

2018 SO₂ EMISSIONS EVALUATION FOR NON- UTILITY SOURCES

FINAL REPORT

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ACRONYMS AND ABBREVIATIONS

AEO	Annual Energy Outlook
BLM	Bureau of Land Management
EGAS	Economic Growth Analysis System
EGU	electricity generating unit
EIA	Energy Information Administration
ERG	Eastern Research Group, Inc.
FCCU	fluid catalytic cracking unit
IC	internal combustion
PADD	Petroleum Administration Defense District
PCA	Portland Cement Association
Pechan	E.H. Pechan & Associates, Inc.
PSD	Prevention of Significant Deterioration
RMP	Resource Management Plan
SCC	source classification code
SIC	standard industrial classification (code)
SIP	State Implementation Plan
SO ₂	sulfur dioxide
SRU	sulfur recovery unit
SSJF	Stationary Sources Joint Forum
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
VOC	volatile organic compounds
WGA	Western Governors' Association
WRAP	Western Regional Air Partnership

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CHAPTER I. INTRODUCTION AND SUMMARY

This study was performed for the Stationary Sources Joint Forum (SSJF) of the Western Regional Air Partnership (WRAP). In order to update the sulfur dioxide (SO₂) emission milestones for the 309 State Regional Haze State Implementation Plans (SIPs), the SSJF/309 work group needs accurate information on projected emissions from non-utility sources of SO₂ in the five milestone States. Milestone sources are defined to be those facilities with greater than 100 tons per year (tpy) of SO₂ emissions at the facility level in 2004. The section 309 States are Arizona, New Mexico, Oregon, Utah, and Wyoming. Facilities that are primarily electricity generating units (EGUs) are excluded from this study.

The starting point for this analysis was the SSJF sponsored analysis that prepared 2018 stationary source emission projections from a 2002 baseline (ERG, 2006). The ERG analysis incorporates 2018 emission projections for the oil and gas production sector that were prepared by ENVIRON. Besides the information in the Eastern Research Group, Inc. (ERG) report, this analysis also used the MS Excel files posted on the Projections portion of the SSJF committee site on www.wrapair.org. These MS Excel files provide the 2002 criteria pollutant emissions, growth and control factors, and equations used to estimate 2018 emissions. Table 1 summarizes the States and primary industrial sectors that were the focus of this analysis.

Table I-1. Sectors Versus States

Sectors	States				
	Arizona	New Mexico	Oregon	Utah	Wyoming
Copper smelters	x	x		x	
Lime Manufacturing	x			x	
Pulp/paper	x		x		
Oil/gas		x		x	x
Chemicals					x
Refining		x		x	x
Cement	x	x		x	x

Note: Facilities in the aluminum smelting and iron and steel industries that were previously in the milestone program are now below the 100 tpy SO₂ cutoff or shutdown, so are not included in this analysis.

One of the overall findings of this analysis is that for SO₂, the retirement/replacement algorithms in the ERG 2018 emission projections only affect the emission forecast for two source types: industrial boilers and petroleum refinery catalytic crackers. All other sources have their 2018 emission estimates in proportion to the expected growth in activity. One result of the above is that facilities with industrial boilers and catalytic crackers usually have predicted declines in SO₂ emissions from 2002 to 2018, while other facilities have predicted increases in SO₂ during this period. In addition, for facilities that have industrial boilers and catalytic crackers, this makes the 2018 forecast very sensitive to having correct information for these types of units. For petroleum refineries, Pechan found that while all of the 309 source refineries in New Mexico, Utah and Wyoming have catalytic crackers, more than half of the facilities did not have these units correctly characterized in the 2002 emissions database. Correcting this problem had a significant influence on the 2018 SO₂ emission projections for this sector. This issue is discussed in more detail in the next chapter.

Sector-specific findings are summarized below and addressed in more detail in Chapter 2.

1. Copper smelters—there are only three operating copper smelters in the 309 States. Their 2018 SO₂ emissions were estimated using permitted allowable SO₂ emissions as the best indicator of future emission levels.
2. Petroleum refineries—corrections were made to the base year information for catalytic cracking units, which revised the emission projections for 7 of the 11 refineries in the study region. On the activity side, recent policy changes make it more likely that capacity expansions will occur at some western state refineries in the forecast period. However, potential increases in refinery SO₂ emissions at these facilities is expected to be tempered by firm's desire to keep any emission increases below levels that might trigger Prevention of Significant Deterioration (PSD) or new source review.
3. Oil and gas production—with some of the recent fluctuations in SO₂ emissions at facilities in this sector, a good part of this analysis involved developing a representative base year emission value for the facilities that had large yearly differences in emissions in 2002, 2003, and 2004. State and industry contacts were contacted to develop this information. In addition, Pechan found that the activity indicators in the previous 2018 projections used multiple data sources that were not properly calibrated to provide an accurate picture of expected regional growth. Pechan revised some of the milestone source projections to ensure consistency with projected regional growth rates.

CHAPTER II. ANALYSIS OF KEY SECTORS

A. COPPER SMELTERS

There are three copper smelters that continue to operate in the WRAP Section 309 States. The two copper smelters operating in Arizona are the ASARCO smelter in Hayden and the Phelps Dodge smelter in Miami. The other operating copper smelter is the Kennecott Utah Copper Corporation near Garfield, Utah.

This analysis uses the estimated permitted allowable SO₂ emissions for each of the three operating copper smelters as the best estimate of 2018 SO₂ emissions for this sector. Those emission values by facility are listed in Table II-1.

Table II-1. Copper Smelter SO₂ Emissions Projections (tpy)

State	Facility Name	2018
Arizona	ASARCO Smelter – Hayden	21,000
	Phelps Dodge – Miami	10,000
Utah	Kennecott Utah Copper Corp. *	1,000
Total Copper Smelter		32,000
* This SO ₂ estimate does not include boiler emissions at this facility.		

B. PETROLEUM REFINERIES

One of the problems that we have identified with the petroleum refinery emissions projections is that the fluid catalytic cracking units (FCCUs), which are present at all of the New Mexico, Utah, and Wyoming refineries, are not consistently included in the 2002 emissions inventory. This is a significant issue because this source type is a major fraction of SO₂ emissions at most refineries. Recent EPA/Department of Justice settlements with refinery companies target the FCCUs for SO₂ control, plus the projection methods used by ERG to estimate 2018 emissions apply large reduction factors to petroleum refinery FCCUs, but not to any other SO₂ sources as refineries, except certain industrial boilers (with specific fuel types).

The result of the above is that refineries with FCCUs correctly included in the 2002 emissions inventory have lower SO₂ in 2018 than in 2002, but all other refineries have 2018 SO₂ emissions that increase in proportion to expected growth in refinery activity.

The ERG 2018 SO₂ emissions projection methods account for retirements and replacements for a very limited number of source categories. Their SO₂ retirement and replacement reduction factors are listed in Table 5-2 of their report (ERG, 2006), and are provided in Table II-2.

Table II-2. Retirement and Replacement Reduction Factors

Category	Applicable SCCs	SO ₂
Industrial Coal Boilers	102001xx, 102002xx, 102003xx, 10500102	0.900
Industrial Oil Boilers	102004xx, 102005xx, 10201302, 10500105, 10500113, 10500114	0.900
Industrial Natural Gas Boilers	102006xx, 10500106	0.900
Industrial Oil Turbines	20200101, 20200103, 20200108, 20200109	0.900
Petroleum Refineries	30600201, 30600202	0.850

From the SO₂ floor allocation report that was prepared by the Market Trading Forum in 2002 (Pechan, 2002), we know that petroleum refineries have four major sources of SO₂ emissions. These four sources are: (1) the sulfur recovery unit (SRU); (2) fuel gas combustion units; (3) catalytic crackers; and (4) flares. All four of these primary SO₂ sources are present at each of the refineries in the Section 309 States, with their relative importance differing somewhat from refinery to refinery. Using the SO₂ emission estimates in the floor allocation report, FCCUs contribute from 25 to 60 percent of the SO₂ emissions at refineries in New Mexico, Utah, and Wyoming.

The result of the above is that the ERG 2018 SO₂ emission estimate for petroleum refineries is very sensitive to whether the FCCU SO₂ emissions are characterized correctly in the 2002 point source emissions database. Pechan's review of the State-by-State MS Excel files shows that two of the three New Mexico refineries are indicated as having FCCUs in the 2002 database; two of the four Utah refineries have FCCUs indicated; but none of the four Wyoming refineries have FCCU emissions in the database. Therefore, in the 2018 SO₂ emission projections, New Mexico refinery SO₂ emissions decline, Utah SO₂ emissions stay steady, and Wyoming refinery SO₂ emissions increase by about a factor of two.

The Wyoming DEQ indicated that the 2002 emissions data in version 1.3 of the WRAP-EDMS were accurate for the refineries in that state, so the base year emissions and 2018 projections were updated to incorporate these source-specific emissions data. For all other refinery sources with data issues, Pechan used the SO₂ emission estimates by facility from the floor allocation report to estimate the fraction of the facility-level SO₂ emissions that should be from the FCCU in 2002. Then, the 2018 projection was revised to include the relative SO₂ emission reduction factors from the ERG methods.

Arizona Clean Fuels, based in Phoenix, has been granted approval for air permits concerning what could be the first refinery to be built in the United States since the 1970s. The planned \$2.5 billion facility would be built on desert land about 40 miles east of Yuma, AZ. The Arizona Department of Environmental Quality drafted the air permit that set emission limits and pollution control requirements for the facility. The SO₂ emissions for this facility are included in the 2018 emission projections with the emissions amount equal to the permitted SO₂ emission limits for the plant. This permitted SO₂ emission amount is 251 tons per year.

1. Non-fuel Combustion Process Growth Indicators

ERG utilized Economic Growth Analysis System (EGAS) growth factors to project emission activity changes for non-fuel combustion refinery processes in these States. EGAS utilizes national projections of the supply of total petroleum products from Annual Energy Outlook (AEO) 2004 as the growth indicators for these processes. Pechan researched the availability of alternative refinery projections from AEO and other sources. The AEO publishes regional projections by Petroleum Administration Defense District (PADD) of refinery distillation base capacity, expansion, and utilization that indicate much higher growth over the 2002-2018 than the EGAS projections (5.4 percent annual growth vs. 1.6 percent annual growth). Because refining activity in PADD IV, which includes the States of interest, is very small relative to national activity, a relatively small projected increase in PADD IV refining distillation translates into very large percentage increases relative to baseline levels. Pechan had discussions with refinery industry contacts in Utah and Wyoming to obtain stakeholder opinion of the validity of the large percentage capacity increases that EIA is forecasting in the region. The consensus was that some capacity expansion is likely, but probably not to the extent estimated by the current AEO forecasts. As a result, Pechan retained the current EGAS-based emission activity growth factors for non-fuel combustion refinery processes.

2. Fuel Combustion Process Growth Indicators

ERG utilized EGAS growth factors to project refinery fuel combustion process emission activity changes. These growth factors were linked to the base year inventory via source classification codes (SCCs). Most of the refinery fuel combustion SCCs in the base year inventory are specific to the petroleum industry (e.g., Petroleum Industry, Process Heaters, Natural Gas). For these SCCs, EGAS assigns the AEO 2004 national refinery fuel consumption projections as growth indicators. In other cases, a petroleum refinery is listed with processes that are not specific to the refinery sector (e.g., Industrial, Internal Combustion Engines, Natural Gas). For these cases, EGAS assigns AEO 2004 fuel projections for generic sectors (both Industrial and Electric Generation sector SCCs are assigned). Because of this limitation, and for consistency with other milestone fuel combustion sectors, Pechan revised the growth indicator assignments for the petroleum refinery facilities of interest. In particular, all petroleum refinery milestone facilities growth factors were replaced with composite growth factors. These composite growth factors are computed by adjusting the EGAS-based refinery growth factor (1.315) for the projected change in energy use per dollar output by fuel type from AEO's Refining sector fuel consumption forecasts.

For example, AEO 2004 projects growth in refinery sector constant dollar output from \$182.886 billion in 2002 to \$231.598 billion in 2018, and forecasts refinery sector natural gas consumption to increase from 776.859 trillion Btu to 931.384 trillion Btu over the same period. These values indicate a projected 5.3 percent decrease in refinery sector natural gas consumption per dollar of output over the study period. The specific calculations are as follows:

$$2002 \text{ natural gas consumption per dollar of output} = 776,859/182.886 = 4,244.78$$

$$2018 \text{ natural gas consumption per dollar of output} = 931,384/231.598 = 4,021.55$$

$$\text{Adjustment factor for natural gas consumption} = (4,021.55 / 4,244.78) = 0.947.$$

Ultimately, Pechan applied a 1.245 growth factor to all natural gas combustion SCCs associated with petroleum refinery milestone sources in the base year inventory (i.e., $1.315 * 0.947 = 1.245$).

C. OIL AND GAS PRODUCTION AND EXPLORATION

The primary issues that were examined by Pechan for this sector included the representativeness of 2002 versus 2004 SO₂ emissions by facility in making projections to 2018, the complete inclusion of all milestone sources in the 2018 analysis in a consistent manner, and the methods that were used to estimate growth factors for the State and sub-State areas within the study region. Pechan's findings and recommendations for each of these issues are summarized below.

The 2004 Regional SO₂ Emissions and Milestone Report indicates that a number of oil and gas facilities had reported SO₂ emissions during 2004 that were more than 20 percent above or below the emissions for 2003. The non-EGU Facilities on this list were evaluated to determine whether it was appropriate to use a base year other than 2002 in the emission forecast. For example, the Duke Energy Field Services Linam Ranch Gas Plant and Eunice Gas Plant had 2004 SO₂ emissions well above recent historical emissions. A contact at Duke Energy indicated that the high 2004 emissions were the result of upset problems at these plants with excess SO₂ being released, not any increased production at these fields. Information about permitted SO₂ emission limits is provided below.

The Empire Abo Gas plant in New Mexico had no SO₂ emissions in the New Mexico 2002 point source emission inventory, so it was not included in the ERG files as a 309 source. The Frontier Field Services contact indicates that that facility was operating during 2002, so this analysis uses the reported 2004 emissions of 465 tpy as an appropriate base year value for use in these 2018 emission projections. (The 2003 SO₂ emissions of 1,956 tpy were well above the permitted annual emissions value of 565 tons.)

Contacts were also made with a representative of the Dynegy Midstream Services regarding their Eunice Gas Plant and Monument Plant emissions during 2003 and 2004, but no information was provided by them as of this report date. Therefore, 2002 SO₂ emissions have been used for these facilities in the 2018 emissions forecast.

The State of Wyoming has four facilities included in the ERG 2018 emission forecasts that are in the milestone report, but were not included in Wyoming's 2002 emission database. The ERG 2018 forecast carries along the 2004 reported emissions for these well fields as its 2018 forecasted values. Based on information provided by the Wyoming DEQ, Pechan assigned SCC codes to these units and included them in the 2018 forecast using growth factors methods that are consistent with the treatment of other oil and gas production units in the State. The SIC code in the ERG file indicated that these well fields are in the natural gas transmission industry (4922). This SIC code was revised to 1311 which is the natural gas production industry. The SCC assigned to these units is 31000205—Natural Gas Production—Flares.

1. Non-fuel Combustion Process Growth Indicators

For most non-fuel combustion oil/gas production/exploration milestone sources, ERG applied AEO 2004 regional oil/gas production forecasts. For a small number of records, ERG applied a method based on information provided in Resource Management Plans (RMPs). RMPs, which are produced by the Bureau of Land Management (BLM), reflect BLM's planned use for lands/mineral resources under its stewardship. RMPs for oil/gas production areas generally provide estimates of the number of new oil/gas wells anticipated over a 10 to 20 year period. ERG combined these estimates with their own estimates of the number of wells that would be abandoned over the study period. The number of abandoned wells was estimated based on historical rates for a given geographic region. The ERG method is flawed because there is little reason to believe that historic closure rates are related to future closure rates in areas where new wells are expected to come on-line.¹ At least for the milestone sources, Pechan observed that all non-AEO growth oil/gas production growth factors were higher than the AEO growth factors. Therefore, it appears that the ERG method will result in overall oil/gas production growth that is higher than projected by AEO. To ensure that overall oil/gas production growth is consistent with AEO 2004 forecasts, Pechan replaced all milestone source non-AEO growth factors with factors based on the AEO regional projections. Pechan recommends that the WRAP consider implementing these revisions for non-milestone oil/gas production sources as well.

2. Fuel Combustion Process Growth Indicators

The ERG projections use EGAS growth factors to project oil/gas sector fuel combustion emission activity changes. These growth factors were linked to the base year inventory via SCCs. The oil/gas fuel combustion SCCs in the base year inventory are not specific to the oil/gas sector. Instead, fuel combustion emission processes at oil/gas production milestone facilities are identified with either Industrial sector or Electric Generation sector fuel consumption source categories (e.g., Internal Combustion Engines, Electric Generation, Natural Gas, Turbine). These SCCs are assigned to either AEO total Industrial or AEO total Electric Generation sector fuel consumption forecasts in EGAS. In keeping with all other milestone facilities, Pechan revised the existing generic fuel consumption estimates to better reflect expected growth in the sector of interest. For oil/gas sector facilities, Pechan computed new growth factors that adjust the overall oil/gas production growth factors for the projected change in energy use per dollar output by fuel type from AEO's Mining sector fuel consumption forecasts. For natural gas combustion at oil/gas production facilities, for example, Pechan adjusted the overall AEO gas production 2002-2018 growth factors for the projected change in natural gas consumption per dollar of Mining sector output over this time-frame.

D. PULP AND PAPER

1. Non-fuel Combustion Process Growth Indicators

Currently, pulp and paper facility process emission activity is forecast using growth factors from EGAS. EGAS utilizes output projections for the Pulp, Paper, and Paperboard sector as the

¹ In fact, there are reasons to believe that there will be much faster abandonment of existing wells in areas adjacent to where new wells are expected—new wells tend to be drilled when existing wells are close to running dry.

growth indicator for non-fuel combustion pulp and paper SCCs. The pulp and paper milestone facility SO₂ emission records are all associated with sulfate (kraft) pulping processes. Therefore, Pechan investigated the availability of sulfate pulp production forecasts. Research uncovered that the U.S. Department of Agriculture (USDA)'s Forest Service recently published a long-term forecast of pulpwood receipts at pulp mills in the West region that indicates an annual decline of approximately 0.6 percent in these receipts (Haynes, 2003).² Pechan calculated the equivalent 2002-2018 growth factor (0.912) from this West region forecast and assigned this value to project sulfate pulping SCC emission activity.

2. Fuel Combustion Process Growth Indicators

ERG applied SCC-assigned growth factors from EGAS to project fuel combustion process emission activity at pulp and paper milestone facilities. In some cases, the fuel combustion SCC is identified as specific to the Paper industry, while in other cases, the SCC is listed as a generic Industrial or Electric Generation sector fuel combustion process. In keeping with all other milestone facility fuel combustion records, Pechan applied composite growth indicators to pulp and paper sector milestone facilities. These growth indicators were a composite of the aforementioned 0.912 general process activity factor and a factor representing the 2002 to 2018 change in energy consumption per dollar output for the given fuel type as projected nationally by AEO for the Paper sector.

E. CHEMICALS

1. Non-fuel Combustion Process Growth Indicators

Pechan investigated alternatives to the existing growth indicator assignments for a chemical manufacturing facility (SF Phosphates) located in Wyoming. The current growth indicators for this facility are from EGAS and were applied based on the SCCs of specific facility emission records. For example, there are two sulfur production processes that are assigned EGAS growth factors representing the projected change in Industrial Chemicals sector output in Wyoming. Research determined that this facility produces phosphate fertilizer from a combination of phosphate ore, sulfur, and ammonia inputs. Pechan was unable to identify any readily available growth projections for phosphate fertilizer production. However, Pechan was able to identify that the phosphate ore that this facility uses is mined in Vernal, Utah and that 90 percent of phosphate rock consumption is used to manufacture phosphoric acid for fertilizer products.

Pechan compiled historical data on phosphate rock sold/used by phosphate producers in the United States and in the combined States of Idaho and Utah (Utah data are combined with Idaho to avoid disclosing individual company data). The general trend since 1996 has been for a decline in phosphate rock use in these States (and even more pronounced decline is observed in the national totals). Pechan also identified a statement by the U.S. Geological Survey that suggests that current phosphate rock consumption levels are not expected to be exceeded in the foreseeable future (USGS, 2006). Based on this information, Pechan adopted a no growth assumption for all non-fuel combustion processes at the SF Phosphates facility.

² Note that this compares to a significant increase in these receipts (1.1 percent annual growth) that the USDA projected for South region pulp mills.

2. Fuel Combustion Process Growth Indicators

As noted elsewhere in this report, ERG applied SCC-assigned growth factors from EGAS to project changes in fuel combustion emission activity. The SF Phosphate facility is identified as having three fuel combustion SCCs: Industrial Boiler, Natural Gas; Internal Combustion (IC) Engines, Reciprocating: Distillate; and IC Engines, Large Bore Engine: Diesel. In keeping with EGAS defaults, these SCCs are assigned to generic Industrial sector natural gas/diesel growth indicators from AEO. Pechan revised these growth indicators to reflect a combination of the projection for no change in overall production over the forecast period, and factors representing the 2002 to 2018 change in energy consumption per dollar output for the given fuel type as projected nationally by AEO for the Bulk Chemicals sector.

F. CEMENT MANUFACTURING

In Arizona, the two cement plants have varying emissions such that they cross the 100 tpy line going in opposite directions between 2002 and 2004. It was decided to retain both plants in this analysis. If we had decided to remove one of these plants based on 2004 emissions being below 100 tpy, then as the raw material being processed by this plant changed in future years, the facility might be above the 100 tpy threshold again and included in the milestone program.

1. Non-fuel Combustion Process Growth Indicators

To reflect emission activity changes in non-fuel combustion cement manufacturing processes, ERG relied on EGAS growth factors. For dry process kilns, the EGAS growth factors are based on the output of an equation, developed from national historical dry cement production data, which relates total output (sales) to cement production. EGAS does not incorporate a similar equation for wet process kilns, but instead uses forecast changes in Hydraulic Cement sector output as the emission activity growth indicator. Pechan investigated the availability of recent forecasts of cement production activity and determined that the Portland Cement Association is projecting a 1.7 percent annual increase in national cement production through 2030 (PCA, 2006). To account for potential State-level differences in cement production, Pechan developed ratios for each WRAP State representing the proportion of total national output occurring in each State in both 2002 and 2018. Pechan then computed the 2002 to 2018 change in these proportions for each State and applied these factors to the national PCA forecast-based cement production growth factor to yield each State's non-fuel combustion cement manufacturing emission activity growth factor. For example, the Arizona growth factor (1.461) was computed as a product of the national PCA forecast-derived growth factor (1.354) and the State total output proportion forecast-derived factor (1.079).

2. Fuel Combustion Process Growth Indicators

There was only one fuel combustion process identified in the base year inventory for cement manufacturing milestone sources: Commercial/Institutional Boilers, Natural Gas. ERG utilized the SCC-specific EGAS growth factors to reflect changes in this emission activity. EGAS assigns this SCC to AEO's forecast for Commercial sector natural gas consumption. Pechan

revised the ERG applied growth factor to reflect a combination of the projection for State-specific cement production forecasts (noted above), and the 2002 to 2018 national forecast change in natural gas consumption per dollar output as projected by AEO for the Cement industry.

G. LIME MANUFACTURING

1. Non-fuel Combustion Process Growth Indicators

There are multiple non-fuel combustion emission processes identified in the base year inventory for lime manufacturing milestone facilities. These are: Lime Kilns; Mining/Quarrying (Open Pit Blasting); and Stone Quarrying-Processing, Blasting-General. EGAS uses state-level Concrete, Gypsum, and Plaster sector output projections as the growth indicator for Lime Kiln processes. To reflect emission activity level changes for the milestone facility Mining/Quarrying processes, EGAS uses state-level output forecasts for the Nonmetallic Minerals, Except Fuels sector. Pechan researched the availability of lime production forecasts, but was unable to identify any such forecasts. Therefore, Pechan did not revise the lime manufacturing non-fuel combustion process growth factors for milestone sources.

However, Chemical Lime Corporation (CLC) indicated that their 2002 SO₂ emissions estimate for their Nelson plant in Arizona was revised since their original data submittal to the Arizona DEQ, so the base year emissions for this facility were revised to 893 tons per year. In addition, because 2002 was not a representative year of operation for the CLC Douglas lime kilns, their 2005 calendar year SO₂ emissions of 755 tons per year were used in the Pechan forecasts for 2018.

2. Fuel Combustion Process Growth Indicators

ERG applied SCC-assigned growth factors from EGAS to project fuel combustion process emission activity at lime manufacturing sector milestone facilities. In most cases, the lime facility fuel combustion SCC is identified as a generic Industrial, Electric Generation, or Commercial sector fuel combustion process. In keeping with all other milestone facility fuel combustion records, Pechan applied composite growth indicators to lime manufacturing sector milestone facilities. These growth indicators were a composite of the aforementioned general process activity factors and factors representing the 2002 to 2018 change in energy consumption per dollar output for the given fuel type as projected nationally by AEO for the “Other Manufacturing” sector.

CHAPTER III. REVISED 2018 EMISSION FORECASTS

This chapter compares the 2018 facility-level SO₂ emission forecasts from Pechan with baseline SO₂ emissions and previous 2018 forecasts from ERG. Separate tables are provided for each of the section 309 States. Table II-1 for Arizona shows a 12 thousand ton reduction in Pechan's 2018 SO₂ emission projections (compared with previous values), which is mostly attributable to differences in how 2018 copper smelter emissions are estimated. Other changes to the Arizona values include upward revisions in base year SO₂ emissions for the two lime manufacturing plants, which lead to proportional increases in 2018 emission forecasts, and the addition of a new refinery, which is planned to be constructed east of Yuma.

Results for New Mexico are summarized in Table III-2. Pechan's 2018 SO₂ emission estimates for New Mexico are largely consistent with previous estimates by ERG. This result occurs because New Mexico's SO₂ emissions are dominated by the oil and gas production sector, and Pechan made only minor changes to the forecasts for this sector. Revisions to the forecasts for the three NM refineries balance out (increases offset decreases).

Table III-3 summarizes the revised 2018 forecasts for Oregon. This state is dominated by emissions from the pulp and paper industry, and the lower SO₂ emissions in the Pechan forecast result from revisions to the growth indicators for this sector.

Revised 2018 emission forecasts for Utah are shown in Table III-4. The revised forecast has 2018 emissions that are about 1,000 tons, or 10 percent lower than ERG's forecast. This difference is largely from lower 2018 emissions from the Kennecott copper smelter, with lesser differences resulting from the changes to refinery forecasts.

Wyoming results are in Table III-5. As with New Mexico, this state's SO₂ emissions are dominated by oil and gas production and Pechan has not made any significant revisions to the estimates for that sector. Changes to the refinery sector projections incorporate better information about the breakdown of SO₂ emissions among FCCUs, boilers, process heaters, flares, and sulfur recovery units. The net result of the changes to the refinery projections in Wyoming reduces the 2018 SO₂ estimates by 1,576 tons. The other major change to the Wyoming 2018 estimates is for SF Phosphates where the revision to the growth factors applied reduces 2018 emissions by about one thousand tons.

Table III-1. Facility-Level SO₂ Emissions Data – Arizona

State County FIPS	State Facility Identifier	SIC Primary	NAICS Primary	Facility Name	City	Sector	Base Year Emissions	2018 Emissions (ERG)	2018 Emissions (Pechan)
4027		2911	32411	Arizona Clean Fuels Refinery	Yuma	Refining	0	0	251
4019	40192869	3241	32731	Arizona Portland Cement Company	Rillito	Cement	107	18	146
4003	40032148	3274	32741	Douglas Lime Plant	Douglas	Lime	755	195	1,173
4025	40255992	3274	32741	Nelson Lime Plant	Peach Springs	Lime	893	1,097	1,388
4007	40071391	3331	331411	Phelps Dodge-Miami	Claypool	Copper	6,804	9,848	10,000
4025	40252393	3241	32731	Phoenix Cement	Clarkdale	Cement	270	478	395
4007	40072435	3331	331411	ASARCO-Ray Complex - Smelter & Mill	Hayden	Copper	18,438	34,490	21,000
4017	40171807	2611	322122	Abitibi-Snowflake Pulp Mill	Snowflake	Paper	1,519	1,043	980
TOTAL							28,786	47,170	35,333

Table III-2. Facility-Level SO₂ Emissions Data – New Mexico

State County FIPS	State Facility Identifier	SIC Primary	NAICS Primary	Facility Name	City	Sector	Base Year Emissions	2018 Emissions (ERG)	2018 Emissions (Pechan)
35015	350150024	1311	211111	Agave Energy-Yates Gas Plant	Artesia	Oil/Gas	2,099	2,842	2,842
35015	350150011	1321	211112	Duke Energy-Artesia Gas Plant	Artesia	Oil/Gas	838	1,134	1,134
35015	350150010	2911	32411	Navajo Refining-Artesia	Artesia	Refining	1,975	1,159	1,171
35031	350310008	2911	32411	Giant Refining Ciniza	Gallup	Refining	1,102	1,289	996
35015	350150285	1321	211112	Duke Energy-Dagger Draw Gas Plant	Artesia	Oil/Gas	170	230	230
35025	350250007	1311	211111	JL Davis-Denton Plant	Lovington	Oil/Gas	295	399	399
35015	350150002	1321	211112	BP America-Empire Abo Plant	Artesia	Oil/Gas	465	0	630
35025	350250044	1321	211112	Duke Energy-Eunice Gas Plant	Eunice	Oil/Gas	1,330	1,801	1,801
35025	350250060	1321	211112	Dynegy-Eunice Gas Plant	Eunice	Oil/Gas	704	532	953
35015	350150008	1311	211111	Marathon-Indian Basin Gas Plant	Carlsbad	Oil/Gas	2,040	2,762	2,794
35025	350250008	1321	211112	Sid Richardson-Jal No. 3	Jal	Oil/Gas	1,206	1,633	1,633
35025	350250035	1321	211112	Duke Energy-Linam Ranch Gas Plant	Hobbs	Oil/Gas	931	1,260	1,261
35025	350250004	1321	211112	Frontier-Maljamar Gas Plant	Maljamar	Oil/Gas	2,491	3,373	3,373
35025	350250061	1321	211112	Dynegy-Monument Plant	Monument	Oil/Gas	856	1,135	1,159
35045	350450023	2911	32411	Giant Refining-San Juan Refinery (Bloomfield)	Bloomfield	Refining	560	441	476
35045	350450247	1321	211112	Western Gas Resources-San Juan River Gas Plant	Kirtland	Oil/Gas	504	760	735
35025	350250063	1321	211112	Dynegy-Saunders Plant	Lovington	Oil/Gas	271	367	378
TOTAL							17,837	21,119	21,965

Note that Pechan revised baseline emissions for Empire Abo Plant.

Table III-3. Facility-Level SO₂ Emissions Data – Oregon

State County FIPS	State Facility Identifier	SIC Primary	NAICS Primary	Facility Name	City	Sector	Base Year Emissions	2018 Emissions (ERG)	2018 Emissions (Pechan)
41045	0002	2063	311313	Amalgamated Sugar	Nyssa	Food	813	595	595
41009	1849	2611	322121	Boise Cascade Corporation	Saint Helens	Paper	1,144	1,616	1,042
41007	4	2621	322121	Fort James Operating Company	Clatskanie	Paper	1,323	1,762	1,203
41041	5	2631	322130	Georgia-Pacific West, Inc.	Toledo	Paper	307	445	283
41051	1876	3221	327213	Owens-Brockway Glass Container Inc.	Portland	Glass	109	180	180
41043	3501	2611	322121	Pope & Talbot, Inc.	Halsey	Paper	97	134	88
41071	6142	2611	322122	Smurfit Newsprint Corporation	Newberg	Paper	547	831	517
41005	2145	2621	322121	West Linn Paper Company	West Linn	Paper	516	2	321
41043	471	2621	322130	Weyerhaeuser Company	Albany	Paper	443	412	275
TOTAL							5,301	5,979	4,503

Note that Pechan revised baseline emissions for West Linn Paper Company facility.

Table III-4. Facility-Level SO₂ Emissions Data – Utah

State County FIPS	State Facility Identifier	SIC Primary	NAICS Primary	Facility Name	City	Sector	Base Year Emissions	2018 Emissions (ERG)	2018 Emissions (Pechan)
49049	10790	8221	611310	BYU-Main Campus	Provo	Misc.	142	97	97
49027	10313	3274	212312	Graymont Western US-Cricket Mountain Plant	Delta	Lime	310	461	461
49029	10007	3241	327310	Holcim-Devil's Slide Plant	Morgan	Cement	58	97	83
49011	10122	2911	324110	Flying J Refinery (Big West Oil Co.)	North Salt Lake	Refining	281	344	261
49037	10034	1311	211111	Lisbon Natural Gas Processing Plant	Moab	Oil/Gas	1,453	2,119	2,119
49011	10123	2911	324110	Phillips Refinery	Woods Cross	Refining	452	549	567
49035	10572	1021	212234	Kennecott--Power Plt/ Lab/ Tailings	Magna	Copper	2,788	1,916	1,916
49035	10335	2911	324110	Tesoro-Salt Lake City Refinery	Salt Lake City	Refining	712	846	718
49011	10119	2911	324110	Chevron-Salt Lake Refinery	Salt Lake City	Refining	1,332	1,232	1,268
49035	10346	3331	331411	Kennecott-Smelter & Refinery	Magna	Copper	939	1,690	1,000
49043	10676	3295	212399	Shale Processing	Rockport	Metals/Mining	117	121	121
49007	10096	4911	221112	Sunnyside Cogeneration Facility	Sunnyside	Cogeneration	1,013	704	704
TOTAL							9,597	10,176	9,314

Table III-5. Facility-Level SO₂ Emissions Data – Wyoming

State County FIPS	State Facility Identifier	SIC Primary	NAICS Primary	Facility Name	City	Sector	Base Year Emissions	2018 Emissions (ERG)	2018 Emissions (Pechan)
56041	5604100012	1311	211111	BP America - Whitney Canyon	Evanston	Oil/Gas	6,291	9,172	9,172
56013	56003-00012(?)	1311		Burlington Resources - Bighorn Wells		Oil/Gas	2,163	3,284	3,154
56013	5601300028	1311	211111	Burlington Resources_Lost Cabin	Lost Cabin	Oil/Gas	2,174	3,170	3,170
56029	3	3275		Celotex Corp.	Cody	Gypsum	299	391	391
56037	0	1311		Chevron USA - Table Rock Field		Oil/Gas	150	232	219
56041	0	1311		Chevron USA - Whitney Canyon/Carter Creek Wellfield		Oil/Gas	812	876	1,184
56023	5602300013	1311	211111	Exxon Shute Creek I	Kemmerer	Oil/Gas	1,818	2,722	2,651
56037	5603700048	2812	327999	FMC Corp_Green River Plant_Sodium Prod		Lime	5,258	3,612	3,555
56021	5602100001	2911	324110	Frontier Refining, Inc.	Cheyenne	Refining	1,495	1,964	1,292
56037	5603700002	1474	327999	General Chemical		Nonmetallic Minerals	4,965	3,411	3,620
56017	9	4922		Hallwood Petroleum-Federal Packsaddle 1-24		Oil/Gas	141	206	206
56017	8	4922		Hallwood Petroleum-Federal Packsaddle #1		Oil/Gas	971	1,416	1,416
56043	5604300003	1321	48621	Hiland Partners, Llc_Hiland Gas Plant		Oil/Gas	264	385	385
56029	5602900012	1311	211111	Howell Pet Corp_Elk Basin Gas Plant	Powell	Oil/Gas	1,465	2,258	2,136
56017	6	1311	211111	KCS Mountain Resrcs_Golden Eagle Flare	Unk	Oil/Gas	360	525	525
56029	5602900007	1321	211112	Marathon Oil Co _ Oregon Basin Gas Plant	Cody	Oil/Gas	300	456	438
56001	5600100002	3241	23571	Mountain Cement Co		Cement	207	316	314
56037	5603700003	3312	331111	P4 Production_Rock Springs Facility		Comm. Fuel Combust	859	1,008	1,008
56013	11	1311	211111	Santa Fe Snyder_Riverton Plant		Oil/Gas	193	258	269
56037	5603700022	2874	325312	SF Phosphates, Inc	Rock Springs	Chemicals	2,015	3,129	2,015
56007	5600700001	2911	324110	Sinclair Oil Corp-Sinclair Refinery	Sinclair	Refining	3,255	4,703	3,709
56025	5602500005	2911	324110	Sinclair Refinery - Casper	Casper	Refining	1,081	1,389	1,165
56037	5603700008	1321	211112	Union Pac_Brady	Rock Springs	Oil/Gas	144	222	210
56001	5600100005	8221	221112	Univ Of Wyoming—Heat Plant		Misc.	188	189	189
56045	5604500001	2911	324110	Wyoming Refining Co_Newcastle Refinery	Newcastle	Refining	778	391	705
TOTAL							37,647	45,685	43,097

CHAPTER IV. SUMMARY OF FINDINGS

Tables IV-1 and IV-2 summarize the state and sector-level results of the 2018 forecast revisions. At the sector level, the biggest change in the 2018 emission estimates is for copper smelters, and because the two biggest copper smelter SO₂ sources are in Arizona, the forecast for that state is the most affected by the changes.

Other significant findings of this project are as follows:

1. Oil and gas production base year emissions are based on actual non-upset SO₂ emissions in a single year. The milestone report shows that there can be significant variability in these emissions year-to-year. Perhaps a better practice for this sector is to establish 2018 milestone SO₂ estimates using permitted allowable emissions. Firms that own these facilities operate them in a way that attempts to avoid triggering PSD or New Source Review.
2. There is a need to examine the relationships between existing source emission rates and new source emission rates for sources other than industrial boilers and FCCUs. Then, that information should be incorporated in the 2018 forecasts.
3. The upset SO₂ emissions at some NM gas plants during 2003 and 2004 exceed the SO₂ emissions from the SRU incinerators. These upset emissions are not included in the base year emission values used to develop this forecast.
4. Industry representatives indicate that oil and gas industry SO₂ emissions may decline over the next few years as sour gas field operations are reduced (or cease).

Table IV-1. State-Level Emission Comparisons

State	Base Year Emissions	2018 Emissions (ERG)	2018 Emissions (Pechan)
Arizona	28,786	47,170	35,333
New Mexico	17,837	21,119	21,965
Oregon	5,301	5,979	4,503
Utah	9,597	10,176	9,314
Wyoming	37,647	45,685	43,097
5 State Total	99,167	130,129	114,212

Table IV-2. Sector-Level Emission Comparisons

Sector	Base Year Emissions	2018 Emissions (ERG)	2018 Emissions (Pechan)
Cogeneration	3,801	2,620	2,620
Copper	26,181	46,028	32,000
Wood/Paper/Pulp	5,897	6,247	4,708
Cement	642	909	937
Chemicals/Plastics	2,015	3,129	2,015
Oil and Gas	32,900	45,529	46,574
Refining	13,023	14,308	12,579
Food	813	595	595
Glass	109	180	180
Metals/Mining/Minerals	12,596	9,289	10,710
Miscellaneous	1,189	1,294	1,294
Subtotal	99,167	130,129	114,212

CHAPTER V. REFERENCES

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APPENDIX A. FACILITY-LEVEL SO₂ EMISSIONS DATA BY STATE - 100 TPY OR MORE SO₂ IN EITHER 1990 OR 2000

This appendix provides historical SO₂ emission estimates for milestone sources (some of these may no longer be included in the milestone program) for the period of 1990 to 2004. The 2003 and 2004 SO₂ emission estimates are from recent SO₂ emission milestone tracking. Emission estimates for prior years are from related WRAP-sponsored studies.

Table A-1. Facility-Level SO₂ Emissions Data - 100 tpy or More SO₂ in Either 1990 or 2000 – Arizona

State	State ID	County ID	Facility ID	IAS Region	SIC	MTF Sector	Sector Description	Facility Name (1990)	Current Facility Name (if different from 1990)	SO ₂ tpy 1990	SO ₂ tpy 1996	SO ₂ tpy 1998	SO ₂ tpy 2000	SO ₂ tpy 2003	SO ₂ tpy 2004
100 tpy or More SO₂															
AZ	4	007	0004	45	3331	2	Copper	ASARCO Smelter - Hayden		29,814	33,124	22,077	16,753	18,977	19,395
AZ	4	021	0032	46	3331	2	Copper	BHP (Magma Metals)	BHP - San Manuel	15,900	16,678	10,409	0	0	0
AZ	4	007	0006	45	3331	2	Copper	Cyprus Miami Mine	Phelps Dodge - Miami	5,676	5,737	6,097	6,810	8,005	8,754
AZ	4	019	0040	46	1021	2	Copper	Cyprus Sierrita		800	548	<100	<100		0
AZ	4	025	0011	41	3274	10	Metals/Mining/Minerals	Chemical Lime (Chemstar)	Nelson	141	122	639	702	1,038	850
AZ	4	003	0003	47	3274	10	Metals/Mining/Minerals	Chemical Lime (Douglas)		212	364	724	742	0	126
AZ	4	019			3241	4	Cement/Concrete	Arizona Portland Cement		101	13	10	8		107
AZ	4	025		41	3241	4	Cement/Concrete	Phoenix Cement		<100	197	339	539	6	6
AZ	4	017	0007	43	2611	3	Wood/Paper/Pulp	Stone Container	Abitibi	2,012	2,455	2,448	1,893	1,987	2,020
AZ	4	005	0001	42	2911	6	Oil/Gas	Intermountain Refining		803	0	0	0		0
										55,559	59,238	42,843	27,547	30,013	31,258

Table A-2. Facility-Level SO₂ Emissions Data - 100 tpy or More SO₂ in Either 1990 or 2000 – New Mexico

State	State ID	County ID	Facility ID	IAS Region	SIC	MTF Sector	Sector Description	Facility Name (1990)	Current Facility Name (if different from 1990)	SO ₂ tpy 1990	SO ₂ tpy 1996	SO ₂ tpy 1998	SO ₂ tpy 2000	SO ₂ tpy 2003	SO ₂ tpy 2004
100 tpy or More SO₂															
NM	35	017	0001	64	3331	2	Copper	Phelps Dodge/Chino Mines		28,058	14,784	15,685	11,420	0	11
NM	35	023	0003	64	3331	2	Copper	Phelps Dodge/Hidalgo Smelter		41,433	32,121	29,188	0	0	0
NM	35	015	0024	65	1311	6	Oil/Gas	Agave Energy/Yates Plant		962	962	962	2,983	2,333	2,320
NM	35	015	0002	65	1311	6	Oil/Gas	Arco Permian/Empire Abo Gas Plnt		700	565	565	565	1,956	465
NM	35	025	0004	65	1321	6	Oil/Gas	Conoco/Maljamar Gas Plant	Maljamar Gas Plant	3,573	1,464	3,574	3,574	3,574	1,818
NM	35	045	0023	60	2911	6	Oil/Gas	Giant Industries/Bloomfield Ref		676	772	920	920	393	364
NM	35	031	0008	61	2911	6	Oil/Gas	Giant Refining/Ciniza Refinery		1,346	1,115	1,779	1,779	1,061	1,006
NM	35	025	0044	65	1321	6	Oil/Gas	Gpm Gas Eunice Gas Plant	Versado Gas Producers LIC	1,988	1,933	1,933	2,759	1,598	8,023
NM	35	015	0011	65	1321	6	Oil/Gas	Gpm Gas/Artesia Gas Plant	Duke Energy/Artesia Gas Plant	1,459	1,516	1,516	1,459	1,080	1,210
NM	35	015	0006	65	1311	6	Oil/Gas	Gpm Gas/Indian Hills Amine Plnt		900	450	450	900		
NM	35	025	0046	65	1311	6	Oil/Gas	Gpm Gas/Lee Gas Plant		818	0	818	818		
NM	35	025	0035	65	1321	6	Oil/Gas	Gpm Gas/Linam Ranch Gas Plant		274	1,302	1,302	1,304	3,539	7,837
NM	35	025	0007	65	1311	6	Oil/Gas	J.L. Davis Gas Process/Denton		385	890	891	1,158	1,158	535
NM	35	015	0008	65	1321	6	Oil/Gas	Marathon Oil/Indian Bsn Gas Plt		1,460	852	1,460	1,100	1,228	2,565
NM	35	015	0010	65	2911	6	Oil/Gas	Navajo Refining/Artesia Refinery		1,549	1,552	969	980	702	142
NM	35	015	0138	65	1311	6	Oil/Gas	Pan Energy/Burton Flats Gas Plt	Duke Energy/Burton Flats		196	196	246	0	0
NM	35	015	0285	65	1311	6	Oil/Gas	Pan Energy/Dagger Draw Gas Plt	Duke Energy/Dagger Draw		218	247	247	180	0
NM	35	025	0008	65	1321	6	Oil/Gas	Sid Richardson Gasoline/Jal#3		1,206	540	540	1,206	1,360	1,665
NM	35	025	0055	65	1321	6	Oil/Gas	Texaco/Buckeye Gasoline Plant	Dynergy	2,329	2,490	2,933	0		
NM	35	025	0052	65	1311	6	Oil/Gas	Texaco/Eunice North Gas Plant		673	1,076	1,346	673		
NM	35	025	0051	65	1311	6	Oil/Gas	Texaco/Eunice South Gas Plant		4,019	4,386	3,355	5,476	1	0
NM	35	015	0003	65	1311	6	Oil/Gas	Transwestern Pipe	Duke Energy/Huber Gas	221	231	231	231		
NM	35	041	0001	63	1311	6	Oil/Gas	Warren Petroleum/Bluitt Gas Plant		270	3,348	582	270		
NM	35	025	0060	65	1321	6	Oil/Gas	Warren Petroleum/Eunice Gas Plant	Eunice Gas Plant	3,285	2,388	2,388	1,226	1,109	1,933
NM	35	025	0061	65	1311	6	Oil/Gas	Warren Petroleum/Monument Plant	Monument Plant	1,460	1,709	1,432	1,432	872	2,416
NM	35	025	0063	65	1321	6	Oil/Gas	Warren Petroleum/Saunders Plant	Saunders Plant	913	3,312	1,387	1,387	486	569
NM	35	025	0064	65	1321	6	Oil/Gas	Warren Petroleum/Vada Gas Plant		1,204	2,149	0	0		
NM	35	045	0247	60	1311	6	Oil/Gas	Western Gas Processors/San Juan Rvr		5,475	980	980	3,138	452	428
NM	35	025	0128	65	1311	6	Oil/Gas	Citation/Antelope Rdg Gas Plant		291	0	NA			
NM	35	025	0118	65	1311	6	Oil/Gas	Conoco/Bell Lake 2 Well #6		129	0	NA			
NM	35	015	0125	65	1311	6	Oil/Gas	Feagan Energy/W Dagger Draw Gas Plt		240	0	NA			
NM	35	005	0050	65	1311	6	Oil/Gas	Yates Petroleum/Pathfinder Amine		227	57	57			
NM	35	001			3241	10	Metals/Mining/Minerals	Rio Grande Portland Cement					22	22	17
										107,523	83,357	77,686	47,273	23,104	33,324

Table A-3. Facility-Level SO₂ Emissions Data - 100 tpy or More SO₂ in Either 1990 or 2000 – Oregon

State	State ID	County ID	Facility ID	IAS Region	SIC	MTF Sector	Sector Description	Facility Name (1990)	Current Facility Name (if different from 1990)	SO ₂ tpy 1990	SO ₂ tpy 1996	SO ₂ tpy 1998	SO ₂ tpy 2000	SO ₂ tpy 2003	SO ₂ tpy 2004
100 tpy or More SO₂															
OR	41	045	0002	?	2062	7	Food	Amalgamated Sugar Company, The		594	625	1,235	987	905	775
OR	41	009	1849	6	2621	3	Wood/Paper/Pulp	Boise Cascade Company		2,453	685	746	1,834	2,496	1,636
OR	41	041	0005	5	2631	3	Wood/Paper/Pulp	Georgia-Pacific West, Inc.		56	207	322	452	486	418
OR	41	019	0007	5		10	Metals/Mining	Glenbrook Nickel Company		7	174	113	0	0	
OR	41	039	2125	5	3339	10	Metals/Mining/Minerals	Globe Metallurgical Inc.		204	200	228	197		
OR	41	019	0036	5	2631	3	Wood/Paper/Pulp	International Paper		874	602	1,006	0	0	
OR	41	007	0004	5	2621	3	Wood/Paper/Pulp	James River II, Inc.	Georgia- Pacific (Wauna Mill)	331	573	617	643	1,434	878
OR	41	065	0001	5	3334	10	Metals/Mining/Minerals	Northwest Aluminum Company, Inc.		423	448	375	397	0	0
OR	41	051	1876	5	3221	8	Glass	Owens-Brockway Glass Container, Inc.		103	169	116	108	113	113
OR	41	043	3501	5	2621	3	Wood/Paper/Pulp	Pope & Talbot Pulp, Inc.		485	133	92	293	231	528
OR	41	051	1851	5	3334	10	Metals/Mining/Minerals	Reynolds Metals Company		3,340	90	503	1,510	0	
OR	41	071	6142	5	2621	3	Wood/Paper/Pulp	Smurfit Newsprint Corporation 2		592	368	461	519	573	507
OR	41	039	8866	5	2421	3	Wood/Paper/Pulp	Weyerhaeuser Company	SierraPine, Ltd.	119	201	127	0.4		
OR	41	039	????	5		3		Weyerhaeuser Particle board		377	372	296			
OR	41	043	0471	5	2631	3	Wood/Paper/Pulp	Willamette Industries, Inc.	Weyerhaeuser Company	396	54	485	327	198	160
OR	41	039	8850	5	2631	3	Wood/Paper/Pulp	Collins Products LLC	Weyerhaeuser Co. (Particleboard)	202	0	3	1,721		
OR	41	071	5034	5	4953	9	Misc.	Cascade Steel Rolling Mills, Inc.		116	29	29			
OR	41	009	2520	5	4911	1.1	Electricity	Enron Corp.		103	0	44			
OR	41	051	2028	5	5171	6	Oil/Gas	Gatx Terminals Corporation	Kinder Morgan Energy Partners, L.P	180	3	3			
OR	41	029	0041	5	2821	5	Chemicals/Plastics	Georgia-Pacific Resins, Inc.		1,008	0	<100			
OR	41	035	0013	6	2421	3	Wood/Paper/Pulp	J. Peterkort & Company	Collins Products LLC	189	3	3			
OR	41	047	5398	5	9511	9	Misc.	Ogden Martin Systems of Marion, Inc.	Covanta Marion, Inc.	127	18	22			
OR	41	051	2050	5	8221	9	Misc.	Oregon Health Sciences University		246	2	5			
OR	41	005	2145			3	Wood/Paper/Pulp	West Linn Paper Co						380	516
										12,525	4,956	6,831	8,988	6,816	5,531

Table A-4. Facility-Level SO₂ Emissions Data - 100 tpy or More SO₂ in Either 1990 or 2000 – Utah

State	State ID	County ID	Facility ID	IAS Region	SIC	MTF Sector	Sector Description	Facility Name (1990)	Current Facility Name (if different from 1990)	SO ₂ tpy 1990	SO ₂ tpy 1996	SO ₂ tpy 1998	SO ₂ tpy 2000	SO ₂ tpy 2003	SO ₂ tpy 2004
100 tpy or More SO₂															
UT	49	035	0030	32	3331	2	Copper	Kennecott Utah Copper Corp.		26,829	1,556	762	937	973	870
UT	49	035	0004	32	2911	6	Oil/Gas	Amoco Petroleum Products	Tesoro Petroleum	6,701	983	1,116	1,368	700	893
UT	49	049	0004	33	8221	9	Misc.	Brigham Young University		248	90	158	125	142	147
UT	49	027	0001	35	1081	10	Metals/Mining/Minerals	Brush Wellman Inc.		161	175	208	179	16	0
UT	49	011	0003	31	2911	6	Oil/Gas	Chevron Products Company		2,424	1,116	845	1,242	1,191	1,365
UT	49	027	0005	35	3274	10	Metals/Mining/Minerals	Continental Lime Inc.	Graymont Western US	115	297	275	331	345	418
UT	49	011	0008	31	2911	6	Oil/Gas	Flying J Incorporated		312	574	225	300	398	378
UT	49	049	0027	33	3312	10	Metals/Mining/Minerals	Geneva Steel		8,473	2,020	881	979	0	0
UT	49	029	0001	31	3241	4	Cement/Concrete	Holnam Incorporated	Holcim US Inc.	911	3	247	288	58	228
UT	49	011	0013	31	2911	6	Oil/Gas	Phillips 66 Company		5,672	864	862	601	489	474
UT	49	037	0032	35	1311	6	Oil/Gas	Unocal Corporation	Tom Brown-Lisbon	1,575	1,391	1,478	1,252	1,224	795
UT	49	005		?	8221	9	Misc.	Utah State University			134	123			
UT	49	035	10572		1021	1A	CHP	Kennecott Utah Copper Corp.		2,905	2,141	2,200	2,534	2,499	2,955
UT	49	007	10096		4911	1A	CHP	Sunnyside Cogeneration Associates		0	1,006	970	1,054	890	
UT	49	043	10676		3295	10	Metals/Mining/Minerals	Utelite Corporation					133	109	130
UT	49	035	0034	32	8062	9	Misc.	LDS Hospital		330	20	20			
UT	49	035	0063	32	8221	9	Misc.	University of Utah		238	7	3			
UT	49				3295	10	Metals/Mining/Minerals	Utelite Corporation - Shale Processing							
										56,894	12,376	10,373	11,323	9,034	8,653

Table A-5 (continued)

Table A-5. Facility-Level SO₂ Emissions Data - 100 tpy or More SO₂ in Either 1990 or 2000 – Wyoming

State	State ID	County ID	Facility ID	IAS Region	SIC	MTF Sector	Sector Description	Facility Name (1990)	Current Facility Name (if different from 1990)	SO ₂ tpy 1990	SO ₂ tpy 1996	SO ₂ tpy 1998	SO ₂ tpy 2000	SO ₂ tpy 2003	SO ₂ tpy 2004
100 tpy or More SO₂															
WY	56	029	0012	9	1311	6	Oil/Gas	Amoco - Elk Basin	Howell Petroleum - Elk Basin	1,096	1,218	1,422	2,638	1,497	1,396
WY	56	041	0012	9	1311	6	Oil/Gas	Amoco - Whitney Canyon	Bp America-Whitney Canyon	6,401	5,835	11,130	6,889	6,165	4,284
WY	56	041	0009	9	1311	6	Oil/Gas	Chevron - Carter Creek		1,537	1,165	3,330	2,096	36	26
WY	56	023	0013	8	1311	6	Oil/Gas	Exxon - Shute Creek		1,078	1,999	2,015	1,383	1,368	1,237
WY	56	035		8	1311	6	Oil/Gas	Exxon Black Canyon Dehy & Wellfield					167	241	46
WY	56	037	0010	9	1474	10	Metals/Mining/Minerals	FMC - Granger (Texas Gulf)		475	473	149	212		0
WY	56	037	0048	9	2812	5	Chemicals/Plastics	FMC - Green River		4,795	5,256	4,533	4,901	5,348	5,387
WY	56	023	0001	8	3312	10	Metals/Mining/Minerals	FMC Coking Plant	Astaris Coking Plant	1,194	1,413	1,454	1,409	0	0
WY	56	021	0001	9	2911	6	Oil/Gas	Frontier Oil & Refining - Cheyenne		1,521	1,769	1,422	1,396	1,657	1,565
WY	56	037	0002	9	1474	10	Metals/Mining/Minerals	General Chemical		4,196	5,651	4,538	5,000	4,796	4,750
WY	56	015	0001	9	2063	7	Food	Holly Sugar - Torrington	Western Sugar-Torrington	374	266	154	178	93	99
WY	56	043	0003	9	1321	6	Oil/Gas	Interenergy - Hiland	Wildhorse Energy - Hiland	21	415	110	269		115
WY	56	017		9	1311	6	Oil/Gas	KCS Mountain Resources - Golden Eagle			558	942	17	56	
WY	56	003		9	1311	6	Oil/Gas	KCS Mountain Resources - Ainsworth			807	845	0	0	
WY	56	013	0005	9	2819	5	Chemicals/Plastics	Koch Sulfur Products Company		1,104	1,109	1,237	1,245	0	
WY	56	013	0028	9	1311	6	Oil/Gas	Louisiana Land & Explor - Lost Cabin	Burlington Resources - Lost Cabin		4,547	1,336	1,700	1,332	2,230
WY	56	029	0007	9	1311	6	Oil/Gas	Marathon Gas Plant - Oregon Basin		406	456	388	358	321	371
WY	56	017		9	1311	6	Oil/Gas	Marathon Oil - Mill Iron			234	260	0	30	
WY	56	037	0003	9	3312	10	Metals/Mining/Minerals	Sweetwater Resources	P4 Production - Rock Springs	933	663	642	633	859	955
WY	56	037	0022	9	2874	5	Chemicals/Plastics	SF Phosphates, Inc	Simplot Phosphates	578	1,154	1,971	1,790	2,051	2,236
WY	56	025	0001	9	2911	6	Oil/Gas	Little America Refining Company	Sinclair - Casper	1,899	1,629	1,305	1,458	1,165	870
WY	56	007	0011	9	2911	6	Oil/Gas	Sinclair @ Sinclair		5,917	3,990	3,524	3,407	2,903	2,749
WY	56	013	0011	9	1311	6	Oil/Gas	Snyder Oil - Riverton Dome	Devon Sfs - Riverton Dome	2,010		147	492		
WY	56	037		9	1474	10	Metals/Mining/Minerals	Solvay Minerals			101	72	52	46	53
WY	56	003	0012	9	1311	6	Oil/Gas	Texas-Byron Plant	Big Horn Gas Processing - Byron	192	169	605	257	0	0
WY	56	037	0008	9	1311	6	Oil/Gas	Union Pac - Brady	Rme Petroleum - Brady	415	331	576	300	97	89
WY	56	001	0005	9	8221	9	Misc.	UW Central Heat Plant		152	154	223	193	159	204
WY	56	045	0001	9	2911	6	Oil/Gas	Wyoming Refining Co	Wyoming Refining - Newcastle	630	930	804	876	848	886
WY	56	013	0008	9	1311	6	Oil/Gas	Devon Sfs Operating Co.	Beaver Creek				831	70	37

Table A-5 (continued)

State	State ID	County ID	Facility ID	IAS Region	SIC	MTF Sector	Sector Description	Facility Name (1990)	Current Facility Name (if different from 1990)	SO ₂ tpy 1990	SO ₂ tpy 1996	SO ₂ tpy 1998	SO ₂ tpy 2000	SO ₂ tpy 2003	SO ₂ tpy 2004
WY	56	011	0003	9	1452	10	Metals/Mining/Minerals	American Colloid - West Colony		212	80	53		54	51
WY	56	025	0002	9	2911	6	Oil/Gas	Amoco Refinery		1,153	0	0			
WY	56	003	0001	9	1452	10	Metals/Mining/Minerals	Bentonite Corporation	Lovell	192	3	41			
WY	56	037	0014	9	1311	6	Oil/Gas	Colorado Interstate Gas - Table Rock		522	20	39			
WY	56	003	0013	9	1311	6	Oil/Gas	Marathon Oil Company - Garland		257	7	10			
WY	56	001	0002		3241	4	Cement/Concrete	Mountain Cement-Laramie						185	197
WY	56	005	0146					Black Hills Corporation - Wygen 1						432	
WY	56	005			1321	6	Oil/Gas	Anadarko E&P Company Lp - Tablerock Gas Plant						187	255
WY	56	013			1321	6	Oil/Gas	Burlington Resources - Big Horn Wells						3,284	2,163
WY	56	037			1321	6	Oil/Gas	Chevron USA - Table Rock Field						232	150
WY	56	041			1321	6	Oil/Gas	Chevron USA - Whitney Canyon/Carter Creek Wellfield						867	812
WY	56	013		9	1311	6	Oil/Gas	Devon Energy Corp. - Beaver Creek Gas Field							61
										39,260	42,402	45,277	40,147	36,379	33,274