APPENDIX 5.1F

Offsets and Interpollutant Offset Ratio Analysis

APPENDIX 5.1F

Offsets and Interpollutant Offset Ratio Analysis

Under District Rule 2201, A2PP must provide offsets for the portion of the facility emissions after modification that exceed the SJVAPCD offset thresholds. Because the proposed project is a modification to an existing stationary source, the calculation of the offset requirements must account for the emissions from the existing TID Almond power plant facility. Table 5.1F-1 shows annual proposed potential to emit from the new A2PP units, the annual potential to emit for the existing units, and the total emissions from the combined facility after modification, and compares these totals with the offset thresholds to determine the offsets required for the project.

TABLE 5.1F-1

Offset Requirements for the A2PP

	Annual Emissions, tons			
	NOx	**SOx**	**VOC**	**PM_{10}**
A2PP Project Emissions	70.7	19.4	17.0	32.9
Pre-Existing PTE	26.3	5.7	5.3	8.8
Rule 2201 Offset Threshold	10.0	27.4	10.0	14.6
Emissions Required to be Offset	70.7	0	12.2	27.0

District Rule 2201 allows the APCO to approve interpollutant offsets on a case-by-case basis. A2PP proposes to use SO_2 ERCs as offsets for PM_{10}. The interpolllutant offset ratio analysis in Attachment 5.1F-1 demonstrates that ratio of 1.0 ton of SO_2 for 1 ton of PM_{10} will provide equivalent air quality benefits as required under the NSR rules.

The required quarterly calculation of offsets is provided in Table 5.1F-2. This calculation demonstrates that more than sufficient offsets are being provided to achieve the no net increase provision of the District NSR rule (Rule 2201 §1.0).

Table 5.1F-3 provides a demonstration that sufficient mitigation is being provided under CEQA. Table 5.1F-4 provides documentation regarding the location and method of reduction for each ERC certificate proposed to be used for the project.

Table 5.1F-2
TID Almond 2 Power Plant
Quarterly Offset Summary (lbs/qtr)

VOC					
	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual (tpy)
Project VOC Emissions	**8,389**	**8,482**	**8,576**	**8,576**	**17.0**
Pre-Existing PTE	2,614	2,614	2,614	2,614	5.2
VOC Offset Threshold (1)	5,000	5,000	5,000	5,000	10.0
VOC Emissions Required to be Offset (2)	6,003	6,096	6,190	6,190	12.2
VOC ERCs Required for District regulations (3)	**9,005**	**9,145**	**9,284**	**9,284**	**18.4**
VOC ERCs					
C-348-1	10,250	10,250	10,250	10,250	**20.5**
VOC ERCs Excess (Shortfall)	**1,245**	**1,105**	**966**	**966**	**2.1**

NOx					
	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual (tpy)
Project NOx Emissions	**34,885**	**35,273**	**35,661**	**35,661**	**70.7**
Pre-Existing PTE	13,012	13,012	13,012	13,012	26.0
NOx Offset Threshold (1)	5,000	5,000	5,000	5,000	10.0
NOx Emissions Required to be Offset (2)	34,885	35,273	35,661	35,661	70.7
NOx ERCs Required for District regulations (3)	**52,328**	**52,909**	**53,491**	**53,491**	**106.1**
NOx ERCs					
S-2991-2	55,800	55,800	55,800	55,800	**111.6**
Total	55,800	55,800	55,800	55,800	111.6
NOx ERCs Excess (Shortfall)	**3,472**	**2,891**	**2,309**	**2,309**	**5.5**

Table 5.1F-2
TID Almond 2 Power Plant
Quarterly Offset Summary (lbs/qtr)
(cont'd)

SOx					
	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual (tpy)
Project SOx Emissions	**9,558**	**9,664**	**9,770**	**9,770**	**19.4**
Pre-Existing PTE	2,865	2,865	2,865	2,865	5.7
SOx Offset Threshold (1)	13,688	13,688	13,688	13,688	27.4
SOx Emissions Required to be Offset (2)	0	0	0	0	0.0
SOx ERCs Required for District Regulations (3)	**0**	**0**	**0**	**0**	**0.0**
SOx ERCs					
S-2726-5 (Calpine)	55,614	40,150	0	84,936	**90.4**
Total	55,614	40,150	0	84,936	90.4
SOx ERCs Needed for PM10	**19,920**	**20,190**	**20,460**	**20,460**	**40.5**
Allocate 4th Quarter SOx ERCs to 3rd Quarter	**--**	**--**	**20,460**	**-20,460**	**0.0**
SOx ERCs Excess (Shortfall)	**35,694**	**19,960**	**0**	**44,016**	**49.8**

PM10					
	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual (tpy)
Project PM10 Emissions	**16,200**	**16,380**	**16,560**	**16,560**	**32.9**
Pre-Existing PTE	4,380	4,380	4,380	4,380	8.8
PM10 Offset Threshold (1)	7,300	7,300	7,300	7,300	14.6
PM10 Emissions Required to be Offset (2)	13,280	13,460	13,640	13,640	27.0
PM10 ERCs Required for District regulations (3)	**19,920**	**20,190**	**20,460**	**20,460**	**40.5**
PM10 ERCs					
Total	0	0	0	0	0.0
PM10 ERCs Excess (Shortfall)	**(19,920)**	**(20,190)**	**(20,460)**	**(20,460)**	**(40.5)**
PM10 Reductions from SOx ERCs (at 1.0 to 1.0) (4)	**19,920**	**20,190**	**20,460**	**20,460**	**40.5**
PM10 Reductions Excess (Shortfall)	**0**	**0**	**0**	**0**	**0.0**

Notes:

1. Offset thresholds from SJVAPCD Rule 2201, Table 4.1
2. Offset liability from SJVAPCD Rule 2201, Section 4.7.2
3. Max distance ratio assumed based on SJVAPCD Rule 2201, Table 4.2: 1.5
4. SOx:PM10 ratio evaluation from Attachment 5.1F-1. Use 1.00

Table 5.1F-3
TID Almond 2 Power Plant
CEQA Mitigation Summary

VOC	tons per year
Project VOC Emissions	17.0
VOC ERCs Required for CEQA Mitigation	**17.0**
C-348-1	20.5
VOC ERCs Excess (Shortfall)	**3.5**

NOx	tons per year
Project NOx Emissions	70.7
NOx ERCs Required for CEQA Mitigation	**70.7**
NOx ERCs	
S-2991-2	111.6
Total	111.6
NOx ERCs Excess (Shortfall)	**40.9**

SOx	tons per year
Project SOx Emissions	19.4
SOx ERCs Required for CEQA Mitigation	**19.4**
SOx ERCs	
S-2726-5 (Calpine)	90.4
Total	90.4
SOx ERCs Excess (Shortfall)	**71.0**
SOx ERCs Used for PM10	**32.9**
SOx ERCs Excess (Shortfall)	**38.1**

PM10/PM2.5	tons per year
Project PM10/PM2.5 Emissions	32.9
PM10/PM2.5 ERCs Required for CEQA Mitigation	**32.9**
PM10 ERCs	
Total	0.0
PM10 ERCs Excess (Shortfall)	**(32.9)**
PM10/PM2.5 Reductions from SOx ERCs (at 1.0 to 1.0) (1)	**32.9**
PM10/PM2.5 Reductions Excess (Shortfall)	**0.0**

Notes:

1. SOx:PM10 ratio evaluation from Attachment 5.1F-1. Use 1.00

Table 5.1F-4
TID A2PP ERCs

ERC Certificate	Date of Reduction	Issue date	ERCs, lbs					Previous Owner	Location of Reduction	Method of Reduction
			Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual			
NOx										
S-2991-2	12/5/1990	9/25/2008	55,800	55,800	55,800	55,800	223,200	Pastoria Energy Facility, LLC	Elk Hills, Tupman, CA; STR NE35/30S/23E	Retrofit engines with pre-combustion chambers
SOx										
S-2726-5	10/4/2007	5/14/2008	55,614	40,150	0	84,936	180,700	Kern Oil & Refining Company	Panama Ln & Weedpatch Hwy, Bakersfield, CA 93307-9210 STR 25/30S/28E	Reduction in refinery fuel gas H2S content prior to combustion
VOC										
C-348-1	10/2/1992	12/22/1999	10,250	10,250	10,250	10,250	41,000	Calpine Corporation	2365 E North Ave, Fresno, CA 93725	Shutdown of cotton gin (natural gas-fired dryers)

Attachment 5.1F-1
Interpollutant Offset Analysis

ATTACHMENT 5.1F-1

Interpollutant Offset Analysis

The objective of an emission offset requirement is to ensure that new projects will have a net air quality benefit in the region. The offset program seeks to achieve this by reducing emissions at one location to balance, or offset, an emission increase elsewhere.

The simplest case involves the generation of emission offsets by reductions from an existing source at, or near, the new source. When the pollutants are the same and the location is the same, the presence or absence of a net air quality benefit is relatively easy to determine: if the new emissions are less than the old emissions, a regional net air quality benefit is achieved.

When the location of the source of offsets is different from the source of new emissions, the areas impacted by the two sources differ. It is often impossible to demonstrate that the area impacted by the new source is benefited everywhere by the reductions from the existing source. Agencies usually address this by setting an offset ratio that takes distance into account. The amount of reductions required is higher than the emission increase, resulting in a net benefit to the region as a whole and to most locations in the impacted area as well. This approach is usually coupled with a requirement to conduct an impact analysis to ensure that no significant increases occur in those areas where the effect of the increase is greater than the benefit from the decrease.

The analysis becomes much more complicated when the proposed reduction is of a different pollutant than that emitted by the proposed new source. The principle is the same: a net air quality benefit must be demonstrated. However, when the offsetting pollutant is different than the new pollutant, the demonstration is not straightforward.

Although the statutory requirement is to show an overall net air quality benefit, the practice has been to apply this test on a pollutant-specific basis. The agencies have allowed the reduction of one pollutant to offset the increase of another pollutant only where the two pollutants can be related, generally because one pollutant is a precursor for the other, or both are precursors for a third pollutant.

The SJVAPCD is not in attainment with the state 24-hour standard for PM_{10}. The District's new source review rule requires offsets for most increases in emissions of PM_{10} and its precursors, which include NOx, SO_2, VOC, and PM_{10}. The A2PP project will be required to provide offsets for all of these pollutants except SO_2. TID has purchased NOx, SO_2, VOC offsets. However, the applicant has not been able to obtain sufficient PM_{10} offsets to offset project PM_{10} with PM_{10} reductions.

SJVAPCD allows the use of interpollutant offsets, provided the project demonstrates a net air quality benefit and the impact analysis demonstrates that the project does not worsen or cause non-compliance with any ambient air quality standard.

The applicant proposes to meet the PM_{10} offset requirements for the A2PP by providing interpollutant SO_2 reductions. The direct impact analysis requirement, which demonstrated

that the PM_{10} emissions from the proposed project would not contribute significantly to an existing violation, was addressed in Section 5.1.2.5. TID proposes to follow the District's March 2009 guidance (attached) and to provide SO_2 reductions at a 1.0:1.0 ratio (not including the distance ratio requirement in Rule 2201).

Attachment 5.1F-1.1
SJVAPCD Interpollutant Offset Ratio Explanation

Interpollutant Offset Ratio Explanation

The Air District's Rule 2201, "New and Modified Source Review", requires facilities to supply "emissions offsets" when a permittee requests new or modified permits that allow emissions of air contaminants above certain annual emission offset thresholds. In addition, Rule 2201 allows interpollutant trading of offsets amongst criteria pollutants and their precursors upon the appropriate scientific demonstration of an adequate trading ratio, herein referred to as the interpollutant ratio. A technical analysis is required to determine the interpollutant offset ratio that is justified by evaluation of atmospheric chemistry. This evaluation has been conducted using the most recent modeling analysis available for the San Joaquin Valley. The results of the analysis are designed to be protective of health for the entire Valley for the entire year, by applying the most stringent interpollutant ratio throughout the Valley.

It is appropriate for District particulate offset requirements to be achieved by either a reduction of directly emitted particulate or by reduction of the gases, called particulate precursors, which become particulates from chemical and physical processes in the atmosphere. The District interpollutant offset relationship quantifies precursor gas reductions sufficient to serve as a substitute for a required direct particulate emissions reduction. Emission control measures that reduce gas precursor emissions at the facility may be used to provide the offset reductions. Alternatively, emission credits for precursor reductions may be used in accordance with District regulations.

The amount of particulate formed by the gaseous emissions must be evaluated to determine how much credit should be given for the gaseous reductions. Gases combine and merge with other material adding molecular weight when forming into particles. Some of the gases do not become particulate matter and remain a gas. Both the extent of conversion into particles and resulting weight of the particles are considered to establish mass equivalency between direct particulate emissions and particulate formed from gas precursors. The Interpollutant offset ratio is expressed as a per-ton equivalency.

The District interpollutant analysis uses the most recent and comprehensive modeling of San Joaquin Valley particulate formation from sulfur oxides (SOx) and nitrogen oxides (NOx). Modeling compares industrial directly emitted particulate to particulate matter from precursor emissions. The interpollutant modeling procedure, assumptions and uncertainties are documented in an extensive analysis file. Additional documentation of the modeling procedure for the San Joaquin Valley is contained in the 2008 PM2.5 Plan and its appendices. The 2008 PM2.5 Plan provides evaluation of the atmospheric relationships for direct particulate emissions and precursor gases when they are highest during the fourth quarter of the year. The southern portion of the Valley is evaluated by both receptor modeling and regional modeling of chemical relationships for precursor particulate formation. Regional modeling was conducted for the entire Valley through 2014. The two modeling approaches are combined to determine interpollutant offset ratios applicable to, and protective of, the entire Valley (SOx for PM 1:1 and NOx for PM 2.629:1).

Attachment 5.1F-1.2
SJVAPCD Development of the Interpollutant Offset Ratio

DEVELOPMENT OF THE INTERPOLLUTANT RATIO

For the proposed substitution of reductions of sulfur oxides (SOx) or nitrogen oxides (NOx) for directly emitted particulate matter

March 2009

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Introduction

Goal of Interpollutant Evaluation: Establish the atmospheric exchange relationship for substitution of alternative pollutant or precursor reductions for required reductions of directly emitted particulate

Evaluation to establish the atmospheric relationship of different pollutants is required as a prerequisite for establishing procedures for allowing a required reduction to be met by substitution of a reduction of a different pollutant or pollutant precursor. Proposed new facility construction or facility modifications may result in increased emissions of a pollutant. The District establishes requirements for reductions of the pollutant to “offset” the proposed increase. A facility may propose a reduction of an alternative pollutant or pollutant precursor where reductions of that material have already been achieved at the facility beyond the amount required by District regulations or where emission reductions credits for reductions achieved by other facilities are economically available; however, for such a substitution to be allowed the District must establish equivalency standards for the substitution. The equivalency relationship used for offset requirements is referred to in this discussion as the interpollutant ratio. The interpollutant ratio is a mathematical formula expressing the amount of alternative pollutant or precursor reduction required to be substituted for the required regulatory reduction. This discussion is limited to the atmospheric relationships and does not address other policy or regulatory requirements for offsets such as are contained in District Rule 2201.

The following description is provided to explain key elements of the analysis conducted to develop the atmospheric relationship between the commonly requested substitutions. Emission reductions of sulfur oxide emissions or nitrogen oxide emissions are proposed by many facilities as a substitution for reduction of directly emitted particulates. Elemental and organic carbon emissions are the predominant case and dominant contribution to directly emitted particulate mass from industrial facilities, although other types of directly emitted particulates do occur. Therefore this atmospheric analysis examines directly emitted carbon particulates from industrial sources in comparison to the formation of particles from gaseous emissions of sulfur oxides and nitrogen oxides.

Analyses included in Interpollutant evaluation

Factors Considered

The foundation for this analysis is provided by the atmospheric modeling conducted for the 2008 PM2.5 Plan. Modeling conducted for this State Implementation Plan was conducted by the District and the California Air Resources Board using a variety of modeling approaches. Each separate model has technical limitations and uncertainties. To reduce the uncertainty of findings, a combined evaluation of results of all of the modeling methods is used to establish "weight of evidence" support for technical analysis and conclusions. The modeling methods are supported by a modeling protocol which was sent to ARB and EPA Region IX for review and was included in the appendices to the Plan.

The analysis file prepared for the interpollutant ratio evaluation includes emissions inventories, regional model daily output files, chemical mass balance modeling and speciated rollback modeling as produced for the 2008 PM2.5 Plan. This well examined and documented modeling information was used as a starting point for additional evaluation to determine interrelationships between directly emitted pollutants and particulates from precursors.

The interpollutant ratio analysis is limited to evaluation of directly emitted PM2.5 from industrial sources and formation of PM2.5 from precursor gases. While both directly emitted particulates and particulate from precursor gases also occur in the PM10 size range, there is much more uncertainty associated with deposition rates and particle formation rates for the larger size ranges. Additionally, because PM2.5 is a subset of PM10; all reductions of PM2.5 are fully creditable as reductions towards PM10 requirements. This analysis concentrates on the quarter of the year when both directly emitted carbon from industrial sources and secondary particulates are measured at the highest levels. Assessing atmospheric ratios at low concentrations is subject to much greater uncertainty and has limited value toward assessment of actions to comply with the air quality standards.

Elements from 2008 PM 2.5 Plan

- Regional modeling daily output for eleven locations
- Chemical Mass Balance (CMB) modeling for four locations – source analysis, speciation profile selection, event meteorology evaluation
- Receptor speciated rollback modeling with adjustment for nitrate nonlinearity for four locations, evaluation of spatial extent of contributing sources
- Emission inventories and projections to future years as developed for the 2008 PM 2.5 Plan

- Modeling protocols for receptor modeling, regional modeling, and Positive matrix Factorization (PMF) analysis and evaluation of technical issues applicable to particulate formation in the San Joaquin Valley
- Model performance analysis as documented in appendices to the 2008 PM 2.5 Plan

Extension by additional analysis

Additional evaluation was conducted to evaluate the receptor modeling relationship between direct PM from industrial sources and sulfate and nitrate particulate formed from SOx and NOx precursor gases. Area of influence adjustments were evaluated to ensure appropriate consideration of contributing source area for different types of pollutants for both directly emitted and secondary particulate. This evaluation was possible only for the southern four Valley counties and was conducted for both 2000 and 2009.

The regional model output was evaluated for the fourth quarter to evaluate general atmospheric chemistry in 2005 and 2014 to determine the correlation between northern and southern areas of the Valley. This evaluation determined that the atmospheric chemistry observed and modeled in the north was within the range of values observed and modeled in the southern SJV. This establishes that a ratio protective of the southern Valley will also be protective in the north.

The District determined from the additional analyses of both receptor and regional modeling that the most stringent ratio determined for the southern portion of the Valley would also be protective of the northern portion of the Valley. Due to the regional nature of these pollutants, actions taken in other counties must be assumed to have at least some influence on other counties; therefore to achieve attainment at the earliest practical date it is appropriate to require all counties to establish a consistent interpollutant ratio for the entire District.

Strengths

The interpollutant ratio analysis uses established and heavily reviewed modeling and outputs as foundation data. Analysis of model performance has already been completed for the models and for the emissions inventories used for this analysis. The modeling was performed in accordance with protocols developed by the District and ARB and in accordance with modeling guidelines established by EPA. The combination of modeling approaches provides an analysis for the current year and provides projection to 2014. Weight of evidence comparison of various modeling approaches establishes the reliability of the foundation modeling, with all modeling approaches showing strong agreement in predicted results. Additional analysis performed to develop the interpollutant ratio uses both regional and receptor evaluations which were the primary models used for the 2008 PM 2.5 Plan.

Limitations

Both industrial direct emissions and secondary formed particulate may be both PM2.5 and PM10. The majority of secondary particulates formed from precursor gases are in the PM2.5 range as are most combustion emissions from industrial stacks, however both secondary and stack emissions do contain particles larger than PM2.5. Regional modeling is more reliable for the smaller fraction due to travel distances and deposition rates. Large particles have much higher deposition and are much more difficult to replicate with a regional model. This leads to a strong technical preference for evaluating both emission types in terms of PM2.5 because the integration of receptor analysis and regional modeling for coarse particle size range up to PM10 has a much greater associated uncertainty.

Analyses contained in Receptor modeling

Factors Considered

This modeling approach uses speciated linear modeling based on chemical mass balance evaluation of contributing sources with San Joaquin Valley specific identification of contributing source profiles, adjustments from regional modeling for the nonlinearity of nitrate formation, adjustments for area of influence impacts of contributing sources developed from back trajectory analysis of high concentration particulate episodes and projections of future emission inventories as developed for the 2008 PM2.5 Plan.

Analyses in receptor modeling that use input from regional modeling

The receptor modeling analysis uses a modified projection of nitrate particulate formation from nitrogen oxides based upon results of regional modeling. The atmospheric chemistry associated with nitrate particulate formation has been determined to be nonlinear; while the default procedures for speciated rollback modeling assume a linear relationship. This adjustment has been demonstrated as effective in producing reliable atmospheric projections for the prior PM10 Plans.

Extension by additional analysis

Additional evaluations were added to results of the receptor modeling performed for the 2008 PM2.5 Plan. Calculations determine the observed micrograms per ton of emission for each contributing source category that can be resolved by chemical mass balance modeling methods. These ten categories allow differentiation of industrial direct emissions of organic and elemental carbon from other sources that emit elemental and organic carbon. The interpollutant calculation is developed as an addition to the receptor analysis by calculating the ratio of emissions per ton of directly emitted industrial PM2.5 to the per ton ratio of secondary particulate formed from NOx and SOx emissions. Summary tables and issue and documentation discussion was added to the analysis.

Strengths

Receptor modeling provides the ability to separately project the effect of different key sources contributing to carbon and organic carbon. This is critical for establishing the atmospheric relationship between industrial emissions and the observed concentrations due to industrial emissions. Regional modeling methods at this time do not support differentiation of vegetative and motor vehicle carbon contribution from the emissions form industrial sources. The area of influence of contributing sources was also considered as a factor with the methods developed by the District to incorporate the gridded footprint of contributing sources into the receptor analysis. While regional

models use gridded emissions, current regional modeling methods do not reveal the resulting area of influence of contributing sources.

Limitations

Receptor modeling uses linear projections for future years and cannot account for equilibrium limitations that would occur if a key reaction became limited by reduced availability of a critical precursor due to emission reductions. The regional model was used to investigate this concern and did not project any unexpected changes due to precursor limitations.

Analyses contained in Regional modeling

Factors Considered

The analysis file includes the daily modeling output representing modeled values for the base year 2005 and predicted values for 2014 for each of the eleven Valley sites that have monitoring data for evaluation of the models performance in predicting observed conditions. These sites are located in seven of the eight Valley counties. Madera County does not have monitoring site data for this comparison.

Modeling data for all quarters of the year was provided. Due to the higher values that occur due to stagnation events in the fourth quarter, both industrial carbon concentrations and secondary particulates forming from gases are highest in the fourth quarter. Evaluating the interpollutant ratio for other quarters would be less reliable and of less significance to assisting in the reduction of high particulate concentrations. Modeling for lower values has higher uncertainty. Modeling atmospheric ratios when the air quality standard is being met are axiomatically not of value to determining offset requirements intended to assist in achieving compliance with the air quality standard. However, for consistency of analysis between sites, days when the standard was being met during the fourth quarter were not excluded from the interpollutant ratio analysis. Bakersfield fourth quarter modeled data included only eight days that were at or below the standard. Fresno and Visalia sites averaged twelve days; northern sites 24 days and the County of Kings 38 days.

Modeling output provided data for both 2005 and 2014. While there is substantial emissions change projected for this period, the regional modeling evaluation does not project much change in the atmospheric ratios of directly emitted pollutants and secondary pollutants from precursor gases. This indicates that the equilibrium processes are not expected to encounter dramatic change due to limitation of reactions by scarcity of one of the reactants. This further justifies using the receptor evaluation determining the interpollutant ratio for 2009 through the year 2014 without further adjustment. If observed air quality data demonstrates a radical shift in chemistry or components during the next few years, such a change could indicate that a limiting reaction has been reached that was not projected by the model and such radical changes might require reassessment of the conclusion that the ratio should remain unchanged through 2014.

Extension by additional analysis

Regional modeling results prepared for the 2008 PM2.5 Plan were analyzed to extract fourth quarter data for all sites. The atmospheric chemistry for all counties was analyzed for consistency and variation. This analysis provided a determination that the secondary formation chemistry and component sources contributing to concentrations observed in the north fell within the range of values similarly determined for the southern four counties. Based upon examination of the components and chemistry, the northern counties would be expected to have an interpollutant ratio value less than the

ratio determined for Kern County but greater than the one for Tulare County. This establishes that the interpollutant ratio determined by receptor analysis of the southern four counties provides a value that is also sufficiently protective for the north.

Strengths

Regional models provide equilibrium based evaluations of particulate formed from precursor gases and provide a regional assessment that covers the entire Valley. The projection of particulate formed in future years is more reliable than linear methods used for receptor modeling projections.

Limitations

The regional model does not provide an ability to focus on industrial organic carbon emissions separate from other carbon sources such as motor vehicles, residential wood smoke, cooking and vegetative burning. Regional modeling does not provide an assessment method for determination of sources contributing at each site or the area of influence of contributing emissions. Receptor analysis provides a more focused tool for this aspect of the evaluation.

Results and Documentation

SJVAPCD Interpollutant Ratio Results

SOx for PM ratio: 1.000 ton of SOx per ton of PM

NOx for PM ratio: 2.629 tons of NOx per ton of PM

These ratios do not include adjustments for other regulatory requirements specified in provisions of District Rule 2201.

The results of the modeling analysis developed an atmospheric interpollutant ratio for NOx to PM of 2.629 tons of NOx per ton of PM. This result was the most stringent ratio from the assessment industrial carbon emissions to secondary particulates at Kern County; with Fresno, Tulare and Kings counties having a lower ratio. The assessment of chemistry from the regional model required comparison of total carbon to secondary particulates and is therefore not directly useful to establish a ratio. However, the regional model does provide an ability to compare the general atmospheric similarity and compare changes in chemistry due to Plan reductions. Evaluation revealed that the atmospheric chemistry of San Joaquin, Stanislaus and Merced counties falls within the range of urban characteristics evaluated for the southern four counties; therefore the ratio established should be sufficiently protective of the northern four counties. Additionally, comparison of future year chemistry showed minimal change in pollutant ratio due to the projected changes in the emission inventory from implementation of the Plan. The SOx ratio as modeled indicates a value of less than one to one due to the increase in mass for conversion of SOx to a particulate by combination with other atmospheric compounds; however, the District has set guidelines that require at least one ton of an alternative pollutant for each required ton of reduction in accordance with District Rule 2201 Section 4.13.3. Therefore the SOx interpollutant ratio is established as 1.000 ton of SOx per ton of PM. These ratios do not include adjustments for other regulatory considerations, such as other provisions of District Rule 2201.

A guide to the key technical topics and the reference material relevant to that topic is found on the next page. References from the 2008 PM2.5 Plan may be obtained by requesting a copy of that document and its appendices or by downloading the document from http://www.valleyair.org/Air_Quality_Plans/AQ_Final_Adopted_PM25_2008.htm. References in Italics are spreadsheets included in the interpollutant analysis file "09 Interpollutant Ratio Final 032909.xls" which includes 36 worksheets of receptor modeling information from the 2008 PM2.5 Plan, 11 modified and additional spreadsheets for this analysis and two spreadsheets of regional model daily output. This file is generally formatted for printing with the exception of the two spreadsheets containing the regional model output "*Model-Daily Annual*" and "*Model-Daily Q4*" which are over 300 pages of raw unformatted model output files. The remainder of the file is formatted to print at approximately 100 pages. This file will be made available on request but is not currently posted for download.

Interpollutant Ratio Issues & Documentation

	TOPIC	Reference
1	**Reason for using PM2.5 for establishing the substitution relationship between direct emitted carbon PM and secondary nitrate and sulfate PM:** consistency of relationship between secondary particulates and industrial direct carbon combustion emissions.	2008 PM2.5 Plan, Sections 3.3.2 through 3.4.2
2	**Reason for using 4th Quarter analysis:** Highest PM2.5 for all sites.	*DV Qtrs*
3	**Reason for using analysis of southern SJV sites to apply to regional interpollutant ratio:** Northern site chemistry ratios are within the range of southern SJV ratios. Peak ratio will be protective for all SJV counties.	*Q4 Model Pivot, Model-site chem, Model-Daily Q4*
4	**Reason for using combined results of receptor and regional model:** Receptor model provides breakdown of different carbon sources to isolate connection between industrial emissions and secondary PM.	2008 PM2.5 Plan, Appendix F
	Regional model provides atmospheric information concerning the northern SJV not available from receptor analysis.	2008 PM2.5 Plan, Appendix G
5	**Most significant contributions of receptor evaluation:** Separation of industrial emissions from other source types. Area of influence evaluation for contributing sources.	2008 PM2.5 Plan, Appendix F
6	**Most significant contributions of regional model:** Scientific equilibrium methods for atmospheric chemistry projections for 2014. Receptor technique is limited to linear methods.	2008 PM2.5 Plan, Appendix G
7	**Common area of influence adjustments used for all receptor evaluations:**	
	Geologic & Construction, Tire and Brake Wear, Vegetative Burning - contribution extends from more than just the urban area (L2)	Modeling evaluation by J. W. Sweet February 2009 Reflected in *IPR* County *2000-2009* worksheets
	Mobile exhaust (primary), Organic Carbon (Industrial) primary, Unassigned - contribution extends from more than larger area, subregional (L3)	
	Secondary particulates from carbon sources are dominated by the local area with some contribution from the surrounding area (average of L1 and L2)	
	Marine emissions not found present in CMB modeling for this analysis.	
8	**Variations to reflect secondary area of influence specific to location:**	
	Fresno: Evaluation shows extremely strong urban signature (L1) for secondary sources Kern: Evaluation shows a strong urban signature mixed with emissions from the surrounding industrial areas (average L1 and L2) for both carbon and secondary sources Kings and Tulare: Prior evaluation has show a shared metropolitan contribution area (L2)	Modeling evaluation by J. W. Sweet February 2009 Reflected in *IPR* County *2000-2009* worksheets
9	**Reasons for using 2009 Interpollutant Ratio Projection:**	
	2009 Interpollutant ratio is consistent with current emissions inventories	2008 PM2.5 Plan
	Regional modeling does not show a significant change in chemical relationships through 2014.	*Q4 Model Pivot*
10	**Reason for using SOx Interpollutant Ratio at 1.000:** A minimum offset ratio is established as 1.000 to 1.000 consistent with prior District policy and procedure for interpollutant offsets.	District Rule 2201 Section 4.13.3