

Revised December 17, 2008

Utah Division of Air Quality

Modeling Guidelines

Revised December 17, 2008

Utah Division of Air Quality

New Source Review Section

(801) 536-4000

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Preface

Industry and regulatory agencies have long expressed a need for consistency in the application of air quality models for regulatory purposes. This Utah Division of Air Quality (UDAQ) guideline document provides a common basis for estimating the air quality concentrations used in assessing control strategies and developing emission limits for sources in Utah.

The continuing development of new air quality models and dispersion modeling techniques, in response to regulatory requirements and the expanded requirements for models to cover even more complex problems have emphasized the need for periodic review and update of this guidance document. Three on-going activities provide direct input to revisions of these guidelines. The first activity consists of UDAQ staff meetings conducted for the purpose of ensuring consistency and providing clarification in the application of models. The second activity, directed toward the improvement of modeling procedures, is the cooperative agreement that UDAQ has with the Environmental Protection Agency (EPA) and the scientific community. This agreement provides scientific assessment of procedures and proposed techniques, and sponsors workshops on key technical issues. The third activity is the solicitation and review of new models from the technical and user community. In the March 27, 1980 Federal Register, a procedure was outlined for the submittal to EPA of privately developed models. After extensive evaluation and scientific review, the models and modeling techniques are made available by EPA, for use in regulatory modeling analyses.

This document is intended to be used in conjunction with the Notice of Intent Guide by sources seeking an Approval Order from the Utah Division of Air Quality. Although the text has been revised since its original publication, the present content and topics are similar. As necessary, new sections and topics are included. The UDAQ does not make changes to the guidance on a predetermined schedule, but rather on an 'as needed' basis. The UDAQ believes that revisions to this guideline should be responsive to user needs and should involve public participation to the greatest possible extent. Information on changes not reflected in this modeling guidance document may be obtained from the UDAQ modeling staff.

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List of Acronyms & Abbreviations

ACGIH	American Conference of Governmental Industrial Hygienists
AO	Approval Order
AQRV	Air Quality Related Values
BBS	Bulletin Board System
BPIP	Building Profile Input Program
CO	Carbon Monoxide
EPA	Environmental Protection Agency
ETF	Emissions Threshold Factor
ETV	Emission Threshold Value
FDM	Fugitive Dust Model
FLM	Federal Land Manager
GAQM	Guidelines on Air Quality Models
GEP	Good Engineering Practice
HAP	Hazardous Air Pollutant
MACT	Maximum Achievable Control Technology
NAAQS	National Ambient Air Quality Standards
NO₂	Nitrogen Dioxide
NOI	Notice of Intent
NSR	New Source Review
PM₁₀	Particulate Matter less than 10 microns in diameter
PSD	Prevention of Significant Deterioration
SIA	Significant Impact Analysis
SIL	Significant Impact Level
SO₂	Sulfur Dioxide
TLV	Threshold Limit Value
TPY	Tons Per Year
TSL	Toxic Screening Level
TTN	Technical Transfer Network
	Utah Administrative Code
UDAQ	Utah Division of Air Quality
UTM	Universal Transverse Mercator
VOC	Volatile Organic Compound

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Utah Division of Air Quality Modeling Guidelines

The modeling guidelines outlined herein are based upon EPA documents, and the Utah Administrative Code (UAC). In case of contradictions between these guidelines and the EPA documents or the UAC, the EPA documents and the UAC prevail.

I. Sources Requiring Dispersion Modeling

New sources or a significant modification to an existing source, may require computer dispersion modeling to demonstrate compliance with the National Ambient Air Quality Standards (NAAQS) and Prevention of Significant Deterioration (PSD) increments (R307-410-4), or to provide documentation of the potential impact of hazardous air pollutant releases (R307-410-5). Sources whose emissions are covered under the requirements of R307-401-1 would be included. The Utah Division of Air Quality (UDAQ) has established minimum emission rate increase levels for new sources or existing sources, above which modeling is required to be performed by the applicant source.

The extent of the required modeling necessary will vary from one source to another. For new or modified sources with one or two emission points, compliance may be shown by using simple screening techniques, such as the SCREEN3 model or other applicable screening models. If compliance can be properly demonstrated with the use of a screening model, no further modeling will be required. Sources that cannot properly demonstrate compliance using screening techniques are required to use a more refined model(s) with representative meteorological data in their analyses. Complex multi-point emitting sources, or sources with unusual pollutant dispersion environments for which screening techniques are not applicable, would also be required to use a more refined modeling technique.

Applicants are encouraged to contact the UDAQ modeling staff prior to conducting any modeling analysis to determine the extent of modeling, if any, that would be needed. Such contact will help to ensure the completeness of any modeling analysis submitted to the UDAQ, thereby expediting the review process. Reference documents used in the preparation of this document are listed at the end of this publication. Applicants preparing modeling analyses are further advised to reference the EPA 'Guidelines on Air Quality Models' (GAQM), (40 CFR Part 51, Appendix W) for details concerning the proper use of acceptable air dispersion models.

a. Criteria Pollutants Impacts in Attainment Areas

New sources, or modifications to existing sources, whose total controlled emission increase levels are greater than those listed in Table 1 (R307-410-4) are required to submit a dispersion modeling analysis as part of a complete Notice of Intent (NOI). Dispersion modeling analyses conducted for criteria pollutant sources must demonstrate compliance with all applicable NAAQS. Major PSD sources are also required to show compliance with the PSD increment ceilings (R307-401-6). In the case of relocating portable equipment to another temporary location where actual equipment operation period does not exceed 180 work days per calendar year and the length of the temporary relocation does not to exceed 365 consecutive days, dispersion modeling is required only to address the impact of the source on the NAAQS.

Previously permitted sources that seek a modification to an existing AO may be excused from this requirement if a review of the modification and previously submitted dispersion modeling information indicates that the applicable NAAQS or PSD increments will not be violated (R307-410-3).

New sources, or modifications to existing sources, whose total controlled emission increase levels are less than those listed in Table 1 may also require dispersion modeling if unusual conditions concerning the source or its surrounding environment warrant further review. Unusual conditions to be considered would include such factors

as: special meteorological events that may occur, elevated terrain close to the facility, pollutant release mechanisms which result in low final plume heights (i.e., low pollutant release heights, low gas exit temperature or exit velocity, or horizontal or restricted venting system), or any other conditions that would inhibit dispersion once the pollutant leaves the exhaust control system. In addition, sources seeking an AO modification with an increase in emissions less than those listed in Table 1, where previous modeling showed impacts that were close to a standard, may require additional modeling for the increase. Such sources will be modeled in-house by the UDAQ at the discretion of the Executive Secretary.

Table 1: Total Controlled Emission Rates (in TPY) for New Sources, or Emissions Increase* Levels for Existing Sources, where Dispersion Modeling may be Required (R307-410-4).

Pollutant	Emissions Levels to Require Modeling
SO ₂	40
NO ₂	40
PM ₁₀ - fugitive emissions	5
PM ₁₀ - non-fugitive emissions	15
CO	100
Lead	0.6

b. Criteria Pollutant Impacts in Non-attainment Areas

The UDAQ currently does not require sources to perform dispersion modeling for pollutants that are not in attainment of the NAAQS, if that source is located in an area that is non-attainment for that pollutant. However, sources seeking permits in these non-attainment areas, or near these areas, are required to meet the following:

- 1) For sources located inside a non-attainment area, obtain emission offsets for NO₂, SO₂, and PM₁₀, if the combined emissions of NO₂, SO₂, and PM₁₀ is greater than 25 TPY (R307-403-5). The offset ratio for these sources is;
 - a) 1:1 for sources of NO₂, SO₂, and PM₁₀ greater than 25 TPY, but less than 50 TPY combined.
 - b) 1.2:1 for sources of NO₂, SO₂, and PM₁₀ greater than 50 TPY combined.
- 2) For new or modifying sources located outside a non-attainment area having a combined emissions increase of NO₂, SO₂, and PM₁₀ greater than 25 TPY are required to submit a dispersion modeling analysis of the proposed source's impact on the non-attainment area. If the source's combined NO₂, SO₂, and PM₁₀ impact on the non-attainment area is greater than 1.0 µg/m³ annually or 3.0 µg/m³ for a 24-hour averaging period, emissions offset as described under (1) are required (R307-403-5). If a source's impact is less than the concentration levels listed above, no emission offsets are required.
- 3) For sources of CO located outside a non-attainment area, the maximum allowable impact on the non-attainment area is 2000 µg/m³ for a 1-hour averaging period or 500 µg/m³ for an 8-hour averaging period (R307-403-3).

- 4) Obtain VOC emission offsets of 1.15:1, if the combined emission of VOCs is greater than 100 TPY (R307-420-3).

As of the date of this revision, the areas presently designated as non-attainment or maintenance are:

PM₁₀ - Salt Lake County, Utah County, and Ogden City (Maintenance SIP in progress)
O₃ - Salt Lake and Davis County (O₃ Maintenance Areas)
CO – Ogden, Provo, and Salt Lake City. (CO Maintenance Areas).
SO₂ - Salt Lake County and Tooele County above 5,600 ft (Maintenance SIP in progress)

c. Hazardous Air Pollutants

R307-410-5 requires applicant sources proposing any increase of HAPs emissions to submit all HAP emission levels and pollutant release information for their facility. However, under R307-410-5(1)(i), the requirements of R307-410-5 do not apply to installations which are subject to or are scheduled to be subject to an emission standard promulgated under 42 U.S.C. 7412 at the time a notice of intent is submitted, except as defined in R307-410-5(1)(ii). This exemption does not affect requirements otherwise applicable to the source, including requirements under R307-401.

R307-410-5 further requires each source to submit:

- 1) The estimated maximum lb/hr emission rate increase of each type HAP from all relevant emission points or areas.
- 2) The type of pollutant release (R307-410-2), whether it is *vertically 'restricted'*, (i.e., fugitive emissions, horizontally directed releases to include side venting, elbows, raincaps, and stack point release levels with a stack height to building ratio less than 1.3:1), or *vertically 'unrestricted'* (i.e., unobstructed vertically directed emission release point having a stack height to building ratio greater than or equal to 1.3:1).
- 3) The maximum release duration in minutes per hour. This value is critical for evaluating batch process releases of acute HAP. For acute HAP releases having a duration period less than one hour, this maximum pounds per hour emission rate will need to be scaled so that it is consistent with an identical operating process having a continuous release for a one-hour period or more.
- 4) The release height of the emission point or area as measured from ground level.
- 5) The height at the peak of any adjacent building or structures which may cause building downwash of the HAP emissions. This includes any building located within a distance equal to or less than 5 times its own height from an emission release point. Sources may be asked to submit plot plans drawn to scale showing the location and height of all significant structures used in determining applicability (R307-401-5).
- 6) The shortest distance from each release point to any area defined as 'ambient air' under 40 CFR 50.1(e).
- 7) The emission threshold value (ETV - emission level above which a dispersion modeling analysis is required as part of a complete NOI), equal to the HAP's threshold limit value (TLV) times the appropriate emission threshold factor (ETF) in Table 2 (R307-410-5). Expressed as: $ETV = TLV \times ETF$.

In the case of arsenic, benzene, beryllium, and ethylene oxide, ETVs shall be calculated using chronic ETFs, and for formaldehyde, using an acute ETF (R307-410-5.1c).

Table 2: Emission Threshold Factors (ETF) for Hazardous Air Pollutants (lb-m³ / mg-hr) (R307-410-5)

Distance to Property Boundary	Acute HAP	Chronic HAP	Carcinogenic HAP
<u>Vertically Restricted and Fugitive Emission Release Points</u>			
20 meters or less	0.038	0.051	0.017
21 - 50 meters	0.051	0.066	0.022
51 - 100 meters	0.092	0.123	0.041
Beyond 100 meters	0.180	0.269	0.090
<u>Vertically Unrestricted Emission Release Points</u>			
50 meters or less	0.154	0.198	0.066
51 - 100 meters	0.224	0.244	0.081
Beyond 100 meters	0.310	0.368	0.123

Applicant sources proposing to increase their plant-wide HAP emission levels by an amount greater than or equal to the ETV must submit a modeling analysis which addresses the impact of the HAP increase (R307-410-5.1c). Sources whose HAP analyses indicated ambient air concentration levels greater than the HAP's toxic screening level (TSL) as outlined in Section II.b of this document are required to submit additional information relating to:

- a) the symptoms and adverse health effects that can be caused by the HAP,
- b) exposure conditions or dose rates sufficient to cause the adverse effects,
- c) a description of human population or biological species which could be exposed to the HAP,
- d) and use for the impacted areas, and
- e) the environmental fate and persistency.

d. Volatile Organic Compounds

Volatile organic compounds (VOC) are precursors to ozone formation and may be modeled under the assumption that all of the pollutant will be converted to ozone (1:1). However, in the atmosphere, the reaction equilibrium between ozone precursors is reached prior to a complete conversion. Thus, the UDAQ feels that the 1:1 conversion method is overly conservative. Conversion of VOCs to ozone can be realistically estimated through the use of a reactive plume model, however, in most permitting cases of new or modifying VOC sources, such a modeling effort could be considered impractical due to the cost, labor, and applicability of the modeling effort. Currently, the UDAQ does not require these sources to conduct dispersion modeling for VOC

to ozone conversion as part of the NSR permitting process. The UDAQ, however, continues to explore research associated with estimating VOC to ozone conversion, and may in the future adopt a modeling methodology to address the impact of VOCs.

II. Criteria Pollutant Standards

The State of Utah uses a two-step process to demonstrate compliance with the National Ambient Air Quality Standards (NAAQS) and Prevention of Significant Deterioration (PSD) increments for criteria pollutants. All sources are required to address their impact on NAAQS in their analysis process. The State of Utah currently requires that only PSD source analyses address impacts on Class I and II increments.

- 1) The first step is the *significant impact analysis* (SIA). The SIA is a dispersion modeling analysis of the proposed new source or emission increase. This analysis includes only the emission from the proposed new source or modification. It does not include any existing emissions from the source, or other nearby sources. The purpose of this analysis is to determine if the resulting impact is significant enough to warrant the inclusion of other existing emissions in the surrounding area, commonly referred to as a ‘full’ or ‘cumulative’ impact analysis. EPA, in conjunction with the Federal Land Managers (FLMs) have developed significance impact levels (SILs) to be used in PSD Class I and II areas. NAAQS analysis use the Class II SIL. If the impact of the proposed project is less than the individual SIL, no further modeling is required to address the source’s impact on that standard. If the impact is above the SIL, further modeling as outlined in step two, is required.
- 2) The second step requires the source to perform a cumulative impact analysis. The cumulative analysis should include any new emissions proposed by the source, any existing emissions at the source, contributing emissions from other sources of the pollutant in the surrounding area, and a representative background concentration. Hourly emission levels used in the analysis should be consistent with the standards and averaging periods addressed.

a. Significant Impact Analysis

In the significant impact analysis, the highest estimated concentration at each receptor in ambient air is compared to the SILs. If the estimated concentration levels are below the applicable modeling significance level for all averaging periods for a particular pollutant, no further analysis is required for that pollutant and the source is considered to have an insignificant impact. If impacts are below the significance levels in Table 3, a compliance demonstration for the NAAQS and Class II PSD increments are not required.

Table 3: Significant Impact Levels for NAAQS and PSD Class II Analyses

Pollutant	Averaging Period	Class II SIL ($\mu\text{g}/\text{m}^3$)
Sulfur Dioxide	3-hour	25
	24-hour	5
	Annual	1
PM₁₀	24-hour	5
	Annual	1
Nitrogen Dioxide	Annual	1
Carbon Monoxide	1-hour	2000
	8-Hour	500

If the impact exceeds the modeling significance levels for any of the averaging periods for a pollutant, the source or modification has a significant impact in ambient air for that particular pollutant and must perform a cumulative impact analysis demonstrating compliance with the NAAQS. In addition, major sources must include a cumulative impact analysis to address compliance with the PSD Class II increments.

A similar procedure for determining Class I impact significance is performed for new major sources and major modifications. Major sources located within 10 kilometers of a Class I area must also demonstrate that impacts are less than 1 micrograms/cubic meter, 24-hour average, in order for the Class I impacts to be considered insignificant (40CFR 51.166). If the impacts are below the significance levels in Table 4, a compliance demonstration for Class I PSD increments is not required. If the impact exceeds the significance levels, the source has a significant impact in that Class I area for that particular pollutant and averaging period, and must perform a cumulative impact analysis demonstrating compliance with the PSD Class I increment.

Table 4: – Significant Impact Levels for PSD Class I Analyses

Pollutant	Averaging Period	Class I SIL ($\mu\text{g}/\text{m}^3$)
Sulfur Dioxide	3-hour	1
	24-hour	0.2
	Annual	0.1
PM₁₀	24-hour	0.3
	Annual	0.2
Nitrogen Dioxide	Annual	0.1

b. “Less than Significant” Contributions

If a modeled short term NAAQS violation from existing sources is predicted to occur within the significant impact area of the proposed source, but it is determined that the proposed source will not exceed the applicable significant impact levels within this area during the same time periods when the modeled violation occur, the source’s contribution to the model predicted violation is less than significant. No further air quality impact analysis to address the modeled violation is required by the new source or modification.

c. Cumulative Impact Analysis

The *Cumulative Impact Analysis* is performed when a source’s impact is modeled and found to be above the SILs for a pollutant. This applies separately to both Class I and Class II areas. In addition, SILs for Class II areas are also used to determine if a full NAAQS analysis is required.

The State of Utah has adopted the federal NAAQS and PSD increment consumption limits for criteria pollutants to protect and preserve the air quality for its people and the environment, as listed in 40CFR, Part 50 and Part 51. Any source seeking an AO from the State of Utah that has a significant impact as determined according to II(a) above, must perform a cumulative impact analysis. This analysis must comply with all applicable NAAQS and Class I and Class II PSD increments, as indicated in Table 5 below. Cumulative NAAQS analyses shall include impact from other permitted or existing sources in the area, along with a representative background concentration added to the model’s cumulative impact results. PSD analyses shall include the cumulative impacts from other increment consuming sources in the surrounding area. More details on this can be found in section VII.

Table 5: National Ambient Air Quality Standards and PSD Increment Ceilings for Criteria Pollutants. (in $\mu\text{g}/\text{m}^3$)

POLLUTANT	AVERAGING TIME	NAAQS		PSD CLASS INCREMENTS		
		PRIMARY	SECONDARY	I	II	III ^e
SO ₂	3-HR ^a		1300	25	512	700
	24-HR ^a	365		5	91	182
	ANNUAL ^b	80		2	20	40
PM ₁₀	24-HR	150 ^f	150 ^f	8 ^a	30 ^a	60 ^a
PM _{2.5}	24-HR ^g	35	35			
	ANNUAL ^d	15	15			
NO ₂	ANNUAL ^b	100	100	2.5	25	50
O ₃	8-HR ^{c d}	157	157			
CO	1-HR ^a	40000				
	8-HR ^{a c}	10000				
Pb	3-Month ^b	1.5				

- a) Not to be exceeded more than once per year.
- b) Never to be exceeded.
- c) 8-hour averaging period based on an 8-hour running average.
- d) Statistical evaluation of mean required.
- e) No PSD Class III areas presently exist in the State of Utah.
- f) The standard is attained when the expected number of days per calendar year with a 24-hour average concentration above $150 \mu\text{g}/\text{m}^3$, as determined in accordance with 40 CFR Part 50 appendix K, is equal to or less than one.
- g) The standards are attained when the 98th percentile 24-hour concentration, as determined in accordance with 40 CFR Part 50 appendix N, is less than or equal to $35 \mu\text{g}/\text{m}^3$.

III. Toxic Screening Levels

The UDAQ has adopted Toxic Screening Levels (TSLs) to assist in the evaluation of hazardous air pollutants released into the atmosphere from sources seeking a new or modified AO. The TSLs do not constitute a standard which the impact of a source's toxic emissions cannot exceed. Rather, they are screening levels above which the UDAQ has determined that additional information should be obtained to substantiate that the model-predicted concentration would not expose sensitive individuals, animals, or vegetation, to unnecessary health risks.

TSLs are derived from Threshold Limit Values (TLVs) listed in the American Conference of Governmental Industrial Hygienists (ACGIH) - "Threshold Limit Values for Chemical Substances and Physical Agents." Values reported in the ACGIH handbook are based on specific exposure limits to a healthy adult in the work place. Persons who would be overly sensitive to such an exposure, such as children, the elderly, or the physically ill, would require thresholds lower than the TLVs. To ensure protection for sensitive individuals and to facilitate the use of longer concentration averaging periods for chronic and carcinogenic HAPs, safety factors were applied as follows:

TLV divided by 10 - relate the threshold of an average healthy adult to that of a sensitive individual.
TLV divided by 3 - converts the 8-hour TLV to a 24-hour concentration (chronic and carcinogenic HAPs only).
TLV divided by 3 - additional safety factor for carcinogens.

The above safety factors when applied to the TLVs result in the following TSLs and concentration averaging periods for comparison with model-predicted concentrations:

Acute HAPs - $TLV / 10$ (instantaneous concentration), averaging period of 1-hour or less;
Chronic HAPs - $TLV / 30$, 24-hour averaging period;
Carcinogenic HAPs - $TLV / 90$, 24-hour averaging period. – A1 or A2 known or suspected carcinogenic.

IV. PSD Class I Areas and Air Quality Related Values

The Federal Land Managers (FLMs) have established Air Quality Related Values (AQRVs) to address the impact of a source on PSD Class I areas such as acid deposition, regional haze, and the degradation of sensitive species issues. Areas presently under the protection of Class I designations in the State of Utah are Arches National Park, Bryce Canyon National Park, Canyonlands National Park, Capitol Reef National Park, and Zion National Park (R307-405-4(1)). The impact on Class I areas in other states may also need to be addressed.

Applicants are advised to contact the modeling staff at the UDAQ for information concerning the modeling methodology for Class I areas. Applicants should also contact the FLMs for information concerning the modeling methodology for individual Class I area AQRVs. New or major modifications to PSD sources are required to address their impact on all Class I areas within 300 km of the subject sources. In addition, any major source located within 10 kilometers of a Class I area must also demonstrate that impacts from all pollutants emitted in significant amounts, are less than 1 micrograms/cubic meter, 24-hour average, in order for the Class I impacts to be considered insignificant (40CFR 51.166).

V. Modeling Protocol

The modeling protocol serves to identify the appropriate framework for the impact analysis and to expedite the UDAQ's review. The purpose of the protocol is to define the type of analyses required for a complete NOI. It should also outline the type of models to be used in the analyses, and the meteorological and topographical data that will be used to run the models. Before conducting a refined modeling analysis, applicants are encouraged to submit a written modeling protocol to the UDAQ. Information detailed in the modeling protocol should include the following:

- 1) A detailed discussion of the proposed source or modification.
- 2) Type of permit requested.
- 3) Plant-wide potential-to-emit estimates of any new or existing emissions proposed by the applicant.

- 4) Air quality analyses required under State and Federal rules to be included in the NOI.
- 5) Environmental standards, thresholds, and/or screening levels the analyses will address.
- 6) The model(s) to be used in the analysis, and an explanation of why the model(s) would be applicable.
- 7) Technical options to be used with the model(s).
- 8) Source/site plot plan including all proposed source locations, structure locations, structure heights, property boundaries, and roads in UTM coordinates. Include the horizontal datum (NAD27 or NAD83).
- 9) The type of meteorological data which will be used in the analysis, its origin, period it represents, and why it should be considered site representative.
- 10) Discussion of surrounding terrain and the effects it will have on pollutant dispersion.
- 11) Background concentrations and background monitor location to be used in the analysis.
- 12) For cumulative analyses, include information on all nearby sources that are not considered to be included in the background but may impact the area of maximum impact.

Optional Information:

- 13) Emission rates, source type, source release parameters (point, volume, or area source model input parameters), operating schedules for the new or modified source(s), and a scaled drawing of the facility's building structural layout.
- 14) Emission rates, source type, source release parameters, and operating schedules for any existing source(s) at the facility.
- 15) Emission rates, source type, and source release parameters for all surrounding sources which would have an additive impact with the subject source.
- 16) Receptor grid(s) type and spacing to be used in the analysis.

Sources that have collected on-site meteorological data are not required to submit the representative meteorology analysis with their modeling protocol, since that information should have been submitted to the UDAQ in the on-site meteorological monitoring protocol.

The modeling protocol will be reviewed by the UDAQ modeling staff. In most cases, applicants will be notified in writing of the approval, or changes necessary to obtain approval, by the UDAQ within five to ten working days of receiving the written modeling protocol. Applicants should be aware that an approved modeling protocol does not necessarily limit the extent of the modeling that will be required to demonstrate compliance with all standards. It is often the case that during the course of the State's review process, previously unseen issues will arise, as information detailing the source's possible impact on the surrounding environment is reviewed.

VI. Air Quality Models

a. EPA Preferred Models

Applicants should consult with the UDAQ prior to the selection of a particular model(s) in order to ensure that its use is appropriate for the type of analysis being performed. The UDAQ accepts the use of EPA approved models for regulatory analyses. Models which do not fall under the category of "EPA Preferred Models" as defined in the GAQM, are subject to the approval of the UDAQ prior to their use in a regulatory modeling analysis. Dispersion models previously approved by EPA for use in a regulatory modeling analysis, and the supporting documentation, are available to the public at no cost, through the EPA - Technology Transfer Network (TTN) Internet website at <http://www.epa.gov/ttn/scram/>.

For dispersion modeling within a 50-km (31 miles) radius of the modeled source, the EPA steady state Gaussian plume models that are available are AERMOD, SCREEN3, ISCST3, and ISCST3-PRIME. The ISCST3 and SCREEN3 models incorporate the COMPLEX 1 source code to allow users to evaluate pollutant impacts in simple, intermediate, and complex terrain during a single execution of the model. AERMOD does not distinguish between simple, intermediate, or complex terrain, and is considered to be more refined than ISCST3 when the proper meteorological data inputs are available. Currently, AERMOD is the preferred model and ISCST3 is considered to be an alternate model (alternate models will need EPA approval if used for new/modified major PSD source analyses). The UDAQ will allow minor sources to continue using ISCST3 instead of AERMOD, in cases where the meteorological data necessary to run AERMOD is not available or of poor quality.

The use of a steady state Gaussian plume model beyond a distance of 50 km may produce overly conservative concentrations. Steady state modeling results will not be accepted for receptor distances beyond 50 km. For dispersion modeling beyond a distance of 50 km, EPA recommends the use of the long-range transport model called CALPUFF.

b. Technical Options

Technical options to be selected for regulatory modeling are outlined in the GAQM document and individual model user guides. Any selection of a technical option which deviates from regulatory guidelines, is subject to prior approval by the UDAQ. Applicants are required to inform the UDAQ of any intent to make changes in a model source code, which requires the written approval of EPA, if the proposed change will alter in any way the concentrations predicted by the model (R307-410-2).

c. Proprietary Models and Software

The UDAQ recognizes the use of proprietary software ('user friendly') in regulatory analyses. Applicants are required to inform the UDAQ if they plan to use a proprietary model or software in their analysis. The UDAQ may require applicants to submit software and source code to aid in the review of the analysis. The UDAQ recognizes the ownership right of all proprietary software, and therefore cannot release any proprietary models, support software, or documentation to the public without the prior approval of the software vendor. Applicants are encouraged to contact software vendors with any questions concerning the specific operation of proprietary software.

VII. Source Data

a. Emission Rates

The applicant should exercise caution when proposing emission rates for any modeling analysis. Modeled emission rates should be representative of the averaging period(s) for which impacts are being determined. The emission rate used in the modeling analyses to establish maximum short-term concentrations (24 hours or less) should be representative of the pending AO's permitted maximum allowable emission level for that time period, unless it can be documented that the subject source routinely operates at a significantly lower emission rate (in line with federally enforceable operating limits).

For buoyant plumes, maximum concentrations may be associated with operating levels less than 100%. Hence, maximum concentrations resulting from stack parameters reflecting operating levels of 50% and 75% may also need to be addressed if operating the facility in a partial load capacity will result in a decrease in the height of the model predicted plume rise.

Relevant stack test parameter data should be incorporated in a modeling analysis whenever available. When actual source parameters are not available, applicants are encouraged to consult with the UDAQ to determine source parameters that are closely representative and conservative.

The applicant should address the impact of startup and shutdown emissions if these emissions are part of normal operation, and are expected to be higher than the emission levels that went into the modeling for normal operations after startup and before shutdown. The UDAQ has determined that this analysis may be necessary to demonstrate compliance with the NAAQS.

For determining PSD increment consumption, the baseline area with respect to NO₂, SO₂, and PM₁₀ must first be determined to see if an increment analysis is required. Such analyses are conducted in attainment or maintenance areas only and are not performed in non-attainment areas.

The major source baseline date for PM₁₀ in Davis, Salt Lake, Utah, and Weber Counties is the date that EPA approves the PM₁₀ maintenance plan that was adopted by the Board on July 6, 2005, and for all other areas of the state it is January 6, 1975. The major source baseline date for SO₂ for Salt Lake County is the date that EPA approves the SO₂ maintenance plan that was adopted by the Board on January 5, 2005, and for all other areas of the state it is January 6, 1975. The major source baseline date for NO₂ is February 8, 1988.

The minor source baseline date means the earliest date after the trigger date on which the first complete application under 40 CFR 52.21 or R307-405 is submitted for a new major source or major modification subject to the requirements of 40 CFR 52.21 or R307-405. The minor source baseline date is the date after which emissions from all new or modified sources consume or expand increment, including emissions from major and minor sources as well as any or all general commercial, residential, industrial, and other growth. The trigger date for NO₂ is February 8, 1988 and for SO₂ and PM₁₀ the trigger date is August 7, 1977.

b. Surrounding Source Contributions

Surrounding sources may be excluded from the modeling analysis for a particular pollutant if the results of the *Significant Impact Analysis* indicate that impacts are below the SILs for that pollutant, as shown in Table 3.

For sources that have a significant impact, all surrounding sources that will contribute to the maximum impact of a new or modified source must be considered in the modeling analysis. Applicants are encouraged to contact the emission inventory section of the UDAQ in order to identify any possible contributing sources in the area

surrounding the subject source. For NAAQS and PSD Class II analyses, all permitted sources which are located within 50 km of the subject source's area of significant impact should be included in the analysis. For PSD Class I analyses, all permitted sources located within 50 kilometers of the Class I area being analyzed should be included in the analysis, if the new major source or major modification has an impact in that Class I area that is over the Class I SIL, as shown in Table 4.

Modeled emission rates for these surrounding sources should be consistent with EPA guidance, as found in the GAQM. Generally, permit limits or maximum potential emissions should be used in the NAAQS analysis, and increment consuming/expanding actual emissions should be used in the PSD analysis.

c. Background Concentrations

If a source's impact is greater than any of the Class II SILs for a pollutant, then modeled concentrations must be added to the existing background concentration in order to evaluate the total impact relative to the NAAQS for that pollutant (R307-410-3).

New major sources or major modifications are required to demonstrate through modeling whether monitoring data for the pollutants that are emitted in significant amounts will be required, based on Table 6 below. For these sources, if the modeled concentration is above the values listed in Table 6, then pre-construction monitoring data will be required as part of the final modeling analysis (R307-405-14). This data is normally collected for a period of one year, based on a UDAQ approved monitoring plan, submitted prior to conducting the monitoring.

Table 6 : Pre-Construction Monitoring Exemption Thresholds for Major PSD Sources ($\mu\text{g}/\text{m}^3$)

Pollutant	Annual	24-Hour	8-Hour	1-Hour
SO ₂		13		
PM ₁₀		10		
NO ₂	14			
CO			575	
Lead		0.1		
Mercury		0.25		
Beryllium		0.0005		
Flourides		0.25		
Vinyl Chlorides		15		
Total Reduced Sulfur				10
Hydrogen Sulfide				0.04
Reduced Sulfur Compounds				10

For minor sources, conservative background concentration values (and some actual monitored values) are available for rural areas throughout the state of Utah; however, this data may not be representative of actual pollutant background concentrations at the specific site. In cases where the UDAQ background concentrations are unreasonably conservative or are not representative of actual monitored background concentrations, the applicant source may want to collect on-site ambient air quality data for use in their NAAQS analysis.

VIII. Receptor Grids and Related Topics

a. Polar / Rectangular Receptor Grids

The model user may prefer to choose a receptor grid with receptors spaced at large intervals (coarse grid), in order to identify the areas where pollutant concentrations tend to be higher (hotspots). The UDAQ does not place any limits on the number or spacing of receptors for the purpose of coarse grid modeling; but the grid should be able to delimit the areas of highest possible impact. After the hotspots have been located, the user is required to remodel these areas with a receptor grid tight enough to ensure that the maximum point of impact has been identified (refined grid). During the review of a modeling analysis, the UDAQ may find it necessary to add more receptors in order to determine the maximum impact in ambient air, if the applicant did not add sufficient receptor coverage.

For refined receptor grids, the GAQM states: "Receptor sites for refined modeling should be utilized in sufficient detail to estimate the highest concentrations and possible violations of a NAAQS or a PSD increment." The reader is referred to section IV.D.2, pp C.39 - C.42 of the New Source Review Workshop Manual for a detailed discussion concerning receptor grid network design.

It is the applicant's responsibility to demonstrate that the final receptor network is sufficiently dense to identify the maximum estimated pollutant concentration for each applicable averaging period. This applies both to the PSD increments and to the NAAQS. As a general rule of thumb, the receptor network may be considered adequate if the difference of concentrations at neighboring receptors is no larger than one-half the difference between the maximum modeled concentration and the NAAQS (or increment) under consideration; stated numerically:

$$\begin{aligned} \text{where:} \quad & X_1 - X_2 < 0.5 \times \text{NAAQS (or increment)} - X_{\max} , \\ & X_{(1 \text{ or } 2)} = \text{Concentration at receptor 1 and 2 (adjacent receptors)} \\ & X_{\max} = \text{Maximum concentration of receptors 1 and 2.} \end{aligned}$$

In addition to using a network of evenly spaced receptors, the applicant will need to add discrete receptors at locations such as: the boundary of the nearest Class I or non-attainment area, the location(s) of ambient air monitoring sites, and locations where potentially high ambient air concentrations are expected to occur.

b. 'Ambient Air' Boundary Receptors

Receptor spacing along the ambient air boundary is required to assess the impact of a source at the closest area considered to be 'ambient air'. EPA defines 'ambient air' in a January 21, 1986 policy memorandum (9) from Joseph A. Tikvart to Regional Modeling Contacts, Regions I - X. In this memorandum, EPA states: "The policy is based on 40 CFR part 50.1 (e) which defines ambient air as ". . . that portion of the atmosphere, external to buildings, to which the general public has access. Exemption from ambient air is available only for the atmosphere over land owned or controlled by the source and/or to which public access is precluded by a fence or other physical barriers." Plot plans that show the property, or other legal property descriptions (i.e., survey data) are used by UDAQ modelers to review if the receptor locations used in the model adequately cover all areas that meet the definition of ambient air. This information should be included as part of the modeling protocol or NOI/modeling submittal.

c. Terrain Elevations

Simple terrain (terrain elevations below the level of pollutant release) and complex terrain (terrain elevations above the level of pollutant release) will need to be addressed in all modeling analyses if terrain within the vicinity of the subject source is expected to have an effect on pollutant dispersion. Applicants may contact the UDAQ to determine the extent to which terrain effects will need to be addressed in their modeling analysis.

Terrain elevations for modeling analyses should be obtained from USGS databases. For refined-grid analyses, terrain data should be based on 1:24,000 scale Digital Elevation Model (DEM) data. Larger scale DEM data (i.e., 1:250,000 scale) will be considered for coarse-grid modeling where receptor spacing is 5000 meters or greater. DEM data may contain errors, and should be verified against a topographic map for accuracy by using plotting software such as Surfer©. There are several sources for DEM and topographic map data including the State of Utah AGRC web site (www.agrc.utah.gov), USGS web site (data.geocomm.com), as well as private contractor web sites (www.WebGIS.com).

IX. Meteorological Data

The meteorological conditions under which a pollutant is released into the atmosphere is the controlling determinant of dispersion efficiency in the air quality models. In most dispersion modeling analyses, the user will attempt to define the worst-case scenario for pollutant dispersion, thereby yielding the highest possible model predicted concentration.

a. Screening Meteorological Data

Screening models use a worst-case meteorological data set. Meteorological data in the SCREEN3 model simulates a full set of atmospheric conditions to calculate the highest possible concentration. SCREEN3, however, is limited to simulating dispersion from single, fairly simplistic sources. The UDAQ has constructed a worst-case data screening set using meteorological data assumptions from the SCREEN3 model for use with the ISCST3 model (for modeling multiple, more complex sources). The UDAQ will allow minor sources to use worst-case meteorological data in a refined screening model for NAAQS modeling analyses only if a representative actual meteorological data set is not available. Only 1-hour concentrations can be calculated using the worst-case meteorological data set. For other averaging periods, impacts must be calculated by applying the time-scaled conversion factors, listed in Table 7, to the model predicted 1-hour concentration.

b. Representative Meteorological Data

Ideally, a modeling analysis should attempt to simulate dispersion under conditions that would actually occur at a source. This data should be representative of transport wind directions, speed, and turbulence at the elevation of final plume stabilization height, as prescribed by the GAQM. Therefore, the UDAQ requires that actual meteorological data be used in a refined modeling analysis. New or major modifications to PSD sources will be required to collect at least one year of continuous on-site meteorological data for use in their modeling analyses. If on-site data is not available for modeling, representative data collected from another meteorological site may be used, provided it is close enough and is within the same hydrological basin. Meteorological data used in modeling must be approved by the UDAQ for quality assurance and site representativeness prior to its use in a regulatory analysis. To demonstrate data representativeness, the applicant may provide an analysis comparing the physiographic and meteorological parameters of the data site using the minimum requirements that are detailed in Appendix II. In the case where the meteorological data is not determined to be representative, the applicant source may be required to collect on-site meteorological data.

The UDAQ requires that at least one full year of representative meteorological data be used in all refined modeling analyses for the near field, where near field is defined to be within 50 kilometers of the source. If more than one year of data is available, the user shall run the model with all available years, up to a maximum of five years (R307-410-3). Sources that are required to gather on-site meteorological data are advised to contact the UDAQ to establish a monitoring protocol for locating a representative meteorological site and gathering the necessary meteorological data.

c. CALPUFF Meteorological Data

The UDAQ requires that at least three years of mesoscale meteorological (MM5) data be used in all refined CALPUFF modeling analyses (R307-410-3). The applicant must work with the UDAQ and FLMs in determining the MM5 domain that will be used in the modeling analysis.

X. Time Averaging Periods

Applicants preparing regulatory analyses are required to address all applicable NAAQS and PSD increment averaging periods which would apply to the pollutant being modeled (R307-410-3). Some models such as SCREEN3, however, will only calculate 1-hour average concentrations, or 24-hour averages if addressing complex terrain issues. EPA has established time-scaled persistence factors to convert 1-hour averages to other averaging periods. These time-scaled factors appear in Table 7. Time-scaled persistence factors are not to be applied with area source modeling for averaging periods of 24-hours or less. When converting SCREEN3 24-Hour concentrations to 1-hour averages, be sure to use the conversion factors that SCREEN3 uses and not those listed in table 7 below (i.e., 4.0 for “Complex Terrain 24-HR Calcs” and 2.5 for “Simple Terrain 24-HR Calcs”).

Table 7: Persistence Factors for Converting 1-Hour Averaging Periods.

Averaging Period	Persistence Factor	
	Flat and Simple Terrain	Complex Terrain
3-Hour	0.9	0.7
8-Hour	0.7	0.50
24-Hour	0.4	0.15
3-Month	0.12	na
Annual	0.08	0.03

XI. Building Downwash

Air flow over and around buildings and other solid structures may restrict the dispersion of a pollutant source. When modeling release points where the release height is less than good engineering practice (GEP), the effects of building downwash will need to be addressed in the modeling analysis. The GAQM requires that EPA's 'Building Profile Input Program' (BPIP) or a proprietary version of BPIP be used to generate building profile input data for input to the ISCST3, AERMOD, or the ISC3-PRIME model.

XII. Cavity Modeling

Applicant sources with release points located near their property boundary are required to submit a cavity region analysis with their modeling. Cavity concentrations are considered to be a valid ground concentration when addressing NAAQS and PSD increment consumption, if the length of the cavity extends beyond a restricted property boundary. If cavity impacts are deemed to be important, the applicant should consult the UDAQ regarding the proper inputs/options that are required to evaluate cavity impacts in SCREEN3.

XIII. Visibility (Plume Blight) Modeling

All new major sources or major modifications to existing sources are required to conduct plume visibility modeling for all of the Class I areas in Utah (R307-406-2). EPA recommends the use of the VISCREEN model for visibility analyses involving plume blight when the distance to the Class I area is less than 50 kilometers. Applicants performing visibility modeling are advised to first perform a VISCREEN - Level I analysis. If the source fails the Level I analysis, a Level II analysis should be performed. Visibility modeling use of the PLUVUE II model would then be recommended if the source fails both the VISCREEN Level I and II analyses. In addition to plume blight modeling, the FLMs may require that a regional haze analysis be performed for Class I areas that are farther than 50 kilometers away, using the CALPUFF modeling system and guidance from the Federal Land Manager's Air Quality Guide (FLAG). The applicant should contact the FLMs responsible for this analysis.

XIV. Post-Construction Monitoring

If modeling results for a facility are predicted to be greater than 90% of the respective NAAQS, not including background, then the UDAQ may require that the applicant perform post-construction monitoring for that pollutant. If this is the case, then the applicant should meet with the UDAQ and prepare a monitoring plan for the collection of this data.

XV. Submittal Requirements

a. General Requirements

Applicants submitting regulatory modeling analyses to the UDAQ should include the following items, information, and documents with their modeling analysis (R307-401-5). Exclusion of this information from the notice of intent may result in lengthy delays to the reviewing process.

- 1) A detailed description of the new source's proposed activity. For modified sources, a description of the proposed modification and the source's activity prior to and after the proposed modification.
- 2) A detailed description of the proposed new emission or change in emission level.
 - a) Point sources - emission rate, stack height, stack diameter, temperature, exit velocity, and nearby building dimensions (downwash).
 - b) Area sources - the height, area/dimensions, and average emission rate per unit area. Road emissions should include the length, surface type, silt content, and location/orientation.

- c) Volume sources - the release height, initial vertical and horizontal dimension, and emission rate.
- d) Flare Sources - emission rate, stack height, stack diameter, exit velocity, and total heat content.
- 3) A scaled map showing the location of all sources, structures, property boundaries, and receptors used in the analysis.
- 4) A description of the model(s) selected and why it (each) was (were) selected.
- 5) A description of the site topography and receptor grids used in the analysis.
- 6) A description of meteorological data and why it is representative. Quality assurance documentation should also be included. Electronic copies of both ASCII and model compatible formatted meteorological data used in the analysis on a 3.5 disk or CD.
- 7) Technical support documentation for any assumptions made in the modeling analysis which deviate from GAQM.
- 8) Model input (regulatory compatible version) and output files in DOS format on a 3.5 inch floppy disk or CD along with file descriptions.
- 9) A summarization of model predictions showing compliance with NAAQS and PSD increment ceilings for both Class I and II areas. The summarization must include the information described in the following two subsection

b. NAAQS

- 1) Table showing pollutants, averaging period, ambient standards, background concentration, highest (and second highest, if appropriate) modeled concentration, the model used, and the impact location in UTM's.
- 2) Concentration isopleth maps with facility boundary for each pollutant and averaging period, along with the ASCII file containing the x, y and q (concentration) coordinates from which the isopleth was plotted.

c. PSD Increment – Major PSD Sources Only

- 1) Table showing pollutants, averaging periods, maximum increment consumed by both major and minor sources within 50 km of the subject source since the baseline date, the model used, and the impact location in UTM's.
- 2) Increment consumption isopleth maps, with facility boundary, for each pollutant and averaging period, along with the ASCII file containing the x, y and q (concentration) coordinates from which the isopleth was plotted.

References

1. Clean Air Act of 1990. EPA Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711.
2. Guidelines on Air Quality Models. 40 CFR Part 51, Appendix W. EPA Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711.
3. Prevention of Significant Deterioration. 40 CFR 52.21. EPA Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711.
4. New Source Review Workshop Manual – Draft 1990. EPA Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711.
5. Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised. EPA-454/R-92-019. EPA Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711.
6. EPA - Technology Transfer Network (TTN) website (www.epa.gov/ttn). EPA Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711.
7. Utah Administrative Code. (R307). Utah Division of Air Quality, 150 North 1950 West, Salt Lake City, Utah 84114-4820.
8. Preparing Your Notice of Intent (NOI), The NOI Guide. Eighth Edition (November 11, 2002). Utah Division of Air Quality, 150 North 1950 West, Salt Lake City, Utah 84114-4820.
9. Policy Memorandum from Joseph A. Tikvart to Regional Modeling Contacts, Regions I - X. January 21, 1986. Definition of Ambient Air.

Appendix I

Methodology for Estimating Emissions Threshold Values (ETVs) for Hazardous Air Pollutants (HAPs)

The R307-410-5 requires sources submitting a NOI to document increases in HAP emissions. All NOIs requesting increases or new emissions of HAPs must submit the following information/documentation for each effected emission unit's pollutant release point or area:

- 1) The estimated maximum lb/hr emission rate of each HAP for each affected emission unit (R307-410-5.1c),
- 2) The type of release, the maximum release duration in minutes per hour, the release height, and the height of any surrounding building, and the distance to 'ambient air' (R307-1-3.7.3(C)(1)(b)), and
- 3) The emission threshold value in lb/hr (equal to the HAP's TLV divided by the appropriate emission threshold factor in Table 5) (R307-1-3.7.3(C)(1)(c)).

This information is used to determine if dispersion modeling is required. Using these values:

- 1) Select the appropriate ETF (see Table 5 of R307-410-5.1c) for each pollutant release point or area (emission unit). Selection of ETFs is based on the information specified under R307-410-5.1c(iB) and the classification of the HAP proposed to be emitted.
- 2) Select the lowest valued ETF from the group of affected emission units.
- 3) Multiply the lowest ETF times the HAP's TLV. This is the ETV (modeling trigger emissions level) for the HAP in lb/hr.
- 4) Compare the ETV's emission level against the sum of the proposed new or increase in emissions (in maximum estimated lb/hr) from all affected emission units for the HAP. If the ETV is greater than or equal to the proposed new or increased emission level, the applicant source is not required to perform dispersion modeling or submit addition documentation under this rule for that particular HAP. If the ETV is less than the proposed new or increased emission level, the applicant source should proceed to Method Two for this HAP.
- 5) Repeat steps 1 through 4 for each proposed type of HAP.

b. Method Two (Weighted ETF Method)

This methodology establishes a weighted ETF which has been adjusted to represent the actual layout of the source and the amount of pollutant released from each point or area (emission unit). The affected emission unit's ETF is weighed by the percentage of the increase for that particular emission unit to the total amount of emissions increase proposed by the applicant (see example problems at end of appendix). For each HAP for which new emissions, or an increase in emissions is proposed in the NOI:

- 1) Select the appropriate ETF (see Table 5 of R307-410-5.1c) for each pollutant release point or area (emission unit). Selection of ETFs is based on the information specified under R307-410-5.1c and the classification of the HAP proposed to be emitted. Multiply each emission unit's ETF times the percentage of the total proposed new or increasing emissions level which will be released from that emission unit (in maximum estimated lb/hr). These are the adjusted ETFs for each affected emission unit.

Example: For each emission unit the 'adjusted ETF' is equal to the emission unit's ETF times the estimated lb/hr emission increase at the emission unit divided by the total estimated emissions increase from all effected emission units.

- 2) Sum the adjusted ETFs from the group of effected emission units. This is the total adjusted ETF for the HAP.
- 3) Multiply the total adjusted ETF times the HAP's TLV. This is the adjusted ETV (modeling trigger emissions level) for the HAP in lb/hr.
- 4) Compared the ETV's emission level against the sum of the total proposed new or increase in emissions from all affected emission units for the HAP. If the ETV is greater than or equal to the proposed new or increased emission level, the applicant source is not required to perform dispersion modeling or submit addition documentation under this rule for that particular HAP. If the ETV is less than the proposed new or increased emission level, the applicant source is required to perform dispersion modeling and submit addition documentation under this rule for that particular HAP.
- 5) Repeat steps 1 through 4 for each proposed type of HAP.

c. Working Examples

To best illustrate how this determination is to be made, we will use an example source submitting a NOI for 3 HAPs: toluene, hydrogen chloride, and zinc chromate (chromium compound).

Table 5 (R307-410-5): Emission Threshold Factors (ETF) For Hazardous Air Pollutants

Distance to Property Boundary	Acute	Chronic	Carcinogenic
Vertically-Restricted and Fugitive Emission Release Points			
20 meters or less	0.038	0.051	0.017
21 - 50 meters	0.051	0.066	0.022
51 - 100 meters	0.092	0.123	0.041
Beyond 100 meters	0.180	0.269	0.090
Vertically-Unrestricted Emission Release Points			
50 meters or less	0.154	0.198	0.066
51 - 100 meters	0.224	0.244	0.081
Beyond 100 meters	0.310	0.368	0.123

The user should first attempt to identify the health effect classification for each HAP, and the appropriate Threshold Limit Value (TLV) from the most current version of the “American Conference of Governmental Industrial Hygienists (ACGIH) - Threshold Limit Values for Chemical Substances and Physical Exposure” handbook (see definitions for TLV, acute, chronic, and carcinogenic under R307-101-2 or Appendix VI of this document). The classification and TLV for the three pollutants are:

- Toluene - classified as a chronic HAP. The TLV is 188 mg/m³.
- Hydrogen Chloride - classified as an acute HAP. The TLV is 7.5 mg/m³.
- Zinc Chromate (chromium compound) - classified as a carcinogenic HAP. The TLV is 0.01 mg/m³.

The example applicant source submits the following information with its NOI

Emission Unit 1 -	Emission Unit 2 -
max. est. emission rates -	max. est. emission rate -
Toluene - 8 lb/hr	Toluene - 5 lb/hr
Hyd. Chlor. - 0.24 lb/hr	Hyd. Chlor. - 0.10 lb/hr
Zinc Chrom. - 0.0002 lb/hr	Zinc Chrom. - 0.0003 lb/hr
release type - vent fan on side of building	release type - stack w/ vent cover
release duration - 60 minutes/hour	release duration - 30 minutes/hour
release height - 15 feet	release height - 28 feet
building height - 20 feet	building height - 20 feet
distance to ambient air - 80 meters	distance to ambient air - 45 meters

Using Table 5 from the rule and the information above, we will work through each pollutant starting with toluene.

Example 1: Toluene

Method One

Total the maximum estimated lb/hr emissions rates from all of the emission units. $8 + 5 + 10 + 12 = 35$ lb/hr. The lowest emissions threshold factor (ETF) from Table 5 that applies to the emission units are:

Emission Unit 1: The release is vertically-restricted since the emissions are vented horizontally through the side wall (See definition for vertically restricted emissions release). Since the release is 80 m from the property boundary, the ETF is 0.123.

Emission Unit 2: The release is vertically-restricted. The emissions are vented vertically through a stack, but the emissions are directed horizontally when striking the rain cap (See definition for vertically restricted emissions release). Since the release is 45 m from the property boundary, the ETF is 0.066.

Emission Unit 3: The release is vertically-restricted. The emissions are vented vertically through a stack without a rain cap, but the release height is less than 1.3 times the building height (See definition for vertically restricted emissions release). Since the release is 120 m from the property boundary, the ETF is 0.269.

Emission Unit 4: The release is vertically-unrestricted since the emissions are vented vertically through a stack without a rain cap and the release height is greater than 1.3 times the building height (See definition for vertically unrestricted emissions release). Since the release is 15 m from the property boundary, the ETF is 0.198.

Emission Unit 2 has the lowest ETF, 0.066. This will be the appropriate ETF for this method. Next we calculate the Emissions Threshold Value (ETV) which is the ETF times the HAP's TLV ($0.066 \text{ m}^3 \cdot \text{lb} / \text{mg} \cdot \text{hr} \times 188 \text{ mg} / \text{m}^3 = 12.4 \text{ lb} / \text{hr}$). Since the maximum estimated emission rate of 35 lb/hr exceeds the emission threshold value, the applicant should move forward with method two.

Method Two

The maximum estimated lb/hr emissions rate from all of the emission units is 35 lb/hr. Using the information from method one above, the adjusted ETFs for each emission unit are:

Emission Unit 1: Adjusted $\text{ETF}_1 = 0.123 \times 8 \text{ lb} / \text{hr} \div 35 \text{ lb} / \text{hr} = 0.028$

Emission Unit 2: Adjusted $\text{ETF}_2 = 0.066 \times 5 \text{ lb} / \text{hr} \div 35 \text{ lb} / \text{hr} = 0.009$

Emission Unit 3: Adjusted $\text{ETF}_3 = 0.269 \times 10 \text{ lb} / \text{hr} \div 35 \text{ lb} / \text{hr} = 0.077$

Emission Unit 4: Adjusted $\text{ETF}_4 = 0.198 \times 12 \text{ lb} / \text{hr} \div 35 \text{ lb} / \text{hr} = 0.068$

The total adjusted ETF for the emissions increase is: Total Adjusted $\text{ETF} = 0.028 + 0.009 + 0.077 + 0.068 = 0.182$

The Emissions Threshold Value (ETV) which is the Total Adjusted ETF times the HAP's TLV is: $0.182 \text{ m}^3 \cdot \text{lb} / \text{mg} \cdot \text{hr} \times 188 \text{ mg} / \text{m}^3 = 34.2 \text{ lb} / \text{hr}$. Since the maximum estimated emission rate exceeds the emission threshold value ($35 \text{ lb} / \text{hr} > 34.2 \text{ lb} / \text{hr}$), dispersion modeling is required for toluene.

Example 2: Hydrogen Chloride

Method One

For acute HAPs, it is very important to take into consideration that very short term exposure to these HAPs may result in adverse health effects. Therefore, when dealing with batch process emission units having a release duration of less than one hour, the maximum lb/hr emission rate should be reflective of an identical process having a release rate of one hour or more. In the case of emission unit 2, the release duration is 30 minutes, therefore the maximum lb/hr release rate for emission unit 2 should be; $(60 \text{ min.} / 30 \text{ min.}) \times 0.10 \text{ lb} / \text{hr} = 0.20 \text{ lb} / \text{hr}$.

The total maximum estimated lb/hr emissions rates from all of the emission units is: $0.24 + 0.20 + 0.05 + 0.07 = 0.56 \text{ lb} / \text{hr}$.

From the source's release information above, choose the lowest emissions threshold factor (ETF) from Table 5 that applies to the emission units.

Emission Unit 1: The release is vertically-restricted at 80 m from the property boundary, the ETF is 0.092.

Emission Unit 2: The release is vertically-restricted at 45 m from the property boundary, the ETF is 0.051.

Emission Unit 3: The release is vertically-restricted at 120 m from the property boundary, the ETF is 0.180.

Emission Unit 4: The release is vertically-unrestricted at 15 m from the property boundary, the ETF is 0.154.

Thus emission unit 2 has the lowest ETF, 0.051. This will be the appropriate ETF for this method.

The Emissions Threshold Value (ETV) which is the ETF times the HAP's TLV is: $0.051 \text{ m}^3 \cdot \text{lb} / \text{mg} \cdot \text{hr} \times 7.5 \text{ mg} / \text{m}^3 = 0.383 \text{ lb} / \text{hr}$. Since the maximum estimated emission rate exceeds the emission threshold value, the applicant should move forward with method two.

Method Two

The maximum estimated lb/hr emissions rate from all of the emission units is 0.56 lb/hr. Using the information from method one above, the adjusted ETFs for each emission unit are:

Emission Unit 1: Adjusted ETF1 = $0.092 \times 0.24 \text{ lb} / \text{hr} \div 0.56 \text{ lb} / \text{hr} = 0.039$
Emission Unit 2: Adjusted ETF2 = $0.051 \times 0.20 \text{ lb} / \text{hr} \div 0.56 \text{ lb} / \text{hr} = 0.018$
Emission Unit 3: Adjusted ETF3 = $0.180 \times 0.05 \text{ lb} / \text{hr} \div 0.56 \text{ lb} / \text{hr} = 0.016$
Emission Unit 4: Adjusted ETF4 = $0.154 \times 0.07 \text{ lb} / \text{hr} \div 0.56 \text{ lb} / \text{hr} = 0.019$

The total adjusted ETF for the emissions increase is: Total Adjusted ETF = $0.039 + 0.018 + 0.016 + 0.019 = 0.092$

The Emissions Threshold Value (ETV) which is the Total Adjusted ETF times the HAP's TLV is: $0.092 \text{ m}^3 \cdot \text{lb} / \text{mg} \cdot \text{hr} \times 7.5 \text{ mg} / \text{m}^3 = 0.69 \text{ lb} / \text{hr}$. Since the maximum estimated emission rate is less than the emission threshold value ($0.56 \text{ lb} / \text{hr} < 0.69 \text{ lb} / \text{hr}$), dispersion modeling is not required for hydrogen chloride.

Example 3: Zinc Chromate (Chromium Compound)

Method One

The total maximum estimated lb/hr emissions rate from all of the emissions unit is: $0.0002 + 0.0001 + 0.0003 + 0.0004 = 0.0010 \text{ lb} / \text{hr}$. From the source's release information above, the ETFs from Table 5 that apply to the emission units are:

Emission Unit 1: The release is vertically-restricted at 80 m from the property boundary, the ETF is 0.041.
Emission Unit 2: The release is vertically-restricted at 45 m from the property boundary, the ETF is 0.022.
Emission Unit 3: The release is vertically-restricted at 120 m from the property boundary, the ETF is 0.090.
Emission Unit 4: The release is vertically-unrestricted at 15 m from the property boundary, the ETF is 0.066.

Emission Unit 2 has the lowest ETF, 0.022. This will be the appropriate ETF for this method.

The Emissions Threshold Value (ETV) which is the ETF times the HAP's TLV is: $0.022 \text{ m}^3 \cdot \text{lb} / \text{mg} \cdot \text{hr} \times 0.01 \text{ mg} / \text{m}^3 = 0.00022 \text{ lb} / \text{hr}$. Since the maximum estimated emission rate exceeds the emission threshold value, the applicant should move forward with method two.

Method Two

The maximum estimated lb/hr emissions rates from all of the emission units is 0.0010 lb/hr. Using the information from method one above, the adjusted ETFs for each emission unit are:

Emission Unit 1: Adjusted ETF1 = $0.041 \times 0.0002 \text{ lb/hr} \div 0.0010 \text{ lb/hr} = 0.008$

Emission Unit 2: Adjusted ETF2 = $0.022 \times 0.0001 \text{ lb/hr} \div 0.0010 \text{ lb/hr} = 0.002$

Emission Unit 3: Adjusted ETF3 = $0.090 \times 0.0003 \text{ lb/hr} \div 0.0010 \text{ lb/hr} = 0.027$

Emission Unit 4: Adjusted ETF4 = $0.066 \times 0.0004 \text{ lb/hr} \div 0.0010 \text{ lb/hr} = 0.026$

The total adjusted ETF for the emissions increase is: Total Adjusted ETF = $0.008 + 0.002 + 0.027 + 0.026 = 0.063$

The Emissions Threshold Value (ETV) which is the Total Adjusted ETF times the HAP's TLV is: $0.063 \text{ m}^3\cdot\text{lb}/\text{mg}\cdot\text{hr} \times 0.01 \text{ mg}/\text{m}^3 = 0.00063 \text{ lb/hr}$. Since the maximum estimated emission rate exceeds the emission threshold value ($0.001 \text{ lb/hr} > 0.00063 \text{ lb/hr}$), dispersion modeling is required for zinc chromate.

Appendix II

Minimum Requirements to Establish Data Representativeness

A. Physiographic Analysis

Analysis of local terrain features extending out to 1-mile radius from the site and on a regional scale including several townships for overall impact. The analysis must include the following:

- 1) Two sites must fall in the same generic category of terrain:
 - a) Flat terrain
 - b) Shoreline conditions
 - c) Complex terrain
 - 1) Three dimensional terrain
 - 2) Simple valley
 - 3) Complex valley
 - 4) Two dimensional terrain features
- 2) For representativeness of sites in complex terrain the following conditions must be similar:
 - a) Alignments of major terrain features in north-south orientation
 - b) Ratios of height of valley walls to width of valley and terrain profiles
 - c) Height of ridge to length of ridge
 - d) Height of isolated hills to width of hills at the bases
 - e) Slope of terrain
 - f) Ratio of terrain heights to stack/plume heights
 - g) Distance of proposed source from terrain features, i.e., valley wall, ridge, hill, etc.

B. Meteorological Analysis comparison must contain:

- 1) Comparison of regional meteorology to include typical synoptic weather patterns.
 - a) Comparison of site meteorology to include similarity of wind flows, temperatures, inversion types/periods, etc.
 - b) Comparison of the plume rise characteristics for each site.

Appendix III

Utah Administrative Code Language and Definitions for Modeling

(As in effect on April 1, 2008)

R307. Environmental Quality, Air Quality.

R307-410. Permits: Emissions Impact Analysis.

R307-410-1. Purpose.

This rule establishes the procedures and requirements for evaluating the emissions impact of new or modified sources that require an approval order under R307-401 to ensure that the source will not interfere with the attainment or maintenance of any NAAQS. The rule also establishes the procedures and requirements for evaluating the emissions impact of hazardous air pollutants. The rule also establishes the procedures for establishing an emission rate based on the good engineering practice stack height as required by 40 CFR 51.118.

R307-410-2. Definitions.

- (1) The following additional definitions apply to R307-410.

"Vertically Restricted Emissions Release" means the release of an air contaminant through a stack or opening whose flow is directed in a downward or horizontal direction due to the alignment of the opening or a physical obstruction placed beyond the opening, or at a height which is less than 1.3 times the height of an adjacent building or structure, as measured from ground level.

"Vertically Unrestricted Emissions Release" means the release of an air contaminant through a stack or opening whose flow is directed upward without any physical obstruction placed beyond the opening, and at a height which is at least 1.3 times the height of an adjacent building or structure, as measured from ground level.

- (2) Except as provided in (3) below, the definitions of "stack", "stack in existence", "dispersion technique", "good engineering practice (GEP) stack height", "nearby", "excessive concentration", and "intermittent control system (ICS)" in 40 CFR 51.100(ff) through (kk) and (nn) effective July 1, 2005 are hereby incorporated by reference.

- (3) (a) The terms "reviewing authority" and "authority administering the State implementation plan" shall mean the executive secretary.

(b) The reference to "40 CFR parts 51 and 52" in 40 CFR 51.100(ii)(2)(i) shall be changed to "R307-401, R307-403 and R307-405".

(c) The phrase "For sources subject to the prevention of significant deterioration program (40 CFR 51.166 and 52.21)" in 40 CFR 51.100(kk)(1) shall be replaced with the phrase "For sources subject to R307-401, R307-403, or R307-405".

R307-410-3. Use of Dispersion Models.

All estimates of ambient concentrations derived in meeting the requirements of R307 shall be based on appropriate air quality models, data bases, and other requirements specified in 40 CFR Part 51, Appendix W, (Guideline on Air Quality Models), effective July 1, 2005, which is hereby incorporated by reference. Where an air quality model specified in the Guideline on Air Quality Models or other EPA approved guidance documents is inappropriate, the executive secretary may authorize the modification of the model or substitution of another model. In meeting the requirements of federal law, any modification or substitution will be made only with the written approval of the Administrator, EPA.

R307-410-4. Modeling of Criteria Pollutant Impacts in Attainment Areas.

Prior to receiving an approval order under R307-401, a new source in an attainment area with a total controlled emission rate per pollutant greater than or equal to amounts specified in Table 1, or a modification to an existing source located in an attainment area which increases the total controlled emission rate per pollutant of the source in an amount greater than or equal to those specified in Table 1, shall conduct air quality modeling, as identified in R307-410-3, to estimate the impact of the new or modified source on air quality unless previously performed air quality modeling for the source indicates that the addition of the proposed emissions increase would not violate a National Ambient Air Quality Standard, as determined by the Executive Secretary.

TABLE 1

POLLUTANT	EMISSIONS
sulfur dioxide	40 tons per year
oxides of nitrogen	40 tons per year
PM10 - fugitive emissions	5 tons per year
PM10 - non-fugitive emissions	15 tons per year
carbon monoxide	100 tons per year
lead	0.6 tons per year

R307-410-5. Documentation of Ambient Air Impacts for Hazardous Air Pollutants.

- (1) Prior to receiving an approval order under R307-401, a source shall provide documentation of increases in emissions of hazardous air pollutants as required under (c) below for all installations not exempt under (a) below.
 - (a) Exempted Installations.
 - (i) The requirements of R307-410-5 do not apply to installations which are subject to or are scheduled to be subject to an emission standard promulgated under 42 U.S.C. 7412 at the time a notice of intent is submitted, except as defined in (ii) below. This exemption does not affect requirements otherwise applicable to the source, including requirements under R307-401.
 - (ii) The executive secretary may, upon making a written determination that the delay in the implementation of an emission standard under R307-214-2, that incorporates 40 CFR Part 63, might reasonably be expected to pose an unacceptable risk to public health, require, on a case-by-case basis, notice of intent documentation of emissions consistent with (c) below.
 - (A) The executive secretary will notify the source in writing of the preliminary decision to require some or all of the documentation as listed in (c) below.

- (B) The source may respond in writing within thirty days of receipt of the notice, or such longer period as the executive secretary approves.
- (C) In making a final determination, the executive secretary will document objective bases for the determination, which may include public information and studies, documented public comment, the applicant's written response, the physical and chemical properties of emissions, and ambient monitoring data.
- (b) Lead Compounds Exemption. The requirements of R307-410-5 do not apply to emissions of lead compounds. Lead compounds shall be evaluated pursuant to requirements of R307-410-4.
- (c) Submittal Requirements.
 - (i) Each applicant's notice of intent shall include:
 - (A) The estimated maximum pounds per hour emission rate increase from each affected installation,
 - (B) The type of release, whether the release flow is vertically restricted or unrestricted, the maximum release duration in minutes per hour, the release height measured from the ground, the height of any adjacent building or structure, the shortest distance between the release point and any area defined as "ambient air" under 40 CFR 50.1(e), effective July 1, 2005, which is hereby incorporated by reference for each installation for which the source proposes an emissions increase,
 - (C) The emission threshold value, calculated to be the applicable threshold limit value - time weighted average (TLV-TWA) or the threshold limit value - ceiling (TLV-C) multiplied by the appropriate emission threshold factor listed in Table 2, except in the case of arsenic, benzene, beryllium, and ethylene oxide which shall be calculated using chronic emission threshold factors, and formaldehyde, which shall be calculated using an acute emission threshold factor. For acute hazardous air pollutant releases having a duration period less than one hour, this maximum pounds per hour emission rate shall be consistent with an identical operating process having a continuous release for a one-hour period.

TABLE 2
EMISSION THRESHOLD FACTORS FOR HAZARDOUS AIR POLLUTANTS
(cubic meter pounds per milligram hour)
VERTICALLY-RESTRICTED AND FUGITIVE EMISSION RELEASE POINTS

PROPERTY BOUNDARY	DISTANCE TO		
	ACUTE	CHRONIC	CARCINOGENIC
20 Meters or less	0.038	0.051	0.017
21 - 50 Meters	0.051	0.066	0.022
51 - 100 Meters	0.092	0.123	0.041
Beyond 100 Meters	0.180	0.269	0.090

VERTICALLY-UNRESTRICTED EMISSION RELEASE POINTS

PROPERTY BOUNDARY	DISTANCE TO		
	ACUTE	CHRONIC	CARCINOGENIC
50 Meters or less	0.154	0.198	0.066
51 - 100 Meters	0.224	0.244	0.081
Beyond 100 Meters	0.310	0.368	0.123

- (ii) A source with a proposed maximum pounds per hour emissions increase equal to or greater than the emissions threshold value shall include documentation of a comparison of the estimated ambient concentration of the proposed emissions with the applicable toxic screening level specified in (d) below.
- (iii) A source with an estimated ambient concentration equal to or greater than the toxic screening level shall provide additional documentation regarding the impact of the proposed emissions. The executive secretary may require such documentation to include, but not be limited to:
 - (A) A description of symptoms and adverse health effects that can be caused by the hazardous air pollutant,
 - (B) The exposure conditions or dose that is sufficient to cause the adverse health effects,
 - (C) A description of the human population or other biological species which could be exposed to the estimated concentration,
 - (D) An evaluation of land use for the impacted areas,
 - (E) The environmental fate and persistency.
- (d) Toxic Screening Levels and Averaging Periods.
 - (i) The toxic screening level for an acute hazardous air pollutant is 1/10th the value of the TLV-C, and the applicable averaging period shall be:
 - (A) One hour for emissions releases having a duration period of one hour or greater,
 - (B) One hour for emission releases having a duration period less than one hour if the emission rate used in the model is consistent with an identical operating process having a continuous release for a one-hour period or more, or
 - (C) The dispersion model's shortest averaging period when using an applicable model capable of estimating ambient concentrations for periods of less than one hour.
 - (ii) The toxic screening level for a chronic hazardous air pollutant is 1/30th the value of the TLV- TWA, and the applicable averaging period shall be 24 hours.
 - (iii) The toxic screening level for all carcinogenic hazardous air pollutants is 1/90 the value of the TLV-TWA, and the applicable averaging period shall be 24 hours, except in the case of formaldehyde which shall be evaluated consistent with (d)(i) above and arsenic, benzene, beryllium, and ethylene oxide which shall be evaluated consistent with (d)(ii) above.

R307-410-6. Stack Heights and Dispersion Techniques.

- (1) The degree of emission limitation required of any source for control of any air contaminant to include determinations made under R307-401, R307-403 and R307-405, must not be affected by so much of any source's stack height that exceeds good engineering practice or by any other dispersion technique except as provided in (2) below. This does not restrict, in any manner, the actual stack height of any source.

- (2) The provisions in R307-410-6 shall not apply to:
- (a) Stack heights in existence, or dispersion techniques implemented on or before December 31, 1970, except where pollutants are being emitted from such stacks or using such dispersion techniques by sources which were constructed or reconstructed, or for which major modifications were carried out after December 31, 1970; or
 - (b) Coal-fired steam electric generating units subject to the provisions of Section 118 of the Clean Air Act, which commenced operation before July 1, 1957, and whose stacks were constructed under a construction contract awarded before February 8, 1974.
- (3) The executive secretary may require the source owner or operator to provide a demonstration that the source stack height meets good engineering practice as required by R307-410-6.