation, the terms below are used.

- ***Acceptable*** - adverse health or welfare effects would not be expected as a result of exposure to a given constituent concentration.
- ***Allowable*** - the permit engineer has provided justification to the Toxicology Division that the predicted GLCs are not likely to occur or that they occur in a location where public access is limited.

Tier I: Is the off-property GLC_{max} below the ESL?

- **If "Yes" → the impacts are acceptable.**
- **If "No" → Tier II.**

Tier II: Are both of the following conditions met?

1. $GLC_{max} \leq 2 \times ESL$

   where:

   the GLC_{max} occurs on industrial use property

2. The $GLC_{ni} < ESL$

   where:

   the GLC_{ni} is the ground-level concentration at the maximally affected, off-property, nonindustrial receptor.

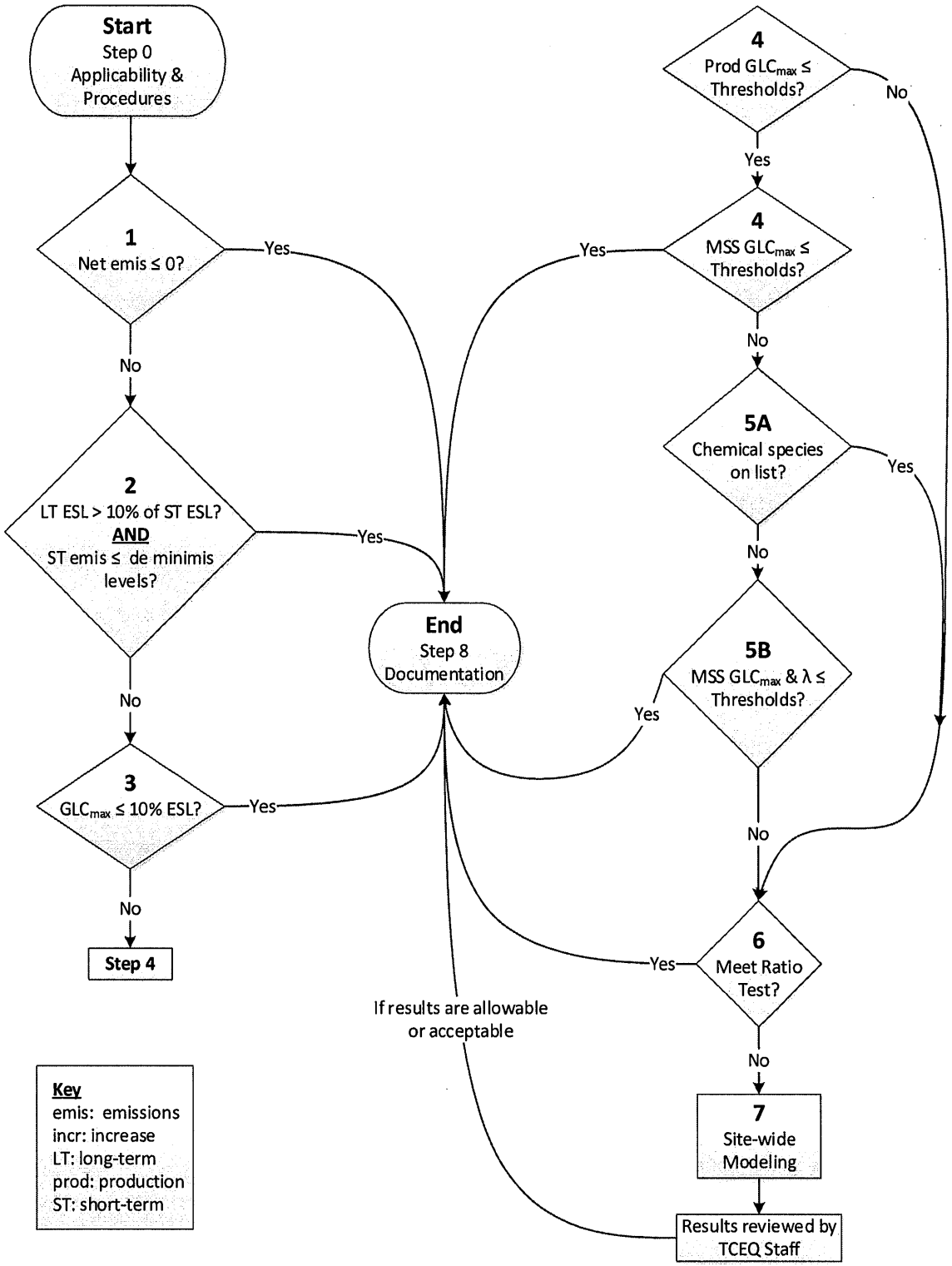
- **If "Yes" → the impacts are acceptable.**
- **If "No" → Tier III**

Tier III: The Toxicology Division will conduct a case-by-case review of the health and welfare effects of the chemical species to determine if the impacts are acceptable, unacceptable, or allowable. The Toxicology Division may consider the following factors.

- Surrounding land use
- GLC_{max} and its frequency of exceedance
- Magnitude of the GLC_{ni}
- Potential for public exposure
- Conservatism of the approach use to determine the GLC_{max}
- Existing concentrations of the chemical species
- Basis of ESL (odor vs. health, degree of confidence, margin of safety)
- Acceptable reductions in existing GLCs

This information is analyzed by the toxicologist to develop a final determination on the likelihood that emissions will increase the risk of adverse health or welfare effects.

Appendix E: MERA Flowchart



This flowchart is a summary of the MERA and is not intended to be a substitute for this guidance.