Colorado Modeling Guideline
Updated Tables to Address $PM_{2.5}$ PSD Program Implementation

May 20, 2011

Table 1. Modeling Thresholds. Modeling is usually warranted to quantify the impact if the emission rate is equal to or greater than these emission thresholds. If the emission rate is less, a qualitative description of the impact is adequate unless there is a situation that warrants modeling.(1) [Note: The long-term (tons per year) thresholds apply to modeling decisions regarding annual average ambient air quality standards. The short term (pound per hour) thresholds apply to modeling decisions for short-term standards (i.e., ≤ 24-hr average).]

Pollutant	Requested Emission Rate from a New Source or Facility-Wide Net Emissions Increase from a Modification
Carbon Monoxide (CO)	100 tons per year or 23 pounds per hour
Nitrogen Oxides (NO_X)	40 tons per year[11] or 0.46 pound per hour
Sulfur Dioxide (SO_2)	40 tons per year or 0.46 pound per hour
Particulate Matter < 10 μm (PM_{10})	15 tons per year or 82 pounds per day
Particulate Matter < 2.5 μm ($PM_{2.5}$)	5 tons per year of primary $PM_{2.5}$ or 11 pounds per day of primary $PM_{2.5}$
Lead (Pb)	25 pounds per 3-months

(1) Modeling is usually warranted, even though the source or modification does not exceed the modeling thresholds in Table 1, if it is reasonable to believe the source will cause or contribute to a violation of applicable ambient air quality standards in circumstances such as:
- (a) Sources where a substantial portion of the new or modified emissions have poor dispersion characteristics (e.g., rain caps, horizontal stacks, fugitive releases[12], or ***building downwash***[13]) in close proximity to ***ambient air*** at the site boundary;
- (b) Sources located in ***complex terrain*** (e.g., terrain above stack height in close proximity to the source);
- (c) Sources located in areas with poor existing air quality;
- (d) Modifications at existing major stationary sources, including grandfathered sources that have never been modeled before.

[11] For new sources or modifications, including those with poor dispersion characteristics, that emit less than 40 tons per year (tpy) of NO_X, modeling for the annual NO_2 NAAQS is usually warranted only in the situations described in caveats (1)(c) and (1)(d), provided that most (e.g., >85%) of the NO_X is emitted as nitric oxide (NO). That is, because of near-field chemical transformation assumptions, NO_2 impacts from a 40 tpy NO_X source are usually expected to be below the annual NO_2 ambient air quality standard. Thus, modeling is only warranted in situations where existing annual NO_2 levels are high enough that the significant impact from the new source or modification might "contribute" to a modeled violation of the annual NO_2 air quality standard.

[12] For sources without stacks (e.g., fugitive releases from area or volume sources), modeling may be warranted at levels less than those in Table 1 if most of the emissions are from sources located less than 250-meters from the limit to public access. The 250-meter recommendation is based on a modeling study performed by the Division.

[13] For sources with emission rates below those in Table 1 where the stack height is less than the U.S. EPA's ***good engineering practice (GEP) stack height,*** modeling may be warranted; however, the presence of a non-GEP stack height does not mean that modeling is automatically warranted. The degree (e.g., severity) of the downwash effects, existing air quality levels, the distance to the boundary of ambient air, and any other relevant factors should be considered.

Table 2. Modeling significance levels for Class I[a] PSD increments.

Pollutant	Averaging Period				
	Annual	24-hr	8-hr	3-hr	1-hr
Nitrogen Dioxide (NO_2)	0.1 μg/m^3	b	b	b	b
Sulfur Dioxide (SO_2)	0.1 μg/m^3	0.2 μg/m^3	b	1.0 μg/m^3	b
Particulate Matter < 10 μm (PM_{10})	0.2 μg/m^3	0.3 μg/m^3	b	b	b
Particulate Matter < 2.5 μm ($PM_{2.5}$)	0.06 μg/m^3	0.07 μg/m^3	b	b	b

a Class I areas are shown in Figure 3; also see protected area for SO_2 in Figure 2.
b A modeling significance level has not been defined for this averaging period.

Table 3. Modeling significance levels for CAAQS, NAAQS, and Class II[a] PSD increments

Pollutant	Averaging Period				
	Annual	24-hr	8-hr	3-hr	1-hr
Carbon Monoxide (CO)	b	b	500 μg/m^3	b	2,000 μg/m^3
Nitrogen Dioxide (NO_2)	1 μg/m^3	b	b	b	4 ppb (c)
Sulfur Dioxide (SO_2)	1 μg/m^3	5 μg/m^3	b	25 μg/m^3	4 μg/m^3 (d)
Particulate Matter < 10 μm (PM_{10})	1 μg/m^3	5 μg/m^3	b	b	b
Particulate Matter < 2.5 μm ($PM_{2.5}$)	0.3 μg/m^3	1.2 μg/m^3	b	b	b

a All areas of Colorado are designated as Class II except for the areas shown in Figure 3.
b A modeling significance level has not been defined for this averaging period.
c Interim modeling significance level adopted by the Division based on EPA (June 28, 2010) recommended interim 1-hr NO_2 significant impact level: http://www.colorado.gov/airquality/permits/Interim1-hrNO2SILmemo.pdf
d Interim modeling significance level developed by the Division: http://www.colorado.gov/airquality/permits/Interim1-hrSO2SIL.pdf

Table 5. National Ambient Air Quality Standards (NAAQS), Colorado Ambient Air Quality Standards (CAAQS), and PSD significant monitoring concentrations. The actual form of each standard is listed first. The values in parentheses are approximations provided for convenience.

Pollutant	Avg. Period	Primary NAAQS	Secondary NAAQS	(Additional Standards) CAAQS	PSD Significant Monitoring Concentration[a]
Nitrogen Dioxide	1-hr	100 ppb	NA	NA	NA
Nitrogen Dioxide	annual	53 ppb	0.053 ppm (100 $\mu g/m^3$)	NA	14 $\mu g/m^3$
Carbon Monoxide	1-hour	35 ppm (40,000 $\mu g/m^3$)	NA	NA	NA
Carbon Monoxide	8-hour	9 ppm (10,000 $\mu g/m^3$)	NA	NA	575 $\mu g/m^3$
Sulfur Dioxide	1-hr	75 ppb	NA	NA	NA
Sulfur Dioxide	3-hour	NA	0.5 ppm (1,300 $\mu g/m^3$)	700 $\mu g/m^3$	NA
Sulfur Dioxide	24-hour	NA	NA	NA	13 $\mu g/m^3$
Ozone	8-hour	0.075 ppm (2008 std)	0.075 ppm (2008 std)	NA	100 tpy VOCs or NO_X
Ozone	8-hour	0.08 ppm (1997 std)	0.08 ppm (1997 std)	NA	100 tpy VOCs or NO_X
Particulate Matter < 10µm (PM_{10})	24-hour	150 $\mu g/m^3$	150 $\mu g/m^3$	NA	10 $\mu g/m^3$
Particulate Matter < 2.5 µm ($PM_{2.5}$)	24-hour	35 $\mu g/m^3$	35 $\mu g/m^3$	NA	4 $\mu g/m^3$
$PM_{2.5}$	annual	15 $\mu g/m^3$	15 $\mu g/m^3$	NA	NA
Lead	rolling 3-month	0.15 $\mu g/m^3$	0.15 $\mu g/m^3$	NA	NA
Lead	3-month	NA	NA	NA	0.1 $\mu g/m^3$
Fluorides	24-hour	NA	NA	NA	0.25 $\mu g/m^3$
Total Reduced Sulfur	1-hour	NA	NA	NA	10 $\mu g/m^3$
Hydrogen Sulfide	1-hour	NA	NA	NA	0.2 $\mu g/m^3$
Reduced Sulfur Compounds	1-hour	NA	NA	NA	10 $\mu g/m^3$

[a] The significant monitoring concentrations (de minimis levels) apply only to new sources and modifications subject to PSD review (see Regulation No. 3, Part D, §VI).

Table 7. Prevention of Significant Deterioration (PSD) increments (μg/m^3)

Pollutant	Period	Class I	Class II	Class III
Nitrogen Dioxide (NO_2)	Annual	2.5	25	50
Sulfur Dioxide (SO_2)	3-hr	25	512	700
	24-hr	5	91	182
	Annual	2	20	40
Particulate Matter < 10 μm (PM_{10})	24-hr	8	30	60
	Annual	4	17	34
Particulate Matter < 2.5 μm ($PM_{2.5}$)	24-hr	2	9	18
	Annual	1	4	8

Table 8. PSD baseline dates in Colorado as of May 20, 2011.[a]

Pollutant	Major Source Baseline Date	Minor Source Baseline Date	Baseline Area
Nitrogen Dioxide (NO_2)	February 8, 1988	March 30, 1989	Entire State
Sulfur Dioxide (SO_2)	January 6, 1975	October 12, 1977	Entire State
Particulate Matter < 10 μm (PM_{10})	January 6, 1975	November 1, 1988	AQCR 1
Particulate Matter < 10 μm (PM_{10})	January 6, 1975	November 17, 1980	AQCR 2
Particulate Matter < 10 μm (PM_{10})	January 6, 1975	November 14, 2000	AQCR 3
Particulate Matter < 10 μm (PM_{10})	January 6, 1975	November 1994	AQCR 4
Particulate Matter < 10 μm (PM_{10})	January 6, 1975	November 9, 2000	AQCR 5
Particulate Matter < 10 μm (PM_{10})	January 6, 1975	June 19, 1989	AQCR 6
Particulate Matter < 10 μm (PM_{10})	January 6, 1975	April 1994	AQCR 7
Particulate Matter < 10 μm (PM_{10})	January 6, 1975	Not Triggered[a]	AQCR 8
Particulate Matter < 10 μm (PM_{10})	January 6, 1975	Not Triggered[a]	AQCR 9
Particulate Matter < 10 μm (PM_{10})	January 6, 1975	August 20, 1984	AQCR 10
Particulate Matter < 10 μm (PM_{10})	January 6, 1975	October 12, 1977	AQCR 11
Particulate Matter < 10 μm (PM_{10})	January 6, 1975	July 1983	AQCR 12
Particulate Matter < 10 μm (PM_{10})	January 6, 1975	Not Triggered[a]	AQCR 13
Particulate Matter < 2.5 μm ($PM_{2.5}$)	October 20, 2010		Entire State
Particulate Matter < 2.5 mm ($PM_{2.5}$)		Not Triggered[a]	TBD[a]

a Contact the Division's Stationary Sources Program for the latest information.

Colorado Modeling Guideline
Updated Tables to Address Revised SO_2 NAAQS

August 20, 2010

Table 1. Modeling Thresholds. Modeling is usually warranted to quantify the impact if the emission rate is equal to or greater than these emission thresholds. If the emission rate is less, a qualitative description of the impact is adequate unless there is a situation that warrants modeling.(1) [Note: The long-term (tons per year) thresholds apply to modeling decisions regarding annual average ambient air quality standards. The short term (pound per hour) thresholds apply to modeling decisions for short-term standards (i.e., ≤ 24-hr average).]

Pollutant	Requested Emission Rate from a New Source or Facility-Wide Net Emissions Increase from a Modification
Carbon Monoxide (CO)	100 tons per year or 23 pounds per hour
Nitrogen Oxides (NO_X)	40 tons per year[11] or 0.46 pound per hour
Sulfur Dioxide (SO_2)	40 tons per year or 0.46 pound per hour
Particulate Matter < 10 μm (PM_{10})	15 tons per year or 82 pounds per day
Particulate Matter < 2.5 μm ($PM_{2.5}$)	5 tons per year of primary $PM_{2.5}$ or 11 pounds per day of primary $PM_{2.5}$
Lead (Pb)	25 pounds per 3-months

(1) Modeling is usually warranted, even though the source or modification does not exceed the modeling thresholds in Table 1, if it is reasonable to believe the source will cause or contribute to a violation of applicable ambient air quality standards in circumstances such as:
- (a) Sources where a substantial portion of the new or modified emissions have poor dispersion characteristics (e.g., rain caps, horizontal stacks, fugitive releases[12], or ***building downwash***[13]) in close proximity to ***ambient air*** at the site boundary;
- (b) Sources located in ***complex terrain*** (e.g., terrain above stack height in close proximity to the source);
- (c) Sources located in areas with poor existing air quality;
- (d) Modifications at existing major stationary sources, including grandfathered sources that have never been modeled before.

[11] For new sources or modifications, including those with poor dispersion characteristics, that emit less than 40 tons per year (tpy) of NO_X, modeling for the annual NO_2 NAAQS is usually warranted only in the situations described in caveats (1)(c) and (1)(d), provided that most (e.g., >85%) of the NO_X is emitted as nitric oxide (NO). That is, because of near-field chemical transformation assumptions, NO_2 impacts from a 40 tpy NO_X source are usually expected to be below the annual NO_2 ambient air quality standard. Thus, modeling is only warranted in situations where existing annual NO_2 levels are high enough that the significant impact from the new source or modification might "contribute" to a modeled violation of the annual NO_2 air quality standard.

[12] For sources without stacks (e.g., fugitive releases from area or volume sources), modeling may be warranted at levels less than those in Table 1 if most of the emissions are from sources located less than 250-meters from the limit to public access. The 250-meter recommendation is based on a modeling study performed by the Division.

[13] For sources with emission rates below those in Table 1 where the stack height is less than the U.S. EPA's ***good engineering practice (GEP) stack height,*** modeling may be warranted; however, the presence of a non-GEP stack height does not mean that modeling is automatically warranted. The degree (e.g., severity) of the downwash effects, existing air quality levels, the distance to the boundary of ambient air, and any other relevant factors should be considered.

Table 3. Modeling significance levels for CAAQS, NAAQS, and Class II[a] PSD increments

Pollutant	Averaging Period				
	Annual	24-hr	8-hr	3-hr	1-hr
Carbon Monoxide (CO)	b	b	500 $\mu g/m^3$	b	2,000 $\mu g/m^3$
Nitrogen Dioxide (NO_2)	1 $\mu g/m^3$	b	b	b	4 ppb (d)
Sulfur Dioxide (SO_2)	1 $\mu g/m^3$	5 $\mu g/m^3$	b	25 $\mu g/m^3$	4 $\mu g/m^3$ (e)
Particulate Matter < 10 µm (PM_{10})	1 $\mu g/m^3$	5 $\mu g/m^3$	b	b	b
Particulate Matter < 2.5 µm ($PM_{2.5}$)	0.3 $\mu g/m^3$ (c)	1.2 $\mu g/m^3$ (c)	b	b	b

a All areas of Colorado are designated as Class II except for the areas shown in Figure 3.
b A modeling significance level has not been defined for this averaging period.
c Interim modeling significance level developed by the Division based on level proposed by EPA for NAAQS only.
d Interim modeling significance level adopted by the Division based on EPA (June 28, 2010) recommended interim 1-hr NO_2 significant impact level: http://www.colorado.gov/airquality/permits/Interim1-hrNO2SILmemo.pdf
e Interim modeling significance level developed by the Division.

Table Updated May 20, 2011

Table 5. National Ambient Air Quality Standards (NAAQS), Colorado Ambient Air Quality Standards (CAAQS), and PSD significant monitoring concentrations. The actual form of each standard is listed first. The values in parentheses are approximations provided for convenience.

Pollutant	Avg. Period	Primary NAAQS	Secondary NAAQS	(Additional Standards) CAAQS	PSD Significant Monitoring Concentration[a]
Nitrogen Dioxide	1-hr	100 ppb	NA	NA	NA
Nitrogen Dioxide	annual	53 ppb	0.053 ppm (100 $\mu g/m^3$)	NA	14 $\mu g/m^3$
Carbon Monoxide	1-hour	35 ppm (40,000 $\mu g/m^3$)	NA	NA	NA
Carbon Monoxide	8-hour	9 ppm (10,000 $\mu g/m^3$)	NA	NA	575 $\mu g/m^3$
Sulfur Dioxide	1-hr	75 ppb	NA	NA	NA
Sulfur Dioxide	3-hour	NA	0.5 ppm (1,300 $\mu g/m^3$)	700 $\mu g/m^3$	NA
Sulfur Dioxide	24-hour	NA	NA	NA	13 $\mu g/m^3$
Ozone	8-hour	0.075 ppm (2008 std)	0.075 ppm (2008 std)	NA	100 tpy VOCs or NO_X
Ozone	8-hour	0.08 ppm (1997 std)	0.08 ppm (1997 std)	NA	100 tpy VOCs or NO_X
Particulate Matter < 10µm (PM_{10})	24-hour	150 $\mu g/m^3$	150 $\mu g/m^3$	NA	10 $\mu g/m^3$
Particulate Matter < 2.5 µm ($PM_{2.5}$)	24-hour	35 $\mu g/m^3$	35 $\mu g/m^3$	NA	NA[b]
$PM_{2.5}$	annual	15 $\mu g/m^3$	15 $\mu g/m^3$	NA	NA
Lead	rolling 3-month	0.15 $\mu g/m^3$	0.15 $\mu g/m^3$	NA	NA
Lead	3-month	NA	NA	NA	0.1 $\mu g/m^3$
Fluorides	24-hour	NA	NA	NA	0.25 $\mu g/m^3$
Total Reduced Sulfur	1-hour	NA	NA	NA	10 $\mu g/m^3$
Hydrogen Sulfide	1-hour	NA	NA	NA	0.2 $\mu g/m^3$
Reduced Sulfur Compounds	1-hour	NA	NA	NA	10 $\mu g/m^3$

[a] The significant monitoring concentrations (de minimis levels) apply only to new sources and modifications subject to PSD review (see Regulation No. 3, Part D, §VI).
[b] At this time, the $PM_{2.5}$ PSD program has not been implemented in Colorado.

Table Updated May 20, 2011

Colorado Modeling Guideline
Updated Table 3 for Interim 1-hr NO_2 SIL

July 8, 2010

Table 3. Modeling significance levels for CAAQS, NAAQS, and Class II[a] PSD increments

Pollutant	Averaging Period				
	Annual	24-hr	8-hr	3-hr	1-hr
Carbon Monoxide (CO)	b	b	500 μg/m^3	b	2,000 μg/m^3
Nitrogen Dioxide (NO_2)	1 μg/m^3	b	b	b	4 ppb (d)
Sulfur Dioxide (SO_2)	1 μg/m^3	5 μg/m^3	b	25 μg/m^3	b
Particulate Matter < 10 μm (PM_{10})	1 μg/m^3	5 μg/m^3	b	b	b
Particulate Matter < 2.5 μm ($PM_{2.5}$)	0.3 μg/m^3 (c)	1.2 μg/m^3 (c)	b	b	b

a All areas of Colorado are designated as Class II except for the areas shown in Figure 3.
b A modeling significance level has not been defined for this averaging period.
c Interim modeling significance level developed by the Division based on level proposed by EPA for NAAQS only.
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Table Updated Aug 29, 2010

Colorado Modeling Guideline
Updated Tables to Address Revised NO_2, $PM_{2.5}$, and Pb NAAQS

April 13, 2010

Table 1. Modeling Thresholds. Modeling is usually warranted to quantify the impact if the emission rate is equal to or greater than these emission thresholds. If the emission rate is less, a qualitative description of the impact is adequate unless there is a situation that warrants modeling.(1) [Note: The long-term (tons per year) thresholds apply to modeling decisions regarding annual average ambient air quality standards. The short term (pound per hour) thresholds apply to modeling decisions for short-term standards (i.e., ≤ 24-hr average).]

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Particulate Matter < 10 μm (PM_{10})	15 tons per year or 82 pounds per day
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Lead (Pb)	25 pounds per 3-months

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- (b) Sources located in ***complex terrain*** (e.g., terrain above stack height in close proximity to the source);
- (c) Sources located in areas with poor existing air quality;
- (d) Modifications at existing major stationary sources, including grandfathered sources that have never been modeled before.

Table Updated Aug 20, 2010

[11] For new sources or modifications, including those with poor dispersion characteristics, that emit less than 40 tons per year (tpy) of NO_X, modeling for the annual NO_2 NAAQS is usually warranted only in the situations described in caveats (1)(c) and (1)(d), provided that most (e.g., >85%) of the NO_X is emitted as nitric oxide (NO). That is, because of near-field chemical transformation assumptions, NO_2 impacts from a 40 tpy NO_X source are usually expected to be below the annual NO_2 ambient air quality standard. Thus, modeling is only warranted in situations where existing annual NO_2 levels are high enough that the significant impact from the new source or modification might "contribute" to a modeled violation of the annual NO_2 air quality standard.

[12] For sources without stacks (e.g., fugitive releases from area or volume sources), modeling may be warranted at levels less than those in Table 1 if most of the emissions are from sources located less than 250-meters from the limit to public access. The 250-meter recommendation is based on a modeling study performed by the Division.

[13] For sources with emission rates below those in Table 1 where the stack height is less than the U.S. EPA's ***good engineering practice (GEP) stack height,*** modeling may be warranted; however, the presence of a non-GEP stack height does not mean that modeling is automatically warranted. The degree (e.g., severity) of the downwash effects, existing air quality levels, the distance to the boundary of ambient air, and any other relevant factors should be considered.

Table 3. Modeling significance levels for CAAQS, NAAQS, and Class II[a] PSD increments

Pollutant	Averaging Period				
	Annual	24-hr	8-hr	3-hr	1-hr
Carbon Monoxide (CO)	b	b	500 $\mu g/m^3$	b	2,000 $\mu g/m^3$
Nitrogen Dioxide (NO_2)	1 $\mu g/m^3$	b	b	b	4 $\mu g/m^3$ (d)
Sulfur Dioxide (SO_2)	1 $\mu g/m^3$	5 $\mu g/m^3$	b	25 $\mu g/m^3$	b
Particulate Matter < 10 µm (PM_{10})	1 $\mu g/m^3$	5 $\mu g/m^3$	b	b	b
Particulate Matter < 2.5 µm ($PM_{2.5}$)	0.3 $\mu g/m^3$ (c)	1.2 $\mu g/m^3$ (c)	b	b	b

a All areas of Colorado are designated as Class II except for the areas shown in Figure 3.
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d Interim modeling significance level developed by the Division.

Table Updated July 8, 2010

Table 5. National Ambient Air Quality Standards (NAAQS), Colorado Ambient Air Quality Standards (CAAQS), and PSD significant monitoring concentrations. The actual form of each standard is listed first. The values in parentheses are approximations provided for convenience.

Pollutant	Avg. Period	Primary NAAQS	Secondary NAAQS	(Additional Standards) CAAQS	PSD Significant Monitoring Concentration[a]
Nitrogen Dioxide	1-hr	0.100 ppm	NA	NA	NA
Nitrogen Dioxide	annual	0.053 ppm (100 μg/m^3)	0.053 ppm (100 μg/m^3)	NA	14 μg/m^3
Carbon Monoxide	1-hour	35 ppm (40,000 μg/m^3)	NA	NA	NA
Carbon Monoxide	8-hour	9 ppm (10,000 μg/m^3)	NA	NA	575 μg/m^3
Sulfur Dioxide	3-hour	NA	0.5 ppm (1,300 μg/m^3)	700 μg/m^3	NA
Sulfur Dioxide	24-hour	0.14 ppm (365 μg/m^3)	NA	NA	13 μg/m^3
Sulfur Dioxide	annual	0.030 ppm (80 μg/m^3)	NA	NA	NA
Ozone	8-hour	0.08 ppm	0.08 ppm	NA	100 tpy VOCs or NO_X
Particulate Matter < 10μm (PM_{10})	24-hour	150 μg/m^3	150 μg/m^3	NA	10 μg/m^3
Particulate Matter < 2.5 μm ($PM_{2.5}$)	24-hour	35 μg/m^3	35 μg/m^3	NA	NA[b]
$PM_{2.5}$	annual	15 μg/m^3	15 μg/m^3	NA	NA
Lead	quarterly	1.5 μg/m^3	1.5 μg/m^3	NA	0.1 μg/m^3
Lead	rolling 3-month	0.15 μg/m^3	0.15 μg/m^3	NA	NA
Fluorides	24-hour	NA	NA	NA	0.25 μg/m^3
Total Reduced Sulfur	1-hour	NA	NA	NA	10 μg/m^3
Hydrogen Sulfide	1-hour	NA	NA	NA	0.2 μg/m^3
Reduced Sulfur Compounds	1-hour	NA	NA	NA	10 μg/m^3

[a] The significant monitoring concentrations (de minimis levels) apply only to new sources and modifications subject to PSD review (see Regulation No. 3, Part D, §VI).
[b] At this time, the $PM_{2.5}$ PSD program has not been implemented in Colorado.

Table Updated Aug 20, 2010

Colorado Department of Public Health and Environment

Colorado Modeling Guideline for Air Quality Permits

December 27, 2005 Air Pollution Control Division / Technical Services Program

Preface

The *Colorado Modeling Guideline* presents current Air Pollution Control Division (Division) air quality modeling guidance for estimating impacts from stationary sources of air pollution. It addresses modeling issues for source types ranging from small ***minor sources***[1] to ***major stationary source***s such as those subject to Prevention of Significant Deterioration (PSD) review. Recommendations in the *Colorado Modeling Guideline* may not be applicable in all situations.

The guideline is intended to help permit applicants, air quality specialists, and others understand the Division's expectations for the ambient air impact analysis and to prevent unnecessary delays in the permit process. It provides a starting point for modeling, but allows the use of professional judgment. To avoid misunderstandings, obtain the most recent version of Colorado's guidance documents from http://apcd.state.co.us/permits/cmg.html. In addition, obtain current regulations and applicable U.S. Environmental Protection Agency (U.S. EPA) guidance.

This guideline is not intended to describe the implications of modeling results. Such implications are generally controlled by the permit rules or other relevant state and federal regulations, laws and guidance. Nevertheless, this guideline contains incidental discussion of the effects of certain modeling results. For example, section 5.6 advises readers that an adverse impact analysis may affect a BACT determination. Such discussion is for informational purposes only and shall not be construed to be authority defining the regulatory impact of any modeling result. For that, the reader should refer to the applicable rules and regulations.

This is a guide through modeling-related regulations and procedures. It is intended to promote technically sound and consistent modeling techniques, while encouraging the use of improved and more accurate techniques as they become available. The guideline helps permit applicants understand when modeling is warranted. It clarifies what modeling-related information and data should be included with a permit application. Supplemental guidance on specific technical issues and other modeling-related data and information, including checklists and meteorological data, are available at http://apcd.state.co.us/permits/cmg.html. If modeling procedures other than those recommended in Colorado and U.S. EPA guidance are used, there might be delays while the procedures are reviewed. In some cases, U.S. EPA approval may be necessary.

This is only a guidance document. It has been published in accordance with §25-6.5-102, C.R.S. It does not have the force and effect of a rule and is not intended to supersede statutory/regulatory requirements or recommendations of the U.S. EPA. U.S. EPA models and guidance are available on the Internet at: http://www.epa.gov/scram001.

[1] Some words are set in *italics* for emphasis. Words in ***bold italics*** are listed in the glossary on page 61. If a word in the glossary occurs several times on a page, only the first occurrence is highlighted.

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1 Introduction

Checklist for determining what should be submitted with a permit application:

- ❑ Review section 2 of the guideline to determine if modeling is warranted and, if so, if it should be submitted with the permit application;
- ❑ Review sections 3 through 5 for guidance about how the modeling and/or analysis should be conducted;
- ❑ Review section 6 for guidance on model selection and application;
- ❑ Review section 7 to determine what types of modeling-related data should be included with the permit application and with modeling reports;
- ❑ Review other guidance documents for additional information and procedures.

Air quality models[2] are used to estimate impacts (air pollutant concentration levels) in ***ambient air*** to determine if a proposed source or activity will comply with applicable ambient air standards and other applicable regulatory requirements. Federal law requires that the Division have legally enforceable procedures in place to prevent construction or modification of any source where the emissions from the projected activity would violate control strategies or interfere with attainment and maintenance of the National Ambient Air Quality Standards (NAAQS). [3]

All estimates of ambient concentrations required under Colorado Air Quality Control Commission (AQCC) Regulation No. 3 must be based on U.S. EPA-approved air quality models, data bases, and other requirements generally approved by the U.S. EPA and specifically approved by the Division. Case-by-case approval from the Division and U.S. EPA is required if a non-EPA model is proposed.

Regulation No. 3, Part A, §VIII.A.1 states that "*all estimates of ambient concentrations required under this Regulation No. 3 shall be based on the applicable air quality models, data bases, and other requirements generally approved by U.S. EPA and specifically approved by the division. If a non-U.S. EPA approved model, such as a wind tunnel study, is proposed, the nature and requirements of such a model should be outlined to the division at a pre-application meeting. The application will be deemed incomplete until there has been an opportunity for a public hearing on the proposed model and written approval of the U.S. EPA has been received.*"

The primary U.S. EPA modeling guideline is ***40 CFR Part 51, Appendix W - Guideline on Air Quality Models*** (USEPA Guideline on Air Quality Models). There are many other U.S. EPA guidance documents,

[2] Air quality models are computer codes for estimating ambient concentration levels (i.e., "impacts") from new and existing sources of air pollution. Models allow one to forecast future air quality levels from sources that have not been constructed. Models simulate in a simplified manner the complex behavior of emissions injected into the atmosphere. Such estimates can provide information on air quality impacts in an efficient and cost effective manner. Some models, such as "screening-level" models, are generally quick and easy to use. U.S. EPA models and guidance are available at: http://www.epa.gov/scram001

[3] Pursuant to section 110(a)(2)(C) of the federal Clean Air Act, the State Implementation Plan (SIP) needs to regulate the "*modification and construction of any stationary source within the areas covered by the plan as necessary to assure that national ambient air quality standards are achieved*." Similarly, 40 CFR section 51.160 requires the State to have the authority to prohibit any construction or modification that would interfere with the attainment or maintenance of a national standard. This includes Prevention of Significant Deterioration (PSD) increments as well as NAAQS. See also 40 C.F.R 51.166. There is no distinction in these provisions between major and minor sources.

memos, and U.S. EPA model clearinghouse decisions that explain modeling procedures. The *Colorado Modeling Guideline* is intended to help permit applicants understand federal modeling procedures. It also provides Colorado's interpretation of gray areas in federal guidance. As such, it presents procedures that are "specifically approved" by the Division.

The primary Colorado regulation for air quality permits is Regulation No. 3.[4] Certain new/modified air pollution sources are subject to the regulatory modeling requirements of Regulation No. 3 (authorized by §25-7-114 to 25-7-114.7, Colorado Revised Statutes (C.R.S.)).

To avoid unnecessary delays in permit processing, pre-application meetings and communications (e.g., phone, e-mail, letter) are strongly recommended, particularly for new ***major stationary sources*** and major modifications.

The Division does not routinely require or perform modeling to determine impacts from hazardous air pollutants (HAPs).

1.1 Requirements Unique to Colorado

Modeling-related regulatory requirements unique to Colorado:

- A major stationary source by itself may not consume more than 75% of any applicable Prevention of Significant Deterioration (PSD) increment (see section 5.4.1);
- Class I SO_2 increments apply to some pristine Class II areas (see section 5.4.2);
- For major stationary sources subject to PSD review, *water* is included as one of the required elements in the *additional impact analysis*; the requirement is intended to provide information on acid deposition in high altitude lakes (see section 5.6.1);
- Sulfur dioxide (SO_2) 3-hour standard of 700 $\mu g/m^3$ (see 4.1.1.7);
- Lead (Pb) monthly average standard of 1.5 $\mu g/m^3$ (see 4.1.1.2).

[4] Colorado regulations are available on the CDPHE website or upon request. To obtain official copies, please contact the Secretary of State's office.

2 When is an Impact Analysis Necessary for Ambient Air Quality Standards?

Regulations require that the Division's preliminary analysis for construction permits indicate the air quality impact from a proposed source or activity. In addition, the Division must determine if the proposed source or activity will comply with applicable ambient air quality standards. The recommended tools for determining *impacts* are air quality models. This section discusses regulatory requirements and provides guidance to help Division permit reviewers and permit applicants understand the Division's typical permit review practices.

While modeling is not required to obtain an operating permit, it may be performed or requested if the operating permit is modified (see Regulation No. 3, Part C, §X - Minor Permit Modification Procedures). Operating permits may also be subject to modeling if the application is for a combined construction/operating permit (see Regulation No. 3, Part C, §III.C.12.d).

2.1 General Considerations

For both ***major stationary sources***[5] and ***minor sources***, Regulation No. 3, Part B, §III.B.5.d states, "*the preliminary analysis shall indicate what impact, if any, the new source will have (as of commencement of operation) on all areas (attainment, nonattainment, unclassifiable), within the probably area of influence of the proposed source…. When the preliminary analysis includes modeling, the model used shall be an appropriate one given the topography, meteorology and other characteristics of the region that the source will impact. Use of any nonguideline model requires U.S. EPA approval under section VIII.A. of Part A of this regulation."*

Regulation No. 3, Part B, §III.D.1 – Construction Permit Review Requirements – states that the Division or the AQCC "*shall grant the permit if it finds that ….the proposed source or activity will not cause an exceedance of any National Ambient Air Quality Standards in any attainment area; and the source or activity will meet any applicable ambient air quality standards and all applicable regulations*…."

Major stationary sources and major modifications are subject to additional requirements. For more, see sections 2.2.1 and 2.3.1.

While Regulation No. 3, Part B, §III.B.5.d requires that the Division indicate the "impact, if any" in its preliminary analysis, it does not explicitly require modeling. Thus, the *impact* analysis can be done using quantitative[6] (modeling) or qualitative[7] (non-modeling) methods, as appropriate; however, U.S. EPA

[5] For a definition of "***major stationary source***" as used in this document, refer to Regulation No. 3, Part D, §II.A.25.

[6] A *quantitative* determination is one that involves a numerical "estimate" of the air pollutant concentration in ambient air.

[7] A *qualitative* determination is one that is made without regard to quantity. That is, it does not involve a numerical estimate of the impact. Instead, it relies on descriptive generalized statements. For example, qualitative arguments are justifiable in situations where, based on professional judgment or general modeling studies, it is reasonable to assume the ambient impacts from a proposed source or activity will be small, insignificant, negligible, or well below applicable standards.

approved models or methods must be used if a numerical *estimate* of the impact (i.e., pollutant concentration in ***ambient air***) is made. [8]

The modeling thresholds in Table 1 of section 2.5 may be used to determine when modeling is warranted. The thresholds are applicable for sources located in nonattainment areas (section 2.2) and attainment areas (section 2.3).

2.2 Nonattainment Areas

The impact analysis requirement of Regulation No. 3, Part B, §III.B.5.d applies in all areas ("attainment, nonattainment, unclassifiable"). Thus, modeling may sometimes be warranted for sources in nonattainment areas. Refer to sections 2.2.1 and 2.2.2 for specific requirements in nonattainment areas. The goals of the impact analysis vary depending on the applicable regulatory requirements.

The regulations refer to the concept of *reasonable further progress* (RFP) for sources located in nonattainment areas. If emissions from a new source or modification would prevent a nonattainment (NAA) area from coming into compliance by the applicable date in the Federal Act or in the SIP, then the source impairs RFP.[9]

2.2.1 New Major Stationary Sources and Major Modifications

New ***major stationary sources*** and major modifications subject to NSR nonattainment area rules are required to submit various types of modeling and/or analysis along with their permit application.

In nonattainment areas, Regulation No. 3, Part D, §V - Requirements Applicable to Nonattainment Areas- contains a number of requirements for obtaining a permit. Refer to the regulation for details. A few of the requirements follow:

- *Offsets must represent reasonable further progress towards attainment of the National Ambient Air Quality Standards when considered in connection with other new and existing sources of emissions.*
- *In addition, offsets for PM10, sulfur oxides, and carbon monoxide must show, through atmospheric modeling, a positive net air quality benefit in the area affected by the emissions.*
- *Provided, however, that offsets meeting the requirements of this section V.A.3 may also be obtained from existing sources outside the nonattainment area if the applicant demonstrates:*
    - *a greater air quality benefit may thus be achieved; or sufficient offsets are not available from sources within the nonattainment area; and*

[8] Regulation No. 3, Part A, §VIII states that "*all estimates of ambient concentrations required under this Regulation No. 3 shall be based on the applicable air quality models, data bases, and other requirements generally approved by EPA and specifically approved by the Division. If a non-EPA approved model, such as a wind tunnel study, is proposed, the nature and requirements of such a model should be outlined to the Division at a pre-application meeting. The application will be deemed incomplete until there has been an opportunity for a public hearing on the proposed model and written approval of the United States EPA has been received.*"

[9] The Common Provisions Regulation defines reasonable further progress as "*the annual incremental reductions in emissions of the applicable air pollutant (including substantial reductions in the early years following approval or promulgation of plan provisions under the Federal Act, section 110(a)(2)(l) and regular reductions thereafter) which are sufficient in the judgment of the commission and U.S. EPA, to provide for attainment of the applicable National Ambient Air Quality Standards by the date required in section 172(a) of the Federal Act.*"

- *the other area has an equal or higher nonattainment classification than the area in which the source is located; and*
- *emissions from such other area contribute to a violation of the National Ambient Air Quality Standard in the nonattainment area in which the source is located.*
- *With respect to offsets obtained from outside the non-attainment area, the division may increase the ratio of the required offsets to new emissions the greater the distance such offsets are from the new or modified source.*

2.2.2 New Minor Sources and Minor Modifications

As described in section 2.1, the *impact* of the new source or modification must be indicated in the Division's preliminary analysis. In addition, the Division must determine if the source or activity will meet applicable air quality standards.

If modeling is not submitted with the permit application, the Division will decide if modeling is warranted to complete the impact analysis and compliance demonstration required by Regulation No. 3. If modeling is warranted, the Division will perform a screening-level analysis if it is technically feasible to perform one. If the screening-level analysis shows there could be modeled violations of applicable standards, the Division will contact the applicant to discuss options. Since the Division does not usually perform refined-level modeling as part of the permitting process, the Division will typically request that the applicant perform any refined modeling that might be warranted. If modeling is warranted, refer to sections 3 and 4.

In the event that compliance with standards cannot be demonstrated using typical attainment area modeling procedures, a case-by-case approach should be developed in consultation with Division staff familiar with the affected nonattainment area.

2.3 Attainment Areas

The impact analysis requirement of Regulation No. 3, Part B, §III.B.5.d applies in all areas ("attainment, nonattainment, unclassifiable"). Thus, modeling may sometimes be warranted for sources in attainment areas. Refer to sections 2.3.1 and 2.3.2 for specific requirements in attainment areas.

2.3.1 Major Stationary Sources and Major Modifications

New ***major stationary sources*** and major modifications subject to PSD attainment area rules are required to submit various types of modeling and/or analysis along with their permit application. The application must include appropriate modeling and/or analysis to be ruled complete. Refer to Regulation No. 3, Part D, §VI.A.2 and §IV.A.6 for source impact analysis requirements.

With respect to ambient air standards, §VI.A.2.a requires that "*the owner or operator of the proposed source or modification shall demonstrate to the division that allowable emission increases from the proposed source or modification in conjunction with all other emissions increases or reductions (including secondary emissions) will not cause or contribute to concentrations of air pollutants in the ambient air in violation of:*

VI.A.2.a - Any state or national ambient air quality standard in any baseline area or air quality control region

VI.A.2.b - Any applicable maximum allowable increase over the baseline concentration in any area (see section 5.4)

Regulation No. 3, Part B, §VI.D.I.b requires that "*the proposed source or modification will achieve an emissions rate which will ensure that the emissions of such pollutant from the source or modification will not significantly affect ambient air quality in the nonattainment area*." That is, the modeling that is required in §VI.A.2.a should be used to determine if the source would have a ***significant impact*** in any nonattainment area.

Major stationary sources and major modifications are subject to additional requirements. See section 3 and 5 for more details.

2.3.2 Minor Sources and Minor Modifications

Minor sources and minor modifications are not required by regulation to submit a compliance demonstration (i.e., modeling) along with their permit application. Nevertheless, applicants may elect to include modeling with the application to prevent unnecessary delays. If modeling is not submitted with the permit application, the Division will decide if modeling is warranted to complete the impact analysis and compliance demonstration required by Regulation No. 3. If modeling is warranted, the Division will perform a screening-level analysis if it is technically feasible to perform one. If the screening-level analysis shows there could be modeled violations of applicable standards, the Division will contact the applicant to discuss options. Since the Division does not usually perform refined-level modeling as part of the permitting process, the Division will typically request that the applicant perform any refined modeling that might be warranted. If modeling is warranted, refer to sections 3 and 4.

2.4 Modifications at Major Stationary Sources Within 10 Kilometers of Class I Areas

Modeling is usually necessary for minor modifications to major sources located within 10 kilometers of a Class I area so the Division can determine if the modification is major. The thresholds in Table 1 were not developed to address compliance with this regulatory requirement. Thus, modeling decisions related to Regulation No. 3, Part D, §II.A.44.c are made on a case-by-case basis. According to §II.A.44.c, any net emissions increase of a regulated pollutant at a major stationary source located within 10 kilometers (6.2 miles) of a federal Class I area should perform modeling to determine if the maximum 24-hour average impact in the Class I area exceeds 1.0 microgram per cubic meter ($\mu g/m^3$) on a 24-hour basis. If it does, the emissions increase is significant and the modification constitutes a major modification subject to PSD review.

The Class I significance level of 1.0 $\mu g/m^3$ on a 24-hour basis is only intended to determine if a modification is major. It should not be used to determine if the impact in a Class I area is significant. To determine if the impact is significant, refer to section 3.

2.5 Modeling Thresholds

The modeling thresholds in this section are applicable for sources located in nonattainment and attainment areas (see sections 2.1, 2.2, and 2.3). The thresholds were not developed to address situations such as those described in section 2.4.

The modeling thresholds were developed to identify new sources and modifications that would have relatively small impacts and do not warrant further analysis with respect to applicable air quality standards. The development of these thresholds is intended to assist the Division Staff, permit applicants, air quality consultants, and others decide when modeling is warranted to determine the impact from a source. This section introduces de minimis emissions, which have a low probability of causing or contributing to an exceedance of an air quality standard. By using this approach, permitting costs associated with the impact analysis required by Regulation No. 3 can be minimized.

Air quality modelers developed the modeling thresholds in Table 1 during a technical peer review of the Division's modeling practices. The Division performed dispersion modeling to help demonstrate that the

thresholds in Table 1 are appropriate.[10] Permit applicants and the Division should try to avoid situations where the decision to perform modeling takes longer than actually performing a screening-level modeling analysis (screening-level models can often be run quickly with minimal cost).

For a given pollutant, modeling is usually warranted if the long-term (tons per year) or short-term (pounds per hour, etc.) ***requested emission rate*** for a new source or the facility-wide net emissions increase for a modification is above the applicable emission threshold in Table 1. If the requested emission rate and/or the facility-wide net emissions increase is below both of the thresholds, modeling is usually not warranted unless one of the situations at the bottom of Table 1 applies. If there is doubt regarding the need for modeling, the applicant should consult with the Division.

[10] The Division's modeling study shows that the thresholds are appropriate in situations where a source has reasonably good dispersion characteristics. In situations where a source has poor dispersion characteristics or in areas with poor existing air quality, the thresholds might not be appropriate. In these situations, the Division will work with the source to determine an appropriate threshold.

Table 1. Modeling Thresholds. Modeling is usually warranted to quantify the impact if the emission rate is equal to or greater than these long-term (tons per year) and/or short-term (pound per hour, etc.) emission thresholds. If the emission rate is less, a qualitative description of the impact is adequate unless there is a situation that warrants modeling. (1)

Pollutant	Requested Emission Rate from a New Source or Facility-Wide Net Emissions Increase from a Modification
Carbon Monoxide (CO)	100 tons per year or 23 pounds per hour
Nitrogen Oxides (NO_x)	40 tons per year[11]
Sulfur Dioxide (SO_2)	40 tons per year or 27 pounds per 3-hours
Particulate Matter (PM10)	15 tons per year or 82 pounds per day
Lead (Pb)	0.6 tons per year or 100 pounds per month

(1) Modeling is usually warranted, even though the source or modification does not exceed the modeling thresholds in Table 1, if it is reasonable to believe the source will cause or contribute to a violation of applicable ambient air quality standards in circumstances such as:
- (a) Sources of SO_2, PM10, CO, or Pb where a substantial portion of the new or modified emissions have poor dispersion characteristics (e.g., rain caps, horizontal stacks, fugitive releases, [12] or ***building downwash***[13]) in close proximity to ***ambient air*** at the site boundary;
- (b) Sources of SO_2, PM10, CO, or Pb located in ***complex terrain*** (e.g., terrain above stack height in close proximity to the source);
- (c) Sources located in areas with poor existing air quality;
- (d) Modifications at existing major stationary sources, including grandfathered sources that have never been modeled before.

Table Updated April 3, 2010

[11] For new sources or modifications, including those with poor dispersion characteristics, that emit less than 40 tons per year (tpy) of NO_x, modeling is usually warranted only in the situations described in caveats (1)(c) and (1)(d), provided that most (e.g., >85%) of the NO_x is emitted as nitric oxide (NO). That is, because of near-field chemical transformation assumptions, NO_2 impacts from a 40 tpy NO_x source are usually expected to be below the NO_2 ambient air quality standard. Thus, modeling is only warranted in situations where existing NO_2 levels are high enough that the ***significant impact*** from the new source or modification might "contribute" to a modeled violation of the NO_2 air quality standard.

[12] For sources without stacks (e.g., fugitive releases from area or volume sources), modeling may be warranted at levels less than those in Table 1 if most of the emissions are from sources located less than 250-meters from the limit to public access. The 250-meter recommendation is based on a modeling study performed by the Division.

[13] For sources with emission rates below those in Table 1 where the stack height is less than the U.S. EPA's ***good engineering practice (GEP) stack height,*** modeling may be warranted; however, the presence of a non-GEP stack height does not mean that modeling is automatically warranted. The degree (e.g., severity) of the downwash effects, existing air quality levels, the distance to the boundary of ambient air, and any other relevant factors should be considered.

3 The Significant Impact Analysis for Ambient Air Quality Standards and PSD Increments

If a modeling analysis is warranted (see section 2), the Division usually recommends that a *significant impact analysis* be conducted to help determine the scope of the modeling analysis. According to ***40 CFR Part 51, Appendix W - Guideline on Air Quality Models***, the *significance* of a source's spatial or temporal contribution to a modeled violation should be considered when deciding if a source causes or contributes to a violation of ambient air quality standards.

The dispersion modeling analysis usually involves two distinct phases (USEPA 1990). The first phase is the significant impact analysis (SIA), which determines if the applicant can forego further air quality analysis for a particular pollutant with respect to Colorado and National Ambient Air Quality Standards and, for new major stationary sources and major modifications, Prevention of Significant Deterioration (PSD) increments. The second phase is the *air quality impact analysis* for the CAAQS, NAAQS, or applicable PSD increments; it is sometimes referred to as the *full impact analysis*[14] or the *cumulative impact analysis.*[15] The *air quality impact analysis* involves a more comprehensive assessment of air quality impacts. It is discussed in sections 4 and 5.

In the *significant impact analysis* for a given pollutant and averaging period, the highest estimated concentration at each ***receptor*** in ***ambient air*** is compared to the modeling significance levels in Table 2 and Table 3. Impacts from ***nearby*** and ***other background sources***, including background concentrations, are NOT considered in the SIA. If the estimated concentration levels are below the applicable modeling significance level, no further analysis is recommended. The source is considered to have an insignificant impact. For example, if impacts are below the significance levels in Table 3, a compliance demonstration for Colorado and National Ambient Air Quality Standards (CAAQS and NAAQS analysis) is not triggered. For ***major stationary sources*** subject to PSD rules, a Class I or Class II PSD increment analysis is not triggered if the impacts are below the significance levels in Table 2 and Table 3, respectively; however, other analysis requirements of the PSD rules must nevertheless be addressed (see section 5). If the impact exceeds the modeling significance levels, the source or modification has a significant impact in ambient air and the next phase of analysis is triggered, as discussed in sections 4 and 5.

The SIA also provides a convenient way to define the "probable area of influence" of a source's emissions (see Regulation No. 3, Part B, §III.B.5.d). In practice, it is sometimes useful to define the significant impact radius or area for the source or activity of interest.

If modeling shows that no violation of a standard (or, for major stationary sources, an applicable PSD increment) will occur within the significant impact area of a proposed source, as determined by a comparison with the applicable modeling significance levels, no *air quality impact analysis* is warranted. If a modeled violation is predicted within the significant impact area, but it is determined that the proposed source will not

[14] U.S. EPA sometimes uses the phrase "full impact analysis" to refer to the National Ambient Air Quality Standards (NAAQS) analysis and the Prevention of Significant Deterioration (PSD) increment analysis.

[15] Federal land managers sometimes use the phrase "cumulative impact analysis" to refer to the air quality related values (AQRV) analysis, visibility analysis, and other analyses.

exceed the applicable significant impact levels in Table 2 or Table 3 at the point (receptor) and time of the modeled violation, no further air quality impact analysis is warranted for the new source or modification, even when a new violation would result from its insignificant impact.

3.1.1 Modeling Significance Levels for Class I PSD Increments

For permitting purposes, the Class I PSD increment *modeling significance levels* in Table 2 are only used for major stationary sources subject to PSD rules. The Class I PSD increment significance levels are based on U.S. EPA proposals from 1996.[16] For minor sources and minor modifications, the Division does not consider compliance with PSD increments as a criterion in determining if a permit should be issued for a minor source or minor modification (see section 4).

The modeling significance levels in Table 2 are only intended for the Class I PSD increment analysis. They were not developed to determine if there would be significant impacts to air quality related values (AQRVs), including visibility.

Table 2. Modeling significance levels for Class I[a] PSD increments.

Pollutant	Averaging Period				
	Annual	24-hr	8-hr	3-hr	1-hr
Nitrogen Dioxide (NO_2)	0.1 μg/m^3	b	b	b	b
Sulfur Dioxide (SO_2)	0.1 μg/m^3	0.2 μg/m^3	b	1.0 μg/m^3	b
Particulate Matter <10 μm (PM10)	0.2 μg/m^3	0.3 μg/m^3	b	b	b

a Class I areas are shown in Figure 3; also see protected area for SO_2 in Figure 2.
b A modeling significance level has not been defined for this averaging period.

Table Updated May 20, 2011

[16] Federal Register: July 23, 1996 (Volume 61, Number 142), Proposed Rules, Page 38249-38344.

3.1.2 Modeling Significance Levels for CAAQS, NAAQS, and Class II PSD Increments

For minor and major stationary sources, the modeling significance levels in Table 3 are used to determine if a CAAQS and NAAQS analysis is triggered (see Figure 1). In addition, for proposed major stationary sources and major modifications, the modeling significance levels in Table 3 are used to determine if a Class II PSD increment analysis is triggered and if a proposed major stationary source located in an attainment area will have a significant impact in a nonattainment area (see section 2.3.1). The significance levels in Table 3 are listed in Regulation No. 3, Part D, §VI.D.2. For more about *Class I* and *Class II* areas, see the opening paragraphs of section 5.

Table 3. Modeling significance levels for CAAQS, NAAQS, and Class II[a] PSD increments.

	Averaging Period				
Pollutant	**Annual**	**24-hr**	**8-hr**	**3-hr**	**1-hr**
Carbon Monoxide (CO)	b	b	500μg/m^3	b	2,000μg/m^3
Nitrogen Dioxide (NO_2)	1 μg/m^3	b	b	b	b
Sulfur Dioxide (SO_2)	1 μg/m^3	5 μg/m^3	b	25 μg/m^3	b
Particulate Matter <10 μm (PM10)	1 μg/m^3	5 μg/m^3	b	b	b

a All areas of Colorado are designated as Class II except for the areas shown in Figure 3.
b A modeling significance level has not been defined for this averaging period.

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3.2 Emission Rates in the Significant Impact Analysis (SIA)

For a new source, the ***requested emission rate***, requested operating rate, or the maximum design rate (after controls) should be modeled in the ***significant impact*** analysis (SIA). If the requested emission or operating rate used in the modeling is less than the maximum design rate, it may become a permit condition. For modifications, the facility-wide net emissions increase for the modification should be modeled in the SIA.

Major stationary sources do not need to include emissions from the commercial, residential, and industrial growth analysis in the SIA. The growth analysis required by the PSD rules is only recommended if a CAAQS and NAAQS analysis, a PSD increment analysis, or a similar air quality impact analysis is triggered.

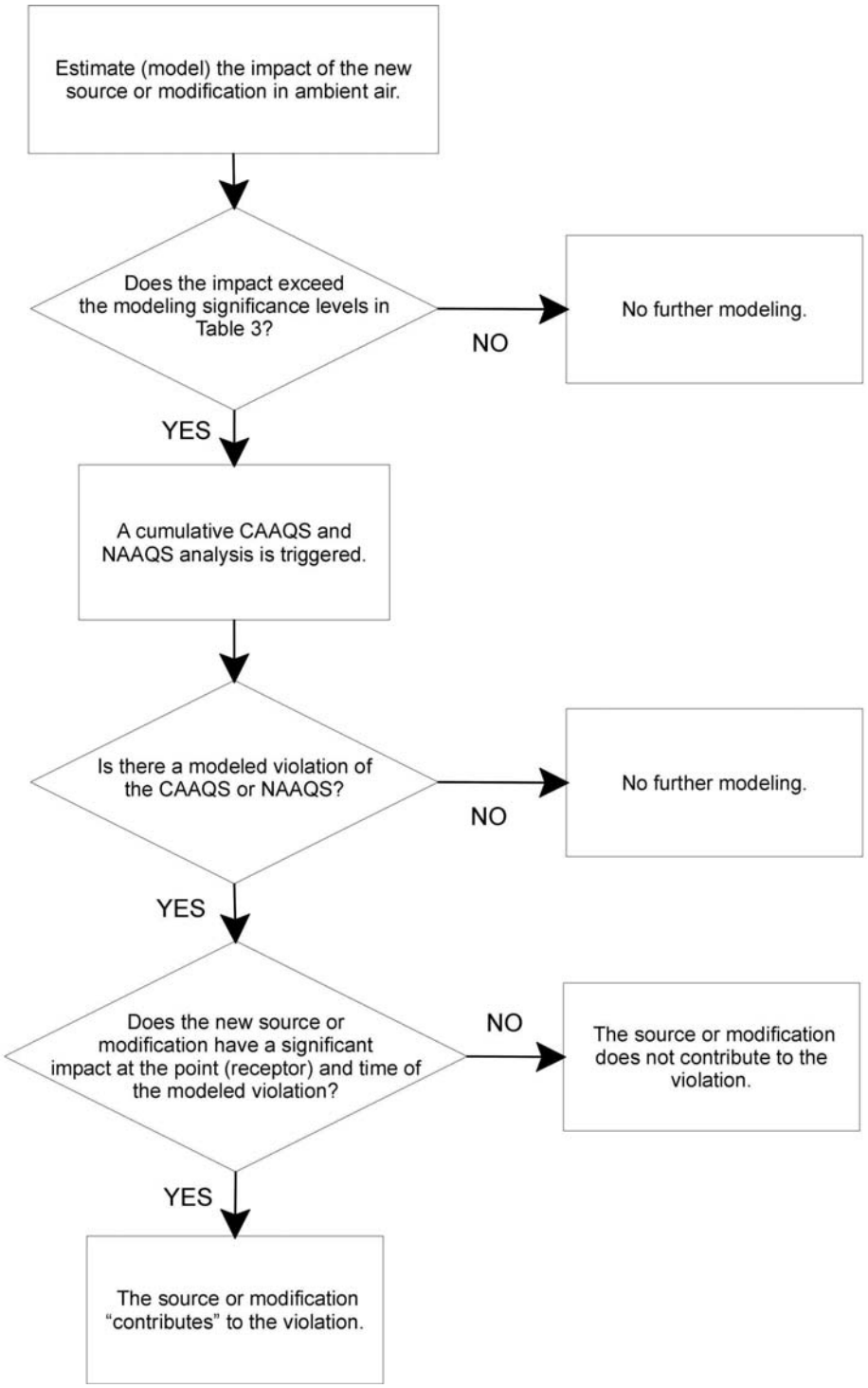

Figure 1. Flowchart of the significant impact analysis process for Colorado and National Ambient Air Quality Standards (CAAQS and NAAQS).

4 Air Quality Impact Analysis for New Minor Sources and Minor Modifications

The components of the *air quality impact analysis* vary depending on the applicable regulatory requirements. For ***minor sources*** and minor modifications, a compliance demonstration with Colorado Ambient Air Quality Standards (CAAQS) and National Ambient Air Quality Standards (NAAQS) is usually the only type of air quality analysis that is requested. Refer to Table 1 to determine if modeling is warranted.

Table 4 summarizes the typical types of air quality analysis that might be applicable. As a first step in the air quality analysis, the Division recommends a ***significant impact*** analysis (section 3) to determine if a full air quality analysis for the CAAQS and NAAQS is warranted. In attainment areas, all new sources and modifications with a significant impact in ***ambient air*** should perform a CAAQS and NAAQS analysis (see section 4.1). For nonattainment area requirements, see section 2.2.2.

Impact analysis requirements are stated in applicable regulations. Regulation No. 3, Part B, §III.D presents the general requirements for all construction permit applications, including minor sources.

For minor sources and minor modifications, a compliance demonstration with the Prevention of Significant Deterioration (PSD) increments is not required to obtain a construction permit. A preliminary opinion in June 1998 from the Colorado Attorney General's office suggests that rulemaking would be necessary before compliance with PSD increments could be a permit issuance criterion for minor sources and minor modifications. Therefore, increment consumption from minor source growth is assessed only during the modeling process for new sources and modifications subject to PSD rules and during periodic increment studies. Nevertheless, since all sources, including minor sources, can consume PSD increment in areas where the PSD minor source baseline date has been triggered, new minor sources and minor modifications are encouraged to voluntarily demonstrate compliance with applicable increments. For a more detailed discussion about PSD increments, refer to section 5.4.

Table 4. Typical types of ambient air quality impact analyses that might be applicable for new minor sources and minor modifications.

Area Classification	Types of Ambient Air Impact Analyses
Attainment, Unclassifiable	CAAQS and NAAQS Analysis (see section 4.1)
Nonattainment	CAAQS and NAAQS Analysis **Or** Reasonable Further Progress (RFP) Analysis (see section 2.2.2)

4.1 Colorado and National Ambient Air Quality Standards Analysis (CAAQS and NAAQS Analysis)

The federal Clean Air Act established two types of national air quality standards. Primary standards set limits to protect public health, including the health of sensitive populations such as people with asthma, children, and the elderly. Secondary standards set limits to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings. Colorado and National Ambient Air Standards (CAAQS and NAAQS) are listed in Table 5. Units of measure for the standards are parts per million (ppm) by volume, milligrams per cubic meter of air (mg/m^3), and micrograms per cubic meter of air ($\mu g/m^3$).

The ambient air quality standards in Table 5 are based on a reference temperature and pressure of 25 degrees Celsius and 760 millimeters of mercury (1,013.2 millibars or 1 atmosphere), respectively. Correction of modeled concentration estimates to reference conditions (i.e., standard temperature and pressure, STP) before comparison with ambient air quality standards is not required for air quality permit modeling in Colorado. If it is necessary to perform unit conversions, the following formula may be used:

$$\chi_{ppm} = \frac{\chi_{\mu g \cdot m^{-3}}}{(40.9 \times MW)}$$; MW = molecular weight of pollutant in $g \cdot mole^{-1}$, and χ is the concentration.[17]

As stated in section 3, a new source or modification can usually avoid a full compliance demonstration for ambient air standards if the impact from the proposed source or modification is not significant. If the impact is significant and a CAAQS and NAAQS modeling analysis is warranted, the modeling should account for the source under review plus existing air pollution levels at the locations (***receptors***) where the source has a ***significant impact***. This can be done in several ways. In general, the compliance demonstration for standards should include:

(i) the estimated (i.e., modeled) impact for the new source or modification (see section 4.1.3);

(ii) an estimate of existing air quality levels within the probably area of influence of the new source or modification; at a minimum, a monitored background concentration is used (see section 4.1.5). In some cases, additional sources should be explicitly included in the model, such as:

(1) existing sources at the facility under review (see section 4.1.4);

(2) existing ***nearby*** and ***other background*** sources (see section 4.1.4);

(3) proposed nearby sources (this includes those which have received PSD permits but are not yet in operation and others that have submitted *complete* PSD applications to a reviewing agency, but have not yet been issued permits; it may also include any large new ***minor sources*** that have received permits, but are not yet in operation).

For simple situations, the CAAQS and NAAQS analysis may be performed with a screening-level model. In some situations, the source configuration, ***complex terrain***, the presence of large nearby sources, and/or other factors may make it difficult or impossible to successfully apply a screening-level model. In

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[17] $$1\,\text{ppm}_v = \frac{1\,L_{pollutant}}{10^6\,L_{air}} = \frac{0.0409\,\text{moles}\cdot L^{-1} \times 1000\,L\cdot m^{-3} \times MW \times 10^6\,\mu g\cdot g^{-1}}{10^6\,L_{air}} = (40.9 \times MW)\mu g\cdot m^{-3}$$

where $n/V = P/RT = 0.0409\ \text{moles}\cdot L^{-1}$, where P =1 atm, T =298 K, R =0.08206 $L\cdot atm\cdot K^{-1}\cdot mole^{-1}$, L = liters,

such cases, a refined model should be used. If an analysis with a screening-level model fails to show compliance with standards or other applicable compliance goals, a refined model should be used. If results from the refined model fail to show compliance with applicable standards, various options to come into compliance can be considered, including, but not limited to:

- emission limits;
- operating schedule restrictions;
- physical changes at the facility to improve dispersion characteristics;
- the use of fences or physical barriers to preclude public access from contiguous land owned or controlled by the operator (i.e., standards and increments only apply in ***ambient air***);
- additional pollution control equipment;
- the use of more refined modeling techniques, including nonguideline models (e.g., non-EPA dispersion models, physical models, and monitoring-based methods); as noted in section 1, the use of a nonguideline model requires approval of the U.S. EPA.

Table 5. National Ambient Air Quality Standards (NAAQS), Colorado Ambient Air Quality Standards (CAAQS), and PSD significant monitoring concentrations. The actual form of each standard is listed first. The values in parentheses are approximations provided for convenience.

Pollutant	Avg. Period	Primary NAAQS	Secondary NAAQS	(Additional Standards) CAAQS	PSD Significant Monitoring Concentration[a]
Nitrogen Dioxide	Annual	0.053 ppm (100 μg/m^3)	0.053 ppm (100 μg/m^3)	100 μg/m^3	14 μg/m^3
Carbon Monoxide	1-hour	35 ppm (40,000 μg/m^3)	NA	40,000 μg/m^3	NA
Carbon Monoxide	8-hour	9 ppm (10,000 μg/m^3)	NA	10,000 μg/m^3	575 μg/m^3
Sulfur Dioxide	3-hour	NA	0.5 ppm (1,300 μg/m^3)	700 μg/m^3	NA
Sulfur Dioxide	24-hour	0.14 ppm (365 μg/m^3)	NA	NA	13 μg/m^3
Sulfur Dioxide	annual	0.030 ppm (80 μg/m^3)	NA	NA	NA
Ozone	1-hour	0.12 ppm (235 μg/m^3)	0.12 ppm (235 μg/m^3)	235 μg/m^3	100 tpy VOCs
Ozone	8-hour	0.08 ppm (157 μg/m^3)	0.08 ppm (157 μg/m^3)	NA	100 tpy VOCs
Particulate Matter <10μm (PM10)	24-hour	150 μg/m^3	150 μg/m^3	150 μg/m^3	10 μg/m^3
PM10	annual	50 μg/m^3	50 μg/m^3	50 μg/m^3	NA
PM2.5[b]	24-hour	65 μg/m^3	65 μg/m^3	NA	NA
PM2.5[b]	annual	15 μg/m^3	15 μg/m^3	NA	NA
Lead	quarterly	1.5 μg/m^3	1.5 μg/m^3	NA	0.1 μg/m^3
Lead	monthly	NA	NA	1.5 μg/m^3	NA
Fluorides	24-hour	NA	NA	NA	0.25 μg/m^3
Total Reduced Sulfur	1-hour	NA	NA	NA	10 μg/m^3
Hydrogen Sulfide	1-hour	NA	NA	NA	0.2 μg/m^3
Reduced Sulfur Compounds	1-hour	NA	NA	NA	10 μg/m^3

[a] The significant monitoring concentrations (de minimis levels) apply only to new sources and modifications subject to PSD review (see Regulation No. 3, Part D, §VI).

[b] At this time, modeling is not required for the PM2.5 standards in this table. They are included here for informational purposes. These standards have not yet been fully implemented for a variety of reasons.

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4.1.1 Modeling Recommendations for Individual Criteria Pollutants

While this section is intended for sources located in attainment or unclassified areas of Colorado, it may, in some cases, be used by sources located in nonattainment areas; however, sources in nonattainment areas should read section 2.2 first.

In a compliance demonstration, the applicable *design concentration* must be calculated. This is usually done within the model or by using a post-processor (see sections 6.2.1 and 6.2.2.).

4.1.1.1 Carbon Monoxide

Compliance demonstrations should address both the 1-hour and 8-hour NAAQS.

4.1.1.2 Lead

Compliance demonstrations should address Colorado's monthly Lead (Pb) standard of 1.5 $\mu g/m^3$. A satisfactory demonstration with the Colorado standard is sufficient to demonstrate compliance with the quarterly average NAAQS of 1.5 $\mu g/m^3$.

4.1.1.3 Nitrogen Dioxide

Compliance demonstrations with the annual NAAQS should initially be based on a 100 percent conversion of nitrogen oxides (NO_x) to nitrogen dioxide (NO_2). If compliance can't be shown, U.S. EPA approved methods such as the ozone limiting method (OLM) or the Ambient Ratio Method (ARM) may be used to determine how much NO_x exists as NO_2 in the atmosphere at a given ***receptor***. Other methods may be used as allowed under federal guidelines.

Colorado currently allows the national default ARM of 75 percent to be used in near-field modeling (source-to-receptor distances less than about 50 kilometers) for all areas of Colorado. The Division does not have specific recommendations for long-range transport modeling (e.g., source-to-receptor distances greater than about 50 kilometers); instead, proposed chemical mechanisms and/or assumptions should be justified on a case-by-case basis.

4.1.1.4 Ozone

In general, accurate and cost effective methods for modeling ozone impacts from stationary point sources are not available. Therefore, ozone modeling is not routinely requested for construction permits, although it could be in unusual cases such as situations where the Division believes ozone standards could realistically be violated by the proposed source or modification. If modeling is considered, the cost of conducting such an analysis will be factored into the decision process.

4.1.1.5 PM10

Compliance demonstrations should address both the 24-hour and annual NAAQS. The PM10 standard proposed in 1997 was not implemented. Thus, all compliance demonstrations should be consistent with the historic form of the PM10 standard (see section 6.2.2).

4.1.1.6 PM2.5

Until further notice, permit modeling is not recommended for the PM-2.5 NAAQS.

4.1.1.7 Sulfur Dioxide

Compliance should be demonstrated with the 3-hour, 24-hour, and annual NAAQS as well as with the Colorado 3-hour standard of 700 $\mu g/m^3$.

4.1.2 Impacts in Nearby States from Emissions Leaving Colorado

The Common Provisions Regulation, §II.A states that if emissions generated from sources in Colorado cross the state line, such emissions shall not cause the air quality standards of the receiving state to be exceeded, provided reciprocal action is taken by the receiving state. The Division is not aware of any formal written agreements regarding reciprocal action. Nevertheless, if the impact from a new or modified source will have a significant impact in another state as defined in section 3, or if it will likely affect another state, the Division recommends contacting the appropriate agency in the affected state to determine if there are any applicable state standards. If so, consult with the Division to determine what if any analysis is recommended.

The Division may recommend that additional analysis be performed to show compliance with applicable standards of that state. If modeling appears to be warranted, staff from the Division and the affected state should discuss the situation to determine an acceptable modeling approach.

4.1.3 CAAQS and NAAQS Emission Inventory for the PROPOSED Source or Modification

This section only applies to the proposed new source or modification. It does not apply to existing emissions. For emissions from existing stationary sources, use the procedures in section 4.1.4.

The emissions estimates used in modeling should be consistent with U.S. EPA recommendations in Table 8.2 of the *USEPA Guideline on Air Quality Models* and other applicable U.S. EPA guidance. Refer to U.S. EPA guidance if the model is to be used to establish emission limits for a source. In general, this means that, for the CAAQS and NAAQS analysis, the design capacity or federally enforceable emission limit (e.g., the allowable emission rate) should be modeled for the source under review.

According to the *EPA Modeling Guideline*, "*for point source applications, the load or operating condition that causes maximum ground-level concentrations should be established. At a minimum, the source should be modeled using the design capacity (100 percent load)….*" Various operating loads for the new source or modification should be modeled when appropriate (e.g., 50%, 75%, 100%). In addition, typical operating scenarios at the facility should be modeled if appropriate. For example, if a facility wants a permit that allows operation of either flares or engines, but not both at one time, both the flare scenario and the engine scenario should be modeled.

Permit conditions may be proposed based on the information used in the modeling. For example, if the operating level is limited or if the modeling uses a restricted operating schedule (i.e., less than 24 hours per day), the operating conditions may become permit conditions, if appropriate to protect standards.

4.1.4 CAAQS and NAAQS Emission Inventory for EXISTING Nearby and Other Background Sources (Cumulative Analyses)

The recommendations in this section only apply to existing sources. The emissions could be from existing sources at the facility under review or from completely separate facilities. For the new source or modification under review, use the inventory procedures in section 4.1.3.

In this document, the terms ***nearby sources*** and ***other background sources*** can be used to refer to existing sources at the facility under review and to existing off-site sources. That is, the terms include all stationary sources except the new source or modification under permit review. Air quality impacts from nearby and other background sources should be considered in the CAAQS and NAAQS analysis.

In particular, U.S. EPA recommends that, at a minimum, all nearby sources should be explicitly modeled as part of the NAAQS analysis. *Other background sources* usually are accounted for by using an appropriate ambient *background concentration* (i.e., see §9.2.2 of the *USEPA Guideline on Air*

Quality Models) or, if a suitable ambient background concentration is not available, by application of a model.

The emissions estimates used in modeling nearby and other background sources should be consistent with U.S. EPA recommendations in Table 8.2 of the *USEPA Guideline on Air Quality Models* and other applicable U.S. EPA guidance. Table 8.2 recommends that actual or design capacity operating levels, whichever is greater, or federally enforceable permit limits should be used for all nearby sources. That is, allowable emission rates should be used. A nearby source is any major source, major stationary source, or minor source that causes a significant concentration gradient in the vicinity of a new or modified source. In most cases, it is acceptable to consider sources with emission rates greater than 100 tons per year as candidates for the nearby source inventory. The threshold is 0.6 tons per year for lead. Sources with lower emission rates should be considered if they are within about 5 kilometers of the source. Nevertheless, this is not a bright line; in some cases, the 5-kilometer distance should be expanded. Professional judgment should be used when selecting sources to model.

The Division can usually provide a background concentration upon request to account for other background sources, including mobile sources and transport from distant sources. Determination of the nearby sources accounted for by the background concentration can be rather subjective. Consequently, the modeler should review the location and the collection date of the background data with respect to nearby sources to determine how it should be incorporated into the overall modeling procedure.

4.1.4.1 How to Obtain a Stationary Source Emissions Retrieval

The Division will provide a stationary source emission inventory data retrieval in printed or electronic format upon request. Refer to the Inventory and Support Unit's Internet page for more information: http://www.cdphe.state.co.us/ap/i-n-s.html

4.1.4.2 Selection of Nearby and Other Background Sources for the CAAQS and NAAQS Analysis

The Division does not recommend a specific objective procedure for determining which sources should be classified as ***nearby sources*** and which should be classified as ***other background sources***. The procedure used to select nearby sources should be based on professional judgment. In addition, it should consider local conditions such as topography, meteorology, dispersion characteristics, availability of ambient monitoring data, existing air quality, and other relevant factors. The procedure should include an examination of the modeling results to ensure that all sources that should have been included were included. The following approach is generally acceptable. For new ***minor sources*** and minor modifications (not subject to PSD rules) with relatively low stack heights, obtain from the Division an emissions inventory of stationary sources within 5 kilometers of the significant impact area for the new source or modification under review. Select appropriate sources from this inventory to include in the modeling analysis. The use of a 5-kilometer radius is based in part on the assumption that minor sources tend to have ***significant impact*** areas less than 5 kilometers in radius. Use professional judgment to decide if five kilometers if adequate.

4.1.4.3 Inventory Data Processing

Once the data retrieval is obtained from the Division, it must be processed into a model-ready format. In some cases, a model-ready inventory may already exist. If so, the Division will provide it to the applicant upon request. If one does not exist, it is usually the responsibility of the applicant to process the inventory data retrieval into a model-ready format.

The Division's Modeling, Meteorology, and Emission Inventory Unit will, upon request, process the inventory data retrieval into a model-ready inventory if the facility-wide emission rate is less than the thresholds in Table 1. If the facility-wide emission rate is greater than the thresholds in Table 1, the inventory processing tasks are usually considered the responsibility of the applicant.

4.1.5 Background Concentrations for CAAQS and NAAQS Analyses

In general, the background concentration is intended to account for sources not explicitly included in the modeling. According to the U.S. EPA Modeling Guideline – section 8.2 – "*background concentrations are an essential part of the total air quality concentration to be considered in determining source impacts. Background air quality includes pollutant concentrations due to: (1) natural sources; (2) nearby sources other than the ones currently under consideration; and (3) unidentified sources. Typically, air quality data should be used to establish background concentrations in the vicinity(s) of the sources under consideration. The monitoring network used for background concentrations should conform to the same quality assurance and other requirements as those networks established for PSD purposes. An appropriate data validation procedure should be applied to the data prior to use. If the source is not isolated, it may be necessary to use a multi-source model to establish the impact of nearby sources. Background concentrations should be determined for each critical (concentration) averaging time*." In section 8.2.2, U.S. EPA states that the background concentration should be appropriate for the "*averaging time of concern*."

For annual standards, the recommended background is typically based on the annual average value. For shorter-term standards, selection of a background concentration can be more challenging. In general, the background concentration should be one that can reasonably be assumed to occur with the modeled concentration.

Determination of a background that can "reasonably be assumed to occur" is sometimes difficult. Using the average *second-high* monitored value for a short-term standard is the obvious place to start for a conservative[18] modeling demonstration, and this is what the Division recommends; but this is not a requirement. If a background based on second-high values is believed to be too high, technical analysis is allowed to show that the second-high value, for example, could not reasonably be assumed to occur at the same time/place as the modeled design value.

In general, the niche being filled by the background concentration should be defined before a value is selected. Since the background concentration field is usually assumed to be spatially uniform, the background should account for elevated concentration levels that are expected to occur in the ***receptor*** grid from non-modeled sources. Alternatively, a variable background field could be used if there is sufficient data to generate one.

For purposes of addressing short-term standards, the total predicted concentration distribution should represent combinations of impact and background that can reasonably be expected to occur simultaneously in the particular application. The Division recognizes that the chance of two independently caused short-term concentration maxima occurring simultaneously at any particular location may be low.

[18] In this document, a "conservative" estimate is one that overestimates a value.

5 Air Quality Impact Analysis for New Major Stationary Sources and Major Modifications

The components of the major stationary source or major modification *air quality impact analysis* vary depending on the applicable regulatory requirements. This section discusses various aspects of the overall air quality impact analysis. In some cases, guidance is provided about the Division's expectations for the analysis. In other cases, this guidance only provides references to applicable regulations. Permit applicants are encouraged to contact the Division as early as possible to discuss permitting requirements. As discussed in sections 5.2 and 6.1, the Division encourages applicants to submit modeling protocols.

All areas of Colorado are classified as Class II with the exception of the twelve federal Class I areas, which are shown in Figure 4 on page 32. Class I areas have the greatest protection from air quality deterioration; Class III areas have the least protection; however, there are no Class III areas in Colorado. In addition to demonstrating compliance with ambient air quality standards (section 4.1), major stationary source permit applicants must demonstrate that they will not cause or contribute to violations of Prevention of Significant Deterioration (PSD) increments (section 5.4). ***Major stationary sources*** located within nonattainment areas are subject to additional requirements (section 2.2.1).

Table 6 summarizes the typical types of air quality analysis that might be applicable. As a first step in the air quality analysis, the Division recommends a ***significant impact*** analysis (section 3) to determine if a full air quality analysis for the CAAQS, NAAQS, and PSD increments is warranted. The significant impact analysis must be performed if there is a possibility the proposed source will impact a nonattainment area (section 2.3.1).

Major stationary sources are required by regulation to submit an *additional impact analysis* to address potential impairment to soils, vegetation, water, visibility, and growth, if applicable; it applies in all areas, including Class I and Class II areas (see section 5.6). In addition, regulations require that applicants submit an analysis of impairment to Air Quality Related Values (AQRVs), including visibility, in affected Class I areas (see section 5.5).

PSD applicants should also consult with the Division to determine if there will be any pre-construction ambient monitoring requirements (see section 5.2). Refer to Regulation No. 3, Part D, §VI and section 5.2 to understand how the Division decides if pre- or post-construction monitoring is required.

There are other regulatory requirements in addition to those required by PSD rules. For example, Regulation No. 3, Part B, §III.D.1 subparts *a* through *g* list general requirements for obtaining a permit. While subpart *e* applies to major PSD sources, subparts *c* and *d* provide requirements that are more general. Thus, the PSD modeling requirements of subpart *e* are only one of many requirements that may be applicable.

Regulation No. 3, Part D, §VI.B states, "*the [PSD] requirements of section VI.A do not apply to a major stationary source or major modification with respect to a particular pollutant if the owner or operator demonstrates that…the emissions from the source or modification would not be significant.*" Thus, the impact analysis and monitoring requirements of the PSD rules are not applicable for a given pollutant if the emission rate is not significant, as defined in Regulation No. 3, Part D, §II.A.44. In situations where the requirements of §VI are waived, modeling for compliance with ambient air standards may nevertheless be warranted under the requirements of Regulation No., 3, Part B, §III (see section 2).

Table 6. Types of ambient air quality impact for new major stationary sources and major modifications.

Area Classification	Primary Types of Ambient Air Impact Analyses
Attainment, Unclassifiable	CAAQS and NAAQS Analysis (section 4.1)
	PSD Increment Analysis (section 5.4)
	Additional Impact Analysis in any area (section 5.6) (Visibility, Water, Soils, Vegetation, and Growth)
	Air Quality Related Value (AQRV), Including Visibility, Analysis in Class I Areas (section 5.5)
	Pre- and Post-Construction Monitoring Analysis (section 5.2)
Nonattainment	CAAQS and NAAQS Analysis **Or** reasonable further progress analysis (section 2.2)
	Net Air Quality Benefit Analysis (section 2.2)
	AQRV and Visibility Analysis in Class I Areas (section 5.5.1)

5.1 Colorado and National Ambient Air Quality Standards Analysis (CAAQS and NAAQS Analysis)

Modeling recommendations for the Colorado Ambient Air Quality Standards (CAAQS) and National Ambient Air Quality Standards (NAAQS) are the same as those described in section 4.1 except that the following additional guidance applies to ***major stationary sources*** and major modifications:

1. Section 4.1.4.1 on page 23 includes specific recommendations for the ***nearby*** and ***other background sources*** NAAQS emissions inventory. For new major stationary sources and major modifications (e.g., sources subject to PSD rules) obtain from the Division an emission inventory of stationary sources within 50 kilometers of the significant impact area of the new source or modification under review. Identify nearby sources to explicitly model. Select additional background sources as appropriate to account for impacts not reflected in the background concentration. Sources beyond 50 kilometers should be considered if long-range transport modeling is being performed for a federal Class I area.
2. In addition to items (i) and (ii) in section 4.1 regarding compliance demonstration for standards, major stationary sources subject to PSD rules must also consider a third item:

   (iii) If appropriate, the analysis must include estimated impacts from growth in residential, commercial, and industrial sources associated with, but not part of, the proposed source. See U.S. EPA guidance for more detailed recommendations (USEPA 1990).

5.2 Pre- and Post-Construction Monitoring Analysis

Division modeling and monitoring staff should be contacted as early as possible to discuss the need to conduct pre-construction monitoring. If monitoring is proposed or required, a monitoring plan consistent with applicable U.S. EPA and Division monitoring guidance (e.g., “Ambient Air Monitoring Requirements

for the Air Pollution Control Division of the Colorado Department of Health") should be submitted for approval.

If the proposed emission rate from a new source or the net emissions increase from a modification is significant for a given pollutant, as defined by Regulation No. 3, the estimated impact from the new source or modification should be compared to the significant monitoring concentration (see Table 5 or Regulation No. 3, Part D, §VI.D.2). In addition, if possible, existing air quality levels should be compared to the significant monitoring concentration.

5.2.1 Pre-Construction Monitoring Analysis

Refer to Regulation No. 3, Part D, §VI.A.3 for details about how pre-construction monitoring requirements are determined.

If existing air quality levels or the estimated impacts from the proposed source or modification are below the applicable monitoring de minimis level, Regulation No. 3 states that the monitoring requirements may not apply. If the levels are above the de minimis levels, pre-construction monitoring may be required if the Division believes it is necessary.

Permit applicants should be aware that the time-line for submitting a PSD application could be affected by the requirement to collect ambient data. For example, if the collection of site-specific meteorological data is required, at least a full year of data must be collected. For air quality data, at least a full year of data is typically required, although as little as four months of data may be allowed in some circumstances. The Division must approve ambient data for use before the permit application can be ruled *complete*.

5.2.2 Post-Construction Monitoring Analysis

The modeling report submitted with the permit application should address the need for post-construction monitoring (see Regulation No. 3, Part D, §VI.A.4).[19] As part of the permit review process, the Division will, based on the language in the regulation, determine if post-construction monitoring is necessary.

5.3 Regulated, Non-Criteria Pollutant Analysis

For regulated, non-criteria pollutants (i.e., fluorides, total reduced sulfur, hydrogen sulfide, and reduced sulfur compounds), a separate air quality analysis should be submitted if the applicant proposes to emit the pollutant in a significant amount from a new source or proposes to cause a significant net emissions increase from a modification. The PSD significant emission rates for these pollutants are as follows:

- fluorides, 3 tons per year;
- sulfuric acid mist, 7 tons per year;
- hydrogen sulfide, 10 tons per year;
- total reduced sulfur (including hydrogen sulfide: 10 tons per year);
- reduced sulfur compounds (including hydrogen sulfide: 10 tons per year);
- see Regulation No. 3, Part A, Definition 58 for significant emission rates of organics, metals, and acid gases from municipal waste combustors.

Estimated impacts from regulated non-criteria pollutants should be presented and compared to the significant monitoring concentrations (see Table 5 or Regulation No. 3, Part D, §VI.B.3). Existing background concentration estimates should be determined in consultation with the Division. If ambient

[19] 40 CFR Part 51.166(v)(2) states that the source "shall...conduct ambient air monitoring as the reviewing authority determines is necessary...." In addition, the NSR Workshop Manual (USEPA 1990) suggests that post-construction monitoring "be done when there is a valid reason, such as (1) when the NAAQS are threatened, and (2) when there are uncertainties in the data bases for modeling."

measurements are available, they should be presented and compared to the significant monitoring concentrations.

5.4 PSD Increment Analysis

The air quality analysis for new/modified sources subject to Prevention of Significant Deterioration (PSD) rules must demonstrate compliance with PSD increments if the impact from the new source or modification is significant. This section is not intended to provide a complete overview of PSD increment consumption; for that, refer to EPA guidance documents (e.g., USEPA 1990).

Refer to section 6.2 for more information about the design value that should be used to determine compliance with applicable PSD increments. Increment consumption is a receptor-by-receptor concept. That is, the consumption of PSD increment by one particular source does not necessarily preclude similar increment consumption by another ***nearby source*** if the consumption occurs on a different day (i.e., under different meteorological conditions) and/or at a different location (e.g., ***receptor***).

All changes in emissions and related parameters[20] after the minor source baseline date may affect PSD increment consumption or expansion.[21] This includes both stationary sources and mobile sources. In addition, modifications at ***major stationary sources*** after the major source baseline date also may affect increment consumption. Refer to U.S. EPA guidance (e.g., USEPA 1990; USEPA 1993a) and Division guidance[22] for procedures.

Table 7. Prevention of Significant Deterioration (PSD) increments ($\mu g/m^3$)

Table Updated May 20, 2011

Pollutant	Period	Class I	Class II	Class III
Nitrogen Dioxide (NO_2)	Annual	2.5	25	50
Sulfur Dioxide (SO_2)	3-hr	25	512	700
	24-hr	5	91	182
	Annual	2	20	40
Particulate Matter < 10µm (PM10)	24-hr	8	30	60
	Annual	4	17	34

All areas of Colorado are Class II areas except for the Class I areas shown in Figure 3. PSD baseline areas for PM10 are based on the Colorado Air Quality Control Regions (AQCRs) shown in Figure 1. It is worth noting that there are both Colorado AQCRs (planning areas) and federal AQCRs. They are comprised of different counties. While the Colorado AQCRs are used as PSD baseline areas for PM10, the federal

[20] "The creditable increase of an existing stack height or the application of any other creditable dispersion technique may effect increment consumption or expansion in the same manner as an actual emissions increase or decrease. That is, the effects that a change in the effective stack height would have on ground level pollutant concentrations generally should be factored into the increment analysis." (USEPA, 1990)

[21] A PSD increment is the maximum allowable increase in concentration that is allowed to occur above a baseline concentration for a pollutant. The baseline concentration is defined for each pollutant and, in general, is the ambient concentration existing at the time of the first complete PSD permit application affecting the area (USEPA, 1990).

[22] Refer to the *Technical Guidance Series: PSD Increment Tracking System* document for a detailed discussion about the PSD increment tracking in Colorado.

AQCRs are used in U.S. EPA's Air Quality System (AQS). The entire state serves as the baseline area for SO_2 and NO_2. The table and map on page 30 show the minor source baseline areas and trigger dates in Colorado.

5.4.1 75% Increment Consumption Restriction for Major Sources

As required by Regulation No. 3, Part D, §X.A.5.a, new sources and modifications subject to PSD rules should demonstrate that the source by itself will not consume more than 75% of any applicable PSD increment. The 75% rule does not apply to ***minor sources***.

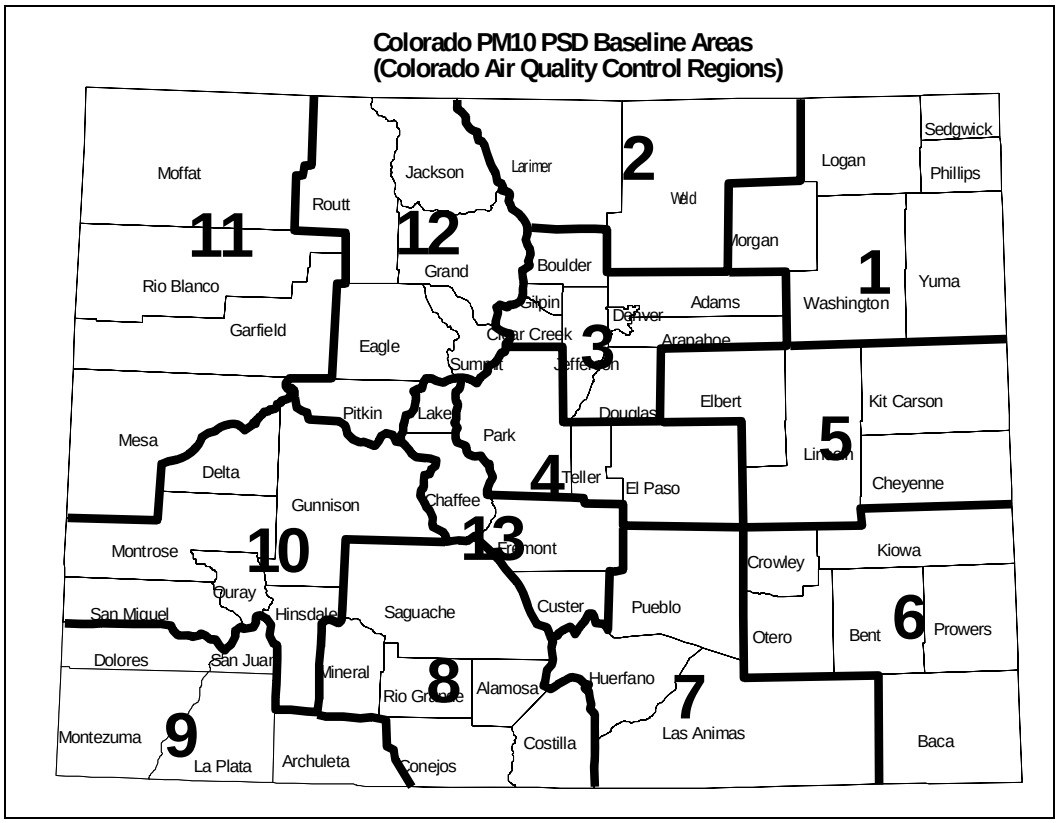

Figure 2. Colorado PSD baseline areas for PM10. The entire state serves as the baseline area for SO_2 and NO_2.

Table 8. PSD baseline dates in Colorado as of January 3, 2001.[a]

Pollutant	Major Source Baseline Date	Minor Source Baseline Date	Baseline Area
Nitrogen Dioxide (NO_2)	February 8, 1988	March 30, 1989	Entire State
Sulfur Dioxide (SO_2)	January 6, 1975	October 12, 1977	Entire State
Particulate Matter	January 6, 1975	November 1, 1988	AQCR 1
Particulate Matter	January 6, 1975	November 17, 1980	AQCR 2
Particulate Matter	January 6, 1975	November 14, 2000	AQCR 3
Particulate Matter	January 6, 1975	November 1994	AQCR 4
Particulate Matter	January 6, 1975	November 9, 2000	AQCR 5
Particulate Matter	January 6, 1975	June 19, 1989	AQCR 6
Particulate Matter	January 6, 1975	April 1994	AQCR 7
Particulate Matter	January 6, 1975	Not Triggered[a]	AQCR 8
Particulate Matter	January 6, 1975	Not Triggered[a]	AQCR 9
Particulate Matter	January 6, 1975	August 20, 1984	AQCR 10
Particulate Matter	January 6, 1975	October 12, 1977	AQCR 11
Particulate Matter	January 6, 1975	July 1983	AQCR 12
Particulate Matter	January 6, 1975	Not Triggered[a]	AQCR 13

a Contact the Division's Stationary Sources Program for the latest information.

Table Updated May 20, 2011

5.4.2 Class II Areas with Class I Protection for Sulfur Dioxide Increments

For SO_2 PSD increments, certain Class II areas (Figure 3) have the same protection as Class I areas. Refer to Regulation No. 3, Part D, §VIII.B for more information. Modeling is recommended for SO_2 sources that could impact these areas, based on boundaries that existed on August 7, 1977:

a) Florissant Fossil Beds National Monument;
b) Colorado National Monument;
c) Dinosaur National Monument;
d) Black Canyon of the Gunnison National Park (areas that are not already Class I);
e) Great Sand Dunes National Park and Preserve (areas that are not already Class I);
f) Uncompahgre Mountain Primitive Area;
g) Wilson Mountain Primitive Area;
h) BLM lands in the Gunnison Gorge Recreation Area.

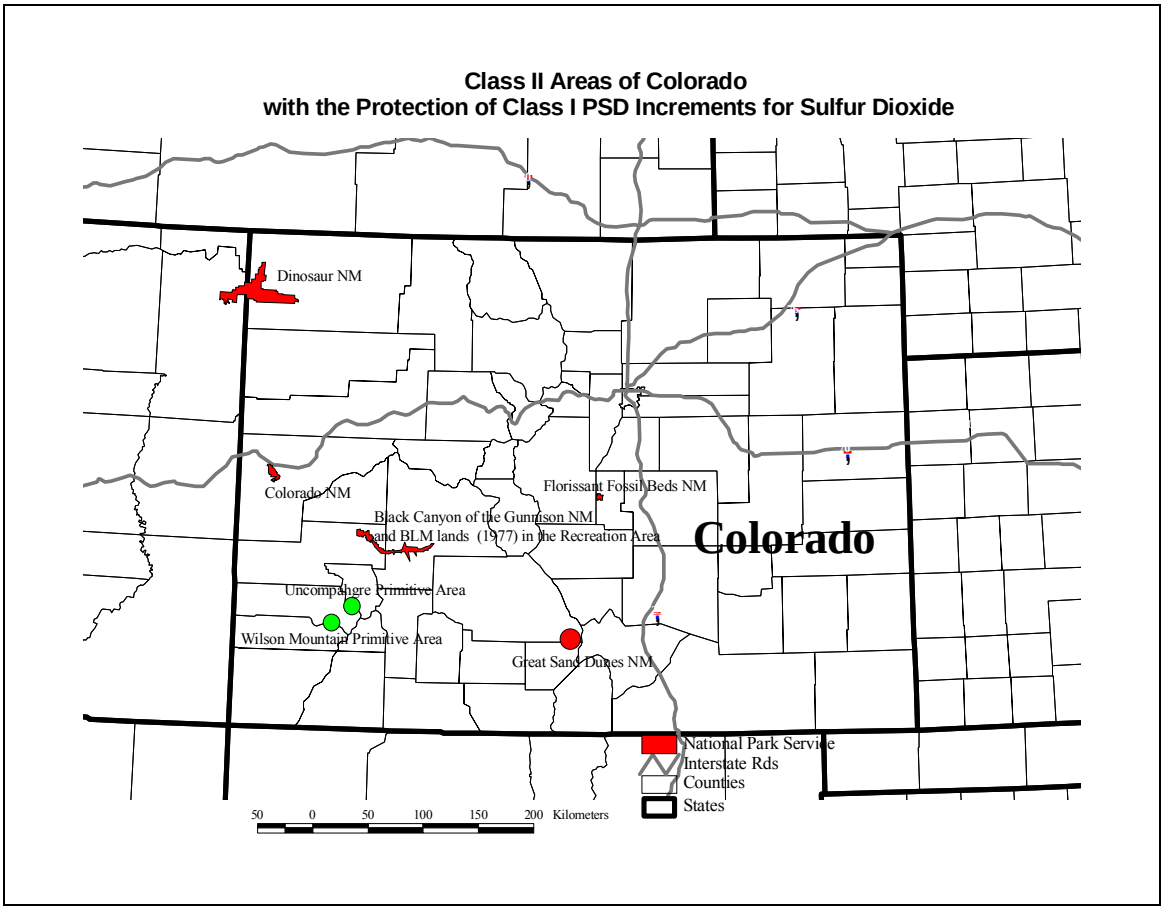

Figure 3. Class II areas with "Class I protection" for SO_2 increments.

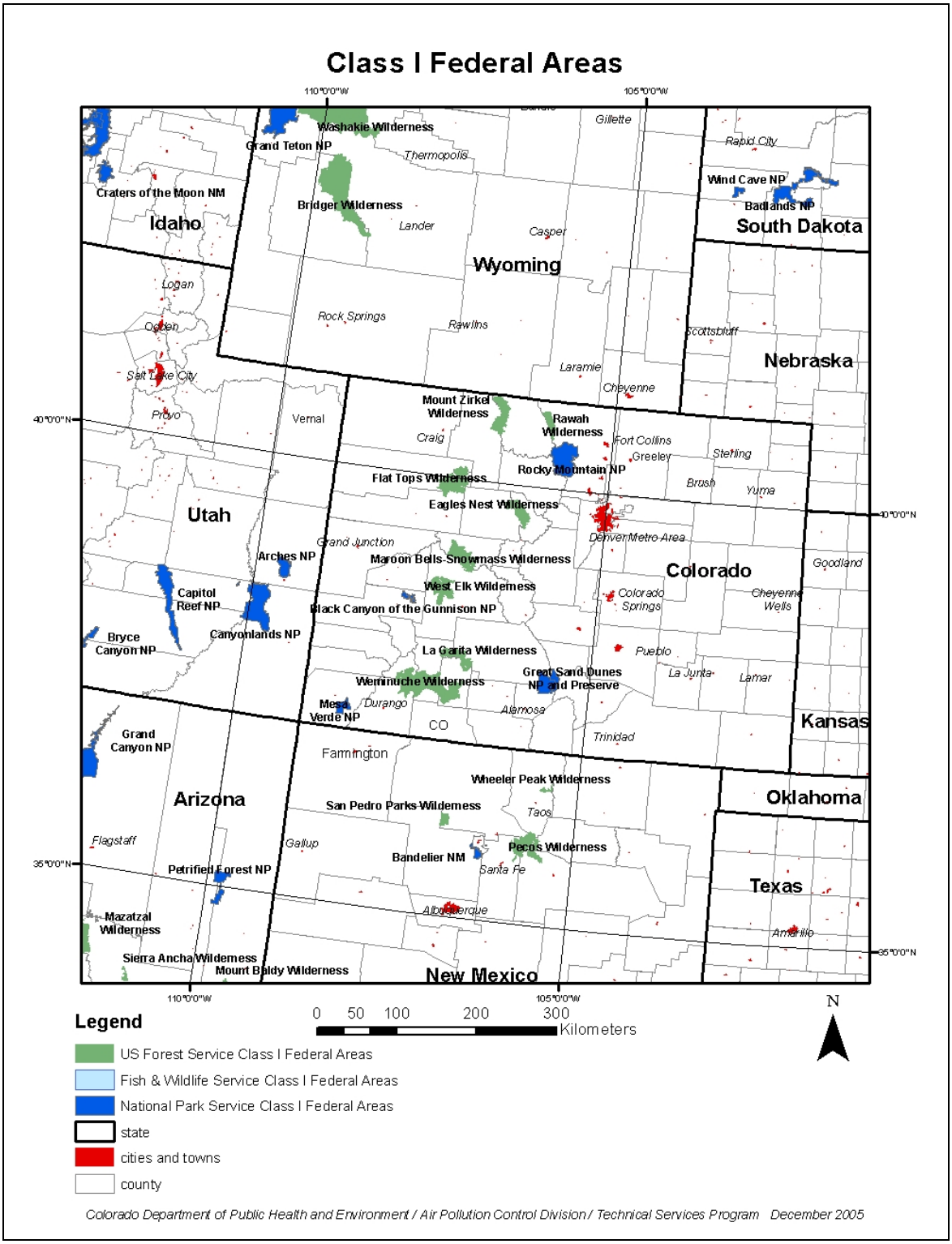

Figure 4. Class I federal areas.

5.4.3 PSD Increment Emissions Inventory for the PROPOSED Source

This section only applies to the proposed new source or modification. It does not apply to existing emissions. For emissions from existing stationary sources, use the procedures in section 5.4.4.

The emissions estimates used in modeling should be consistent with U.S. EPA recommendations in Table 8.2 of the *USEPA Guideline on Air Quality Models* and other applicable U.S. EPA guidance. In general, the design capacity or federally enforceable emission limit (e.g., the allowable emission rate) should be modeled for the source under review. All emissions from a proposed major stationary source or major modification are increment consuming for those pollutants emitted in a significant quantity. Non-significant emissions may or may not be increment consuming, depending on the situation.

The main difference between the NAAQS and PSD increment inventory is in the way ***nearby*** and ***other background sources*** are treated. Refer to section 5.4.4 for more.

5.4.4 PSD Increment Emissions Inventory for EXISTING Nearby and Other Background Sources

The recommendations in this section only apply to existing sources. The emissions could be from existing sources at the facility under review or from completely separate facilities. For the new source or modification under review, use the inventory procedures in section 5.4.3.

The terms ***nearby sources*** and ***other background sources*** can be used to refer to existing sources at the facility under review and to existing off-site sources. That is, the terms include all stationary sources except the new source or modification under permit review. Air quality impacts from nearby and other background sources should be considered in the PSD increment inventory.

The main difference between the NAAQS and PSD increment inventory is that the PSD increment inventory uses *actual* emissions for all sources except for the new source or modification under permit review (One exception, of course, would be for recently permitting PSD sources that are not yet operating.) In addition, not all NAAQS sources are increment consuming. In fact, the number of increment consuming sources will depend on the how much growth has occurred since the applicable major and minor source baseline dates.

Like the NAAQS inventory, the methods to estimate emissions for the PSD increment inventory should be consistent with the Table 8.2 of the *EPA Modeling Guideline* and other applicable U.S. EPA guidance.

For more information on inventory development, refer to the Colorado Technical Guidance Series document "*PSD Increment Tracking System*." It provides additional discussion, for example, regarding increment expansion from retired or shutdown sources. In general, the amount of PSD increment that has been consumed or expanded in a PSD baseline area is determined from the emissions increases and decreases that have occurred since the applicable baseline dates. The focus of increment consumption/expansion modeling is to calculate the concentration *change* attributable to increment consuming or expanding emissions. Emissions increases that consume a portion of the applicable increment are, in general, all those emissions NOT accounted for in the baseline concentration and specifically include:

- *actual emissions increases* occurring after the major source baseline date, which are associated with physical changes or changes in the method of operation (i.e., construction) at a major stationary source.
- *actual emissions increases* at ANY stationary source, area source, or mobile source occurring after the minor source baseline date.

U.S. EPA recommends that, at a minimum, all nearby sources should be explicitly modeled as part of the PSD increment analysis. In most cases, it is recommended that other background sources be explicitly included in the model. If the Division has performed a periodic increment study near the

source under review, an increment inventory may be readily available. Otherwise, on a case-by-case basis, consult with the Division to determine the scope of the PSD inventory analysis.

5.4.4.1 Selection of Nearby and Other Background Sources

Area and mobile sources may be important increment consuming sources. If a mobile and area source NO_x increment analysis is necessary, refer to the general procedures in applicable U.S. EPA guidance (USEPA 1993a). In most situations, the Division can provide at least a county-level inventory of increment consuming area and mobile emissions; however, because of the amount of time required by the Division to develop such inventories, the Division will typically not develop increment inventories for an individual permit application until the permit applicant and the Division agree that an area and mobile source inventory is actually warranted. If the Division does not have the resources necessary to develop the inventory in the time frame needed by the applicant, the burden of doing the area and mobile analysis may fall on the applicant.

The procedure used to select sources for the PSD increment inventory should use professional judgment and be determined on a case-by-case basis after considering local conditions such as topography, meteorology, dispersion characteristics, availability of ambient monitoring data, existing air quality levels, and other relevant factors. The procedure should include an examination of the modeling results to ensure that all sources that should have been included were included.

For new sources and modifications subject to PSD rules, obtain from the Division an emission inventory of stationary sources within 50 kilometers of the significant impact area of the new source or modification under review. Identify nearby sources to explicitly model. Select additional background sources as appropriate so that the overall estimates in the modeling system reasonably account for increment consumption. Sources beyond 50 kilometers should be considered if a long-range transport increment analysis is being performed for a federal Class I area.

5.4.5 Background Concentrations for PSD Increment Analyses

The Division does not typically recommend the use of a background concentration to account for increment consumption. Nevertheless, there may be situations where a statistical analysis or review of trends in ambient air quality data would be useful to quantify local or regional changes in air quality since the minor source baseline date.

5.5 AQRV and Visibility Analysis in Federal Class I Areas

The ***Air Quality Related Values*** (AQRV),[23] including visibility, analysis is required as part of a PSD permit to estimate potential changes in visibility, deposition, soils and water in Class I areas. The goal of the Class I impact analysis is to determine if the projected changes to AQRVs, as a result of the installation of a new source or the modification of an existing source under the PSD regulations, are acceptable for a given Class I area (See Regulation No. 3, Part D, §XIII and XIV for regulatory requirements). The decision to issue a permit is the responsibility of the Division (See section 8.1). A permit application can be denied if a proposed source would impair visibility or other AQRVs in a Class I area. It is important to note that the determination of impairment is done on a case-by-case basis. In the case of visibility, this determination will be made based on the magnitude, number of occurrences, time of year and if such changes would affect a visitor's experience in the area. For more on the regulatory framework, refer to applicable regulations and section 8.1.

In general, the elements of the federal Class I AQRV, including visibility, analysis are determined on a case-by-case basis.

Regulation No. 3, Part D, §XIII.A – Federal Class I Areas – states that "*Within twenty days of receipt of a permit application for a new major stationary source or major modification that may affect visibility or air quality related values in any Federal Class I area, the division shall transmit a copy of the application to all affected Federal Land Managers and consult with them as to its completeness in its analysis and monitoring (if required) of air quality related values. If the division receives advance notification of a permit application of a source that may affect visibility or air quality related values, it will notify all affected Federal Land Managers within thirty days of such notification. The division will consider any analysis performed by a Federal Land Manager that indicates there will be an adverse impact on visibility or air quality related values if such analysis is received within thirty days after the Federal Land Manager receives a copy of the complete application. If the division disagrees with the Federal Land Manager, any notices for public comment or of a public hearing on the application will explain the disagreement or state where the explanation can be obtained.*"

If a protocol is submitted to the Division, as recommended in section 6.1, a copy should be provided for each affected federal land manager.

5.5.1 Air Quality Related Values, Including Visibility, Analysis for Major Stationary Sources

For proposed ***major stationary sources*** and major modifications located in attainment areas, visibility requirements for new sources and modifications subject to PSD rules are found in various sections of Regulation No. 3, Part D including: §VI.A.6, §XIII, and §XIV.E

For proposed major stationary sources and major modifications located in nonattainment areas, refer to Regulation No. 3, Part D, §V.

[23] According to Regulation No. 3, Part D, §II.A.3 an Air Quality Related Value is *"any value of an area that may be affected by a change in air quality. Examples include flora, fauna, soil, water, visibility, cultural, and odor.*"

5.6 Additional Impact Analysis

Regulation No. 3, Part D, §VI.A.6 requires an *additional impact analysis* for ***major stationary sources*** and major modifications. The additional impact analysis applies in all areas, including Class I and Class II areas. The regulation specifically requires an "analysis of the impairment to visibility, water, soils, and vegetation." In some instances, a growth analysis is also required. The growth analysis is recommended only if the new source or modification will have a ***significant impact***; that is, it is only required if an air quality impact analysis (e.g., CAAQS and NAAQS analysis, PSD increment analysis) is triggered.

The *additional impact analysis* can be done using qualitative[24] or quantitative[25] methods. The Division generally views the *analysis of impairment* as a disclosure type of requirement. The level of analysis depends on the situation and the likelihood that there could be some type of impairment.

In general, if the additional impact analysis suggests there might be adverse impacts to soils, vegetation, or visibility, the information may be used in the BACT review process. This does not mean that the BACT determination must fix the problem; it means that all the issues associated with BACT, including economics and environmental impacts should be balanced and considered.

5.6.1 Impact Analysis for Water

The inclusion of water in the additional impact analysis is a Colorado requirement. By regulation, the water analysis in Class II areas does not affect permit approval or denial or control technology selection. The water impact analysis is intended to serve as a data-gathering and analysis mechanism to allow the Division and others to further investigate problems such as acid deposition in high altitude lakes. Refer to the "Additional Impact Analysis" discussion in the "Statement of Basis and Purpose for the Prevention of Significant Deterioration Program Regulations" (adopted March 10, 1983) of the Common Provisions Regulation for more information about the intent of this requirement.

5.6.2 Visibility Analysis

In addition to the Class I visibility analysis discussed in section 5.5, an analysis of impairment to visibility in Class II areas should also be addressed in the permit application (see Regulation No. 3, Part D, §VI.A.6 - Additional Impact Analysis).

According to U.S. EPA guidance (USEPA 1990), "*in the visibility impairment analysis, the applicant is especially concerned with impacts that occur within the impact area of the proposed new source or modification. Note that the visibility analysis required here is distinct from the Class I area visibility analysis requirement. The suggested components of a good visibility impairment analysis are:*

- *a determination of the visual quality of the area,*
- *an initial screening of emission sources to assess the possibility of visibility impairment, and*
- *if warranted, a more in-depth analysis involving computer models.*"

Refer to U.S. EPA guidance for more specific recommendations. The focus of Class I visibility analysis is on assessing visibility impacts within a Class I areas. The focus of the Class II visibility analysis is on sensitive views outside of Class I areas. The Division has developed a database of sensitive views to assess impacts in Class II areas. These are called ***scenic and/or important views***.

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[24] A *qualitative* determination is one that is made without regard to quantity. That is, it does not involve a numerical estimate of the impact. Instead, it relies on descriptive generalized statements. For example, qualitative arguments are justifiable in situations where, based on professional judgment, it is reasonable to assume there will not be impairment.

[25] A *quantitative* determination is one that involves a numerical "estimate" of the air pollutant concentration in ambient air.

They are not integral vistas.[26] The Class II scenic and/or important views do not have the force and effect of the visibility rules in Class I areas. The information regarding levels of change in visibility is used to track changes in visibility that might be important to the public. A list of these views is available from the Division.

The Division does not appear to have the authority to deny a permit if adverse visibility impacts occur outside a Class I area. Instead, the information may be used to consider the need for additional emission controls. Therefore, it is important to keep the Class I visibility analysis distinct from the Class II visibility analysis in the modeling report.

In practice, when PSD applicants contact the Division, the Division will determine if there are any Class II scenic views within the probable area of influence of the proposed source. If there are, the analysis approach should be determined on a case-by-case basis in consultation with the Division. If modeling is warranted, the modeling procedures for the scenic and/or important views are usually based on techniques similar to those used for Class I visibility assessments.

The Division does not have specific thresholds or criteria for determining when there is *impairment* to a Class II view. Impairment determinations are made on a case-by-case basis considering a number of factors including the geographic extent, intensity, duration, frequency, and time of modeled visibility impairment. Other factors such as interference with a visitor's visual experience, correlations between time of impairment with natural conditions that reduce visibility, and other criteria might be considered. Finally, limitations of the modeling system are considered. For example, results from a screening-level model do not carry as much weight as results from a refined model. The ability of the modeling system to properly account for relevant atmospheric chemistry and meteorology is also considered. If, after considering all appropriate criteria, it is believed that Class II visibility may be impaired, the Division may request that the "environmental impact analysis" portion of the "best available control technology" (BACT) determination be revisited.

A compliance demonstration with Colorado's visibility standard, which is applicable in the AIR Program[27] area, is not required to obtain a permit.

5.6.3 Soils and Vegetation Analysis

Regulation No. 3 states that the owner or operator should provide an analysis of impairment to soils and vegetation for each regulated pollutant emitted in a significant quantity. Only vegetation with commercial or recreational value should be addressed. U.S. EPA's guidance states that, for most soils and vegetation, ambient concentrations of criteria pollutants below the secondary National Ambient Air Quality Standards (NAAQS) will not result in harmful effects. Nevertheless, the secondary NAAQS may not adequately protect certain sensitive vegetation and soils, particularly for regulated non-criteria pollutants (USEPA 1990), see section 5.3. As recommended in U.S. EPA guidance, new sources or modifications subject to PSD rules should:

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[26] An integral vista adopted into regulation can be afforded the same level of protection from visibility impairment as the Class I area itself or any lesser level or protection, as determined by a state on a case-by-case basis. Because views in the Western U.S. commonly extend for great distances, integral vistas are a controversial aspect of the Visibility SIP package. The Department of the Interior (DOI) preliminarily identified integral vistas associated with Class I areas on January 15, 1981. However, both the DOI (speaking for the National Park Service) and the Department of Agriculture (speaking for the U.S. Forest Service) later declined to officially list any vistas. One reason given by the DOI was that states already had sufficient opportunity through existing authority to protect integral vistas. Thus, the naming of integral vistas and incorporation into SIPs was left to individual states (CDPHE, 1992).

[27] The AIR program area is defined in 42-4-304, C.R.S. It generally includes all or part of the following counties: Adams, Arapahoe, Boulder, Denver, Douglas, El Paso, Jefferson, Larimer, and Weld.

a) provide an inventory of soils and vegetation with commercial or recreational value in the vicinity of the facility (e.g., crops);
b) review peer-reviewed scientific literature to determine the concentration level (for appropriate averaging times) of regulated pollutants that would be harmful to vegetation; if no information is available in the literature, assume the secondary NAAQS is protective if one exists for the regulated pollutant under review; if modeling has been done, compare modeled impacts to the secondary NAAQS and to other levels of concern identified through a literature search; if the potential impact is determined to be harmful, discuss the nature of the harm and its spatial extent in the modeling report.

6 Model Selection and Application

According to Regulation No. 3, Part A, §VIII, all estimates of ambient concentrations shall be based on the applicable air quality models, databases, and other requirements generally approved by U.S. EPA and specifically approved by the Division. Model selection and application should be consistent with ***Appendix W of 40 CFR Part 51 -*** *Guideline on Air Quality Models* (*USEPA Guideline on Air Quality Models*) and associated guidance (e.g., USEPA 1990; USEPA 1992a). U.S. EPA models, user's guides, guidance, and modeling-related memos and information are available from U.S. EPA's Support Center for Regulatory Atmospheric Modeling (http://www.epa.gov/scram001).[28]

To avoid unnecessary delays in the permit process, applicants and/or their consultants should discuss model and database selections with Division modeling staff prior to submittal of a modeling analysis. A modeling protocol is the preferred method to gain approval.

Procedures and models other than those recommended by U.S. EPA or in this guideline may be approved on a case-by-case basis if there is sufficient technical justification. U.S. EPA approval may be required in some cases. Refer to U.S. EPA guidance for use of alternative models.

If a non-EPA-approved model, such as a wind tunnel study, is proposed, the nature and requirements of such a model should be outlined to the Division at a pre-application meeting. The permit application will be deemed incomplete until there has been a public hearing on the proposed model and written approval of the U.S. EPA has been received (see Regulation No. 3, Part A, §VIII).

The most recent version of U.S. EPA-approved models should be used. Division approval should be obtained if an older version is used.

For Class I area modeling, the Division generally supports the use of models and modeling techniques recommended by the Interagency Workgroup on Air Quality Modeling (IWAQM).[29] Written IWAQM guidance (USEPA 1998) does not always reflect their latest recommendations. In addition, recommendations for the Class I analysis may vary from one area to another. Thus, work with Division staff and affected federal land managers (FLMs) on a case-by-case basis to determine the appropriate methods to address impacts at each affected Class I area.

6.1 Modeling Protocols

The protocol is the primary mechanism by which all affected parties such as the applicant, the Division, U.S. EPA, and federal land managers reach agreement on a modeling approach. The protocol development process is intended to minimize the chances of misunderstandings and to avoid delays in the permit process.

[28] This SCRAM website is a source of information on atmospheric dispersion (air quality) models that support regulatory programs required by the federal Clean Air Act. Documentation and guidance for these computerized models are a major feature of this website.

[29] IWAQM was formed to provide a focus for development of technically sound, regional air quality models for regulatory assessments of pollutant source impacts on federal Class I areas. The guidance included input from the U.S. Forest Service, National Park Service, U.S. Fish and Wildlife Service, the U.S. EPA, and several states.

It explains in detail how a modeling analysis will be performed, how the results will be presented, and how compliance with applicable requirements will be demonstrated.

Submission of a modeling protocol is strongly recommended for:

- new ***major stationary sources*** and major modifications subject to PSD/NSR rules;
- complex new sources or modifications.

6.2 Design Concentrations for Comparison to Standards and Increments

Refer to the *EPA Modeling Guideline* (e.g., §7.2.1.1, 10.1 and 10.2.3) to decide if the *high* or *high second-high* or some other concentration value should be used in the NAAQS, PSD increment, and similar compliance demonstrations. The *design concentration*, as it is sometimes called, is usually calculated directly by the model or by using a post-processor.

For the ***significant impact*** analysis (see section 3), the highest concentration should be used for all averaging periods when comparing impacts to modeling significance levels.

6.2.1 CO, SO_2, Pb, and NO_2 Design Concentrations

According to 40 CFR Part 51, Appendix W, §10.2.3.2, "*for new or modified sources predicted to have a significant ambient impact and to be located in areas designated attainment or unclassifiable for the SO_2, Pb, NO_2, or CO NAAQS, the demonstration as to whether the source will cause or contribute to an air quality violation should be based on: (1) The highest estimated annual average concentration determined from annual averages of individual years; or (2) the highest, second-highest estimated concentration for averaging times of 24-hours or less; and (3) the significance of the spatial and temporal contribution to any modeled violation. For Pb, the highest estimated concentration based on an individual calendar quarter averaging period should be used.*"

Thus, regardless of the number of years of meteorological data used, compliance with short-term standards is based on the *highest, second-highest* modeled concentration. That is, at each ***receptor***, the highest concentration value is ignored; instead, compliance is based on the *second-highest* value. For the annual standards, the highest annual average value would be used for each year. It is not acceptable to use *period* averages for several years, for example, to estimate the *annual* concentration for comparison to standards based on annual averaging periods.

6.2.2 PM10 Design Concentration

According to 40 CFR Part 51, Appendix W, §10.2.3.2, "*for new or modified sources predicted to have a significant ambient impact in areas designated attainment or unclassifiable for the PM–10 NAAQS, the demonstration of whether or not the source will cause or contribute to an air quality violation should be based on sufficient data to show whether: (1) The projected 24-hour average concentrations will exceed the 24-hour NAAQS more than once per year, on average; (2) the expected (i.e., average) annual mean concentration will exceed the annual NAAQS; and (3) the source contributes significantly, in a temporal and spatial sense, to any modeled violation.*"

Thus, if five (5) years of meteorological data were used in the model, for example, the design value (i.e., the value to compare to the standard) for the 24-hour standard would be the *highest, sixth-highest* concentration estimate. That is, at each ***receptor***, the five highest concentration values would be ignored. Compliance would be based on the sixth-high value. For the annual standard, the highest annual average would be used for each year (40 CFR Part 51, Appendix W, §7.2.1.1.d). It is not acceptable to use *period* averages for five years, for example, to estimate the *annual* concentration for comparison to standards.

6.3 Receptor Networks

The approach to creating a ***receptor*** network varies with the goals of the modeling study. Case-by-case professional judgment should be used. Factors such as topography, density of ***nearby sources***, meteorology, and requirements of the selected model should be considered when selecting receptors. In general, the network should be consistent with U.S. EPA's recommendations. *It should extend far enough to define the significant impact area for the source or modification under review*. For elevated point sources, it is sometimes useful to initially use a simple screening-level model to help determine how far out to extend the receptor network.

If the concentration gradient is increasing at the edge of the network, the network should be extended. The Division generally considers a *fine* receptor grid to have receptor spacing of 100 meters or less. A *coarse* receptor grid usually refers to receptor spacing greater than 100 meters.

While source-specific issues such as expected plume rise and topography should be considered when deciding if the following recommendations are appropriate, the following recommendations often provide a good starting point:

a) up to 1 kilometer – grid with 100-meter receptor spacing;
b) from 1 to 3 kilometers – grid with 250-meter spacing;
c) from 3 to 10 kilometers – grid with 500 meter spacing;
d) beyond 10 kilometers – grid with 1-kilometer spacing;
e) along fence line - 50 to 100 meters receptor spacing;
f) if no fence or boundary – 50-m grid receptor spacing near the source under review;
g) discrete receptors for sensitive nearby sites (e.g., residences, schools) unless the grid is sufficient;
h) if the modeled maximum from the facility under review (or the maximum in an *air quality impact analysis* such as a CAAQS and NAAQS analysis) occurs in a *coarse* receptor grid, additional modeling should be performed with a fine grid to find the maximum concentration;
i) additional fine receptor grids or discrete receptors may be necessary in ***complex terrain*** or sensitive areas to clearly define the area of maximum impact.

Receptors may be omitted from the property of the facility under review, provided it is inaccessible to the general public. Refer to the definition of ***ambient air*** in the glossary at the end of this document. If there is not a physical barrier (e.g., fence, wall), receptors should be located on the property of the applicant. Division and/or U.S. EPA approval is necessary if the applicant wants to use a physical barrier such as a canyon, river, tailings pile, or other physical features as the ambient air boundary. If a physical barrier is approved by the Division to preclude public access, frequent posting is usually necessary along with routine security patrols; in addition, points of public access into the posted area (e.g., roads, trails) should be fenced or gated. Refer to U.S. EPA memos[30] on this subject (e.g., USEPA 1984, USEPA 1986, USEPA 1987a, USEPA 1987b, USEPA 1987d, USEPA 1989).

6.4 Elevation Data for Sources and Receptors

Terrain elevations for sources and receptors should be used when appropriate (see U.S. EPA guidance). Discuss the source of terrain data in the modeling report. It is usually best to extract elevations for sources and receptors from the same base data to avoid discontinuities.

[30] Internet links to these U.S. EPA memos can be found in the Reference section of this document on page 59.

The highest resolution U.S. Geological Survey (USGS) 7.5-minute Digital Elevation Model[31] (DEM) data is recommended. If 7.5-minute DEM data are not available, the 1:250,000 scale DEM[32] data may be used if appropriate. In addition, the 1:250,000 scale data may be appropriate for coarse receptor grids or for building terrain files for puff modeling applications. However, caution should be used when using 1:250,000 DEM data since entire ridges and small terrain features might be absent from the data.

Some facility sites are graded (e.g., flat) so that actual site topography is or will be significantly different from the topography that is found in a USGS DEM or in other elevation data. Thus, it may sometimes be appropriate to adjust elevations at the site to reflect actual or anticipated elevations. If this is done, care should be taken to avoid introducing unrealistic elevation discontinuities that might influence model results. Refer to the air quality model user's guide or U.S. EPA guidance for specific recommendations about how to adjust elevations. For example, in some modeling systems, elevation adjustments must be implemented by modifying the DEM file before it is used by the model's terrain processor. Any changes to elevation values in a DEM file to account for site conditions should be documented and justified in the modeling report. Both the original DEM and the modified DEM file should be submitted to the Division.

6.5 Meteorological Data

Meteorological data should be collected, processed, and applied in ways that are consistent with federal regulations (*USEPA Guideline on Air Quality Models*), guidance (USEPA 2000), and model user's guides. If representative meteorological data are not available, it may be necessary to collect at least one (1) year of site-specific data. Any source intending to collect site-specific data should contact the Division prior to setting up a monitoring program. The Division has monitoring guidance available.

Prior to use, meteorological data should be approved by the Division. This can be done prior to the modeling submittal or as a part of the modeling or protocol review. To prevent unnecessary delays during the permit review process, applicants and/or their consultants are strongly encouraged to submit meteorological and ambient air monitoring data to the Division prior to the submission of modeling. Per regulatory requirements, for PSD applications where the Division has required pre-construction meteorological monitoring, the permit application will not be ruled complete until the data has been submitted to the Division and approved (see section 5.2).

As stated in §8.3.1 of the *USEPA Guideline on Air Quality Models*, five (5) years of NWS data or at least one (1) year of site-specific data should be used. If more than one year of site-specific data exist, multiple years (up to five years) should be used. In some cases, the Division may be able to provide model-ready meteorological data. For long-range transport modeling (i.e., source to receptor distances greater than 50 kilometers) and complex wind situations, see §8.3.1.2 (d) of the *USEPA Guideline on Air Quality Models*.

When deciding whether or not to recommend or require collection of site-specific meteorological data, Division modeling staff considers:

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[31] The 7.5-minute DEM data files are digital representations of cartographic information in a raster form. DEMs consist of a sampled array of elevations for a number of ground positions at regularly spaced intervals. Each 7.5-minute DEM is based on 30- by 30-meter data spacing with the UTM projection. Each block provides the same coverage as the standard USGS 7.5-minute map series.

[32] The 1-Degree DEM (3- by 3-arc-second data spacing) provides coverage in 1- by 1-degree block. One-degree DEMs are also referred to as "3-arc second" or "1:250,000 scale" DEM data.

a) existing air quality;
b) proposed emission levels from the new source or modification;
c) dispersion characteristics of the source under review;
d) meteorological and dispersion issues associated with ***complex terrain***;
e) distance to the nearest Class I area (for new sources and modifications subject to PSD rules);
f) the likelihood that the source will have an adverse impact on ambient air quality;
g) whether or not the source is subject to PSD rules (monitoring is more likely to be requested for new major stationary sources or major modifications subject to PSD rules than for ***minor sources***);
h) other relevant factors.

To streamline the permit process and reduce the economic burden for minor sources and minor modifications, collection of site-specific meteorological data is seldom requested for minor sources and modifications. Nevertheless, it may be recommended if there is reason to believe the new source or modification will cause or contribute to a violation of CAAQS or NAAQS (see related discussion in section 4).

If allowed under federal regulations and approved by the Division, conservative screening meteorological data may be used in refined models instead of site-specific data for compliance demonstrations.

7 Data to Include with Permit Applications

Specific data are needed to review and perform modeling. The recommended list of data elements presented here are often necessary to perform and/or review dispersion modeling. The applicant should be prepared to provide these data with the application or upon request by the Division. If the data are not provided with the application and cannot be provided upon request in a timely manner, the permit process may be delayed. In addition, if data cannot be provided in a suitable format, additional staff time may necessary for data-processing tasks. Staff time usually is charged back to the applicant at the permit processing hourly rate. While some of the data elements discussed here are already part of the permit application and APEN forms, they are mentioned here for emphasis.

> The applicant should be prepared to provide modeling-related data with the permit application or upon request by the Division.

7.1 Consistency in Geographic Coordinates

Geographic coordinates are often used in modeling. Whenever possible, the datum upon which geographic coordinates are based should be provided. For example, potentially significant discontinuities in source and ***receptors*** coordinates may occur if some ***Universal Transverse Mercator*** (UTM) coordinates are based on the North American Datum of 1927 (NAD27) while others are based on NAD83. Often, site surveys are performed using ***GPS*** systems that are based upon WGS84 while UTMs might be based upon a NAD27 topographic map. Therefore, a coordinate conversion should be performed when appropriate so that receptors, source locations, and other coordinates reference a consistent system.

7.2 Exemptions from Submitting Modeling-Related Data

New sources and modifications with emissions less than the thresholds in Table 1 and sources not emitting any of the pollutants listed in Table 1 do not need to provide any modeling-related data beyond what is requested in the permit application and/or APEN forms.

Since ozone modeling and HAPs modeling are not routinely performed as part of the permit review process, VOC sources do not need to provide any modeling-related data beyond what is requested in the permit application and/or APEN forms.

7.3 Data to Submit for Small Fugitive Particulate Matter Sources

Small fugitive particulate matter sources such as small sand and gravel operations and other sources of fugitive PM10 with emission rates greater than those in Table 1 should provide a facility plot plan, including the location of sources, property lines, fence lines, and haul roads. Portable sources should also provide a map showing typical configurations of equipment.

Submission of the modeling-related data in sections 7.4 and 7.5 may be requested if refined modeling is necessary to demonstrate compliance with standards.

7.4 Data to Submit for New Sources and Modifications Not Subject to PSD Rules

At a minimum, new sources and modifications NOT subject to PSD rules with emission rates greater than the thresholds in Table 1 should submit the following data with the permit application or be prepared to provide the data upon request:

(a) A facility plot plan to scale showing the fence line, emission sources at the facility, and buildings (see section 7.5(a) for more).

(b) Provide the height, width, length, and base elevation of each building at the facility.

(c) A USGS 7.5 minute topographic map showing the location of the facility [see section 7.5(a) for more].

(d) Provide stack parameters (emission rates, stack height, stack diameter, stack gas exit velocity, stack gas exit temperature) for each new or modified emission point. Provide parameters for area sources such as source dimensions and release heights. Provide similar information for existing sources at the facility upon request by the Division if an *air quality impact analysis* (see section 5) is requested.

(e) Provide sufficient information in the permit application or APEN so that the Division can compute a Universal Transverse Mercator (UTM) coordinate for the source(s). For example, provide the street address of the facility, a USGS 7.5 topographic map (or a copy) with the general facility location marked. If possible, also provide a detailed map showing the location of individual emission points.

(f) If modeling is submitted, provide modeling input/output files on diskette, compact disk, or other means; this includes input/output files from preprocessors and postprocessors.

(g) If modeling is submitted, provide a concise modeling report that justifies key modeling parameters and assumptions, databases, and results. The report should address all applicable regulatory requirements that are relevant to the modeling analysis.

If the applicant submits refined dispersion modeling, all elements in section 7.5 should be provided if possible. Nevertheless, the Division recognizes that providing all elements from section 7.5 may be difficult or unreasonable for some sources not subject to PSD rules. Thus, the Division will generally accept less detailed modeling submittals for applications that are not subject to PSD rules. If a simplified modeling package is submitted, the applicant or the applicant's air quality modeler will be contacted if additional modeling-related information is necessary to complete the review.

7.5 Data to Submit for New Sources and Modifications Subject to PSD Rules

New sources and modifications subject to PSD rules should provide the following data:

(a) A facility plot plan to scale with the fence line, emission sources, and buildings clearly marked. Ideally, the plot plan will contain a unique label for each point that can be cross-referenced with the modeling emission inventory. If possible, plot plans should be submitted in a digital format (e.g., DXF) as well as on paper. If the plot plan does not include latitude/longitude (lat/long) or ***Universal Transverse Mercator*** (UTM) coordinate system markings, it should contain at least one geographic

point of reference with a lat/long or UTM coordinate. The Division does not require submittal of aerial photographs, but they can be useful for modeling complex facilities.

(b) A USGS 7.5 minute topographic map (or a copy of one) showing the location of the facility. If a copy is provided, include the map name. USGS 7.5 minute Digital Raster Graphic (DRG) topographic maps and similar digital products can be used instead of conventional paper maps.

(c) Provide UTM[33] coordinates and stack base elevations for each emissions point.

(d) Provide UTM coordinates for each building corner and dimensions of each building or building tier; this includes the building or tier height, width, length, and base elevation of each building.

(e) Provide stack parameters (emission rates, stack height, stack diameter, stack gas exit velocity, stack gas exit temperature) for each new or modified emission point. Provide parameters for area sources such as source dimensions and release heights. Provide similar information for existing sources at the facility upon request by the Division if an *air quality impact analysis* is requested.

(f) For each pollutant for which the new source or modification is subject to modeling under PSD rules, provide a source history that clearly shows the start-up and shut-down dates of each unit (e.g., emissions source) at the facility. Include current and historic stack parameters and source/building configurations. Compare start-up and shut-down dates to applicable PSD baseline dates to determine PSD increment consuming and expanding emissions (see the Division's "*PSD Increment Tracking System*" for baseline dates and related information). Provide ***metadata***[34] (i.e., describe the methods used to generate the data).[35] The applicant may choose to ignore this data element if an *air quality impact analysis* is not requested or if PSD increment modeling is not requested; however, the Division encourages applicants to provide these data so that PSD increment consumption and expansion can be tracked.

(g) Provide UTM coordinates as necessary to define the fence line (this is used to exclude on-site ***receptors*** from the modeling analysis). These data may not be necessary if sufficient information is provided in item (a).

(h) Discussion of the method[36] used to obtain the UTM coordinates. This information is used to populate metadata fields in Division databases.

(i) If modeling is submitted with the application**,** refer to the definition for *complete* in Regulation 3, Part A, §I .B, 14.a(ii). The elements below usually are necessary to review a modeling submittal. The following list is generalized and actual information may vary on a case-by-case basis. Thus, the

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[33] Here and elsewhere, latitude and longitude coordinates may be provided instead of UTM coordinates.

[34] Metadata, or "data about data," describe the content, quality, condition, and other characteristics of data

[35] Estimates of actual emissions as of the applicable major/minor baseline dates are necessary to compute the change in actual emissions between the baseline date and the present for existing sources at the facility.

[36] Consult with the Division Stationary Sources Program Emission Inventory Unit if guidance is needed on how to obtain UTM coordinates. There are numerous ways to obtain UTM coordinates. For instance, coordinates can be determined from site surveys (including GPS surveys), Geographical Information Systems (GIS), by hand-picking or digitizing coordinates from USGS 7.5-minute (1:24,000) quadrangle maps or from the 7.5 minute quad images on USGS Digital Raster Graphics (DRG) files, and with geocoding software that determines a coordinate from a street address.

items in the list are recommendations and not absolute requirements. Nevertheless, the Division may rule an application incomplete if the items below have not been included with the application and if it is believed the modeling cannot be adequately reviewed without the information:

(1) Modeling input/output files on diskette, compact disk, or other means; this includes input/output files from preprocessors and postprocessors.
(2) Model user's guide and/or code if requested by the Division. This is not required if an EPA-approved model is being used. If modifications to the code of an EPA-approved model have been made, see U.S. EPA guidance to determine if additional U.S. EPA approval is necessary. If approval is needed, provide written evidence of U.S. EPA approval. Provide modified code if requested.
(3) Modeling report that justifies key modeling parameters and assumptions, databases, and results. The report should address all applicable regulatory requirements that are relevant to the modeling analysis; in addition, the report package should include the following:
   - ❑ One or more map(s) showing the source location(s) and receptors with respect to terrain**.** The ***receptor*** locations may be shown on a map of appropriate scale such as a 7.5 minute USGS topographic map, a Digital Elevation Model (DEM) map, a Digital Raster Graphics (DRG) map, or on a similar spatial terrain coverage. The intent of this element is to allow the Division to check receptor locations with respect to terrain to ensure the receptor network is adequate for the topographical setting. This element may be combined with the plot plan.
   - ❑ Concentration isopleth map(s) showing modeled impacts from the proposed/modified source for each applicable pollutant and averaging period. The contour lines for the applicable modeling significance levels should be clearly identified so the Division can determine if the spatial extent of the receptor grid is adequate. (does not apply to *screening analyses*).
   - ❑ A map showing the location of all sources in the emissions inventory. Highlight or mark sources explicitly included in the modeling analysis to distinguish them from sources not included in the model.
   - ❑ ***A*** table showing nearby increment consuming/expanding sources (only recommended if a PSD increment analysis has been performed). Refer to the Division's "*PSD Increment Tracking System*" guidance for details. In particular, see section 2.1.2 - Recommended Procedures for Preparing PSD Increment Emission Inventories (Transition Guidance).
   - ❑ A table comparing maximum modeled impacts with appropriate thresholds such as modeling significance levels, standards, PSD increments, significant monitoring concentrations, and levels of acceptable change to AQRVs.
   - ❑ UTM coordinates for maximum modeled concentration estimate(s) from the PSD increment compliance demonstration modeling (if applicable). These data are used to help the Division track increment consumption across the state.

8 The Review Process for Modeling Submittals

This discussion is intended to provide a general overview of the permit review process in Colorado to make it easier for applicants and their consultants to understand the roles and responsibilities of Division and Department staff.

In general, Division staff with the appropriate expertise review various aspects of the impact analysis. For example, different specialists may provide comments on dispersion modeling, monitoring data, visibility modeling, and air quality related values. Internal comments by reviewers are typically sent directly to the lead permit reviewer in the Stationary Sources Program who interprets the comments and, if necessary, brings staff together to discuss or resolve issues.

Modeling submittals should generally be sent to the Division's Stationary Sources Program where a permit reviewer processes the permit application. The permit reviewer forwards modeling protocols, modeling reports, date, modeling input/output files, the permit application, and other relevant information to appropriate staff. As required by regulations, copies of the permit applications for ***major stationary sources*** are sent to federal agencies such as U.S. EPA Region VIII and affected federal land managers. In some cases, particularly for new sources and modifications NOT subject to PSD rules, the permit reviewer may choose to review the modeling analysis if it is based on a screening model and there are no issues requiring more specialized staff.

In some cases, it is appropriate for applicants or their modelers to send modeling protocols directly to modeling staff in the Division's Technical Services Program. If the protocol is sent to the Technical Services Program modeling staff, a copy should also be sent to the Stationary Sources Program permit review staff since they are responsible for the overall review of the permit.

The Division encourages phone conversations, e-mail, and other types of communication between staff and the applicant's modeler(s) and other specialists to resolve issues once the actual review process begins. It is assumed the applicant's modeler or other specialists will notify the applicant of important modeling-related issues as necessary. It is recommended that significant issues and information transfers be done in writing. Copies of the any letters or e-mail messages should be sent to the lead permit reviewer.

When oversights, errors, or questionable assumptions and/or methods are found during the review process, Division staff use professional judgment to decide if the deficiencies are sufficient to change the outcome of the compliance demonstration. If the ramifications of a modeling-related issue are not significant, the deficiencies are noted in the comments and appropriate language is included to justify that a specific issue is minor. If it is difficult to assess the ramifications without redoing the analysis, the Division may attempt to redo the analysis if computer input and output files and other necessary data are available. If it is unreasonable to redo the analysis, the deficiencies will be noted in the review comments and the applicant will be asked to address the comments.

Any responses to comments may be sent directly to Technical Services Program modeling staff, but it is recommended that a copy also be sent to the permit review engineer. In cases where there are no modeling issues, the Department's modeling comments are not usually forwarded to the applicant. Instead, the written comments are added to the permit file.

Figure 4 graphically depicts the permit review process as it relates to air quality modeling. While the flowchart is applicable to all permit applications for major stationary sources where modeling is required, only

certain portions of the flowchart are applicable for ***minor sources***. For example, the loop involving U.S. EPA Region VIII and the federal land manager (FLM) is not an integral part of the review process for minor sources.

Figure 5 graphically shows the roles and responsibilities for the modeling review process within CDPHE for air quality construction permits.

8.1 Review Process for Federal Class I Areas (New Major Stationary Sources and Major Modifications)

Additional considerations for the federal Class I air quality impact review are discussed here. As stated in Regulation No. 3, Part D, §XIII - Federal Class I Areas (see section 5.5), the Division sends affected federal land managers (FLMs) a copy of the permit application for proposed new sources or modifications that may affect ***Air Quality Related Values*** (AQRVs), including visibility, in any federal Class I area. For relatively small and/or distant ***major stationary sources***, the FLM may not take an active role in the review or modeling process. In other cases where a significant impact may occur or where there may be unacceptable levels of change to AQRVs, including visibility, the FLM usually takes an active role.

While the Division's Stationary Sources Program is responsible for forwarding the permit application to the appropriate FLMs, Technical Services Program staff typically contact affected FLMs to obtain Class I significance levels and other recommendations for the analysis required by Regulation No. 3.

The initial contact with FLMs should occur early in the process. If there is a PSD pre-application meeting, FLMs should be invited. Regulations require that the Division consult with FLMs as to the completeness of the permit application. If the applicant decides to directly contact affected FLMs for recommendations, the Division should be kept in the loop.

8.1.1 Flowchart of Regulatory Decision Process for Air Quality Related Values, Including Visibility

Figure 7 illustrates key aspects of the regulatory decision process for major stationary sources and major modifications seeking construction permits:

- The first step in the process is to determine those pollutants for which there will be a *significant* emission rate increase for a new source or a significant net emissions increase for a major modification.
- If the proposed emission rate is not significant, the *additional impact analysis* (Regulation No. 3, Part D, §VI.A.6 and the AQRV requirements (§XIII and §XIV.E) do not apply. In practice, new sources are major for some pollutants and minor for others. In some cases, the modification may not be major for any pollutants that would affect AQRVs, including visibility.
- If the Division concludes that an "analysis of impairment" (§VI.A.6) is necessary, there are several key decisions that must be made. For example, the applicant should discuss the project with the Division to decide if any AQRV monitoring is warranted (see §XIII.B). The Division will make this decision after consultation with the FLM. If monitoring is required, a monitoring plan should be prepared and submitted for Division approval. If monitoring is not warranted, which is usually the case, then the applicant can move on to the next step in the flowchart.
- The applicant should consult with the Division to determine the extent of the "analysis of impairment." The regulations do not clearly define what constitutes an "analysis of impairment." Thus, the extent of the analysis is decided on a case-by-case basis. The Division strongly recommends that the applicant submit a protocol.

- When the permit application is submitted to the Division, it must include the "analysis of impairment" to be ruled complete (see the definition of *complete*, Regulation No. 3, Part A, §II.A.12).
- Applicants should be aware of Regulation No. 3, Part B, §XIII.A – Federal Class I Areas; it states, "*within twenty days of receipt of a permit application for a new major stationary source or major modification that may affect visibility or air quality related values in a Federal Class I area, the division shall transmit a copy of the application to all affected Federal Land Managers and consult with them as to its completeness in its analysis and monitoring (if required) of air quality related values. If the division receives advance notification of a permit application of a source that may affect visibility or air quality related values, it will notify all affected Federal Land Managers within thirty days of such notification….*"
- The next step is to determine if the source will cause or contribute to a violation of applicable Class I PSD increments.
- If the source does not cause or contribute to a Class I increment violation, §XIII.A states, "*The division will consider any analysis performed by a Federal Land Manager that there will be an adverse impact on visibility or air quality related values if such analysis is received within thirty days after the Federal Land Manager receives a copy of the complete application….*" But, if the FLM fails to determine if there will be an adverse impact, the Division may perform the analysis, as explained in Regulation No. 3, Part B, §XIII.C.
- If it is determined, through modeling provided by the applicant, that the source will cause or contribute to a violation of applicable Class I PSD increments, then the Division may still issue the permit if the requirements of §XIII.D are met. Regulation No. 3, Part B, §XIII.D (Class I Variances) states, "*the owner or operator of a proposed major stationary source or major modification may demonstrate to the satisfaction of the Federal Land Manager that the emissions from such source or modification would not have an adverse impact on the air quality-related values (including visibility) of Class I lands under the Federal Land Manager's jurisdiction, notwithstanding that the change in air quality resulting from emissions from such source or modification would cause or contribute to concentrations which would exceed the maximum allowable increases for a Class I area. If the Federal Land Manager concurs with such demonstration and so certifies to the division, the division or the commission may, provided that applicable requirements are otherwise met, issue the permit with such emission limitations as may be necessary to assure that emissions of sulfur dioxide, and PM10, and nitrogen oxides would not exceed the following maximum allowable increases over the minor source baseline concentration for such pollutants….*"
    - PM10
        - Annual arithmetic mean 17 $\mu g/m^3$
        - Twenty-four hour maximum 30 $\mu g/m^3$
    - *Sulfur dioxide*
        - Annual arithmetic mean 20 $\mu g/m^3$
        - Twenty-four hour maximum 91 $\mu g/m^3$
        - Three-hour maximum 325 $\mu g/m^3$
    - *Nitrogen dioxide*
        - Annual arithmetic mean 25 $\mu g/m^3$
- Although the FLMs have an affirmative responsibility to protect AQRVs, including visibility, they have no permitting authority under the federal Clean Air Act (CAA). They also have no authority under the CAA to establish air quality-related rules or standards. The FLM role consists of considering whether emissions from a new source may have an adverse impact on AQRVs , including visibility, and providing comments to permitting authorities. Thus, the final decision to grant or deny a permit is made by the Division or AQCC. Regulation No. 3, Part B,

§XIII.A states, "*if the division disagrees with the Federal Land Manager, any notices for public comment or of a public hearing on the application will explain the disagreement or state where the explanation can be obtained*

- If the FLMs disagree with the Division's decision to grant a permit, they may request a hearing (e.g., see Regulation No. 3, Part D, §IV.A.6).

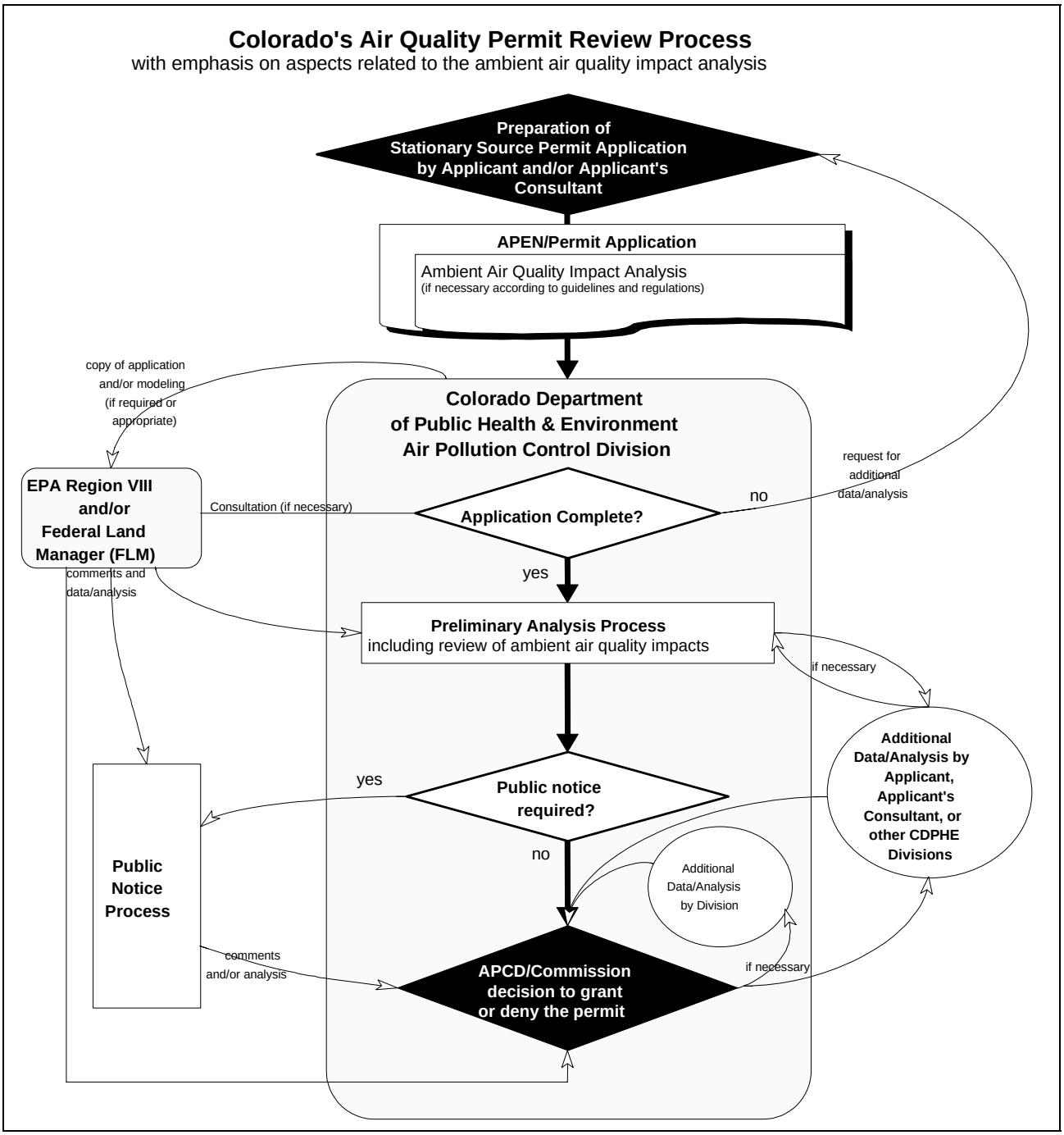

Figure 5. Flowchart of the permit review process from a modeling perspective.

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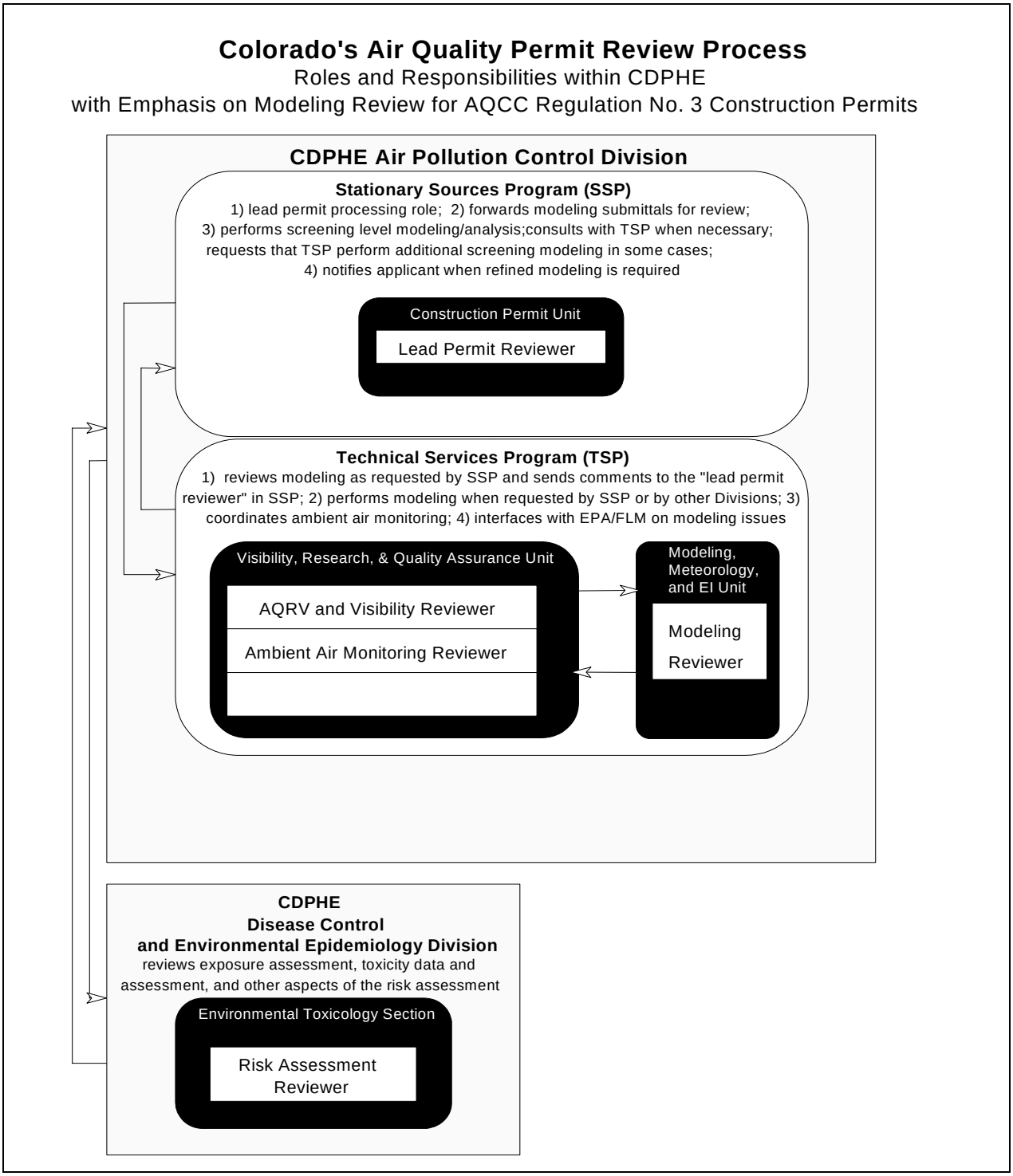

Figure 6. CDPHE roles and responsibilities in the modeling review process for air quality permits.

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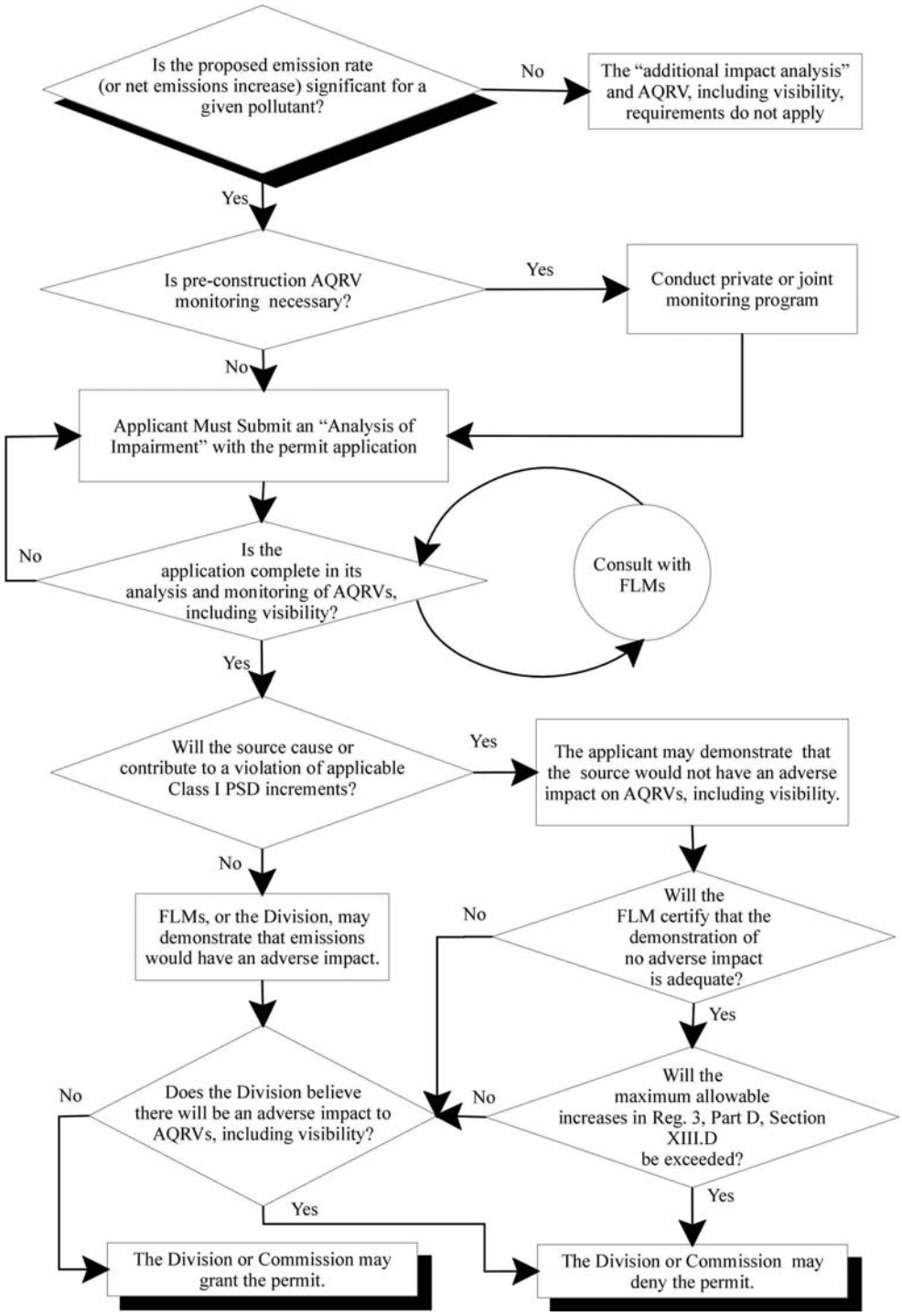

Figure 7. Flowchart of regulatory decision process for Air Quality Related Values, including visibility. This flowchart applies to new major stationary sources and major modifications that might affect air quality in federal Class I areas.

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10 Glossary of Technical Terms

AMBIENT AIR. *Ambient air* is defined by 40 CFR 50.1(e) as "that portion of the atmosphere, external to the source, to which the general public has access." NAAQS and PSD increments apply only in ambient air. Refer the applicable U.S. EPA memos on this subject (e.g., USEPA 1984, USEPA 1986, USEPA 1987a, USEPA 1987b, USEPA 1987d, USEPA 1989). In addition, there are sometimes situations where a source leases land within its fence to another company, for example. If this is done, source operators should be aware that the U.S. EPA's general policy is that "leased land is ambient air to the lessor." Thus, if a source operator leases land within its fenced property boundary, the leased land is usually considered ambient air.

APPENDIX W, 40 CFR Part 51 – GUIDELINE ON AIR QUALITY MODELS. The U.S. EPA's *Guideline on Air Quality Models* recommends air quality modeling techniques that should be applied to State Implementation Plan (SIP) revisions for existing sources and to new source reviews, including prevention of significant deterioration (PSD). It is intended for use by the U.S. EPA in judging the adequacy of modeling analyses performed by U.S. EPA, state and local agencies, and industry. The *Guideline* identifies those techniques and databases U.S. EPA considers acceptable. The guide is not intended to be a compendium of modeling techniques. Rather, it serves as a basis by which air quality managers, supported by sound scientific judgment, have a common measure of acceptable technical analysis.

AIR QUALITY RELATED VALUE (AQRV). Air Quality Related Value (AQRV) means a feature or property of a Class I area that may be affected by air pollution. General categories of AQRVs include visibility, odor, flora, fauna, soil, water, geologic features, and cultural resources.

BUILDING DOWNWASH. The wind flowing over buildings or structures can create turbulence that would ordinarily not exist. Emissions from a short stack or roof vent can be caught in the turbulent wake of a building or structure. This downwash effect can alter ground-level concentration levels than would exist in the absence of the building or structure. While building downwash can in some cases cause relatively high concentration levels near a source, there is usually a strong concentration gradient. That is, concentration levels drop quickly with increasing distance from the source. U.S. EPA approved models can simulate the effect of building downwash.

COMPLEX TERRAIN. Complex terrain is any terrain exceeding the height of the stack being modeled. This definition includes terrain that is commonly referred to as intermediate terrain, that is, those ***receptors*** between stack height and plume height.

GOOD ENGINEERING PRACTICT (GEP) STACK HEIGHT. 1) Regulation No. 3, Part A, §VIII.C – Stack Heights – "*sets limits for the maximum stack height credit to be used in ambient air quality modeling for the purpose of setting an emission limitation and calculating the air quality impact of a source. It does not limit the actual physical stack height for any source. The following shall not be considered in determining whether an emission limitation is met: 1. Stack height in excess of good engineering practice (GEP); or 2. Any other dispersion technique; except that provisions of this Section VIII.C shall not apply to stack heights in existence or dispersion techniques implemented before December 31, 1970. Sources which were constructed, reconstructed, or for*

which major modifications were carried out after December 31, 1970, and which are emitting pollutants from such stacks, or using such dispersion techniques, shall be subject to the provisions of this Section." Refer to Regulation No. 3, Part A, § VIII.D for additional options, requirements, and definitions of terms such as *dispersion technique* and *good engineering practice (GEP) stack height*. 2) In addition to the GEP stack height regulations, the concept of GEP stack height is useful to help determine situations where a plume may be subject to building downwash. The GEP stack height in meters (H_{GEP}), as measured from the ground level elevation at the base of the stack, can be calculated as follows: $H_{GEP}=H+1.5L$. In this equation, H = "the structure or building height in meters" and L = "the lesser of the structure height or width in meters."

GLOBAL POSITIONING SYSTEM (GPS). The U.S. Department of Defense Global Positioning System (GPS) satellites transmit signals that allow one to determine, with great accuracy, the locations of GPS receivers. GPS is used in air, land and sea navigation, mapping, surveying and other applications where precise positioning is necessary (*GPS World.* ISSN 1051-9858. Advanstar Communications, 859 Willamette St, Eugene, OR.).

MAJOR STATIONARY SOURCE. Refer to the definition for major stationary source in Regulation No. 3, Part A, §I.B.59.

METADATA. Metadata, or *data about data*, describe the content, quality, condition, and other characteristics of data (reference: National Spatial Data Infrastructure (NSDI), Federal Geographic Data Committee (FGDC), "*Content Standard for Digital Geospatial Metadata*," Version 1.0). Refer to EPA documents for information about federal requirements regarding metadata. [37]

MINOR SOURCE. As used in this document, a minor source is any *stationary* source that is not defined as a ***major stationary source*** in Regulation No. 3, Part D, §II.A.25. The term is sometimes used rather loosely. The definition may vary based on the context in which it is used.

NEARBY SOURCES. A nearby source is any major source, major stationary source, or minor source that causes a significant concentration gradient in the vicinity of a new or modified source.

OTHER BACKGROUND SOURCES. Other background sources include all sources of air pollution other than the source under review and those identified as ***nearby sources***. Examples include area and mobile sources, natural sources, most ***minor sources***, and distant major sources and ***major stationary sources***. They usually are accounted for by using an appropriate ambient background concentration as recommended in §8 of Appendix W of 40 CFR Part 51 or by application of a model using inventory recommendations in Table 8-2 of Appendix W.

RECEPTOR. As used here, a receptor is a geographic location (point) at which the model calculates the impact (i.e., air pollutant concentration) from a source of air pollution. In practice, a large number of receptors (i.e., a grid of receptors) is used to estimate air quality impacts over the probable area of impact from a source. Each receptor has a unique geographic coordinate and elevation.

REQUESTED EMISSION RATE. The emission rate calculated using the maximum rated (design) capacity of the source or the emission rate specified as an enforceable permit condition. Refer to the definition of *allowable emissions* in Regulation No. 3, Part A, §I.B.7.

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[37] U.S. EPA Locational Data Policy (LDP) Sub-Work Group of the Regional GIS Work Group, "Method Accuracy Description Information Coding Standards for the U.S. Environmental Protection Agency's Locational Data Policy (LDP)," Version 6.1.

SCENIC AND/OR IMPORTANT VIEWS. A scenic and/or important view is an important or sensitive panorama or long-range view anywhere in Colorado. They include important views of landmarks or panoramas. The Division maintains a list of scenic and/or important views in Colorado.

SIGNIFICANT IMPACT. A concentration in ambient air that exceeds a modeling significance level.

SIMPLE TERRAIN. Locations where the terrain elevation is lower than the top of a stack.

UNIVERSAL TRANSVERSE MERCATOR (UTM). The UTM system is a plane coordinate system that uses distances from a specified reference point as the basis for all locations. It is based on a transverse Mercator projection that divides the Earth's surface into zones that are 6 degrees of longitude wide. Precise locations on the earth are described in terms of north-south (northing) and east-west (easting) distances, measured in meters from the origin of the appropriate UTM zone (Star and Estes, 1990). Most of Colorado is in zone 13, while the western seventh is in zone 12.

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