Appendix A

La Paz Agreement Annex IV Text

ANNEX IV TO THE AGREEMENT BETWEEN
THE UNITED STATES OF AMERICA
AND THE UNITED MEXICAN STATES
ON COOPERATION FOR THE PROTECTION AND IMPROVEMENT
OF THE ENVIRONMENT IN THE BORDER AREA

AGREEMENT OF COOPERATION BETWEEN
THE UNITED STATES OF AMERICA
AND THE UNITED MEXICAN STATES
REGARDING TRANSBOUNDARY AIR POLLUTION CAUSED
BY COPPER SMELTERS ALONG THEIR COMMON BORDER

PREAMBLE

The Government of the United States of America ("the United States"), and the Government of the United Mexican States ("Mexico"), ("the Parties"),

Recognizing public concern for health and environmental damage resulting from air pollution caused by copper smelters along their common border;

Taking note that such public concern led to consultations between the Parties in the framework of their Agreement on Cooperation for the Protection and Improvement of the Environment in the Border Area of 1983 ("the 1983 Agreement");

Taking note also with satisfaction that such consultations led to the taking by each of the Parties, in their respective territories, of measures which will yield an improvement of the air quality in the border area;

Recognizing that the decision in the United States to close the Phelps Dodge copper smelter in Douglas, Arizona, by January 15, 1987, will constitute a significant contribution to the protection of the environment in the border area;

Recognizing also that the efforts already in progress in Mexico to establish a high efficiency plant for the processing of sulphur dioxide to sulphuric acid, in the Mexicana de Cobre La Caridad copper smelter in Nacozari, Sonora, by June 1, 1988, will constitute a significant contribution to the protection of the environment in the border area;

Considering the importance for the Parties to ensure the implementation of the above described measures, as well as the need to contemplate the adoption of other measures to further protect and improve air quality from activities by copper smelters in the border area;

Reaffirming Principle 21 of the 1972 Declaration of the United Nations Conference on the Human Environment, adopted at Stockholm, which provides that States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national

__Desirous__ to cooperate effectively to protect public health and welfare from the effects of air pollution caused by copper smelters in the border area; and

__Recalling__ that Article 3 of the 1983 Agreement provides that the Parties may conclude specific arrangements for the solution of common problems in the border area as annexes to that Agreement;

Have agreed as follows:

ARTICLE I

Emissions Reduction Measures

1. The United States undertakes to ensure that in the event that the Phelps Dodge copper smelter in Douglas, Arizona, recommences smelting after January 15, 1987, or that any other copper smelter is established in its side of the border area in the future, such smelter will be subject upon commencement of smelting operations to the taking of effective measures necessary to ensure that sulphur dioxide emissions shall not exceed .065 percent by volume during any six-hour period.

2. In the United States other existing copper smelters in its side of the border area, whether currently operating or not, will continue to be subject to effective control measures necessary to protect the environment from sulphur dioxide emissions, as provided by applicable state and federal law.

3. Mexico undertakes to ensure that operations of the Mexicana de Cobre la Caridad copper smelter in Nacozari, Sonora, after 1 June 1988, or the establishment of any other copper smelter in its side of the border area in the future, will upon commencement of operations be subject to the taking of effective measures necessary to ensure that sulphur dioxide emissions shall not exceed .065 percent by

volume during any six-hour period. Until that date, the Nacozari smelter will continue operating at a maximum average sulphur dioxide emissions limit that does not exceed any ambient concentration up to 0.13 parts per million during any twenty-four hour period.

4. Mexico undertakes to ensure that any future expansion of the smelting capacity of the Compania Minera de Cananea copper smelter in Cananea, Sonora, will be subject, at the time of commencement of such expanded operations, to the taking of effective measures to ensure that sulphur dioxide emissions shall not exceed .065 percent by volume during any six-hour period.

5. For the purpose of determining compliance with the .065 emissions limitation established in this Annex,

   a) Six-hour average sulphur dioxide concentrations shall be calculated and recorded daily for the four consecutive six-hour periods of each operating day, beginning at 12 a.m.

   b) Each six-hour period shall be contiguous one-hour average sulphur dioxide concentrations.

   c) One-hour average emissions concentrations shall be computed from four or more data points equally spaced over each one-hour period

5. The Parties shall endeavor to take, subject to the availability of resources, any other appropriate interim emissions reduction measures intended to protect public health and welfare from air pollution caused by copper smelters in the border area.

ARTICLE II

Emissions Monitoring, Recordkeeping and Reporting Systems

1. Any copper smelter that, in accordance with this Annex, will be required to comply with the emissions limitation of .065 percent by volume during any six-hour period, shall install, operate and maintain continuous emissions monitoring, recordkeeping and reporting systems, on the following bases:

   a) For the purpose of monitoring emissions of sulphur dioxide, the monitoring system shall be installed, calibrated and maintained by the owner or operator of any copper smelter to which this Article applies, with zero and span checks to be performed daily and a quality assurance program.

b) For the purpose of recordkeeping, all records of emissions shall be kept for two years following the dates of such emissions, and:

i) Other information to be kept on file may include continuous monitoring system, monitoring device and performance testing measurements, all continuous monitoring system or monitoring device calibration checks, adjustments or maintenance performed on these systems or devices, and all other information that the competent national authority may require be kept.

ii) The smelter owner or operator shall be required to keep a monthly record of the total smelter charge.

iii) The copper smelter owner or operator shall be required to submit to the competent national authority, on a quarterly basis, written reports of sulphur dioxide emissions that exceed .065 percent by volume during any six-hour period, as well as the following information:

- The magnitude of any emissions which exceed .065 percent by volume during any six-hour period, and the date and time of commencement and completion of each time period of these emissions.

- Specific identification of each six-hour period in which emissions exceed .065 percent by volume during startup, shutdown or malfunctions of the smelter, the nature and cause of any malfunction, if known, and the corrective actions taken.

- The date, time, and duration of each period during which the continuous monitoring system was inoperative, except for zero and span checks, and the nature of the system repairs or adjustments.

2. The emissions monitoring, recordkeeping and reporting systems referred to in paragraph 1 of this Article, are aimed at availing each Party with adequate information to enable it to undertake whatever practicable measures are regarded as appropriate, or to enable the Parties to cooperate to that end, and in no way shall such resulting information be interpreted so as to alter the commitments of the Parties specified in Article I of this Annex or in any of its other provisions.

3. The Parties shall consult in order to find effective means of cooperation, to ensure the most immediate means for the prompt and full implementation of the provisions in this Article.

ARTICLE III

Atmospheric Monitoring Facilities

The Parties shall continue to consult concerning their existing atmospheric monitoring facilities located in the border area, and will continue to cooperate to enhance effective monitoring.

ARTICLE IV

Working Group of Technical Experts

1. The Parties confirm the binational body established by the First Annual Meeting of National Coordinators, in the spirit of Article 11 of the 1983 Agreement, of technical experts known as the U.S.-Mexico Air Quality Working Group ("Working Group"). The Working Group shall be co-chaired by officials who shall be appointed by and report to the United States and Mexican Coordinators ("National Coordinators") as provided for under Article 8 of the 1983

Agreement. The Working Group shall meet on a regular basis and shall include participation, as appropriate or necessary, of state and local officials from both countries.

2. The Working Group shall meet at least once every six months to review progress in abating smelter pollution in the border area, as contemplated by this Annex and, if necessary, to make findings on additional corrective measures for recommendation to the National Coordinators. The Working Group shall submit all its recommendations and its evaluation of the Parties' compliance with the terms of this Annex in a bi-annual report to the National Coordinators. The National Coordinators shall, by mutual agreement, implement such recommendations as they deem appropriate.

3. The National Coordinators shall forward all Working Group reports to the respective Foreign Ministries in each country, namely, the Department of State, in the case of the United States, and the Secretariat of External Relations, in the case of Mexico, and shall recommend, taking into account Working Group reports, such additional action as may be needed to further the purposes of this Annex.

4. The Parties shall, consistent with their respective domestic legislation and regulations, exchange information and data on copper smelters in their respective border states, and also ensure that the Working Group is provided with complete information, including atmospheric and emissions monitoring data in the border area and other information either existing or which may become available as a result of this Annex.

ARTICLE V

Legislative Authority

The Parties will promote legislative authority, as may be necessary, to provide for the abatement of transboundary air pollution caused by copper smelters. The Parties shall continue to consult with respect to these matters.

ARTICLE VI

Effect on Other Instruments

1. Nothing in this Annex shall be construed to prejudice other existing or future agreements concluded between the Parties, or affect the rights or obligations of the Parties under international agreements to which they are Party.

2. The provisions of this Annex shall, in particular, not be deemed to prejudice or otherwise affect the functions entrusted to the International Boundary and Water Commission, in accordance with the 1944 Treaty on the Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande.

ARTICLE VII

Appendices

Any appendices to this Annex may be added through an exchange of diplomatic notes and shall form an integral part of this Annex.

ARTICLE VIII

Amendment

This Annex, and any appendices added hereto, may be amended by mutual agreement of the Parties through an exchange of diplomatic notes.

ARTICLE IX

Review

The Parties shall meet at least every two years from the date of entry into force of this Annex, at a time and place to be mutually agreed upon, in order to review the effectiveness of its implementation and to agree on whatever individual and joint measures are necessary to improve such effectiveness.

ARTICLE X

Entry into Force

This Annex shall enter into force upon an exchange of diplomatic notes between the Parties stating that each Party has completed its necessary internal procedures.

ARTICLE XI

Termination

This Annex shall remain in force indefinitely, unless one of the Parties notifies the other in writing through diplomatic channels of its desire to terminate it, in which case the Annex shall terminate six months after the date of such written notification. Unless otherwise agreed, such termination shall not affect the validity of any agreements made under this Annex.

IN WITNESS WHEREOF the undersigned, being duly authorized by their respective Governments, have signed this Annex.

DONE at Washington, in duplicate, this twenty-ninth day of January, 1987, in the English and Spanish languages, both texts being equally authentic.

FOR THE GOVERNMENT OF THE UNITED STATES OF AMERICA:	FOR THE GOVERNMENT OF THE UNITED MEXICAN STATES:

Appendix B

Copper Smelter Emissions/Monitoring Procedures: Summaries

Table 1. Copper Smelters Within 100 Km. of Border –Emission Limits/Monitoring Procedures–

A. ASARCO El Paso Copper Smelter

1. Points of Contact:

ASARCO El Paso: Tom Martin/Envr. Manager (915) 541-1819
TNRCC El Paso: Joe Saenz/Ambient Monitoring (915) 783-6642

2. Emission Limits, Controls, Stack CEMs:

	Source Type				
	Concentrate Dryer(s)	Roaster	Smelting Furnaces(s)	Primary Converter Gases	Captured Fugitives
SO_2 Limits:					
State Permit to Operate	10 ppm (hourly ave.)	NA	960 ppm 1-hr, 500 ppm 6-hr	960 ppm 1-hr, 500 ppm 6-hr	255 ppm (hourly ave.)
State Rules	--	NA	650 ppm 3-hr	650 ppm 3-hr	
Federal (NSPS)	--	NA	650 ppm 6-hr	650 ppm 6-hr	
PM_{10} Limits:					
State Permit to Operate	0.01 gr/dscf	NA	acid mist at acid plant outlet: 0.2 mg/acf or 3.7 lb/hr	acid mist at acid plant outlet: 0.2 mg/acf or 3.7 lb/hr	0.02 gr/dscf
State Rules	--	NA			
Federal (NSPS)	50 mg/m^3	NA			
Opacity Limits:					
State Permit to Operate	10%	NA	15%	15%	15%
State Rules	20%	NA	15%	15%	20%
Federal (NSPS)	20%	NA	20%	20%	
Control Systems	baghouse	NA	acid plant	acid plant	baghouse
Stack CEMs	opacity	NA	SO_2	SO_2	opacity
Applicable stack CEM calibration, audit, reporting requirements	40 CFR 60, Appendix B, Quarterly EERs submitted	NA	40 CFR 60, Appendix B, Appendix F, Quarterly EERs submitted	40 CFR 60, Appendix B, Appendix F, Quarterly EERs submitted	40 CFR 60, Appendix B, Quarterly EERs submitted

EER: Excess Emission Report

Table 1. Copper Smelters Within 100 Km. of Border –Emission Limits/Monitoring Procedures–

A. ASARCO El Paso Copper Smelter (continued)

3. Ambient SO_2 Monitoring:

Number and type of ASARCO ambient SO_2 monitors:	5 SO_2 monitors, 4 of ASARCO design (wet chemistry). These monitors collect 30-minute grab samples on a continuous basis. Other monitor is electronic, installed below smelter as a result of TNRCC order to determine compliance with TNRCC 1-hour SO_2 standard. Compliance with 1-hour limit was demonstrated over 6 month period, and as a result monitoring is no longer required at this station.
QA procedures:	None required by regulation, though electronic SO_2 monitor was calibrated/audited following the requirements in 40 CFR 52.
Any ASARCO monitors located at/near point of maximum ground level SO_2 concentration?	Yes. One ASARCO monitor is collocated next to a TNRCC SO_2 monitor located on the University of Texas El Paso campus (Hawthorne site).
The state SO_2 monitor is located at/near the point of maximum ground level SO_2 concentration?	Yes. TNRCC TECO 43 ambient SO_2 monitor is located at the UT El Paso campus. Monitor is 1982 vintage, though it continues to pass all audit requirements. Monitor collects 5-minute raw averages to calculate recorded 1-hour average.
Number of SO_2 exceedances?	One recent exceedance in November 1996 due to an acid plant upset. This is only exceedance recorded in several years.
Number of 5-minute peaks at or above 0.6 ppm SO_2 at TNRCC SO_2 monitor (Joe Saenz):	Extremely rare. Once per year or less since ASARCO completed CONTOP smelter upgrade around 1994. Collocated ASARCO monitor typically reads ~ 20 percent higher than TNRCC monitor.

4. Monthly Sulfur Balance:

97 percent is typical sulfur removal estimated by ASARCO El Paso.

5. Capital Investment in Air Pollution Control Systems Since 1988:

ASARCO El Paso replaced roasters and a reverberatory furnace with a fluidized bed dryer and CONTOP cyclone reactors in 1993. This modification resulted in significant reductions in smelter SO_2 and particulate emissions. The fluidized bed dryer is equipped with a cyclone and baghouse. CONTOP reactor secondary hood airflow is routed to a baghouse and then to the tall stack. The overall installed cost of the CONTOP modification was approximately $100,000,000. The total installed cost of the air pollution control systems included with the CONTOP modification project summed to approximately $25,000,000.

Table 1. Copper Smelters Within 100 Km. of Border –Emission Limits/Monitoring Procedures–

B. Phelps-Dodge Hidalgo Copper Smelter, Playas, NM

1. Points of Contact:

Phelps-Dodge Hidalgo: Jerry Roose/Envr. Manager (505) 436-2211
NMED/Air Quality: Eric Aaboe/Ambient Monitoring (505) 827-0040

2. Emission Limits, Controls, Stack CEMs:

	Source Type				
	Concentrate Dryer(s)	Roaster	Smelting Furnaces(s)	Primary Converter Gases	Captured Fugitives
SO_2 Limits:					
State Permit to Operate					
State Rules	≥ 90 percent overall sulfur capture required (current), ≥ 93.5 percent overall sulfur capture required (future)[a]				
Federal (NSPS)	NA	NA	650 ppm 6-hr[a]	650 ppm 6-hr[a]	
PM_{10} Limits:					
State Permit to Operate		NA			
State Rules	0.03 gr/dscf				
Federal (NSPS)	NA	NA	NA		NA
Opacity Limits:					
State Permit to Operate					
State Rules					
Federal (NSPS)	NA	NA	20%[a]	20%[a]	--
Control Systems	ESP, tall stack	NA	acid plant	acid plant	baghouse, tall stack
Stack CEMs	SO_2, opacity[b]	NA	SO_2	SO_2	SO_2, opacity[b]
Applicable stack CEM calibration, audit, reporting requirements	40 CFR 60, Appendix B, Appendix F	NA	40 CFR 60, Appendix B, Appendix F	40 CFR 60, Appendix B, Appendix F	40 CFR 60, Appendix B, Appendix F

Notes:

a) Hidalgo is planning to add a fourth converter. When approved, the acid plant stacks will be subject to NSPS Subpart P SO_2 and opacity limits. The smelter will also be subject to a ≥ 93.5% sulfur capture limit.

b) Both dryer exhaust gases and captured fugitives are ducted to the same tall stack equipped with opacity and SO_2 CEMs.

Table 1. Copper Smelters Within 100 Km. of Border
–Emission Limits/Monitoring Procedures–

B. Phelps-Dodge Hidalgo Copper Smelter, Playas, NM (continued)

3. Ambient SO_2 Monitoring:

Number and type of Hidalgo Smelter ambient SO_2 monitors:	Two TECO 43 SO_2 monitors presently in operation, one located on smelter property and they other located at Gold Hill (approximately 4 miles from smelter). A dozen ambient SO_2 monitors were operated by the smelter until 1996 as part of a GEP stack height study designed and conducted by PD Hidalgo.
QA procedures:	Automatic daily zero and span calibration is performed. Periodic multi-oint calibrations and audits are conducted by in-house personnel.
Any Hidalgo monitors located at/near point of maximum ground level SO_2 concentration?	The Gold Hill site is located at the modeled point of maximum SO_2 concentration.
The state SO_2 monitor is located at/near the point of maximum ground level SO_2 concentration?	Yes. The state monitor is collocated with the PD Hidalgo monitor at Gold Hill.
Number of SO_2 exceedances?	One ambient exceedance in recent years due to an acid plant upset. State monitor at Gold Hill reached maximum span value of 0.5 ppm SO_2 on one occasion in 1996, unknown how high actual concentration was as it was outside span range of instrument.
Number of 5-minute peaks at or above 0.6 ppm SO_2 at NM SO_2 monitor (Eric Aaboe):	Unknown, due to SO_2 monitor span value of 0.5 ppm.

4. Monthly Sulfur Balance:

Required by NM regulation. 94 percent is typical sulfur removal achieved by Hidalgo Smelter.

5. Capital Investment in Air Pollution Control Systems Since 1988:

Converter secondary hooding, and matte and slag tapping hooding, are controlled by separate baghouses installed in 1994. Telescoping converter secondary hoods were also added during the baghouse installation project. The installed cost of these two baghouses and associated converter hoods was approximately $14,000,000. No other major air pollution control capital investments have been made at the Hidalgo Smelter since 1988.

Table 1. Copper Smelters Within 100 Km. of Border –Emission Limits/Monitoring Procedures–

C. Phelps-Dodge Hurley Copper Smelter, Hurley, NM

1. Points of Contact:

Phelps-Dodge Hurley:	Eddie Humphrey/Envr. Manager (505) 537-4305
NMED/Air Quality:	Eric Aaboe/Ambient Monitoring (505) 827-0040

2. Emission Limits, Controls, Stack CEMs:

	Source Type				
	Concentrate Dryer(s)	Roaster	Smelting Furnaces(s)	Primary Converter Gases	Captured Fugitives
SO_2 Limits:					
State Permit to Operate	--	NA			
State Rules	≥ 90 percent overall sulfur capture required				
Federal (NSPS)	–	NA	650 ppm 6-hr	650 ppm 6-hr	
PM_{10} Limits:					
State Permit to Operate		NA			
State Rules	≤ 0.03 gr/dscf				
Federal (NSPS)	50 mg/m^3	NA			
Opacity Limits:					
State Permit to Operate		NA			
State Rules		NA			
Federal (NSPS)	20%	NA	20%	20%	
Control Systems	baghouse	NA	acid plant	acid plant	baghouse, tall stack
Stack CEMs	opacity	NA	SO_2 opacity	SO_2 opacity	SO_2 (2), high and low range
Applicable stack CEM calibration, audit, reporting requirements	40 CFR 60, Appendix B	NA	40 CFR 60, Appendix B, Appendix F	40 CFR 60, Appendix B, Appendix F	40 CFR 60, Appendix B

EER: Excess Emission Report

Table 1. Copper Smelters Within 100 Km. of Border –Emission Limits/Monitoring Procedures–

C. Phelps-Dodge Hurley Copper Smelter, Hurley, NM (continued)

3. Ambient SO_2 Monitoring:

Number and type of Hurley Smelter ambient SO_2 monitors:	Nine Hurley ambient SO_2 monitors presently in operation. One monitor is TECO 43 design, the other eight monitors are ASARCO-type wet chemistry monitors that have been in operation since the 1970s. The TECO 43 is located at the Hilltop site. The Hilltop site was installed as the "high terrain" site in air dispersion model development program that ended in the mid-1990s.
QA procedures:	All ambient SO_2 monitors subject to U.S. EPA ambient monitor 40 CFR 52 audit/calibration procedures. Smelter personnel perform daily zero/span calibration checks. Monitors are manually recalibrated if the calibration check reveals the monitor is outside acceptable drift limits. Smelter personnel also perform quarterly multi-point calibration checks on the monitors. Quarterly audits are also done by an independent testing contractor. All Hurley SO2 monitors are part of the EPA SLAMS ambient monitoring network and as a result are subject to EPA calibration/audit procedures.
Any Hurley monitors located at/near point of maximum ground level SO_2 concentration?	The state agency and Hurley are currently doing attainment modeling. As a result, one monitor will be relocated to the point of maximum impact. Historically Hurley, NM has been an SO_2 non-attainment area, though the area has gone 7 years without an SO_2 exceedance.
The NMED SO_2 monitor is located at/near point of maximum ground level SO_2 concentration?	The closest NMED monitor has historically been located at the Bayard site, approximately 4 miles from the smelter. The monitoring station is currently being moved to the smelter fenceline, as a result of the attainment modeling project.
Number of SO_2 exceedances measured at NMED Bayard site?	One or less 3-hour exceedances in each of the last 7 years. The 3-hour exceedance level is defined as 0.5 ppm (1,300 $\mu g/m^3$)
Number of 5-minute peaks at or above 0.6 ppm SO_2 at NMED SO_2 monitor (Eric Aaboe):	The state monitor is in the process of being moved from the Bayard site to the modeled point of maximum SO_2 concentration near the smelter fenceline. The Bayard site historical data is in the process of being analyzed to determine the number of 5-minute peaks at or above 0.6 ppm SO_2.

4. Monthly Sulfur Balance:

Required by NM regulation. 95 percent is typical sulfur removal achieved by Hurley Smelter.

5. Capital Investment in Air Pollution Control Systems Since 1988:

Converter secondary hooding exhaust gas is controlled by baghouses installed in 1996. The installed cost of these two baghouses was approximately $10,000,000. No other major air pollution control capital investments have been made at the Hurley Smelter since 1988.

Table 2. Cu Smelter in Border State > 100 Km. from Border –Emission Limits/Monitoring Procedures–

A. ASARCO Hayden Copper Smelter

1. Points of Contact:

ASARCO Hayden:	Ed Riege/Environmental Engineer (520) 356-3812
ADEQ Phoenix:	Jim Guyton/Ambient Monitoring (602) 207-2364

2. Emission Limits, Controls, Stack CEMs:

	Source Type				
	Concentrate Dryer(s)	Roaster	Smelting Furnaces(s)	Primary Converter Gases	Captured Fugitives
SO_2 Limits:					
State Permit to Operate		NA			
State Rules	ASARCO Hayden must maintain an average annual SO_2 emission rate of slightly less than 4.8 tons/hour to ensure that SO_2 exceedance criteria established by ADEQ are not triggered.				
Federal (NSPS)	--	NA	650 ppm 6-hr	650 ppm 6-hr	
PM_{10} Limits:					
State Permit to Operate		NA			
State Rules	--	NA			
Federal (NSPS)	50 mg/m^3	NA			
Opacity Limits:					
State Permit to Operate		NA			
State Rules		NA			
Federal (NSPS)	20%	NA	20%	20%	
Control Systems	baghouse, ESP, tall stack	NA	acid plant	acid plant	baghouse or ESP, tall stack
Stack CEMs	opacity	NA	SO_2, opacity	SO_2, opacity	opacity
Applicable stack CEM calibration, audit, reporting requirements	40 CFR 60, Appendix B, Quarterly EERs submitted	NA	40 CFR 60, Appendix B, Appendix F, Quarterly EERs submitted	40 CFR 60, Appendix B, Appendix F, Quarterly EERs submitted	40 CFR 60, Appendix B, Quarterly EERs submitted

EER: Excess Emission Report

Table 2. Cu Smelter in Border State > 100 Km. from Border –Emission Limits/Monitoring Procedures–

A. ASARCO Hayden Copper Smelter (continued)

3. Ambient SO_2 Monitoring:

Number and type of ASARCO Hayden ambient SO_2 monitors:	5 SO_2 monitors, all five are TECO 43 UV fluorescent analyzers. These monitors collect 1-minute raw averages of continuous data. Thirty minute average SO_2 values are calculated from the 1-minute raw averages. The data acquisition system checks for 45 minutes of good data in each 1-hour period as specified in EPA regulations.
QA procedures:	SO_2 monitors are calibrated/audited following the requirements in 40 CFR 50 and 58.
Any ASARCO monitors located at/near point of maximum ground level SO_2 concentration?	Yes. One ASARCO Hayden monitor is collocated next to an ADEQ SO_2 monitor located at the Hayden Jail, approximately 0.5 miles from the smelter.
The state SO_2 monitor is located at/near the point of maximum ground level SO_2 concentration?	Yes. ADEQ TECO 43 ambient SO_2 monitor is located at the Hayden Jail. Monitor is 1982 vintage, though it continues to pass all audit requirements. Monitor collects 5-minute raw averages to calculate recorded 1-hour average.
Number of SO_2 exceedances in last 7 years?	One.
Number of 5-minute peaks at or above 0.6 ppm SO_2 at ADEQ SO_2 monitor:	Unknown.

4. Monthly Sulfur Balance:

Required by ADEQ regulation. 94 percent is typical sulfur removal achieved by ASARCO Hayden.

5. Capital Investment in Air Pollution Control Systems Since 1988:

Secondary hood particulate emissions are routed to a baghouse that has been online since late 1996, then to the existing tall stack. The capital cost of the baghouse (installed) was approximately $4,200,000. ESCV and slag-tapping hood particulate emissions are controlled by an electrostatic precipitator (ESP) that was originally installed in the 1930s. This ESP was rebuilt in 1993 at a cost of approximately $1,000,000. These are the two major air pollution control capital investments at ASARCO Hayden since 1988.

Table 2. Cu Smelter in Border State > 100 Km. from Border –Emission Limits/Monitoring Procedures–

B. BHP San Manuel Copper Smelter

1. Points of Contact:

BHP San Manuel: Jerry May/Environmental Engineer (520) 385-3395
ADEQ Phoenix: Jim Guyton/Ambient Monitoring (602) 207-2364

2. Emission Limits, Controls, Stack CEMs:

	Source Type				
	Concentrate Dryer(s)	Roaster	Smelting Furnaces(s)	Primary Converter Gases	Captured Fugitives
SO_2 Limits:					
State Permit to Operate		NA			
State Rules	BHP San Manuel must maintain an average annual SO_2 emission rate of approximately 9 tons/hour to ensure that SO_2 exceedance criteria established by ADEQ are not triggered.				
Federal (NSPS)	–	NA	650 ppm 6-hr	650 ppm 6-hr	
PM_{10} Limits:					
State Permit to Operate		NA			
State Rules	--	NA			
Federal (NSPS)	50 mg/m^3	NA			
Opacity Limits:					
State Permit to Operate		NA			
State Rules	20%	NA	20%	20%	
Federal (NSPS)	20%	NA	20%	20%	
Control Systems	ESP, tall stack	NA	acid plant	acid plant	ESP, tall stack
Stack CEMs	SO_2, opacity	NA	SO_2	SO_2	SO_2 (converter bldg.)
Applicable stack CEM calibration, audit, reporting requirements	40 CFR 60, Appendix B, Quarterly EERs submitted	NA	40 CFR 60, Appendix B, Appendix F, Quarterly EERs submitted	40 CFR 60, Appendix B, Appendix F, Quarterly EERs submitted	40 CFR 60, Appendix B, Quarterly EERs submitted

EER: Excess Emission Report

Table 2. Cu Smelter in Border State > 100 Km. from Border –Emission Limits/Monitoring Procedures–

B. BHP San Manuel Copper Smelter (continued)

3. Ambient SO_2 Monitoring:

Number and type of BHP ambient SO_2 monitors:	Three SO_2 monitors, all three are TECO 43 UV fluorescent analyzers. These monitors collect 5-minute raw averages of continuous data. One hour average SO_2 values are calculated from the 5-minute raw averages.
QA procedures:	SO_2 monitors are calibrated/audited following the requirements in 40 CFR 52. Both a BHP audit team and the ADEQ perform quarterly multi-point calibration audits of the monitors.
Any BHP monitors located at/near point of maximum ground level SO_2 concentration?	Yes. ADEQ differentiates between Maximum Ground Level Impact (MGLI) from tall stack emissions and MGLI from fugitive emissions. All three BHP monitors are "high level" monitors, 0-2.0 ppm, scaled to accurately quantify high SO_2 excursions. One of these monitors is located near an ADEQ SO_2 monitor located at the LDS church approximately 1 mile from the smelter property line. The LDS church site monitors MGLI from the BHP tall stack. There are two fugitive MGLI monitoring sites operated by BHP, the Hospital site and the Dormitory site. These fugitive MGLI monitoring sites are a few hundred yards from each other and are essentially located at the BHP fenceline.
The state SO_2 monitor is located at/near the point of maximum ground level SO_2 concentration?	Yes. ADEQ API 100A ambient SO_2 monitor is located at the LDS church. Monitor was installed in 1997 and replaced TECO 43. Monitor collects 5-minute raw averages to calculate recorded 1-hour average.
Number of NAAQS SO_2 exceedances in last 7 years?	Zero.
Number of 5-minute peaks at or above 0.6 ppm SO_2 at BHP monitors:	1995: 31 1996: 25 1997: 19 (through June 30, 1997)

4. Monthly Sulfur Balance:

Required by ADEQ regulation. 98 percent is typical sulfur removal achieved by BHP San Manuel.

Table 2. Cu Smelter in Border State > 100 Km. from Border –Emission Limits/Monitoring Procedures–

B. BHP San Manuel Copper Smelter (continued)

5. Capital Investment in Air Pollution Control Systems Since 1988:

The gas cooling tower serving the four BHP converter offgases was overhauled in 1994. This overhaul resulted in a concomitant reduction in SO_2 emissions from the converter building. The cost of the gas cooling tower overhaul was $2,000,000. A third sulfuric acid plant was also started up in 1994. This change debottlenecked the airflow limitation through the converter primary hoods and resulted in a 60+ percent reduction in converter building secondary SO_2 and particulate emissions. The capital cost of the the third acid plant was approximately $61,000,000, and included a rebuild/upgrade of the second acid train. These are the two major air pollution control capital investments at BHP San Manuel since 1988.

Table 2. Cu Smelter in Border State > 100 Km. from Border –Emission Limits/Monitoring Procedures–

C. Cyprus Miami Copper Smelter

1. Points of Contact:

Cyprus Miami:	Wayne Leipold/Senior Environmental Engineer (520) 473-7149
ADEQ Phoenix:	Jim Guyton/Ambient Monitoring (602) 207-2364

2. Emission Limits, Controls, Stack CEMs:

	Source Type				
	Concentrate Dryer(s)	Roaster	Smelting Furnaces(s)	Primary Converter Gases	Captured Fugitives
SO_2 Limits:					
State Permit to Operate		NA			
State Rules	Cyprus Miami must maintain an average annual SO_2 emission rate of approximately 1.2 tons/hour to ensure that SO_2 exceedance criteria established by ADEQ are not triggered.				
Federal (NSPS)	--	NA	650 ppm 6-hr	NA	
PM_{10} Limits:					
State Permit to Operate		NA			
State Rules	weight-based throughput limit	NA			
Federal (NSPS)	NA	NA		NA	
Opacity Limits:					
State Permit to Operate		NA			
State Rules	20%	NA	20%	20%	
Federal (NSPS)	NA	NA	20%	NA	
Control Systems	baghouse	NA	acid plant	acid plant	scrubber, tall stack
Stack CEMs	none	NA	SO_2	SO_2	SO_2
Applicable stack CEM calibration, audit, reporting requirements	40 CFR 60, Appendix B, Quarterly EERs submitted	NA	40 CFR 60, Appendix B, Quarterly EERs submitted	40 CFR 60, Appendix B, Quarterly EERs submitted	40 CFR 60, Appendix B, Quarterly EERs submitted

EER: Excess Emission Report

Table 2. Cu Smelter in Border State > 100 Km. from Border –Emission Limits/Monitoring Procedures–

C. Cyprus Miami Copper Smelter (continued)

3. Ambient SO_2 Monitoring:

Number and type of Cyprus Miami ambient SO_2 monitors:	2 SO_2 monitors, both are TECO 43A UV fluorescent analyzers. These monitors collect 1-minute raw averages of continuous data. 15-minute averages are generated and stored from the the 1-minute values. Reported one-hour average SO_2 values are calculated from the 15-minute averages.
QA procedures:	SO_2 monitors are calibrated/audited following the requirements in 40 CFR 52.
Any Cyprus Miami monitors located at/near point of maximum ground level SO_2 concentration?	Yes. One monitor is located at the modeled maximum SO_2 impact at the Jones Ranch site on a ridge about 1.9 miles from the smelter. The other monitor is in the town of Miami at the Catholic church approximately 1.7 miles from the smelter. The scale used on each monitor is 0-2 ppm SO_2.
The state SO_2 monitor is located at/near the point of maximum ground level SO_2 concentration?	Yes. ADEQ TECO 43 ambient SO_2 monitor is located at the Ridgeline site, approximately 1 mile from the smelter fenceline. This site is the modeled maximum PM_{10} impact area. The ADEQ monitor had been collocated with the Cyprus Miami monitor at the Jones Ranch site until the landowner increased the site rental fee charged to ADEQ. ADEQ chose to move the state monitor to the Ridgeline site instead of paying the increased rent at the Jones Ranch site. The ADEQ monitor is 1982 vintage, though it continues to pass all audit requirements. Monitor collects 5-minute raw averages to calculate recorded 1-hour average.
Number of SO_2 exceedances in last 7 years?	Zero.
Number of 5-minute peaks at or above 0.6 ppm SO_2 at ADEQ SO_2 monitor:	Unknown.

4. Monthly Sulfur Balance:

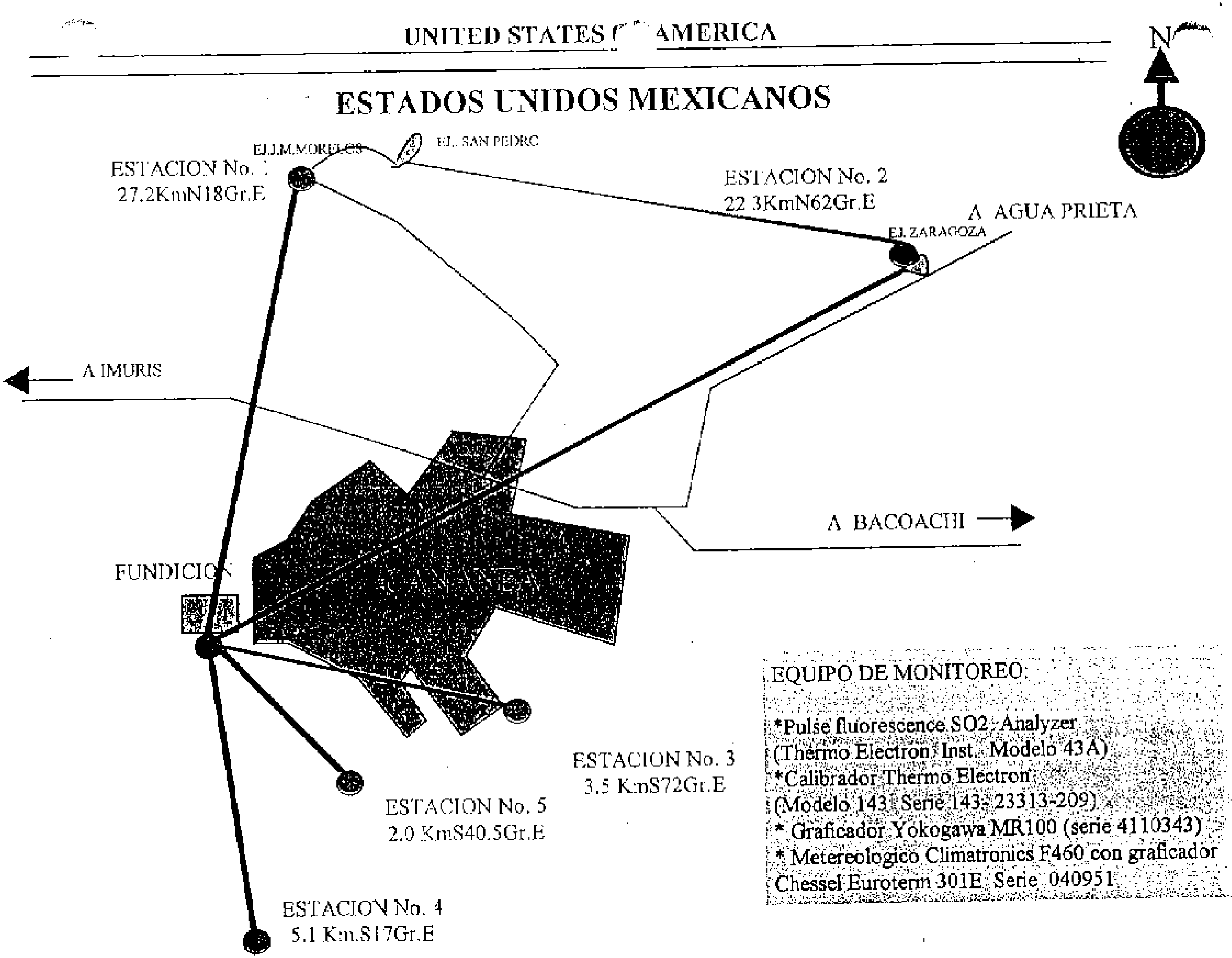
Required by ADEQ regulation. 98 percent is typical sulfur removal achieved by Cyprus Miami.

5. Capital Investment in Air Pollution Control Systems Since 1988:

A packed bed caustic scrubber was installed in 1991 to limit collected fugitive SO_2 emissions to avoid going through NSR. An Isa smelting vessel was brought online in 1992. At that time the acid plant was upgraded with two new wet ESPs and "star" coolers. In the last two years, additional acid plant work has included SO_3 cooler addition and heat exchanger upgrades. This year the acid plant catalytic converter and the final absorption tower were renovated with new equipment. In 1998 the intermediate absorption tower will be replaced and upgraded. These investments in process/air pollution control equipment sum to more than $10,000,000. The Isa smelting vessel was installed in part to meet NSPS equivalent SO_2 limits. If the installed cost of the Isa furnace is added to the other process/air pollution control equipment investments since 1988, total investment exceeds $100,000,000.

Summary Mexico 1

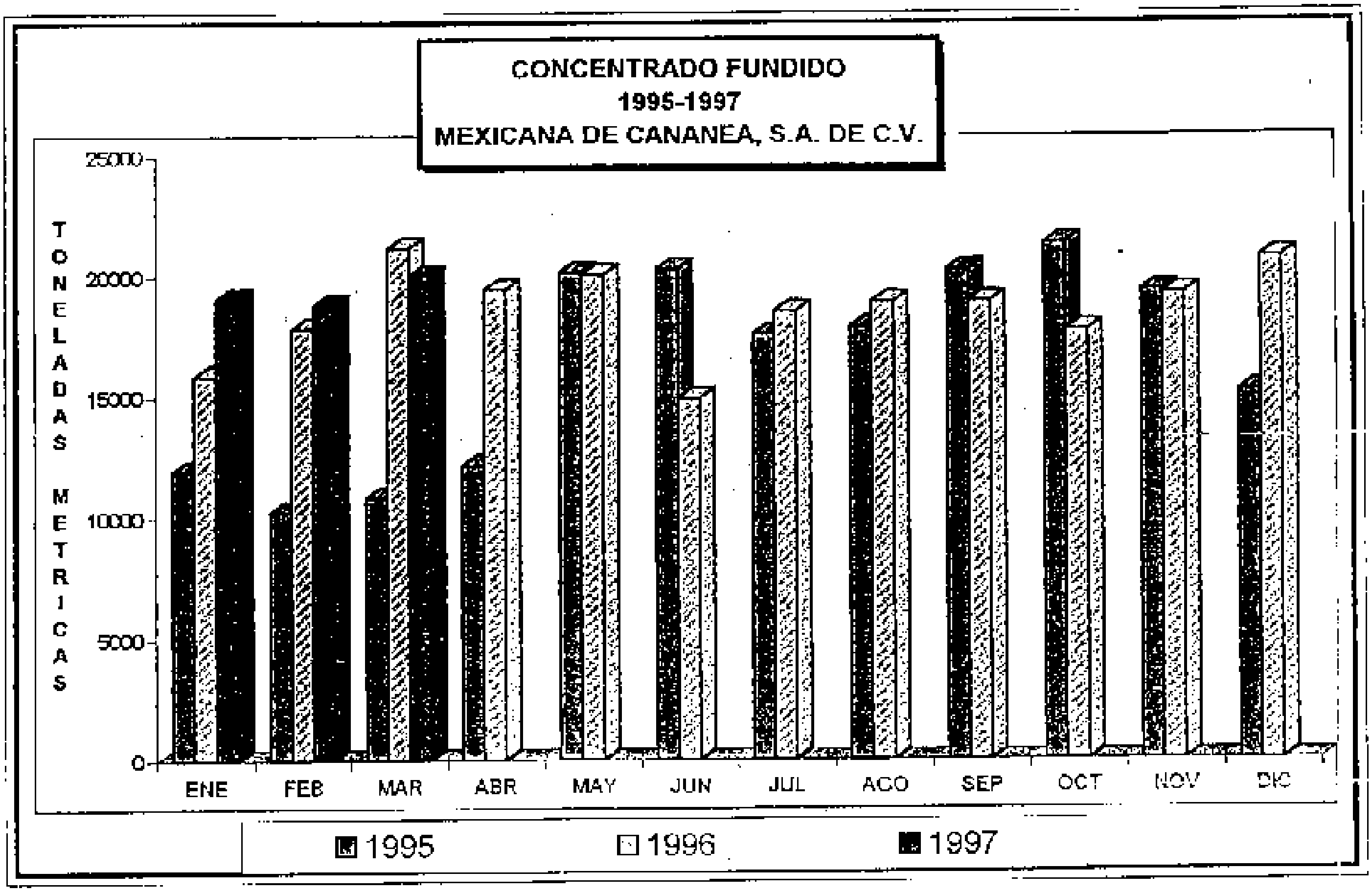
Cananea Copper Smelter



EQUIPO DE MONITOREO:

*Pulse fluorescence SO2 Analyzer
(Thermo Electron Inst. Modelo 43A)
*Calibrador Thermo Electron
(Modelo 143 Serie 143-23313-209)
* Graficador Yokogawa MR100 (serie 4110343)
* Metereologico Climatronics F460 con graficador
Chessel Euroterm 301E Serie 040951

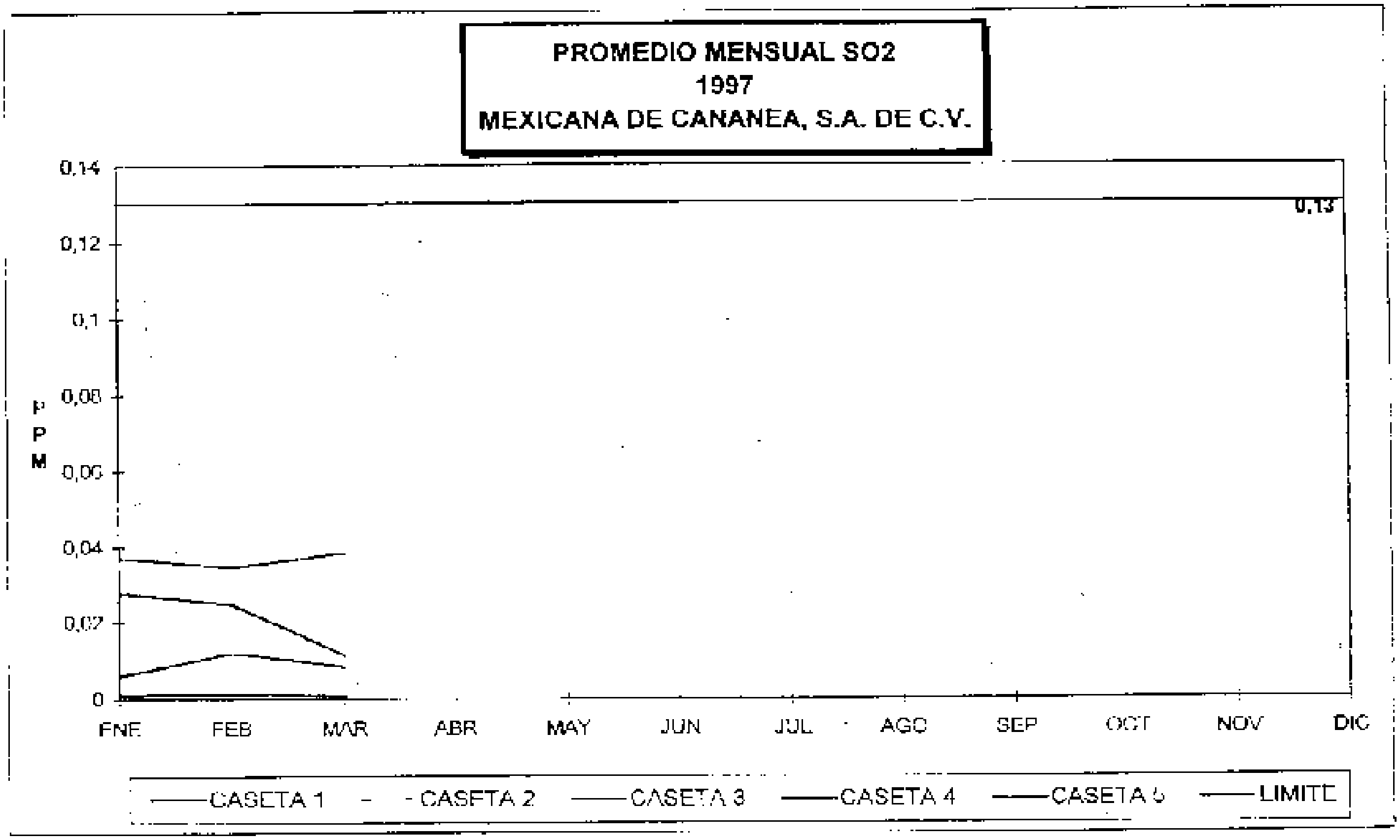
PROCURADURIA FEDERAL DE PROTECCION AL AMBIENTE



* CAPACIDAD INSTALADA DE FUSION EN EL HORNO: 950 TM/DIA DE CONCENTRADO

* FUSION DIARIA ACTUALMENTE: 650 TM/DIA DE CONCENTRADO

PROCURADURIA FEDERAL DE PROTECCION AL AMBIENTE



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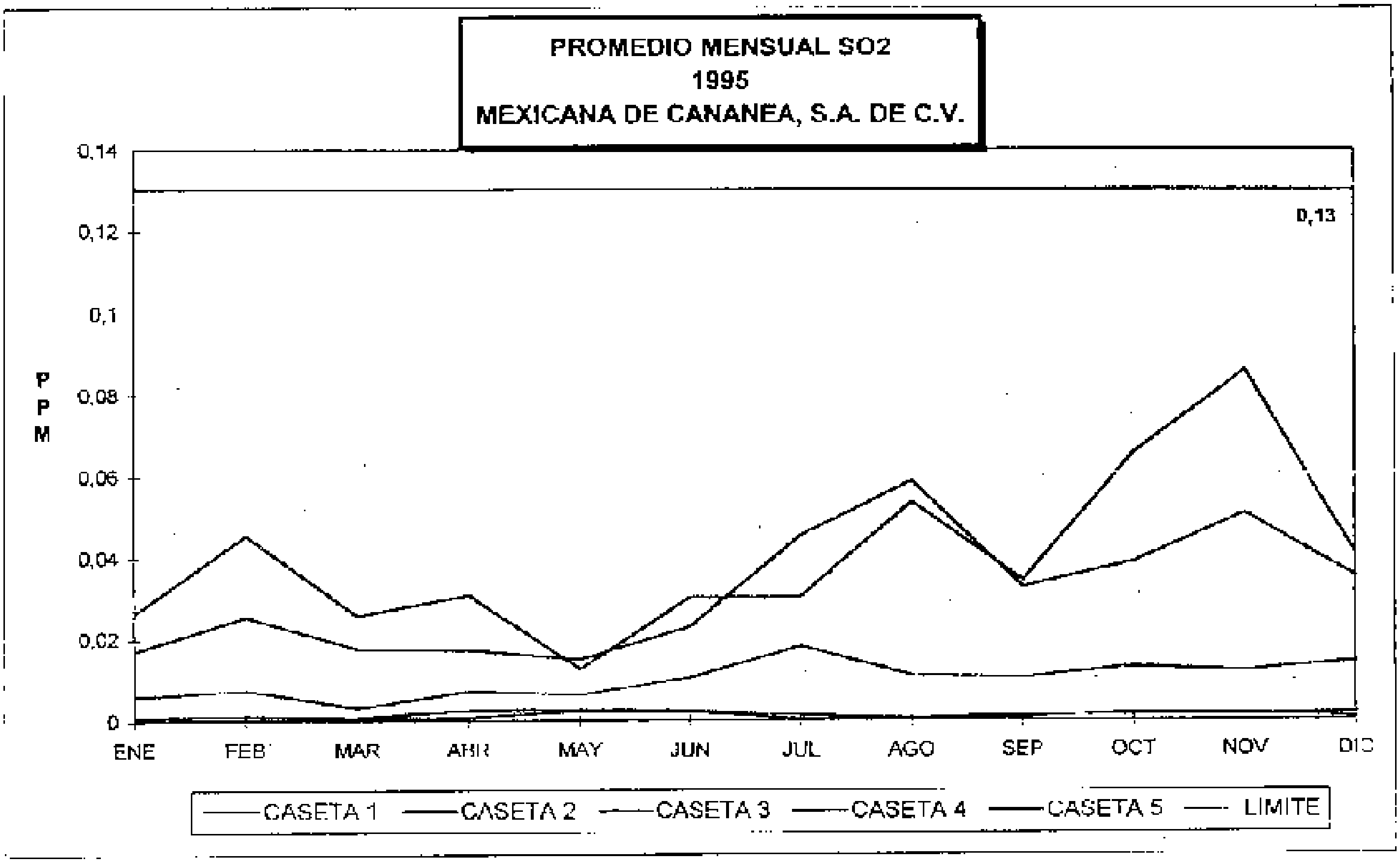

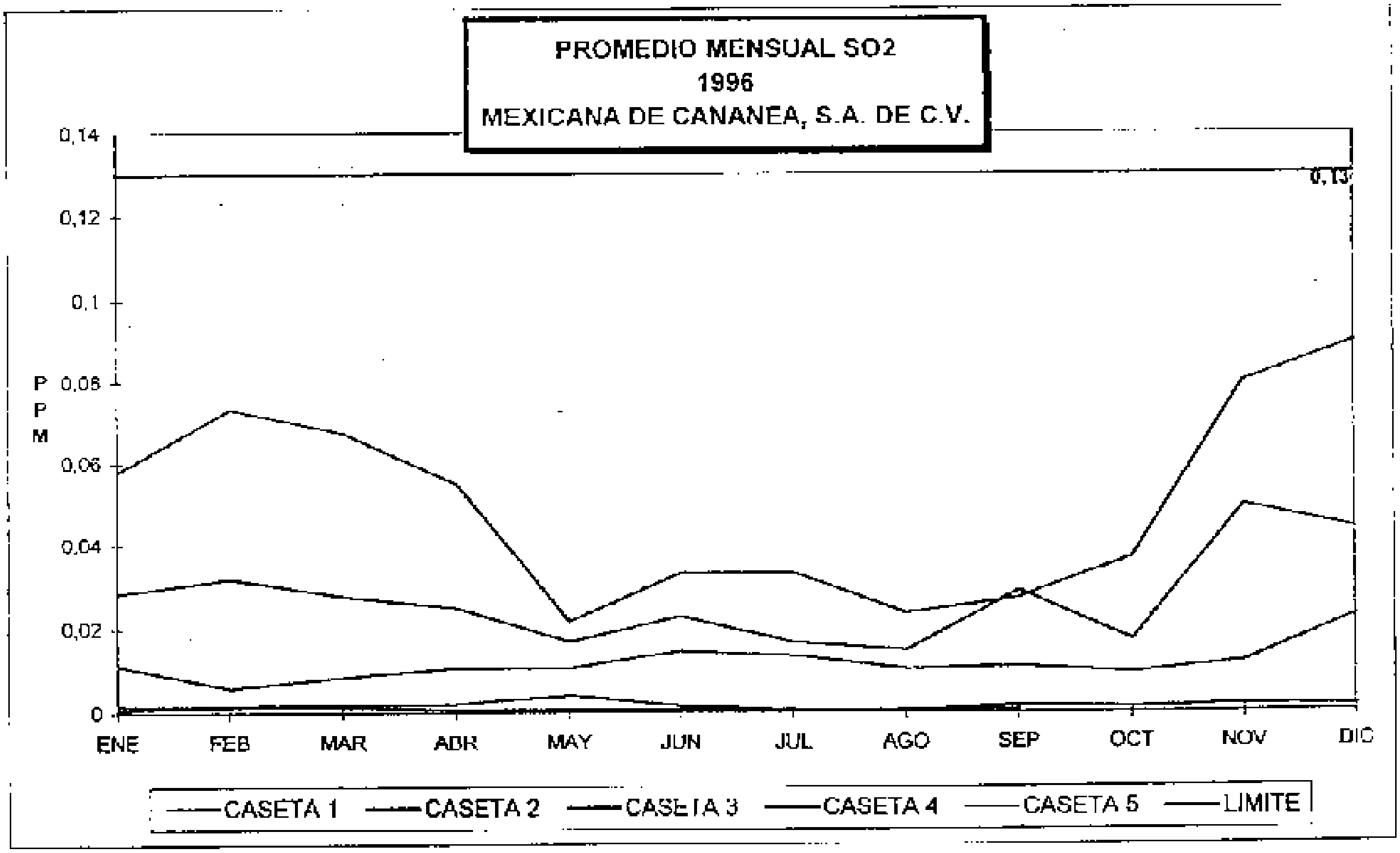

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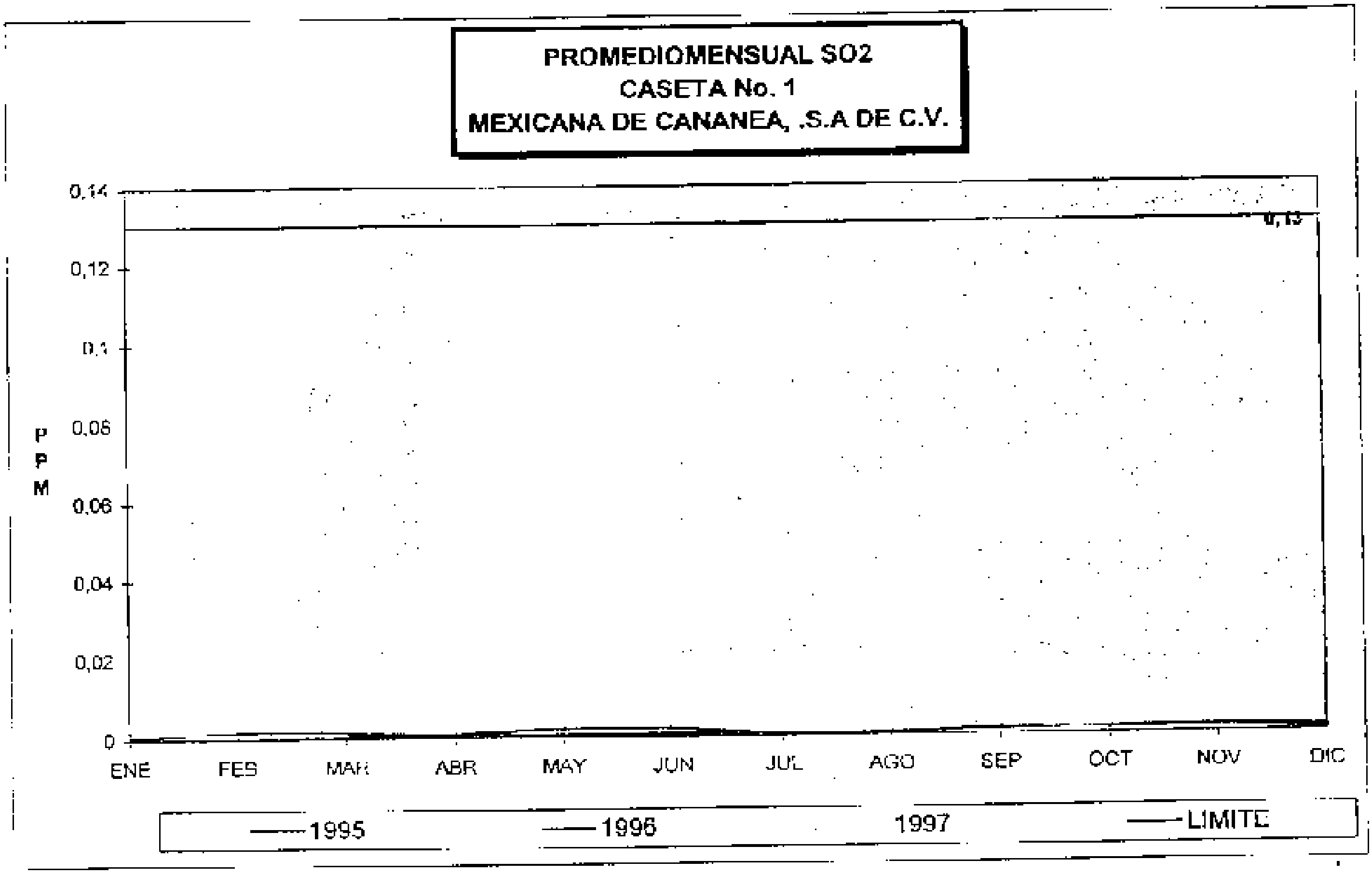
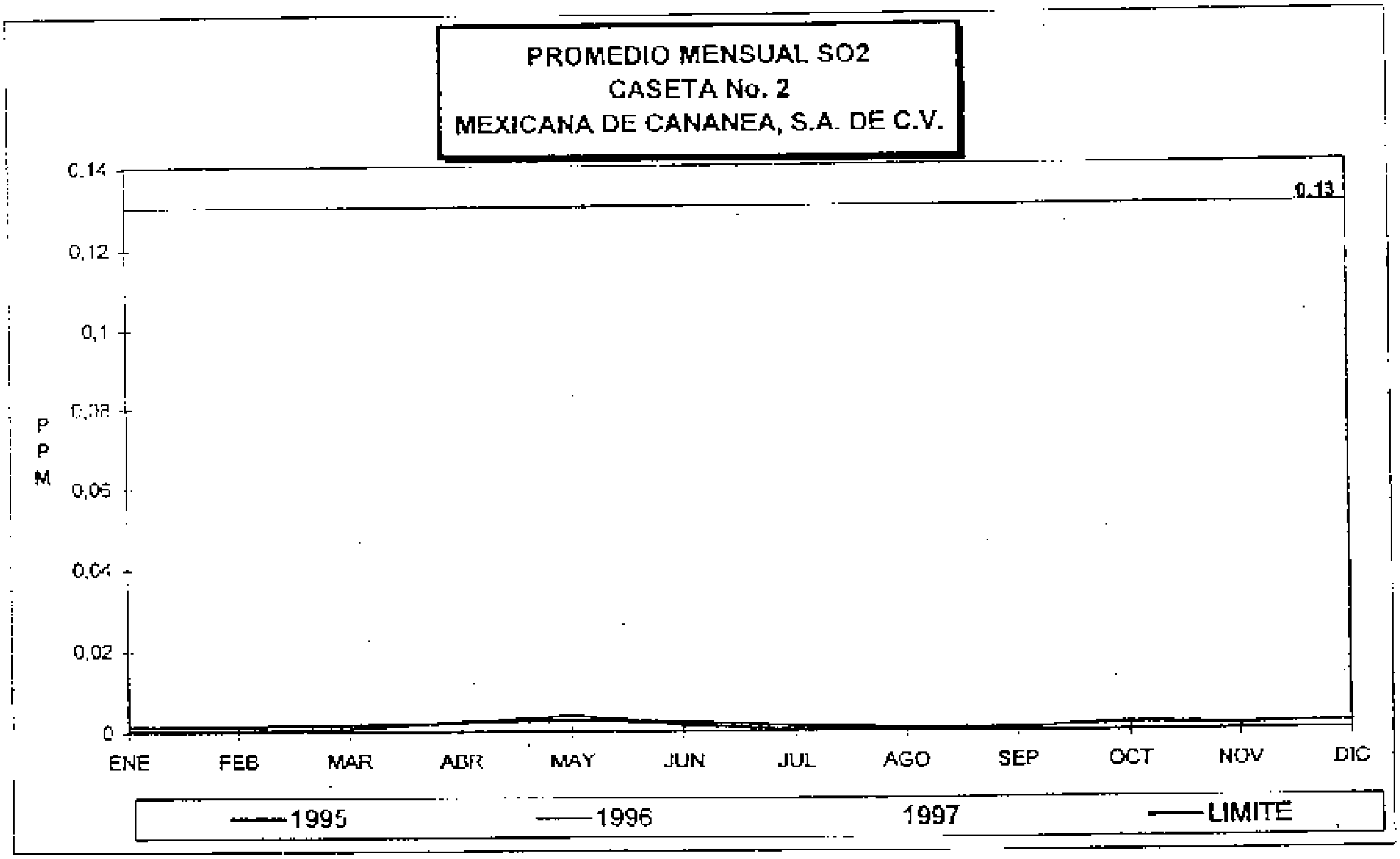

PROMEDIOMENSUAL SO2
CASETA No. 1
MEXICANA DE CANANEA, .S.A DE C.V.


PROMEDIO MENSUAL SO2
CASETA No. 2
MEXICANA DE CANANEA, S.A. DE C.V.

MEXICANA DE CANANEA S.A. DE C.V.

DEPARTAMENTO DE ECOLOGIA

MES: MAYO1997

REPORTE MENSUAL DE MONITOREO AMBIENTAL

ESTACION No. 3 ["CLUB CAMPESTRE" 3/5 Km., S 72° E]

PARAMETRO: BIOXIDO DE AZUFRE

DIA/HR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	PROM.
1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000
2	0,00	0,00	0,00	0,02	0,02	0,01	0,00	0,00	0,01	0,02	0,01	0,03	0,04	0,01	0,01	0,03	0,02	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,010
3	0,00	0,02	0,02	0,00	0,00	0,00	0,00	0,01	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,003
4	0,00	0,02	0,03	0,03	0,00	0,00	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,05	0,00	0,00	0,00	0,00	0,00	0,008
5	0,01	0,01	0,01	0,00	0,02	0,10	0,03	0,00	0,00	0,00	0,01	0,01	0,01	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,03	0,011
6	0,03	0,04	0,06	0,01	0,02	0,01	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,008
7	0,01	0,00	0,01	0,02	0,01	0,04	0,02	0,01	0,00	0,01	0,03	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,007
8	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,02	0,25	0,48	0,032
9	0,07	0,32	0,34	0,03	0,18	0,05	0,02	0,06	0,12	0,04	0,02	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,12	0,06	0,02	0,02	0,063
10	0,00	0,00	0,00	0,00	0,00	0,05	0,08	0,02	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,12	0,12	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,017
11	0,00	0,00	0,01	0,01	0,03	0,03	0,00	0,00	0,00	0,00	0,00	0,01	0,00	0,01	0,00	0,02	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,005
12	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,02	0,00	0,00	0,02	0,01	0,03	0,00	0,02	0,01	0,00	0,00	0,00	0,00	0,00	0,005
13	0,00	0,10	0,08	0,01	0,05	0,04	0,03	0,01	0,08	0,03	0,03	0,02	0,01	0,00	0,03	0,05	0,02	0,22	0,13	0,00	0,26	0,16	0,10	0,00	0,061
14	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,05	0,05	0,03	0,01	0,00	0,05	0,00	0,05	0,20	0,01	0,03	0,00	0,08	0,00	0,00	0,024
15	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,08	0,01	0,02	0,15	0,05	0,00	0,00	0,00	0,00	0,013
16	0,00	0,15	0,02	0,01	0,16	0,36	0,18	0,12	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,02	0,01	0,00	0,00	0,00	0,00	0,02	0,01	0,044
17	0,00	0,00	0,00	0,08	0,12	0,12	0,20	0,02	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,05	0,16	0,20	0,00	0,00	0,02	0,03	0,00	0,042
18	0,00	0,00	0,00	0,00	0,00	0,02	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,04	0,02	0,20	0,01	0,00	0,07	0,015
19	0,16	0,07	0,02	0,01	0,02	0,05	0,03	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,03	0,00	0,01	0,01	0,01	0,00	0,018
20	0,00	0,00	0,02	0,05	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,06	0,12	0,00	0,03	0,03	0,00	0,00	0,00	0,014
21	0,00	0,00	0,00	0,00	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,00	0,00	0,01	0,04	0,003
22	0,00	0,01	0,06	0,06	0,05	0,05	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,03	0,01	0,08	0,00	0,00	0,00	0,00	0,00	0,015
23	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,03	0,03	0,01	0,003
24	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000
25	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000
26	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000
27	0,01	0,01	0,02	0,05	0,08	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,01	0,02	0,01	0,01	0,00	0,00	0,04	0,00	0,011
28	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,02	0,01	0,01	0,01	0,01	0,00	0,00	0,12	0,46	0,16	0,034
29	0,04	0,00	0,00	0,00	0,01	0,00	0,01	0,00	0,00	0,00	0,00	0,01	0,01	0,00	0,00	0,00	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,004
30	0,02	0,04	0,04	0,02	0,03	0,03	0,04	0,03	0,02	0,08	0,03	0,02	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,01	0,018
31	0,01	0,01	0,01	0,02	0,01	0,04	0,25	0,05	0,01	0,00	0,00	0,02	0,01	0,00	0,01	0,00	0,00	0,05	0,15	0,10	0,02	0,38	0,30	0,43	0,078

UNIDADES: Partes Por Millon

PROMEDIO MENSUAL = 0,0182
PROMEDIO MAX. CADA 24 HRS. = 0,0783

MEXICANA DE CANANEA S.A. DE C.V.

DEPARTAMENTO DE ECOLOGIA

MES: MAYO 1997

REPORTE MENSUAL DE MONITOREO AMBIENTAL

PARAMETRO: *BIOXIDO DE AZUFRE*

ESTACION No. 1 "EJIDO J. Ma. MORELOS" 27,2 Km., N 18° E]

DIA/HR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	PROM.
1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,02	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,002
2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000
3	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,001
4	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,001
5	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,001
6	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000
7	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,002
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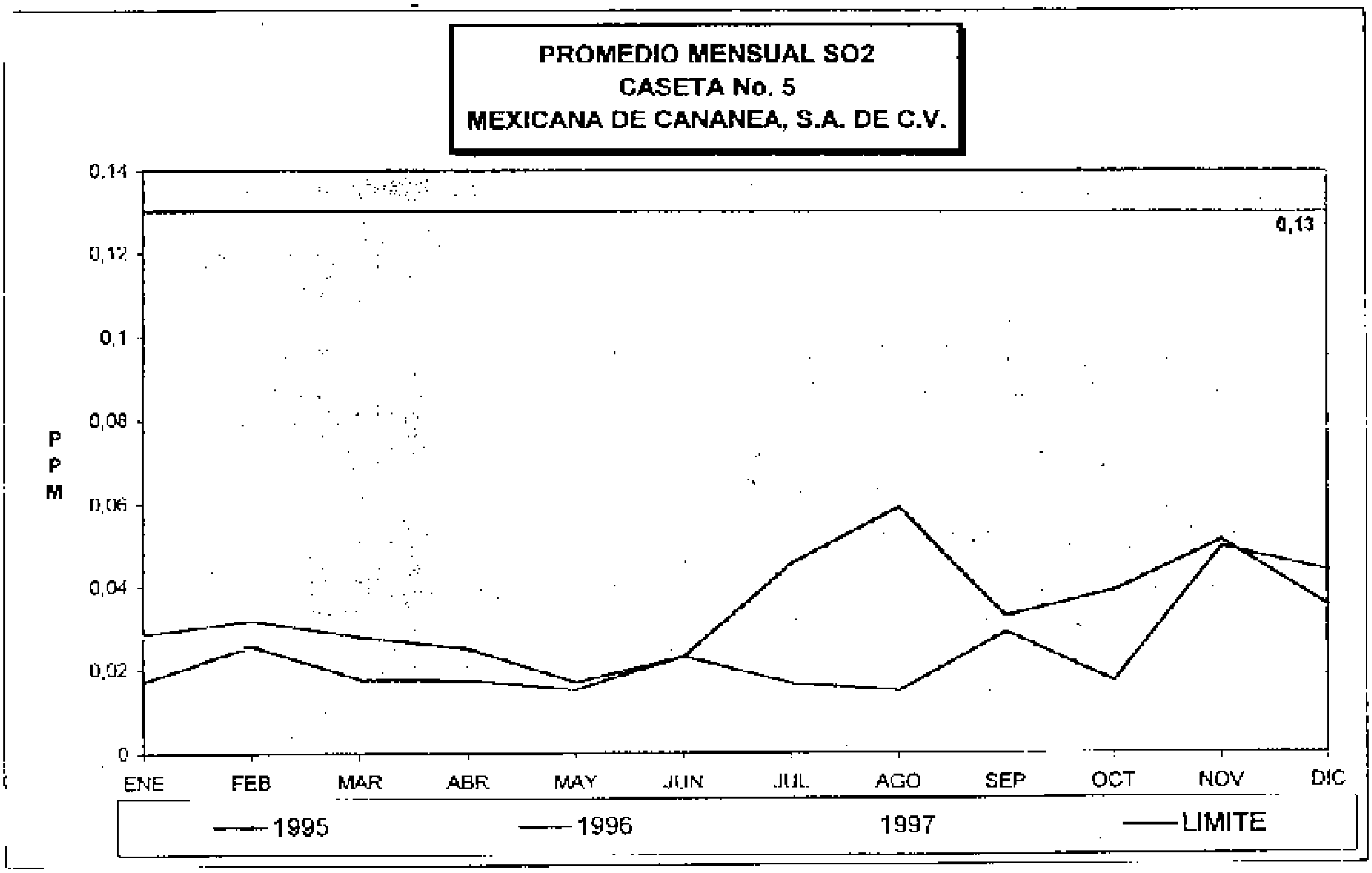
9	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000
10	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,02	0,00	0,01	0,00	0,00	0,001
11	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,001
12	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000
13	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000
14	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000
15	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,01	0,00	0,00	0,001
16	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,001
17	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,001
18	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,002
19	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,01	0,00	0,00	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000
20	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,002
21	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,02	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000
22	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,002
23	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,01	0,02	0,01	0,00	0,00	0,00	0,00	0,00	0,01	0,02	0,00	0,004
24	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,02	0,01	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,003
25	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,02	0,02	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,002
26	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,02	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,001
27	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000
28	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,001
29	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,001
30	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000
31	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	

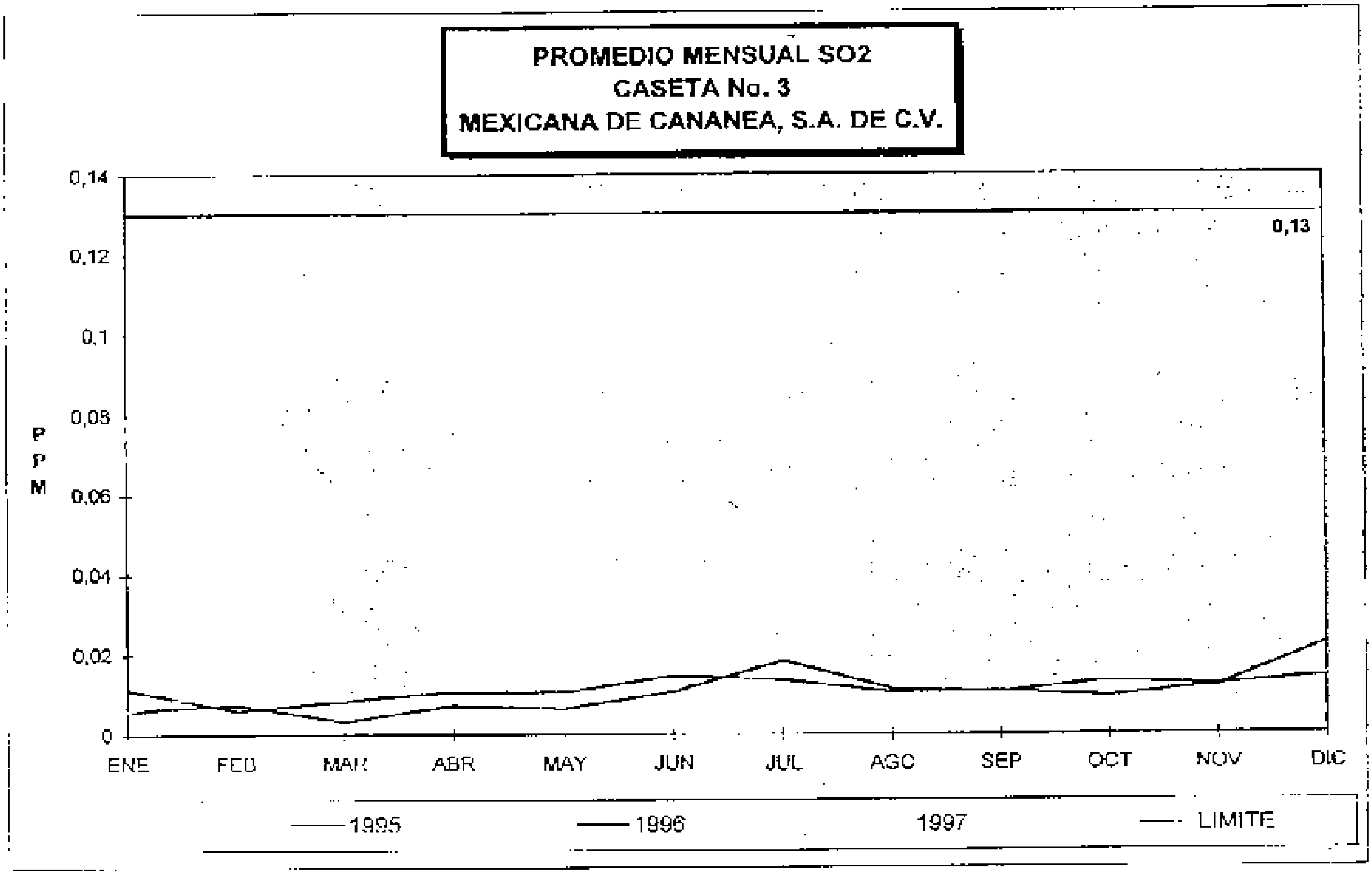
UNIDADES: Partes Por Millon

PROMEDIO MENSUAL = 0,0010
PROMEDIO MAX. CADA 24 HRS. = 0,0038

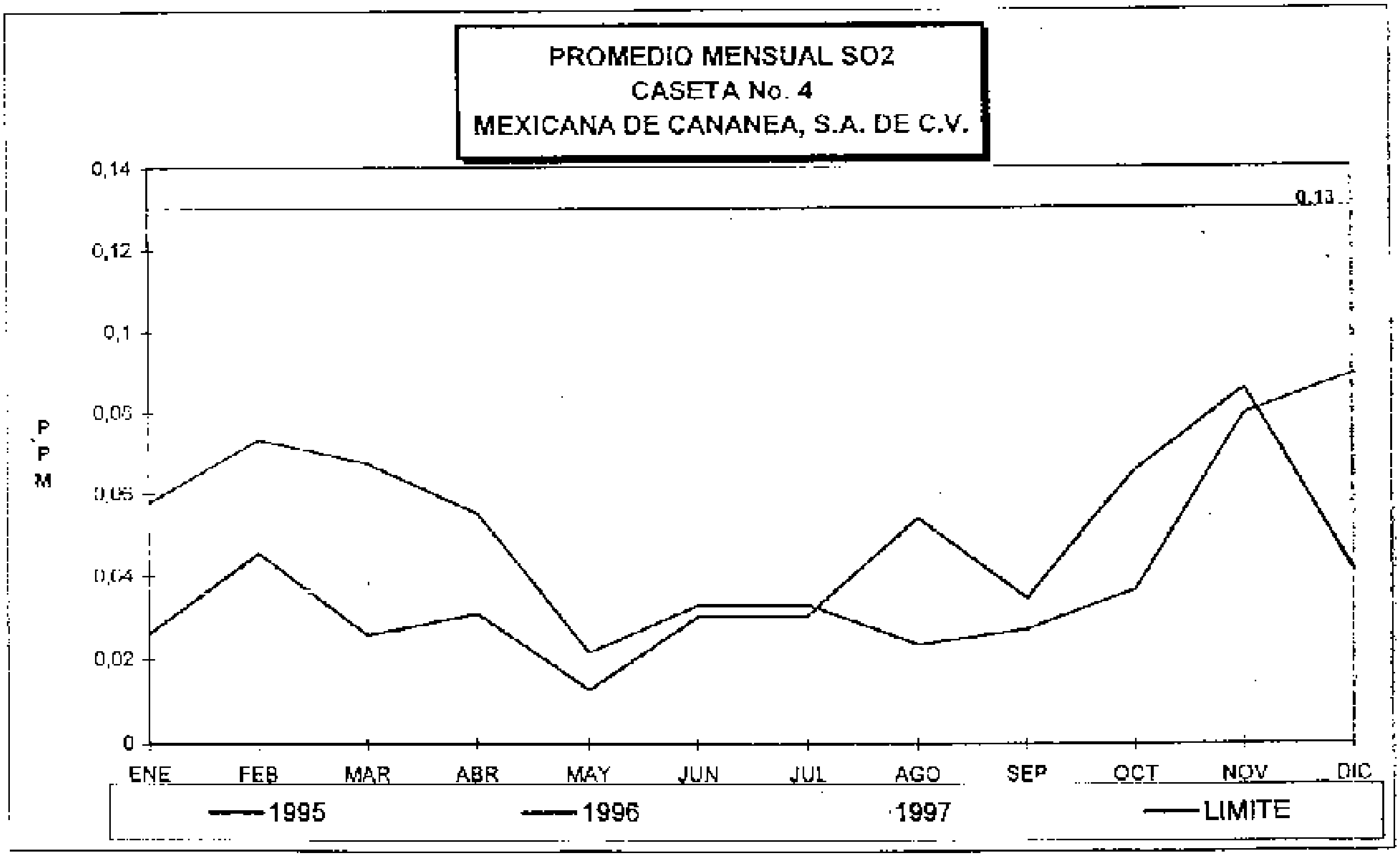
PROCURADURIA FEDERAL DE PROTECCION AL AMBIENTE



PROCURADURIA FEDERAL DE PROTECCION AL AMBIENTE



PROMEDIO MENSUAL SO2
CASETA No. 3
MEXICANA DE CANANEA, S.A. DE C.V.



PROMEDIO MENSUAL SO2
CASETA No. 4
MEXICANA DE CANANEA, S.A. DE C.V.

MEXICANA DE CANANEA S.A. DE C.V.

DEPARTAMENTO DE ECOLOGIA

MES: MAYO 1997

REPORTE MENSUAL DE MONITOREO AMBIENTAL

ESTACION No. 4 ("LAS MEXICANAS" 5,5 Km., S 17° E)

PARAMETRO: BIOXIDO DE AZUFRE

DIA/HR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	PROM.
1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000
2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000
3	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000
4	0,00	0,00	0,00	0,00	0,02	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,001
5	0,00	0,00	0,00	0,00	0,00	0,05	0,08	0,08	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,009
6	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000
7	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000
8	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000
9	0,00	0,00	0,00	0,00	0,00	0,01	0,00	0,00	0,06	0,08	0,02	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,007
10	0,00	0,00	0,14	0,16	0,06	0,07	0,05	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,07	0,04	0,00	0,025
11	0,01	0,00	0,06	0,15	0,12	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,015
12	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,01	0,00	0,00	0,01	0,00	0,16	0,08	0,05	0,14	0,019
13	0,24	0,10	0,06	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,017
14	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000
15	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,04	0,02	0,00	0,00	0,00	0,01	0,00	0,00	0,00	0,00	0,00	0,15	0,06	0,02	0,10	0,017
16	0,02	0,00	0,00	0,00	0,00	0,00	0,00	0,12	0,06	0,12	0,12	0,00	0,00	0,00	0,00	0,00	0,04	0,03	0,00	0,00	0,00	0,00	0,01	0,00	0,022
17	0,00	0,14	0,08	0,04	0,10	0,03	0,02	0,05	0,07	0,10	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,07	0,00	0,028
18	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,16	0,25	0,35	0,25	0,042
19	0,04	0,01	0,01	0,01	0,02	0,02	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,39	0,021
20	0,15	0,04	0,02	0,04	0,09	0,02	0,07	0,08	0,36	0,08	0,02	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,040
21	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000
22	0,00	0,00	0,03	0,02	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,003
23	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000
24	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000
25	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000
26	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000
27	0,00	0,00	0,00	0,00	0,03	0,02	0,02	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,003
28	0,05	0,06	0,04	0,22	0,26	0,32	0,30	0,02	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,053
29	0,00	0,01	0,01	0,00	0,05	0,03	0,14	0,25	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,021
30	0,00	0,00	0,00	0,01	0,01	0,01	0,01	0,00	0,00	0,06	0,03	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,006
31	0,00	0,01	0,01	0,00	0,02	0,02	0,03	0,05	0,06	0,03	0,00	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,010

UNIDADES: Partes Por Millon

PROMEDIO MENSUAL = 0,0115
PROMEDIO MAX. CADA 24 HRS. = 0,0529

MEXICANA DE CANANEA S.A. DE C.V.

DEPARTAMENTO DE ECOLOGIA

MES: MAYO 1997

REPORTE MENSUAL DE MONITOREO AMBIENTAL

PARAMETRO: BIOXIDO DE AZUFRE

ESTACION No. 5 ["SERVICIOS" 2.0 Km., S40.5° E]

DIA/HR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	PROM.
1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000
2	0,00	0,00	0,00	0,04	0,06	0,02	0,01	0,01	0,03	0,06	0,03	0,15	0,06	0,02	0,03	0,08	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,028
3	0,00	0,00	0,00	0,05	0,01	0,01	0,01	0,02	0,22	0,02	0,01	0,00	0,01	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,016
4	0,00	0,05	0,08	0,08	0,12	0,14	0,07	0,02	0,01	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,025
5	0,01	0,01	0,03	0,07	0,16	0,36	0,22	0,03	0,01	0,00	0,01	0,02	0,01	0,02	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,03	0,042
6	0,07	0,13	0,16	0,10	0,04	0,03	0,06	0,03	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,027
7	0,01	0,03	0,06	0,05	0,03	0,06	0,12	0,06	0,02	0,02	0,01	0,01	0,02	0,02	0,02	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,023
8	0,00	0,00	0,01	0,04	0,00	0,00	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,003
9	0,00	0,00	0,02	0,03	0,03	0,00	0,01	0,15	0,22	0,06	0,03	0,01	0,01	0,01	0,01	0,01	0,00	0,01	0,00	0,16	0,12	0,01	0,01	0,01	0,038
10	0,01	0,09	0,34	0,30	0,25	0,32	0,05	0,01	0,01	0,01	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,05	0,10	0,12	0,02	0,070
11	0,00	0,08	0,32	0,08	0,06	0,01	0,00	0,00	0,00	0,00	0,02	0,06	0,00	0,02	0,02	0,00	0,00	0,00	0,00	0,00	0,00	0,10	0,01	0,00	0,033
12	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,02	0,03	0,01	0,01	0,06	0,04	0,02	0,02	0,08	0,02	0,01	0,24	0,03	0,15	0,30	0,044
13	0,45	0,15	0,03	0,02	0,10	0,09	0,07	0,28	0,12	0,10	0,07	0,04	0,05	0,03	0,01	0,06	0,22	0,00	0,00	0,03	0,06	0,00	0,00	0,00	0,083
14	0,00	0,00	0,00	0,01	0,01	0,01	0,01	0,01	0,08	0,12	0,12	0,06	0,02	0,08	0,12	0,04	0,16	0,02	0,16	0,00	0,00	0,01	0,00	0,00	0,043
15	0,00	0,00	0,00	0,00	0,04	0,02	0,01	0,01	0,02	0,09	0,12	0,04	0,01	0,02	0,04	0,06	0,04	0,08	0,00	0,06	0,15	0,08	0,05	0,02	0,040
16	0,20	0,52	0,26	0,20	0,01	0,01	0,00	0,00	0,00	0,00	0,01	0,08	0,15	0,01	0,01	0,01	0,00	0,00	0,16	0,03	0,06	0,25	0,36	0,46	0,116
17	0,46	0,16	0,34	0,25	0,02	0,02	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,15	0,01	0,04	0,01	0,01	0,14	0,01	0,072
18	0,01	0,01	0,01	0,01	0,10	0,23	0,08	0,01	0,01	0,01	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,16	0,08	0,15	0,32	0,01	0,45	0,070
19	0,42	0,38	0,08	0,04	0,06	0,08	0,07	0,04	0,03	0,01	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,25	0,20	0,070
20	0,04	0,06	0,12	0,20	0,15	0,05	0,02	0,05	0,08	0,24	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,05	0,00	0,02	0,04	0,01	0,00	0,00	0,048
21	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,001
22	0,14	0,12	0,12	0,17	0,23	0,16	0,12	0,02	0,01	0,00	0,00	0,00	0,00	0,00	0,01	0,08	0,00	0,05	0,08	0,00	0,00	0,01	0,02	0,01	0,056
23	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,01	0,06	0,04	0,01	0,006
24	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000
25	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000
26	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,000
27	0,02	0,02	0,03	0,08	0,08	0,07	0,07	0,03	0,00	0,00	0,00	0,00	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,00	0,00	0,03	0,022
28	0,13	0,06	0,15	0,00	0,40	0,45	0,45	0,26	0,00	0,00	0,00	0,00	0,00	0,01	0,02	0,02	0,01	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,083
29	0,22	0,18	0,02	0,05	0,15	0,08	0,12	0,03	0,00	0,00	0,01	0,01	0,02	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,038
30	0,12	0,25	0,17	0,20	0,34	0,18	0,14	0,13	0,15	0,26	0,10	0,07	0,03	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,090
31	0,01	0,01	0,10	0,10	0,12	0,18	0,45	0,48	0,08	0,04	0,02	0,07	0,02	0,01	0,01	0,01	0,00	0,04	0,00	0,00	0,00	0,00	0,00	0,00	0,073

UNIDADES: **Partes** Por Millon

PROMEDIO MENSUAL = 0,0406

PROMEDIO MAX. CADA 24 HRS. = 0,1163

— CANANEA —

2.1.5 Resumen de los Resultados de la Red de Monitoreo de Bióxido de Azufre de la Cía. Minera de Cananea, S. A.

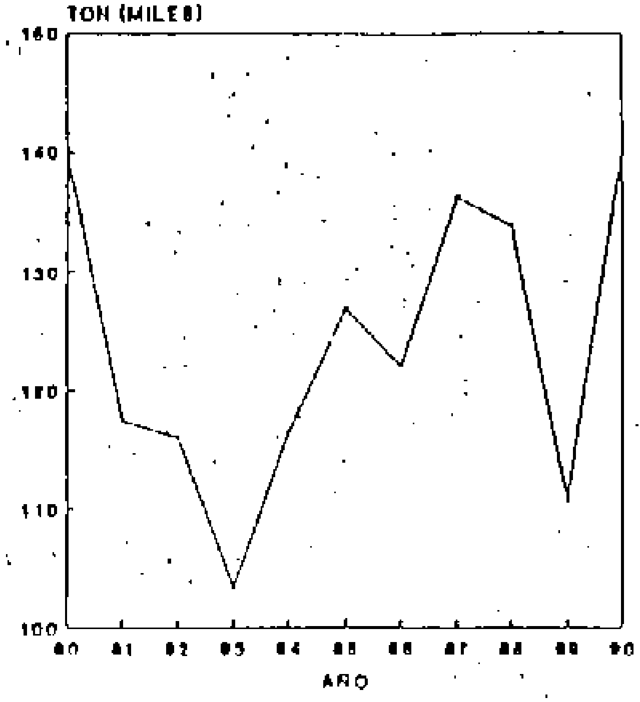
[Mayo 1986 → Abril 1988]

Año	Estación No. 1 Ejido San Pedro Ubicación (27.2 km,N 10°E) Prom. diario mensual	 Prom. diario máximo	 Veces Fuera Norma	Estación No. 2 Ejido Zaragoza Ubicación (20.8 km,N 64°E) Prom. diario mensual	 Prom. diario máximo	 Veces Fuera Norma	Estación No. 3 Campestre Ubicación (3.5 km,Sur 68°E) Prom. diario mensual	 Prom. diario máximo	 Veces Fuera Norma	Estación No. 4 La Mexicana Ubicación (5.5 km,Sur 19°E Prom. diario mensual	 Prom. diario máximo	 Veces Fuera Norma
6	0.00401	0.03002	0	0.00303	0.01401	0	0.0187	0.1003	0	0.0625	0.2345	3
86	0.00171	0.00625	0	0.00189	0.00917	0	0.03507	0.1675	1	0.0589	0.2266	4
86	0.00146	0.01021	0	0.00194	0.01625	0	0.02139	0.1170	0	0.0532	0.2441	1
86	0.00391	0.01458	0	0.00151	0.01042	0	0.02996	0.1487	1	0.0596	0.1979	2
re' 86	0.00506	0.01667	0	0.00350	0.01792	0	0.0085	0.0342	0	0.0116	0.0733	0
' 86	0.00735	0.02750	0	0.00323	0.02000	0	0.00794	0.0566	0	0.0848	0.3783	9
e' 86	0.01026	0.04375	0	0.00614	0.02833	0	0.01262	0.0520	0	0.1082	0.645	0
re' 85	0.01007	0.05250	0	0.00446	0.02125	0	0.00225	0.02125	0	0.1077	0.515	10
87	0.00656	0.03792	0	0.00226	0.01792	0	0.0150	0.069	0	0.1310	0.636	12
' 87	0.00144	0.00483	0	0.00085	0.00333	0	0.0147	0.1687	1	0.035	0.185	2
87	0.00163	0.01333	0	0.00083	0.00958	0	0.0170	0.0833	0	0.0331	0.1441	1
87	0.00069	0.00333	0	0.00296	0.01583	0	0.0133	0.0579	0	0.0979	0.2491	12
7	0.00239	0.00813	0	0.00120	0.01000	0	0.0119	0.0620	0	0.0491	0.1847	4
87	0.00406	0.0439	0	0.00335	0.0098	0	0.0295	0.1204	0	0.0587	0.2650	6
87	0.00237	0.0112	0	0.00268	0.0083	0	0.0186	0.0891	0	0.0109	0.097	0
87	0.097	0.068	0	0.0324	0.0957	0	0.0172	0.0516	0	0.0304	0.086	0
re'87	0.00248	0.00771	0	0.00526	0.02833	0	0.01906	0.07792	0	0.06995	0.22500	7
87	0.00293	0.02063	0	0.00123	0.00500	0	0.01548	0.13167	1	0.03474	0.20500	3
e' 87	0.00111	0.00500	0	0.00211	0.02125	0	0.001172	0.16917	1	0.007903	0.32250	0
e' 87	0.00206	0.01667	0	0.00283	0.02542	0	0.02244	0.16875	1	0.07388	0.29750	7
8	0.00045	0.00333	0	0.00118	0.00583	0	0.01841	0.11750	0	0.07911	0.37167	8
88	0.00017	0.00146	0	0.00127	0.02125	0	0.01123	0.08503	0	0.07714	0.29750	6
	0.00053	0.00333	0	0.00249	0.01375	0	0.01293	0.04458	0	0.06348	0.29667	7
	0.00371	0.005667	0	0.00200	0.01917	0	0.01418	0.11083	0	0.08846	0.47500	9

nte: SEDUE documento Interno

Fig.2

Emisiones de SO2 producidas por la Fundición de Cananea



Fuente: SEDUE documento Interno

Sonora, los cálculos de emisiones corresponden a los añ
que ésta tiene de funcionamiento hasta el 24 de octubre
1991 (Figura 3). La caída en la curva de emisiones expresad
en la Figura 4, coincide con la instalación y puesta en march
de la Planta de Acido Sulfúrico, el 27 de julio de 1988, en
fundición de El Tajo, Nacozari, actualmente en operació

HISTORIA AMBIENTAL DE LA REGION MINERA DEL NORESTE DE SONORA CON ENFASIS EN EL ASPECTO DE CONTAMINACION ATMOSFERICA.

"ENVR. HISTORY OF THE NE SONORA MINING REGION WITH EMPHASIS ON THE AIR POLLUTION ASPECT (1992)"

Cecilia Clausen Galarza

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RESUMEN

En la búsqueda de una causalidad histórica al problema de la contaminación ambiental, se ha investigado una actividad económica que ha caracterizado la vida de la región fronteriza nororiental de Sonora: los procesos mineros de beneficio y fundición de mineral de cobre. Estos se identifican como la causa principal de la contaminación del aire, agua y suelo en la región. Pese a los controles de contaminación implantados, en lo relativo a conservación del medio y salud ambiental, aún hay mucho por hacer. En general, se requiere de la participación conjunta de especialistas técnico-científicos y de ciencias sociales y humanas, para encontrar soluciones integrales y alternativas tecnológicas a los problemas ambientales, teniendo como base una nueva concepción del Progreso.

> *"Tal vez la técnica sea una plaga que sólo puede combatirse con las armas que ella misma nos suministra: no tanto demolición de la técnica, cuanto transformación de la misma en el sentido de una reconciliación con la naturaleza y con la sociedad"*
>
> *Marcuse, H., 1975*

INTRODUCCION

El interés por estudiar desde una perspectiva histórica la naturaleza antropogénica de la contaminación ambiental, radica en el hecho de que, a la vez que es generada por el hombre y que él mismo padece sus impactos, en la misma medida, dependen de él las soluciones. El principal sujeto de la historia es el hombre y su quehacer, y en esta medida interesa a los estudios históricos los problemas de contaminación ambiental. Conocer cronológicamente la evolución del problema nos ayuda a localizar y comprender las causas y condiciones que lo generaron, y a explicar que el problema actual no ha surgido espontáneamente ni existe por sí mismo sino dentro de una compleja red de relaciones económicas, sociales y políticas, que se han desarrollado históricamente.

La contaminación atmosférica de la región del triángulo de las fundiciones es atribuida a una actividad humana bien identificada, la actividad minera industrial que ha caracterizado, a lo largo de su historia, a la zona serrana del noreste de Sonora. Como resultado directo de los procesos... La contaminación del aire ha sido provocada principalmente por las emisiones de gases y polvos que son subproductos contaminantes del proceso de fundición del mineral de cobre (susceptibles de ser recuperados como es el caso del dióxido de azufre). El interés particular por estudiar la región que en algún momento se denominó el "triángulo gris", parte de que se trata, principalmente, de un problema de contaminación atmosférica generado por tres fundiciones que a pesar de encontrarse en dos países diferentes han conformado un solo problema. Así, la pluma de SO_2 en forma de lluvia ácida, ha viajado tanto hacia las Montañas Rocallosas en territorio norteamericano, como hacia los valles agrícolas de Fronteras y Agua Prieta, en Sonora, impactando los suelos, la economía de los rancheros, las aguas de los ríos, la salud de los habitantes, etc.

La región de referencia se encuentra ubicada en la parte nororiental de Sonora; las fundiciones se localizan en las ciudades de Cananea, Son.; la extinta Phelps Dodge en Douglas, Arizona, y la tercera el El Tajo, Municipio de Nacozari, Sonora, existiendo una distancia media entre las tres, de 85 km.

La fundición de Douglas, Arizona, está fuera de operación desde 1987 fecha en que se efectuó el cierre definitivo como resultado de la reacción ciudadana y de la convergencia de otros factores tales como la existencia de un Acuerdo Binacional para la Protección del Medio Ambiente en la Zona Fronteriza entre México y Estados Unidos, y la baja de los precios del cobre en el mercado internacional que no hacían costeable la instalación de equipos de control anticontaminantes en esa fundición. Las otras dos, la de Cananea y la de Nacozari, Sonora, están en operación contando esta última con una planta de ácido sulfúrico que recupera el SO_2. Estas fundiciones, a pesar de la situación actual de control en que se encuentran, han tenido un impacto tanto social como sobre el medio natural que se ha venido dando a lo largo del siglo, por lo menos desde 1903 fecha que inició sus operaciones la fundición de Douglas, Az.

Para comprobar la hipótesis de que el deterioro ambiental evidente a simple vista, así como la contaminación química de aire, aguas y suelo han sido provocados por esta actividad industrial, se ha realizado una investigación que parte desde la historia misma de los centros mineros y sus respectivas fundiciones, pasando por el cálculo de las emisiones de SO_2 en toneladas por año en cada fundición, hasta el análisis comparativo de la situación actual y previa de la fauna y la entrevistas con los habitantes de la región, sin diferenciar sectores sociales ni actividad, con el fin de conocer su percepción del problema.

Hasta la fecha, no se conoce que se hayan realizado para ninguna región de nuestro país, estudios históricos sobre la contaminación ambiental. En relación al caso que nos ocupa, existen estudios sobre aspectos puntuales; un estudio del impacto de los humos de las fundiciones sobre la productividad de los campos agrícolas de Agua Prieta y Fronteras (Williams: 1986), otro estudio sobre la calidad del agua en los represos de la compañía minera de Cananea y arroyos aledaños que son afluentes del importante Río Sonora (Yocupicio: 1985), un reporte del análisis de aguas realizado por químicos de la SEDUE de Sonora (SEDUE,Sonora: 1990), otro más que refiere las implicaciones políticas del problema del "triángulo gris" (Ortiz Monasterio: 1980), y por supuesto, la gran cantidad de notas periodísticas que sobre el problema han aparecido, tanto en los periódicos estatales y locales como en los diarios de Arizona. Se cuenta además con otra larga serie de documentos que han apoyado la investigación, tanto para la comprensión del desarrollo histórico-social de la región como en lo que concierne a la parte física del entorno y sus transformaciones (Natal Lombardo: 1702; Nentuig, Juan: 1764; Atlas geográfico de México, García y Cubas: 1853; Cartas INEGI: 1980; Sonora, Textos de su Historia: 1989; Historia Contemporánea de Sonora: 1991).

EL PROBLEMA Y SU HISTORIA

Creación de los centros mineros.

Durante las tres últimas décadas del siglo XIX, nace en los países occidentales y tiene repercusiones en el resto del mundo, el fenómeno conocido como la Segunda Revolución Industrial que fue posible gracias a un mayor acercamiento entre la ciencia, la tecnología y la industria. El incremento sin precedentes de la producción industrial en los países desarrollados, requirió para su realización, del abastecimiento de fuerza de trabajo barata y materias primas, provenientes de países subdesarrollados o periféricos. La extracción y los procesos industriales primarios de estas materias primas, tales como el beneficio y fundición de minerales para el caso de la minería, se llevaban a cabo en los mismos países proveedores, exportando invariablemente el producto final a los países industrializados para su posterior aprovechamiento. Estas extracciones eran realizadas por compañías extranjeras que aportaban el capital y la tecnología, mediante la obtención de concesiones de explotación en los países donde se instalaban.

La justificación económico-política de éste proceso se encuentra en los postulados del liberalismo económico, que da como resultado la expansión del modelo industrializador capitalista en su forma imperialista, es decir abarcando el planeta entero incorporándolo a una lógica mercantil y a una idea de progreso que, con pocas modificaciones [illegible] avance tecnológico y acumulación de riqueza. Esta idea tiene su fundamento y su posibilidad concreta de realización, en la nueva actitud del hombre frente a la naturaleza, acuñada en el siglo XVIII, "el cual está imbuido de esta convicción, de la creencia de que ha llegado por fin en la historia de la humanidad, el momento en que se podrá arrebatar a la naturaleza su secreto, tan cuidadosamente guardado, el momento en que ya no quedará en la oscuridad de siempre, en su calidad de misterio incomprensible, sino que será sacada a la luz potente del entendimiento que la iluminará con todas sus fuerzas" (1932). La naturaleza fué sometida al rigor científico, e igualmente las ciencias del hombre se organizaron mediante ese modelo racionalizador.

El caso mexicano

En lo que toca a la naturaleza de las concesiones para la explotación de los básicos, esta variaba de acuerdo a las condiciones de cada país que las otorgaba. Para el caso de México, la política porfiriana de "puertas abiertas" permitió la instalación de compañías extranjeras que venían a "invertir" sus capitales en nuestro país, proceso que le permitiría ingresar en el concierto de las naciones industrializadas y modernas del mundo. Así, de acuerdo a este plan, se impulsa el desarrollo industrial del norte de México mediante la participación del gobierno en la instalación de infraestructura básica en comunicaciones y transportes. El resto quedaría en manos de las corporaciones inversionistas. La rama económica privilegiada en este proceso fué la minería, desarrollándose un polo de gran importancia, en la región nororiental de Sonora, zona de grandes yacimientos de minerales conocidos desde épocas coloniales.

Las comunidades mineras que comprenden las fundiciones en cuestión, fueron creadas a fines del siglo XIX y principios del XX. Con la excepción de Nacozari que ya era un antiguo Real de Minas desde mediados del siglo XVII. Cananea y Agua Prieta Sonora, y su "ciudad gemela", Douglas, Arizona, fueron creadas ex-profeso por los inversionistas mineros norteamericanos como unidades económicas tipo enclave, que estaban en función exclusivamente de las necesidades de los mencionados centros.

De las 170 firmas extranjeras que en 1910 tenían el control de la economía mexicana, la American Smelting & Refining Co. (ASARCO) ocupaba el primer lugar, el segundo lo tenía la Greene Cananea Copper Co. y el quinto la Cananea Central Copper Co. Esto nos da una idea de la importancia de las inversiones extranjeras en la rama de la minería, y por lo tanto, de la influencia y poder de éstas. Los centros mineros del nororiente sonorense, Cananea y Nacozari (además de El Tigre en el municipio de Oputo), de acuerdo a este contexto, se desarrollaron en la modalidad de enclave. Estas compañías establecieron "imperios regionales conjuntando la construcción de líneas de ferrocarril [...] el establecimiento de modernas plantas de fundición y de concentración, la electrificación de minas y plantas de beneficio y la concentración de concesiones mineras en un mismo distrito" representando "ejemplos clásicos de este tipo de obras

ara la minería [illegible]
eríodo de mayor importancia pues la base productiva y las écnicas extractivas establecidas, prevalecieron a lo largo a la primera mitad del siglo XX y no fué sino hasta 1961, on la mexicanización de la minería, que se llevan a cabo ambios significativos en las tecnologías, en los estatutos de propiedad de los compañías mineras, a la vez que una evalorización en el mercado mundial, de los precios del obre. Para el caso particular de las minas de la región de estudio, las de Nacozari sobrevivieron las crisis mundiales hasta 1948, la de Cananea mantuvo sus trabajos a lo largo del siglo, aunque con paros temporales, respondiendo a los momentos de crisis con modernizaciones tecnológicas y manteniéndose en los primeros lugares de importancia en la economía regional.

Importancia de las fundiciones

Dentro de este complejo económico-minero, las fundiciones cumplían un papel especial. Además de fundir el mineral de la propia compañía a la que pertenecían, las fundiciones maquilaban el mineral de otras pequeñas empresas mineras nacionales. La importancia de este hecho radica en la información que sobre reservas y producción de minerales en la República Mexicana, tenían las empresas fundidoras. Estas no siempre formaban parte de un complejo minero, al contrario, en ocasiones eran las grandes fundiciones las que adquirían concesiones y empresas mineras generando de ese modo, un monopolio casi absoluto de las fundiciones en México. [Alianza Guggenheim y ASARCO]

La idea de progreso por la que pugnaba el porfiriato y todas las naciones del mundo industrializado, ponía en primer plano el desarrollo industrial como el modelo a seguir por todas las naciones que pretendieran salir del subdesarrollo. No se analiza aquí este modelo de desarrollo, pero no puede dejar de señalarse que si bien la política porfiriana mantenía aparentemente la propiedad de la nación sobre los recursos naturales y las riquezas del subsuelo, al mismo tiempo otorgaba concesiones a empresas extranjeras que usufructuaban el patrimonio nacional.

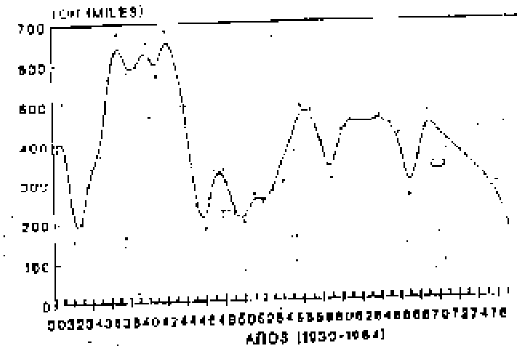
Es en 1917, con la promulgación de la Constitución Revolucionaria, cuando, además de que se reivindica la propiedad de la nación sobre las riquezas del territorio nacional, se menciona por primera vez la preocupación hacia los aspectos de conservación y protección de las mismas. A partir de la segunda mitad del siglo, el problema ambiental en México se fué agudizando, volviéndose necesaria la creación de una legislación ambiental, cuya aparición debió esperar hasta la década de los setentas.

Aún cuando la preocupación por los problemas ambientales no ha sido completamente ajena a la actividad industrial, ésta se manifestó en los principales centros urbano-industriales de Europa. En nuestros países, se ha manifestado y ha ido definiendo sus rasgos, como se dice líneas arriba, en las tres últimas décadas. Para el caso específico de los problemas ambientales provocados por [illegible]

de los diferentes procesos, [illegible] dependen también de esta diferenciación. El caso que nos ocupa, de la contaminación atmosférica provocada por emisiones de SO$_2$, son las únicas que se pueden comprobar en este caso. Aunque no han sido consideradas en este estudio, no se descarta la aportación contaminante de las emisiones de polvos y partículas asociados a la fundición de cobre, entre las que se encuentra el arsénico.

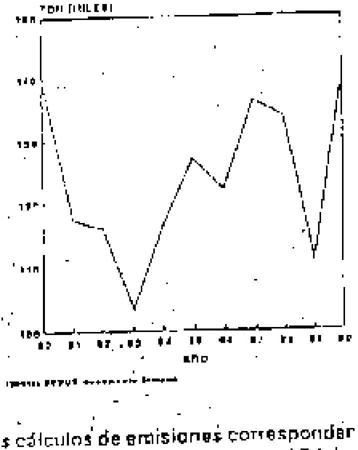
De acuerdo al material obtenido, se han realizado cálculos de emisiones de SO$_2$ de las fundiciones del "triángulo gris" que datan, en el caso de la Phelps Dodge de Douglas, Arizona desde 1930 hasta 1984 (Figura 1). Para el caso de la de Cananea, Sonora, se cuenta con resultados de cálculos de emisiones correspondientes a la década de los ochenta (Figura 2); y para la fundición de El Tajo, en Nacozari, Sonora, los cálculos de emisiones correspondar que ésta tiene de funcionamiento hasta el 24 de 1991 (Figura 3). La caída en la curva de emisiones en la Figura 4, coincide con la instalación y puesta

Fig 1
Emisiones de SO2 producidas por Fundición de Douglas



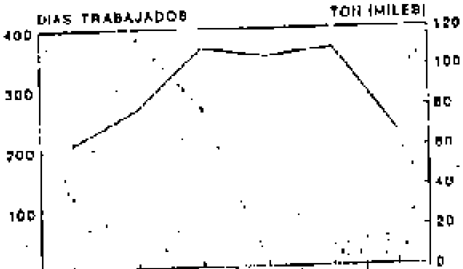
Fuente: SEDUE documento interno

Fig.2
Emisiones de SO2 producidas por la Fundición de Cananea



[illegible]

Días trabajados/año y SO2 emitido por la Fundición de Nacozari

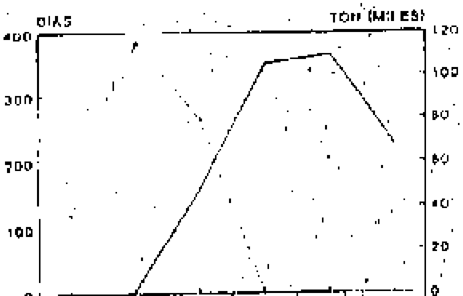


	1986	1987	1988	1989	1990	1991
AS TRAB. —	208	286	366	361	365	228
L SO2 —	35.397	114,061	79,174	0.094	0,098	0,065

AÑOS

SEDUE documento interno

Fig.4 Emisiones de SO2 y Días trabajados/año por la Planta de Acido de Nacozari



	1986	1987	1988	1989	1990	1991
DIAS TRAB. —	0	0	169	351	306	228
EM. SO2 —	35.397	114.88	79.174	0,094	0,098	0,065

AÑOS

Fn: SEDUE documento interno

EFECTOS EN EL MEDIO NATURAL Y HUMANO.

Los primeros registros que arrojan información sobre el medio ambiente de la región, datan por lo menos de 1702. El Vocabulario de Lengua Opata (la extinta etnia de la región) elaborado por el jesuita Lombardo Natal, consigna una gran variedad de especies de flora y fauna que actualmente no están presentes en la biota regional, sin mencionar el águila de dos cabezas que registra Juan Nentuig en su obra. Igualmente, el atlas geográfico de García y Cubas que data de 1853, informa sobre especies hoy ausentes en la zona.

Los efectos negativos de la contaminación generada por las mineras y fundiciones, fué manifestado por los habitantes en diferentes momentos, pero no fué sino hasta finales de los setentas que se volvió explícito el malestar, culminando en agosto de 1983 con la firma del Convenio

Sonora, cumplir con ciertos límites de emisiones. E[illegible] de estudio. las medidas en particular consistieron en: el cierre de la fundición de Douglas, Arizona, la no ampliación de la fundición de Cananea, y la instalación de la Planta de Acido Sulfúrico en El Tajo, Nacozari.

Para este momento ya habían sido calculados los perjuicios de las emisiones de SO_2 de la fundición de Douglas sobre la zona agrícola del Valle de Fronteras y Agua Prieta, habiéndose registrado pérdidas económicas del orden de $ 48,541,000.00 (en pesos de 1986) correspondientes a 1,748 toneladas de cultivos del ciclo agrícola 1984-85 (Williams: 1986).

"La fundición de Phelps Dodge, que fué excluida del Acta de Aire Limpio hasta 1968, para salvar empleos, emite alrededor de 900 toneladas de SO_2 diariamente. La planta, que arroja un tercio más de SO_2 que cualquier otra fundición en los Estados Unidos, se le ha autorizado emitir arriba de 1,100 toneladas por día hasta diciembre de 1987, fecha en que deberá reducir su operación, o cerrar" (Los Angeles Times: ago/24/84)

El daño sobre el suelo provocado por las emisiones de la fundición de Douglas, comprendió una larga serie de indemnizaciones a los agricultores tanto norteamericanos como mexicanos. Cabe aclarar que la erosión del suelo en territorio sonorense, se debe también, en buena medida, a la difundida práctica del sobrepastoreo.

Como medida de presión para acelerar el cierre de la Phelp Dodge de Douglas, se utilizó, a manera de monitor de SO_2, una mujer asmática, que a una distancia considerable de l fundición, reportaba la elevación en los niveles del ga mediante la agudización de sus ataques. Esto era cotejad con la lectura de los monitores, coincidiendo. Sobre situación atmosférica en 1950 en Agua Prieta (ciudad geme de Douglas), comenta un entrevistado, habitante de es ciudad desde 1947: "Nosotros veníamos de Pilares, cuan el cierre de los trabajos en la mina. Agua Prieta nos parec el paraíso, pues allá había por lo menos un muerto cada de semana, y aquí estaba tan bonito, lleno de árboles, pe con el humo, todo andábamos amarillos, parecíam muertos" (ent. 1)

La contaminación atmosférica producida por la fundición Cananea, sigue siendo de importancia en la actualidad. E zona de mayor impacto de los humos localizada haci noreste de la fundición, el suelo presenta una colorac oscura y vegetación atrofiada. La ciudad de Canane encuentra hacia la parte sur de la fundición, que aunqu es la zona de mayor impacto, se ve severamente afect por los humos, cuando los vientos no le favorecen. estadísticas de salud de la Coordinación Médica l correspondientes a los años de 1986, 87 y 88, ubica primer lugar de causas de muerte las cardiopatías segundo todo tipo de cáncer, y en tercero, primer lugar de causas de muerte los cardiopulmonares, en segundo todo tipo de cáncer, y en tercero, las broncopulmonares. Haría falta una profundización mayor en el análisis sobre las causas de muerte y morbilidad, y su relación con las emisiones de la fundición, para atribuirlas solamente a éstas; pero de lo que sí no se puede dudar es de la gran influencia que tienen sobre la salud de los habitantes y en el tipo de padecimientos que sufren, pues se sabe que "varias especies de animales, incluyendo el hombre; reaccionan con broncoconstricción ante el SO_2; este efecto sobre los bronquios se puede evaluar en términos de un ligero aumento en la resistencia en el conducto de aire (...), el óxido de azufre en combinación con partículas y humedad relativa es un peligro potencialmente serio para la salud" (Werner/Wark: 1978). Esto es particularmente importante para Cananea, pues la fundición se encuentra casi en el centro de la ciudad. A propósito comenta un entrevistado, habitante de Cananea: "El humo no es tan dañino como podría ser en otras partes (...) aquí raras veces baja, pero sí pasa, cuando vienen los vientos helados del norte" (ent.2); y para caracterizar la situación en 1945, otra persona entrevistada dice: "Cuando menos en aquel entonces, el humo era parte cotidiana del pueblo, pero lo respiras y sientes una cosa caliente que muchas veces hasta te duele.(...) Regularmente la gente que respira mucho ese humo, se enferma de los bronquios. La bronquitis se debía a la combinación del frío y del ácido sulfúrico" (ent.3)

Las emisiones de la planta fundidora de El Tajo, Nacozari, están actualmente dentro de los niveles permitidos debido a que casi la totalidad de las mismas son recuperadas por la planta de ácido sulfúrico. La denominación de "triángulo gris", se debió a la inminencia de la puesta en operación de la fundición de Mexicana de Cobre, S.A., que sin los controles actuales hubiera resultado verdaderamente desastrozo para el ambiente por la magnitud de su capacidad procesadora.

En lo relativo a la contaminación de los cuerpos de agua, la más denunciada ha sido la contaminación de ríos y arroyos sobre todo los que proceden de la sierra de Cananea, en las inmediaciones de las presas de jales, como el Río San Pedro que corre hacia el norte; y por el sureste los escurrimientos ocurridos de las presas de jales alcanzaron a afectar los afluentes del Río Sonora, tales como el Río Bacanuchi. La permeabilidad del suelo de la zona podría favorecer la contaminación de los mantos subterráneos de las cuencas de la región, debido a las posibles infiltraciones de las presas de jales. En Cananea se localiza un parteaguas de regiones y cuencas hidrológicas. Tomando la ciudad como punto de referencia, hacia el norte se encuentra la cuenca del Río Colorado, al sur la del Río Sonora, y al oeste, la Región Hidrológica 8 o Sonora Norte y la cuenca del Río Altar. Hacia el este, se encuentra la Región Hidrológica 7 o del Río Colorado. La cuenca del Río Yaqui se localiza desde Agua Prieta hacia el sur pasando por Nacozari, lo mismo que la Región Hidrológica 9 o Sonora Sur. Por todo esto es de la mayor importancia, el control de las antes mencionadas presas de aguas residuales de las compañías mineras. Los perjuicios ocasionados a los rancheros, por el agua contaminada proveniente de la minera La Caridad se aprecia en una carta enviada por un agricultor de la región del Valle de [illegible]

ocasionado por las emanaciones que surgen del norte de la Mina de Nacozari..." (SEDUE, Sonora: 1987)

El aporte contaminante de los procesos preindustriales de amalgamación de plata por mercurio, que existieron en la región comprendida básicamente entre Nacozari y Moctezuma (60 Km. al sur de Nacozari) no ha sido considerado en los estudios sobre contaminación ambiental del estado de Sonora. Al respecto existe una referencia sobre el hipertiroidismo existente en la región de Moctezuma, dedicada al beneficio de plata, donde además según la fuente de 1825, se atribuía esta enfermedad "a la mala calidad de las aguas" (Sonora T.: 1989).

CONCLUSIONES

El caso de la región del "triángulo gris", no es más que una pequeña muestra de cómo opera esta lógica económica que se critica. Las acciones llevadas a cabo para controlar los problemas ambientales en la zona, han resultado efectivas para el caso de Douglas y Nacozari, sin ahondar en las medidas que deberán tomarse al respecto de la sobresaturación de ácido sulfúrico existente en el mercado. El plan de control definitivo de contaminantes atmosféricos para el caso de Cananea, consistirá en canalizar, en un futuro próximo, el procesamiento del concentrado de cobre a la fundición de Nacozari, según declaró un funcionario de esa empresa. En lo relativo al problema de contaminación de las aguas, fuera de modificar su PH en las presas de jales y elevar los muros de contención de las mismas, no se conoce otro método de control.

La solución de los problemas ambientales no podrá ser alcanzado en el corto plazo, pues depende de varios factores fundamentales, tales como una inmediata reconversión industrial dirigida a desarrollar procesos no contaminantes; a la necesidad de una nueva orientación en la concepción del diseño industrial de máquinas que incluya la componente anticontaminante; la planeación de políticas económicas de los gobiernos que incluyan consideraciones ecológicas; la profundización en la investigación sobre fuentes alternativas de energía, limitando el uso de los recursos no renovables; y lo más importante, la reconversión en las conciencias, la inversión en las tendencias de acumulación de riqueza a costa de la naturaleza y del hombre.

RECOMENDACIONES

Desde el punto de vista del historiador, las recomendaciones no pueden ser de tipo operativo o técnico. Sólo se limitan a invitar a una revisión de los elementos que componen los actuales problemas de contaminación, incluyendo en esta reflexión, la participación de especialistas de ciencias sociales y humanas. La solución debe alcanzarse mediante la conjunción de los esfuerzos de todas las disciplinas y de todos los hombres, si el objetivo es la preservación de la vida.

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  2. Sr. Sergio Eloy B., Cananea Son, 3/11/91;
  3. Sr. Oscar Salido, Hermosillo Son, 2/11/91.

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Publicado en las memorias del
[illegible]

Summary Mexico 2

Nacozari Copper Smelter

PROCURADURIA FEDERAL DE PROTECCION AL AMBIENTE

MEXICANA DE COBRE, S.A. DE C.V.

Ubicación de las Estaciones de Monitoreo de SO_2

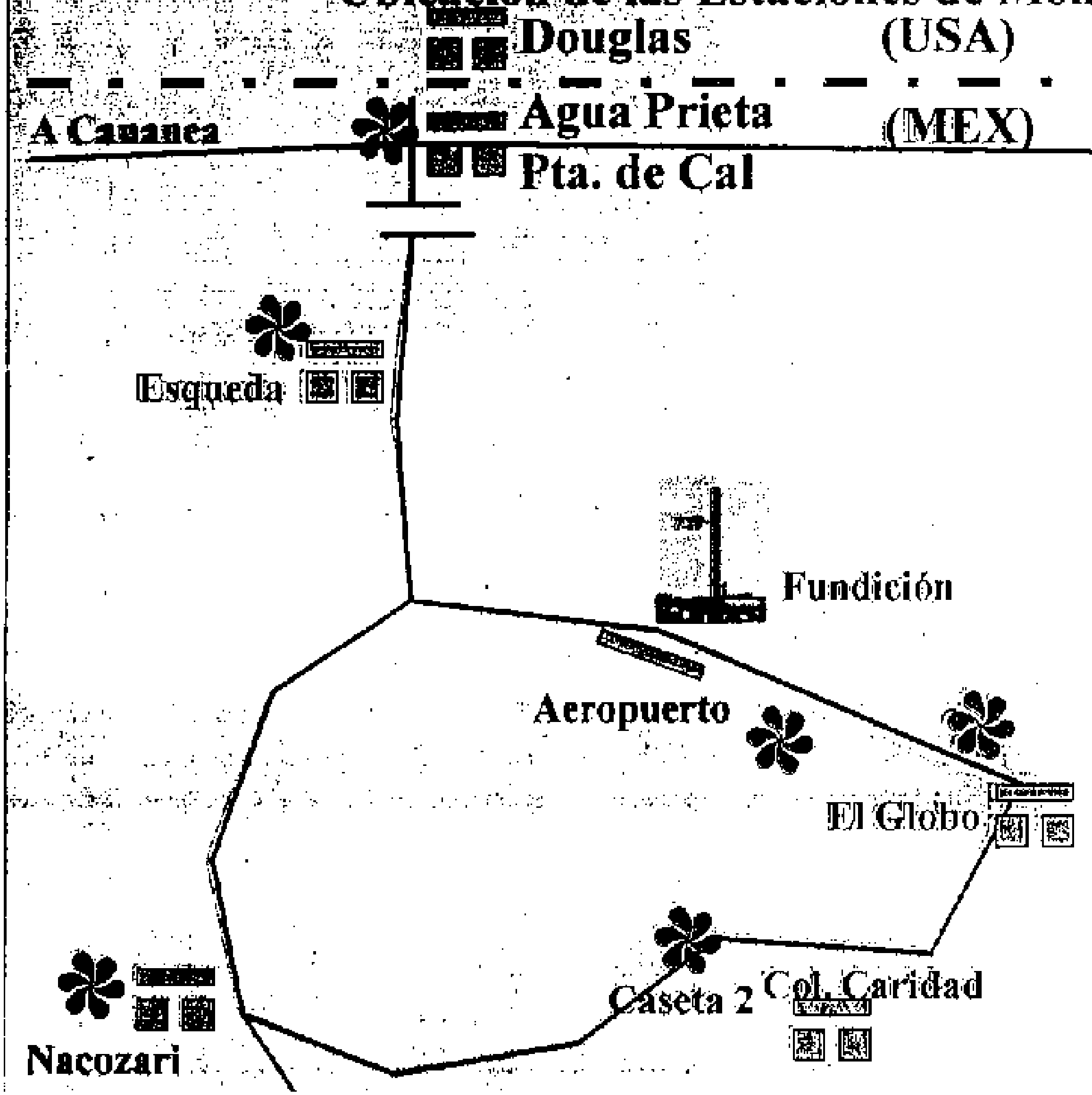


Tabla de Distancias	Km
Agua Prieta-Esqueda	75
Esqueda-Fundición	26
Fundición-Nacozari	25
Fundición-El Globo	21
El Globo-Caseta2	20
Fundición-Aeropuerto	2

✻ Estación de Monitoreo

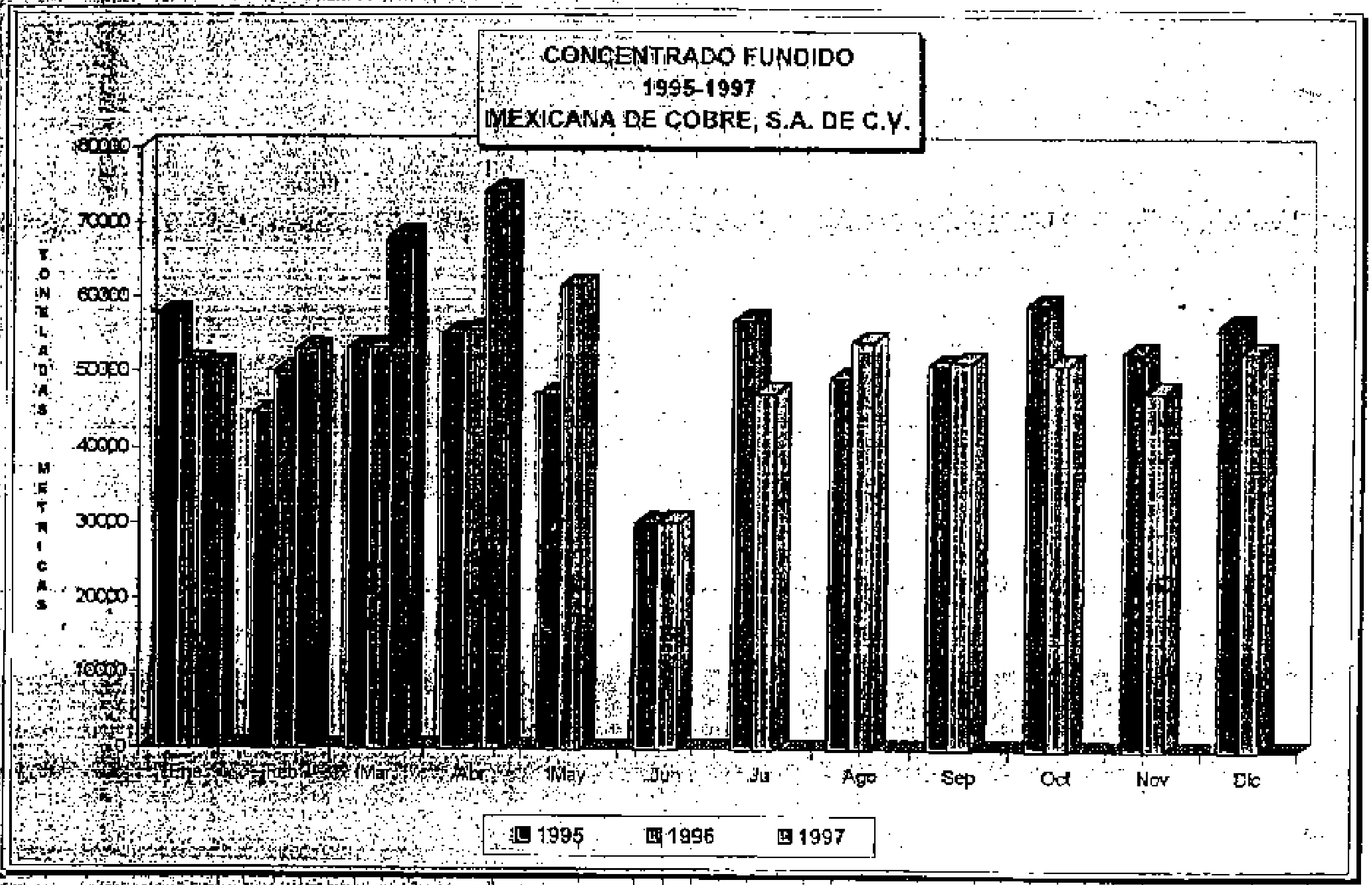
▨ Población

Equipo de Monitoreo

* Pulse fluorescence SO2 Analyzer, Thermo Environmental Model 43C

* Asarco Analyzer Model 600

PROCURADURIA FEDERAL DE PROTECCION AL AMBIENTE

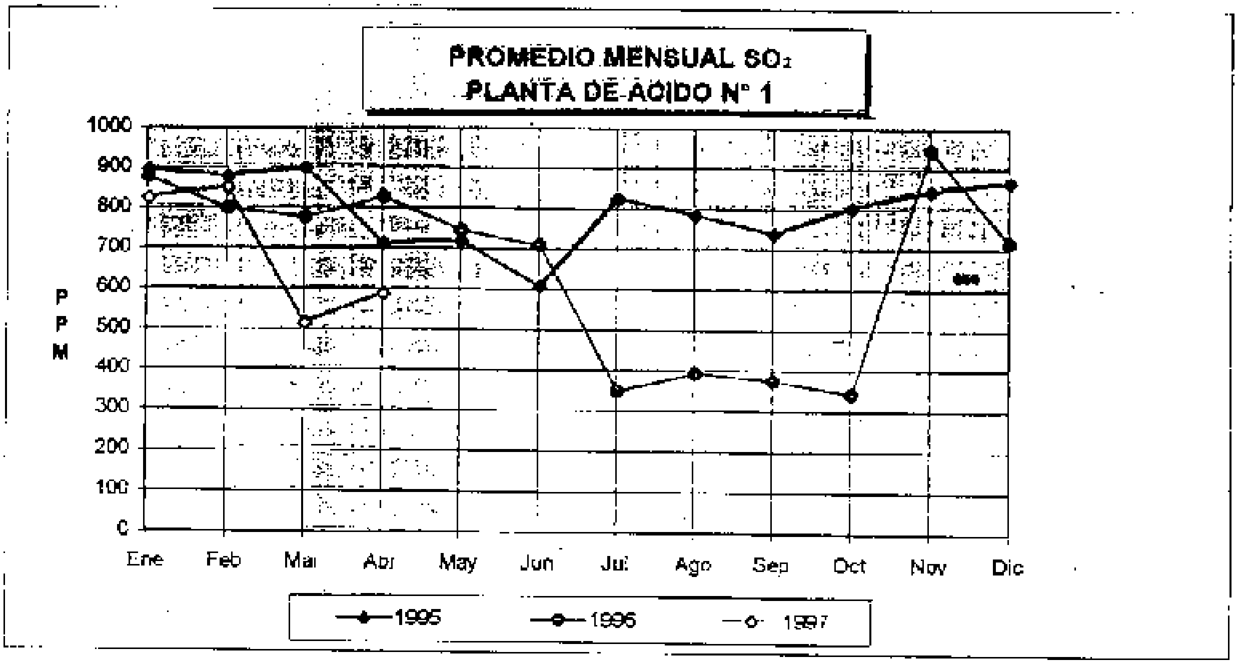


*A PARTIR DEL MES DE MARZO INICIAN PRUEBAS DE AMPLIACIÓN

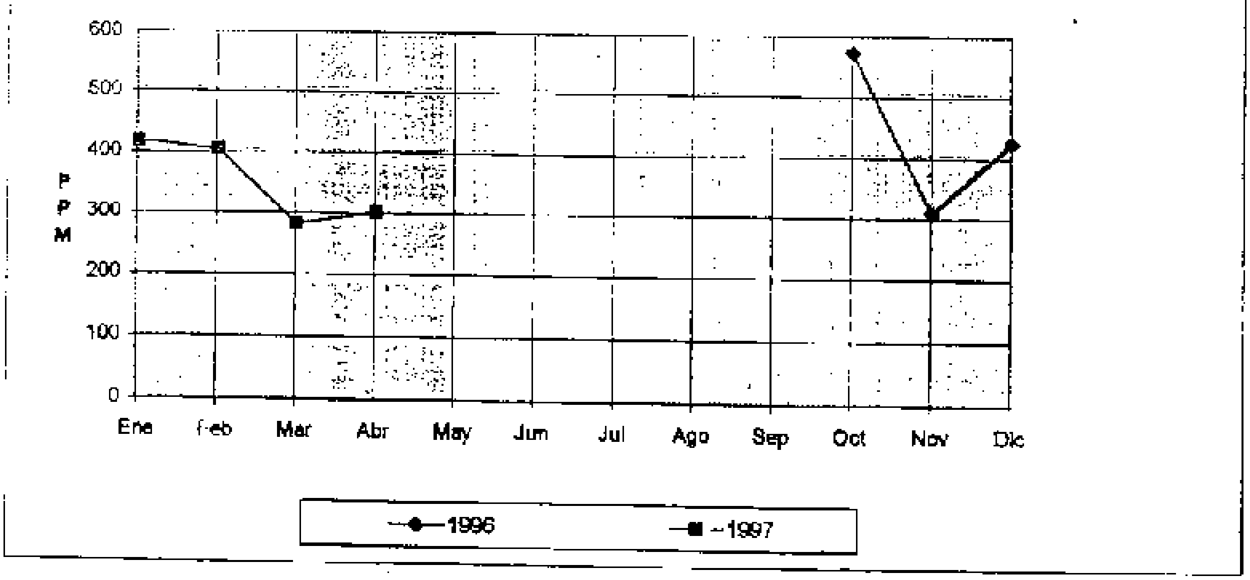
*AUMENTA LA CAPACIDAD INSTALADA EN EL HFI DE 1,800 TM/DIA A 3,200 TM/DIA DE CONCENTRADO A FUNDIR

PROCURADURIA FEDERAL DE PROTECCION AL AMBIENTE

PROMEDIO MENSUAL SO_2
PLANTA DE ACIDO N° 1



PROMEDIO MENSUAL SO_2
PLANTA DE ACIDO N°2



INFORMACION DE FUNDICION
DEPARTAMENTO METALURGICO
DECADA 1980 - 1990

AÑO	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	PROM. ANUAL
ON (TMS)	262,861	220,605	210,042	194,260	210,621	230,415	229,138	256,112	251,337	207,751	263,299	232,775
DE CARGA H.R. (%)	27.50	23.64	23.86	20.64	22.64	22.07	21.81	24.01	23.48	22.83	21.54	23.22
LISTER (TM-Cu Cont	52,639	33,809	35,670	26,802	35,201	37,570	34,301	44,033	44,909	35,169	39,950	38,195
Rato	5:1	7:1	6:1	7:1	6:1		7:1	6:1	6:1	6:1	6:1	

SEPTIEMBRE DE 1991, LAS CIFRAS ACUMULADAS SON LAS SIGUIENTES:

SION: 200,545 TMS
Y DE CARGA: 23.22%
ODUCCION DE COBRE BLISTER: 31,517 TONS.

ta: Aproximadamente el 70% de las toneladas fundidas son de concentrado nuevo.

nitores de SO2: Analizadores termoelectrón modelo 43-A

OPERATIONAL DEVELOPMENT AT EL TAJO SMELTER

BY: JOSE LUIS MUNGARAY FIMBRES

1992

FOR: PRESENTATION AT THE AIME SPRING MEETING
TECHNICAL SESSION

MEXICANA DE COBRE
SMELTER PLANT
NACOZARI, SONORA

IMPURITIES CONTENT IN COPPER CONCENTRATE, MATTE AND ANODE COPPER

YEAR	MONTHS	COPPER CONCENTRATE			MATTE				ANODE COPPER		
		PPM As	PPM Sb	SUM	%Cu	PPM As	PPM Sb	SUM	PPM As	PPM Sb	SUM
1	JANUARY	1500	470	1970	59.63	1600	350	1950	1645	620	2265
	FEBRUARY	1700	640	2340	61.59	1500	620	2120	1460	500	1960
	MARCH	1600	580	2180	61.38	1600	590	2190	1800	430	2230
	APRIL	1500	470	1970	59.97	1300	520	1820	1280	440	1720
	MAY	2000	730	2730	61.03	1400	650	2050	1540	530	2070
9	JUNE	1700	520	2220	59.63	1700	590	2290	1960	650	2610
	JULY	2000	530	2530	59.02	1600	450	2050	1450	450	1900
	AUGUST	1900	400	2300	58.40	1900	430	2330	1355	380	1735
	SEPTEMBER	1600	580	2180	51.54	1700	420	2120	1210	350	1560
9	OCTOBER	1700	640	2340	53.55	1800	400	2200	1500	400	1900
	NOVEMBER	2000	750	2750	54.06	2100	750	2850	1125	400	1525
	DECEMBER	1700	640	2340	54.30	1200	370	1570	1400	500	1900
	AVERAGE	1742	579	2321	57.68	1617	512	2126	1417	471	1948
0	MAXIMUM	2000	750	2750	61.59	2100	750	2850	1960	650	2610
	MINIMUM	1500	400	1970	51.54	1200	350	1570	1125	350	1525
	DIFFERENCE	500	350	780	10.05	900	400	1280	835	300	1085

YEAR	MONTHS	COPPER CONCENTRATE			MATTE				ANODE COPPER		
		PPM As	PPM Sb	SUM	%Cu	PPM As	PPM Sb	SUM	PPM As	PPM Sb	SUM
1	JANUARY	1700	730	2430	60.10	1700	550	2250	1450	440	1890
	FEBRUARY	1800	600	2400	61.10	1600	450	2050	1600	420	2020
	MARCH	2300	1560	3860	61.68	1600	490	2090	2300	850	3150
	APRIL	1700	850	2550	61.45	1200	770	1970	2150	730	2880
	MAY	1300	500	1800	61.24	1200	360	1560	2015	830	2845
9	JUNE	2000	540	2540	60.80	1800	330	2130	2290	640	2930
	JULY										
	AUGUST	1200	680	1880	66.63	1300	790	2090	2300	935	3235
	SEPTEMBER	1400	520	1920	64.68	1300	390	1690	2100	700	2800
9	OCTOBER	1400	530	1930	64.10	1300	300	1600	1800	665	2465
	NOVEMBER	2700	1280	3980	64.92	1900	280	2180	2700	935	3635
	DECEMBER	1900	850	2750	65.17	1400	560	1960	2400	1320	3720
	AVERAGE	1764	788	2552	62.97	1482	488	1970	2100	770	2870
1	MAXIMUM	2700	1560	3980	66.63	1900	790	2250	2700	1320	2960
	MINIMUM	1200	520	1800	60.10	1200	280	1560	1450	420	3073
	DIFFERENCE	1500	1040	2150	6.53	700	510	690	1250	900	3042
	JULY	MAJOR SHUT DOWN PLANT									

Appendix C

SO_2 CEM and Ambient Monitor Audits

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION

REVIEW OF COMPLIANCE TEST REPORT

Name of Company: Magma Copper Company

Company Address: P.O. Box M; San Manuel, AZ 85631 Permit Numbers 1241 & 211136

Source Tested: Relative Accuracy Testing for Facility SO2 & NOx Monitors (see below)

Person Submitting Test Report: Jerry May

Date(s) of Test(s): August 29 - September 12, 1995

Process Rate: Not Applicable

Test Methods Performed: Methods 1-4, 6C, 7E, Performance Spec. 2 & 6, Appendix F

Review of Test Method: Acceptable

Review of Calculations: Acceptable

Comments (precision & accuracy of replicate tests, percent isokinetic sampling, operating anomalies, etc.):

Some minor arithmetic errors were noted. Some raw data sheets were difficult to read.

Pollutant Tested	Tested Emission Rate	Allowable Emission Rate	Pass/Fail
Boilers			
#7 NOx	13.67% Relative Accuracy	20% Relative Accuracy (RA)	Pass
#8 NOx	18.04% RA	20% RA	Pass
#1 Acid Plant			
SO2	10.13% RA	20% RA	Pass
Flow	9.24% RA	20% RA	Pass
#2 Acid Plant			
SO2	4.06% RA	20% RA	Pass
Flow	4.0 RA	20% RA	Pass

Reviewer(s): Wayne Hunt

Date(s): June 22, 1995

xc: ZF Source: X Source File: X Permit Engineer: X

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION

REVIEW OF COMPLIANCE TEST REPORT

Name of Company: Magma Copper Company

Company Address: P.O. Box M; San Manuel, AZ 85631 Permit Numbers 1241 & 211136

Source Tested: Relative Accuracy Testing for Facility SO2 & NOx Monitors (see below)

Person Submitting Test Report: Jerry May

Date(s) of Test(s): August 29 - September 12, 1995

Process Rate: Not Applicable

Test Methods Performed: Methods 1-4, 6C, 7E, Performance Spec. 2 & 6, Appendix F.

Review of Test Method: Acceptable

Review of Calculations: Acceptable

Comments (precision & accuracy of replicate tests, percent isokinetic sampling, operating anomalies, etc.):

Some minor arithmetic errors were noted. Some raw data sheets were difficult to read.

Pollutant Tested	Tested Emission Rate	Allowable Emission Rate	Pass/Fail
#3 Acid Plant			
SO2	4.3% RA	20% RA	Pass
Flow	4.55 RA	20% RA	Pass
Flash Fugitives			
SO2	10.45% RA	20% RA	Pass
Flow	2.50% RA	20% RA	Pass
Converter Fugitives			
SO2	6.78% RA	20% RA	Pass
Flow	1.21 RA	20% RA	Pass

Reviewer(s): Wayne Hunt WH

Date(s): June 22, 1995

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION

REVIEW OF COMPLIANCE TEST REPORT

Name of Company: Magma Copper Company

Company Address: P.O. Box M; San Manuel, AZ 85631 Permit Numbers 1241 & 211136

Source Tested: Relative Accuracy Testing for Facility SO2 & NOx Monitors (see below)

Person Submitting Test Report: Jerry May

Date(s) of Test(s): August 29 - September 12, 1995

Process Rate: Not Applicable

Test Methods Performed: Methods 1-4, 6C, 7E, Performance Spec. 2 & 6, Appendix F.

Review of Test Method: Acceptable

Review of Calculations: Acceptable

Comments (precision & accuracy of replicate tests, percent isokinetic sampling, operating anomalies, etc.):

Some minor arithmetic errors were noted. Some raw data sheets were difficult to read.

Pollutant Tested	Tested Emission Rate	Allowable Emission Rate	Pass/Fail
Flash Bypass Duct			
SO2	15.35 RA	15% RA	Pass
Roof Monitor			
SO2	2.74% RA	15% RA	Pass

Reviewer(s): Wayne Hun Date(s): June 22, 1995

xc: ZF Source: X Source File: X Permit Engineer: X

Eric FYI

AQA:RAT:481-9-9-94

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

Fife Symington, Governor   Edward Z. Fox, Director

September 9, 1994

Fred Kennard
Senior Environmental Engineer
ASARCO
P.O. Box 8
Hayden, Arizona 85235

Dear Mr. Kennard,

On September 8, 1994 ADEQ conducted a performance audit on the SO_2 analyzer's located at the Garfield and Jail sites. Using the criteria set forth on page 39 Section 2.0.12 of the Quality Assurance Handbook for Air Pollution Measurement Systems, July 1984, the analyzer's passed the audit (See attached report form).

If you have any questions please feel free to call me at (602) 207-2359.

Sincerely,

Ron Thaut

Ron Thaut
QA/Monitoring Coordinator

cc: Jim Guyton
Prabhat Bhargava
Dave Kempson

Sul[illegible] Dioxide Audit Report

Approved By:____________

Date: Sept 8,1994

Operator: ASARCO

For Site: Garfield

AUDITED BY: Ron Thaut

Analyzer: Teco M/N: 43B A/N: 833

Range(ppm): 2.00 F/S Output Volts: 10.00

CALIBRATOR: Environics M/N: 100 A/N: 22349

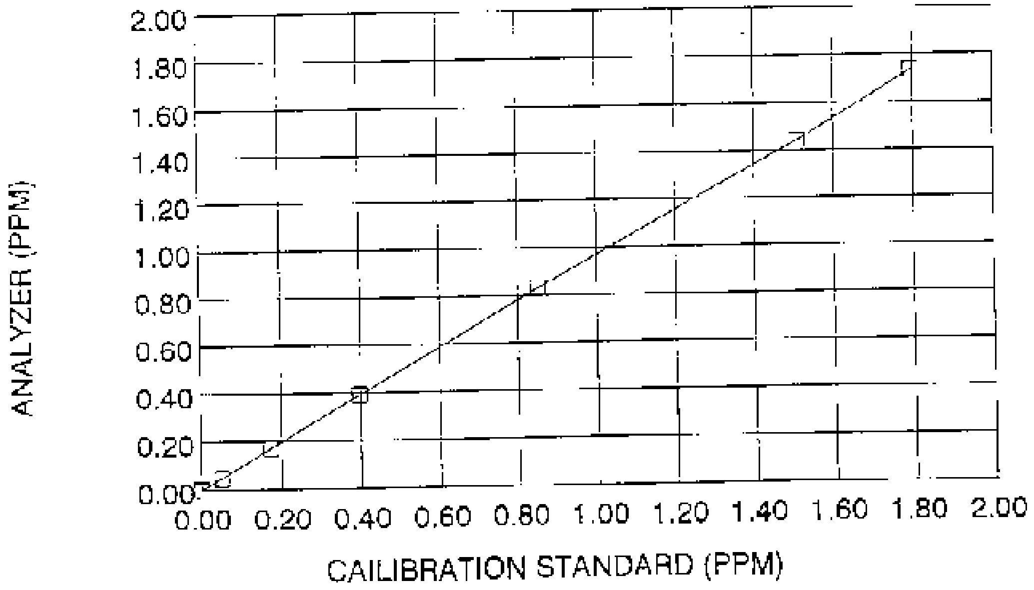
Zero Air Cylinder No: FF2385 Press (psi): 1000

Span Gas Cylinder No: SG9116 PPM: 13.5 Press(psi): 1900

Voltage = ppm/F.S.ppm

Data Point (ppm)	Calibration Gas Concentration (V)	Analyzer (V)	Analyzer (PPM)	Analyzer Net Response (PPM)	Percentage Difference (%)
0.0000	0.0000	-0.0002	0.0000	0.0000	------
0.0500	0.2500	0.2300	0.0460	0.0460	-7.9200
0.1740	0.8700	0.8500	0.1700	0.1700	-2.2759
0.3990	1.9950	1.9600	0.3920	0.3920	-1.7444
0.8510	4.2550	4.1500	0.8300	0.8300	-2.4630
1.5100	7.5500	7.2200	1.4440	1.4440	-4.3682
1.7960	8.9800	8.6800	1.7360	1.7360	-3.3385

		EPA CRITERIA	% Difference	RESULT
Zero (PPM):	0.0000	< 1% FS	-0.002	PASS
Slope:	0.962528	< 15%	-3.74717991	PASS
Intercept:	0.002479	< 3% FS	0.123965715	PASS
Correlation Coefficient:	0.99994993	<= .9950	------	PASS



Sulfur Dioxide Audit Report

Approved By:__________ Date: Sept 8,1994

Operator: ASARCO

For Site: Jail AUDITED BY: Ron Thaut

Analyzer: Teco M/N: 433 A/N: 4884

Range(ppm): 2.00 F/S Output Volts: 10.00

CALIBRATOR: Environics M/N: 100 A/N: 281

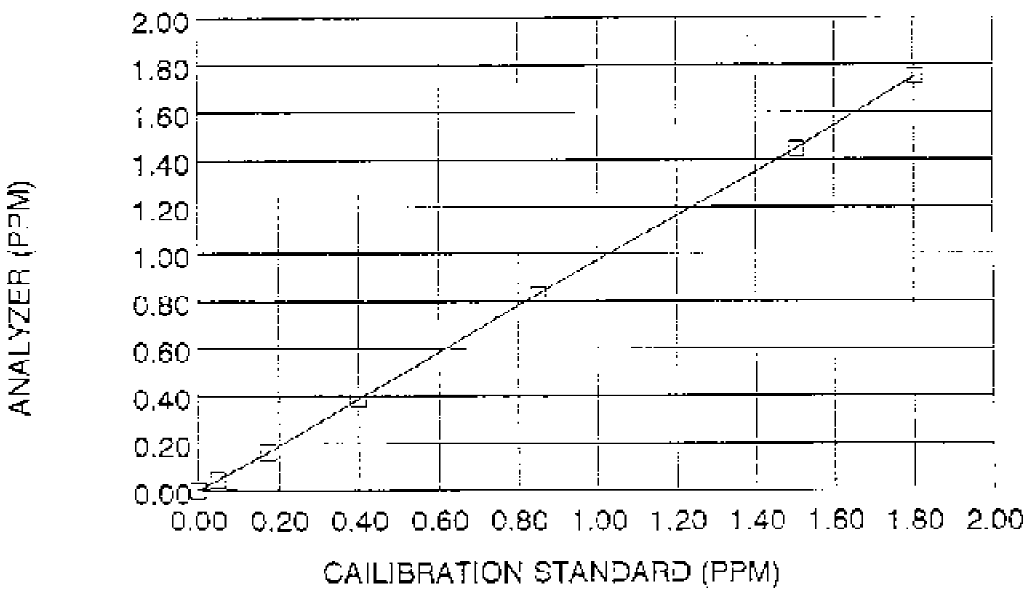
Zero Air Cylinder No: FF2385 Press (psi): 1100

Span Gas Cylinder No: SG9116 PPM: 13.5 Press(psi): 1700

Voltage = ppm/F.S.ppm

Data Point (ppm)	Calibration Gas Concentration (V)	Analyzer (V)	Analyzer (PPM)	Analyzer Net Response (PPM)	Percentage Difference (%)
0.0000	0.0000	−0.0004	−0.0001	0.0000	------
0.0490	0.2450	0.2300	0.0460	0.0461	−5.9592
0.1740	0.8700	0.8100	0.1620	0.1621	−6.8506
0.3990	1.9950	1.9270	0.3854	0.3855	−3.3885
0.8500	4.2500	4.1400	0.8280	0.8281	−2.5788
1.5050	7.5250	7.2400	1.4480	1.4481	−3.7821
1.8020	9.0100	8.7500	1.7500	1.7501	−2.8812

		EPA CRITERIA	% Difference	RESULT
Zero (PPM):	−0.0001	< 1% FS	−0.004	PASS
Slope:	0.969394	< 15%	−3.06059327	PASS
Intercept:	−0.001836	< 3% FS	−0.09181605	PASS
Correlation Coefficient:	0.99997163	<= .9950	-------	PASS



Appendix D

Monthly/Quarterly Emission Summary Reports: U.S. Smelters Within 100 Kilometers of Border

ASARCO

El Paso Plant
L. W. Castor, Unit Manager

February 06, 1997

Mr. Dan Pearson, Executive Director
Texas Natural Resources Conservation Commission
Attn: Ms Jeanne Philquist, Manager (MC 169)
Enforcement division, Air Section
Post Office Box 13087
Austin, Texas 78711-3087

Attention: Compliance Division

Dear Mr. Pearson,

Submitted herewith in compliance with Order No. 70 1701 of the Forty First Judicial District Court is the monthly report for January 1997 of ambient sulfur dioxide excursions above established standards:

	Standard	No. Excursions	%Compliance
TNRCC	0.50 ppm/ 1-hr.avg.	0	100
EPA	0.50 ppm/ 3-hr.avg.	0	100
EPA	0.14 ppm/24-hr.avg.	0	100

Sincerely,

J.A. Baca

J.A. Baca
Sr. Environmental Engineer

cc: File
E.A. Groten
J.B. Richardson
41st Judicial Court
Archie Clouse, Texas Natural Resources Conservation Commission
Jesus Reynoso, El Paso City/County Health and Environmental District

ASARCO

El Paso Plant
L. W. Castor, Unit Manager

January 30, 1997

Mr. Archie Clouse
Manager Air Program
Texas Natural Resource Conservation Commission
7500 Viscount, Suite 147
El Paso, Texas 79925

RE: Quarterly CEM and COM Reporting for Permit No. 20345

Dear Mr. Clouse:

Attached are the required reports for the fourth quarter of 1996 for the continuous emission monitor (CEM) for sulfur dioxide and the two continuous opacity monitors (COM's) required by Special Provision No. 23 of Permit No. 20345.

There were 18 periods of excess SO_2 emissions for 6-hour block averages as indicated on the attached, all resulting from acid plant shutdowns and startups that were reported to your office as required by Rule 101.6 or 101.7. These reports include information concerning the corrective actions taken and are incorporated by reference into this report.

Also enclosed is a copy of the quarterly audit and quality assurance performed on the CEM and COMs during the week of December 16, 1996.

I certify that the information contained in this report is true, accurate, and complete.

Sincerely,

Joseph A. Baca
Senior Environmental Engineer

cc: EA Groten
File

ASARCO INCORPORATED

EL PASO PLANT

CEM/COM SUMMARY REPORT

FOURTH QUARTER 1996

FLUID BED DRYER COM

Pollutant - Opacity
Reporting period dates: October 01, 1996 - December 31, 1996
Company: ASARCO Incorporated, El Paso Plant
Emission Limitation: 10 %
Address: 2301 W. Paisano, El Paso, Texas 79922
Monitor Manufacturer and Model No.: United Sciences, Inc.Model 500C S/N 03941125
Date of Latest CMS Certification or Audit. December 16, 1996.
Process Unit(s) Description: Fluid bed concentrate dryer baghouse
Total source operating time in reporting period: 1824.0 hours
Instrument Tag #AIT078301

A. Emission Data Summary

1. Duration of excess emissions in reporting period due to:

a. Startup/Shutdown:	18 minutes
b. Control equipment problems:	0 minutes
c. Process problems:	6 minutes
d. Other known causes.	0 minutes
e. Unknown causes:	0 minutes

2. Total duration of excess emissions: 24 minutes

3. Total duration of excess emissions was 0.0 % (<1 %) of total source operating time, so no "long form" report required. Please refer to Section D. below for information pertaining to part 1(c) above.

B. CMS Performance Summary

1. CMS downtime in reporting period due to:

a. Monitor equipment malfunctions:	0 minutes
b. Non-Monitor equipment malfunctions:	0 minutes
c. Quality assurance calibration:	1182 minutes
d. Other known causes:	222 minutes
e. Unknown causes:	0 minutes

2. Total CMS downtime: 1404 minutes

3. Total CMS downtime was 1.3% (<5 %) of total source operating time, so no "long form" report is required.

CONVERTER BUILDING VENTILATION BAGHOUSE COM

Pollutant - Opacity
Reporting period dates: October 01, 1996 - December 31, 1996
Company: ASARCO Incorporated, El Paso Plant
Emission Limitation: 15%
Address. 2301 W. Paisano, El Paso, Texas 79922
Monitor Manufacturer and Model No.: United Sciences, Inc.Model 500C S/N 03941119
Date of Latest CMS Certification or Audit: December 17, 1996.
Process Unit(s) Description: Converter Building Ventilation Baghouse
Total source operating time in reporting period: 2208 hours
Instrument Tag # AIT078301

A. Emission Data Summary

1. Duration of excess emissions in reporting period due to:	
a. Startup/Shutdown:	204 minutes
b. Control equipment problems:	0 minutes
c. Process problems:	66 minutes
d. Other known causes:	0 minutes
e. Unknown causes:	0 minutes
2. Total duration of excess emissions:	270 minutes

3. Total duration of excess emissions was 0.2 % (<1 %) of total source operating time so no "long form" report required.

B. CMS Performance Summary

1. CMS downtime in reporting period due to:	
a. Monitor equipment malfunctions:	0 minutes
b. Non-Monitor equipment malfunctions:	0 minutes
c. Quality assurance calibration:	18 minutes
d. Other known causes:	0 minutes
e. Unknown causes:	0 minutes
2. Total CMS downtime:	18 minutes

3. Total CMS downtime was 0.0% (<5 %) of total source operating time,so no "long form" reprot required.

ACID PLANT STACK SO_2 CEM

Pollutant SO_2
Reporting period dates: October 01, 1996 - December 31, 1996
Company: ASARCO Incorporated, El Paso Plant
Emission Limitation: 500 ppm / 6 hours
Address: 2301 W. Paisano, El Paso, Texas 79922
Monitor Manufacturer and Model No : AMETEK 400-460 S/N 7692
Date of Latest CMS Certification or Audit: December 16, 1996.
Process Unit(s) Description: Acid plants #1 and #2 Common stack.
Total source operating time in reporting period: 1485.0 hours
Instrument Tag # AIT078202

A. Emission Data Summary

1. Duration of excess emissions in reporting period due to:
    a. Startup/Shutdown: 108.0 hours
    b. Control equipment problems: 0 hours
    c. Process problems: 0 hours
    d. Other known causes: 0 hours
    e. Unknown causes: 0 hours
2. Total duration of excess emissions: 108.0 hours
3. Total duration of excess emissions was 7.3% (>1 %) of total source operating time. Please refer to Section C. and E. below and to previously filed 101.6 and 101.7 reports (cross referenced in attached table) for information required by 40 CFR §60.7(c).

B. CMS Performance Summary

1. CMS downtime in reporting period due to:
    a. Monitor equipment malfunctions: 0 hours
    b. Non-Monitor equipment malfunctions: 0 hours
    c. Quality assurance calibration: 0 hours
    d. Other known causes: 0 hours
    e. Unknown causes: 0 hours
2. Total CMS downtime: 0 hours
3. Total CMS downtime was 0.0 % (<5%) of total source operating time, so no "long form" report required.

C. Explanation for 6-hour block averages exceeding 500 ppm of SO_2 are as follows:

DATE	6 HR-BLOCK	AVG PPM	EXPLANATION	MAINT/UPSET NO.
10/01/96	1200-1800	1072	ACID PLANT STARTUP	M09/05/1996
10/05/96	0000-0600	705	ACID PLANT STARTUP	U10/02/1996
10/05/96	0600 1200	1055	ACID PLANT STARTUP	U10/02/1996
10/05/96	1200-1800	810	ACID PLANT STARTUP	U10/02/1996
10/18/96	1800-2400	773	ACID PLANT STARTUP	M09/02/1996
10/25/96	1200-1800	534	ACID PLANT STARTUP	M10/08/1996
11/06/96	1200-1800	1204	ACID PLANT STARTUP	M09/02/1996
11/06/96	1800-2400	508	ACID PLANT STARTUP	M09/02/1996
11/07/96	0000-0600	628	ACID PLANT STARTUP	M09/02/1996
11/08/96	1800-2400	573	ACID PLANT STARTUP	M09/02/1996
11/09/96	0000-0600	1116	ACID PLANT STARTUP	M09/02/1996
11/20/96	1800-2400	723	ACID PLANT STARTUP	M11/04/1996
11/22/96	1800-2400	574	ACID PLANT STARTUP	M09/02/1996
11/23/96	0000-0600	1057	ACID PLANT STARTUP	M09/02/1996
12/05/96	1800-2400	716	ACID PLANT STARTUP	M12/02/1996
12/15/96	1800-2400	569	ACID PLANT STARTUP	M12/03/1996
12/27/96	1200-1800	683	ACID PLANT STARTUP	U12/02/1996
12/27/96	1800-2400	1160	ACID PLANT STARTUP	U12/02/1996

D. Explanation for Excess Emissions duration of greater than five (5) percent for the Acid Plant Stack SO_2 CEM:

The high percentage of excess emissions for the 4th quarter of 1996 resulted, in part, from reduced operating hours due to a prolonged shut-down for a major rebuild of Number 2 Acid Plant beginning November 06, 1996. This shutdown, alone, reduced the "Total Source Operating Time", by 784 hours. The result of this shut-down was to improve the conversion of sulfur dioxide to sulfuric acid and lower tail gas emissions. Startups associated with Spray Chamber cleaning accounted for the remainder of excess emissions. All start-ups were preceded by written notification in accordance with TNRCC Requirements for Major Upset (101.6) and Maintenance (101.7).

phelps dodge
Hidalgo Inc. Hidalgo Smelter Playas, New Mexico 88009 • (505) 436-2211

July 7, 1997

Mr. Jimmy Romero
Compliance Section
New Mexico Environment Department
Air Pollution Control Bureau
P. O. Box 26110
Santa Fe, New Mexico 87502

Re: Transmittal Monthly Sulfur Recovery Reports
<u>2nd Quarter 1997</u>

Dear Mr. Romero:

Attached is the sulfur recovery report for the 2nd quarter of 1997, as required by AQCR 652. We are pleased to report that recovery, after exclusion of emissions that were reported to you pursuant to Air Quality Control Regulation 801, was 95.47%, 96.33%, and 96.35% for the months of April, May, and June respectively. More importantly, we are proud to report that actual sulfur capture, i.e., capture of total sulfur input to the smelter without sulfur input and recovery related to emissions reported under AQCR 801, was 95.06%, 95.27%, and 95.86% for the months of April, May, and June respectively.

Because the smelter captured over 90 percent of its actual sulfur input, the 90 percent capture requirement contained in AQCR 652.B was satisfied without regard to emissions exempted under AQCR 801. The smelter therefore had no excess emissions, as that term is defined in AQCR 801, during the months of April, May, and June 1997.

If you have any questions, please contact me or Mr. G. R. Roose at (505) 436-2211.

Sincerely,

A. G. Ross
General Manager - Hidalgo

AGR:gr
Attachment

Phelps Dodge Mining Company
Hidalgo Smelter
Sulfur Recovery - 2nd Quarter 1997

Sulfur Input (Tons)	April	May	June	2nd Quarter
Gross Sulfur Input	21895.80	15222.10	24637.67	61755.57
Less Exempt Under AQCR 801	95.26	170.04	126.92	392.22
Net Sulfur Input	21800.54	15052.06	24510.75	61363.35
Sulfur Recovered (Tons)				
Gross Sulfur Recovered	20814.17	14501.76	23617.26	58933.19
Less Exempt Under AQCR 801	0.93	2.11	1.19	4.23
Net Sulfur Recovered	20813.24	14499.65	23616.07	58928.96
Sulfur Recovery (Percent)	95.47%	96.33%	96.35%	96.03%
w/o 801 Exemptions	95.06%	95.27%	95.86%	95.43%

phelps dodge
Hidalgo Inc.
Hidalgo Smelter, Playas, New Mexico 88009 • (505) 436-2211

April 7, 1997

Mr. Jimmy Romero
Compliance Section
New Mexico Environment Department
Air Pollution Control Bureau
P. O. Box 26110
Santa Fe, New Mexico 87502

Re: Transmittal Monthly Sulfur Recovery Reports
<u>1st Quarter 1997</u>

Dear Mr. Romero:

Attached is the sulfur recovery report for the 1st quarter of 1997, as required by AQCR 652. We are pleased to report that recovery, after exclusion of emissions that were reported to you pursuant to Air Quality Control Regulation 801, was 92.33%, 92.33%, and 95.54% for the months of January, February, and March respectively. More importantly, we are proud to report that actual sulfur capture, i.e., capture of total sulfur input to the smelter without sulfur input and recovery related to emissions reported under AQCR 801, was 91.56%, 90.69%, and 95.08% for the months of January, February, and March respectively.

Because the smelter captured over 90 percent of its actual sulfur input, the 90 percent capture requirement contained in AQCR 652.B was satisfied without regard to emissions exempted under AQCR 801. The smelter therefore had no excess emissions, as that term is defined in AQCR 801, during the months of January, February, and March 1997.

If you have any questions, please contact me or Mr. G. R. Roose at (505) 436-2211.

Sincerely,

A. G. Ross
General Manager - Hidalgo

AGR:gr
Attachment

Phelps Dodge Mining Company

Hidalgo Smelter

Sulfur Recovery - 1st Quarter 1997

Sulfur Input (Tons)	January	February	March	1st Quarter
Gross Sulfur Input	24283.36	22095.31	27479.22	73857.89
Less Exempt Under AQCR 801	204.68	318.06	134.14	656.88
Net Sulfur Input	24078.68	21777.25	27345.08	73201.01
Sulfur Recovered (Tons)				
Gross Sulfur Recovered	22233.00	20038.88	26126.29	68398.17
Less Exempt Under AQCR 801	2.12	3.03	1.50	6.65
Net Sulfur Recovered	22230.88	20035.85	26124.79	68391.52
Sulfur Recovery (Percent)	92.33%	92.00%	95.54%	93.43%
w/o 801 Exemptions	91.56%	90.69%	95.08%	92.61%

Appendix E

Monthly/Quarterly Emission Summary Reports: Mexican Smelters Within 100 Kilometers of Border

MEXICANA DE COBRE, S. A. DE C.V.
FUNDICION
APARTADO POSTAL NO. 70
NACOZARI, SONORA, 84340 MEXICO

TELEFO
634-2-
634-2-0
TELE
54800 N
54801 N

NACOZARI

XX

Agosto 04, 1996

Secretaría del Medio Ambiente,
Recursos Naturales y Pesca
Delegación (139) Sonora
Centro de Gobierno
Hermosillo, Sonora.

R E C I B I D O
AGO. 7 1996
DELEGACION SONORA

At'n : Lic. Ernesto Gándara Camou
Delegado Federal en el Estado de Sonora

Me permito enviar Reporte de Resultados de Monitoreo de Concentración de SO_2 en el ambiente que se origina por las emisiones de la Planta Fundición de Cobre en El Tajo, Municipio de Nacozari de García, Sonora.

Estos reportes corresponden a los monitores instalados en Nacozari, Aeropuerto La Caridad, Col. El Globo, Caseta No. 2 y Planta de Cal, cercana a Agua Prieta, Sonora, durante el mes de Julio de 1996.

Asimismo, anexo registro de la estación meteorológica del Aeropuerto La Caridad.

Quedando a sus órdenes para cualquier aclaración al respecto.

Atentamente,

Ing. Victor del Castillo Alarcón
Superintendente de Ecología

c.c.p. Biol. Patricia Celis Salgado
Ing. Oscar González Rocha
Sr. Rubén Tello Flores
Ing. Jorge H. Meza Viveros
Consecutivo / Archivo

SUB-DELEGACION DE MEDIO AMBIENTE
R E C I B I D O
AGO. 7 1996

MEXICANA DE COBRE S.A DE C.V
UNIDAD LA CARIDAD

CONCENTRACIONES DE BIOXIDO DE AZUFRE

Localidad Esqueda
Mes: JULIO.96

DIAS	HORA																								
	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13.00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22.00	23:00	24:0	PRCM
1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
12	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
13	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
14	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
16	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
17	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
19	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
21	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
22	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
23	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
25	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
26	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
27	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
28	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
29	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
30	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
31	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00

OBSERVACIONES No hubo captaciones

LIMITES: 0.13 ppm/24 hr

RECIBIDO
AGO. 7 1996

Ing. Victor del Castillo A.
Superintendente de Ecología
AGO. 7 1996

MEXICANA DE COBRE S.A DE C.V
UNIDAD LA CARIDAD

CONCENTRACIONES DE BIOXIDO DE AZUFRE

Localidad: Aeropuerto
Mes: JULIO,96

HORA

	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:0	PROM
1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.022	0.220	0.160	0.060	0.060	0.022
8	0.044	0.044	0.027	0.022	0.011	0.000	0.000	0.120	0.015	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012
9	0.027	0.270	0.022	0.027	0.120	0.190	0.011	0.000	0.000	0.000	0.011	0.011	0.011	0.230	0.011	0.000	0.000	0.000	0.000	0.077	0.000	0.000	0.000	0.000	0.042
10	0.000	0.000	0.060	0.016	0.022	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005
11	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.011	0.100	0.055	0.000	0.038	0.011	0.000	0.000	0.000	0.000	0.009
12	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.011	0.011	0.093	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005
13	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.082	0.016	0.022	0.011	0.000	0.000	0.000	0.000	0.000	0.005
14	0.000	0.000	0.000	0.000	0.011	0.044	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003
15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.011	0.000	0.000	0.000	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.001
16	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
17	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
19	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.033	0.022	0.011	0.003
20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
21	0.027	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
22	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
23	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
25	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.027	0.044	0.033	0.022	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005
26	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.022	0.220	0.022	0.022	0.160	0.044	0.011	0.011	0.011	0.011	0.011	0.011	0.023
27	0.011	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
28	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
29	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.022	0.022	0.022	0.027	0.027	0.033	0.033	0.022	0.033	0.027	0.033	0.027	0.033	0.027	0.033	0.027	0.019
30	0.027	0.033	0.033	0.022	0.022	0.027	0.027	0.027	0.022	0.027	0.022	0.027	0.027	0.027	0.027	0.027	0.022	0.033	0.022	0.022	0.027	0.022	0.033	0.038	0.027
31	0.027	0.033	0.038	0.033	0.022	0.027	0.027	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.017

OBSERVACIONES:

LIMITES: 0.13 ppm/24 hr

R AGO 7 1996

Ing. Victor del Castillo A.
AGO 7 1996
Superintendente de Ecologia

MEXICANA DE COBRE S.A DE C.V
UNIDAD LA CARIDAD

CONCENTRACIONES DE BIOXIDO DE AZUFRE

Localidad: Planta de Cal
Mes JULIO 96

HORA

DIA	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:0	PRO
1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
6	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
9	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
11	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
12	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
13	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
14	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
16	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
17	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
19	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
21	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
22	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
23	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
24	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
25	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
26	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
27	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
28	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
29	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
30	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
31	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0

OBSERVACIONES: No hubo captaciones

LIMITES: 0.13 ppm/24 hr

R AGO. 7 1996 O

Ing. Victor del Castillo A.
R AGO. 7 1996 O
Superintendente de Ecología.

MEXICANA DE COBRE S.A DE C V
UNIDAD LA CARIDAD

CONCENTRACIONES DE BIOXIDO DE AZUFRE

Localidad Nacozari
Mes JULIO 96

AS	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:0	PRO
	HORA																								
1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
6	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
9	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
11	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
12	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
13	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
14	0.000	0.000	0.011	0.011	0.011	0.011	0.011	0.027	0.038	0.044	0.055	0.049	0.049	0.033	0.033	0.033	0.033	0.033	0.027	0.027	0.033	0.044	0.044	0.055	0.030
15	0.066	0.066	0.060	0.050	0.055	0.071	0.071	0.044	0.022	0.022	0.011	0.011	0.011	0.011	0.000	0.000	0.000	0.011	0.011	0.011	0.022	0.022	0.022	0.016	0.029
16	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004
17	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
19	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.011	0.000	0.000
20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
21	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
22	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
23	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
25	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
26	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
27	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
28	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
29	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
31	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

OBSERVACIONES:

AGO. 7 1996

Ing. Victor del Castillo A.
AGO. 7 1996
Superintendente de Ecología

MEXICANA DE COBRE S.A DE C.V
UNIDAD LA CARIDAD

CONCENTRACIONES DE BIOXIDO DE AZUFRE

Localidad: Col. El Globo
Mes JULIO.96

	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00	P
1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
6	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
9	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.
11	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.
12	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.
13	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.
14	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.
15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.
16	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
17	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.
18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.
19	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.
20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.
21	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
22	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
23	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
24	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
25	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
26	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
27	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
28	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
29	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
30	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
31	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0

OBSERVACIONES: No hubo captaciones.

LIMITES: 0.13 ppm/24 h

AGO. 7 1996

Ing. Victor del Castillo A.
AGO. 7 1996
Superintendente de Ecolog

MEXICANA DE COBRE S.A DE C.V
UNIDAD LA CARIDAD

CONCENTRACIONES DE BIOXIDO DE AZUFRE

Localidad: Caseta#2
Mes: JULIO.96

	HORA																								
AS	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:0	PROM
1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
12	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
13	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
14	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
16	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
17	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
19	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
21	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
22	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
23	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
25	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
26	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
27	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
28	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
29	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
31	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

OBSERVACIONES: NO HUBO CAPTACIONES

7 1996

Ing. Victor del Castillo A.

AGO. 7 1995

Superintendente de Ecologia

MEXICANA DE COBRE S.A. DE C.V.

ESTACION METEREOLOGICA
AEREOPUERTO "LA CARIDAD"

MES JULIO AÑO 96

DIA	TEMPERATURA SECA	TEMPERATURA HUMEDA	TEMPERATURA DIFERENC.	TEMPERATURA MAXIMA	TEMPERATURA MINIMA	NUBOSIDAD D	NUBOSIDAD MN	NUBOSIDAD N	PRECIPITACION PLUVIAL (PULG.)	DIRECCION VIENTO	FENOMENO	OBSERVACIONES
1	17°c	17°c	0°c	35°c	12°c		X		CERO	SW	CERO	SE TOMO LA LECTURA A LAS 07:00 HRS.
2	20°c	20°c	0°c	35°c	15°c			X	0.03"	NE	LLUVIA	"
3	20°c	20°c	0°c	30°c	15°c			X	0.55"	SE	LLUVIA	"
4	18°c	18°c	0°c	31°c	14°c			X	0.17"	SE	LLUVIA	"
5	19°c	19°c	0°c	34°c	15°c		X		0.15"	SW	LLUVIA	"
6	20°c	20°c	0°c	35°c	15°c		X		0.90"	SE	LLUVIA	"
7	20°c	20°c	0°c	33°c	15°c			X	1.00"	SW	LLUVIA	"
8	18°c	18°c	0°c	33°c	13°c			X	0.97"	SW	LLUVIA	"
9	17°c	17°c	0°c	32°c	12°c			X	0.60"	SW	LLUVIA	
10	17°c	17°c	0°c	30°c	12°c			X	0.05"	SW	LLUVIA	
11	20°c	20°c	0°c	32°c	15°c			X	0.25"	SW	LLUVIA	
12	18°c	17°c	1°c	30°c	12°c			X	0.55"	SW	LLUVIA	
13	18°c	18°c	0°c	29°c	13°c			X	1.00"	SE	LLUVIA	
14	19°c	18°c	1°c	30°c	12°c		X		CERO	SW	CERO	"
15	18°c	17°c	1°c	31°c	12°c			X	CERO	SW	CERO	"
16	18°c	17°c	1°c	30°c	11°c		X		CERO	SE	CERO	"
17	16°c	16°c	0°c	31°c	11°c		X		CERO	SE	CERO	"
18	18°c	18°c	0°c	34°c	12°c		X		CERO	SE	CERO	"
19	19°c	20°c	0°c	33°c	14°c		X		CERO	SW	CERO	
20	17°c	17°c	0°c	32°c	11°c			X	0.40"	SE	LLUVIA	"
21	17°c	17°c	0°c	30°c	11°c			X	0.35"	SW	LLUVIA	"
22	19°c	19°c	0°c	29°c	14°c			X	CERO	SW	CERO	"
23	17°c	17°c	0°c	33°c	12°c			X	0.17"	SE	LLUVIA	"
24	17°c	17°c	0°c	33°c	12°c			X	0.20"	SW	LLUVIA	"
25	20°c	20°c	0°c	32°c	15°c			X	0.06"	SE	LLUVIA	"
26	18°c	18°c	0°c	32°c	12°c			X	0.40"	SW	LLUVIA	"
27	19°c	19°c	0°c	33°c	12°c			X	CERO	SE	CERO	"
28	19°c	19°c	0°c	32°c	13°c			X	0.13"	SW	LLUVIA	"
29	20°c	20°c	0°c	32°c	14°c		X		CERO	SW	CERO	"
30	21°c	21°c	0°c	35°c	15°c		X		CERO	SE	CERO	"
31	23°c	21°c	2°c	35°c	17°c		X		CERO	SE	CERO	"

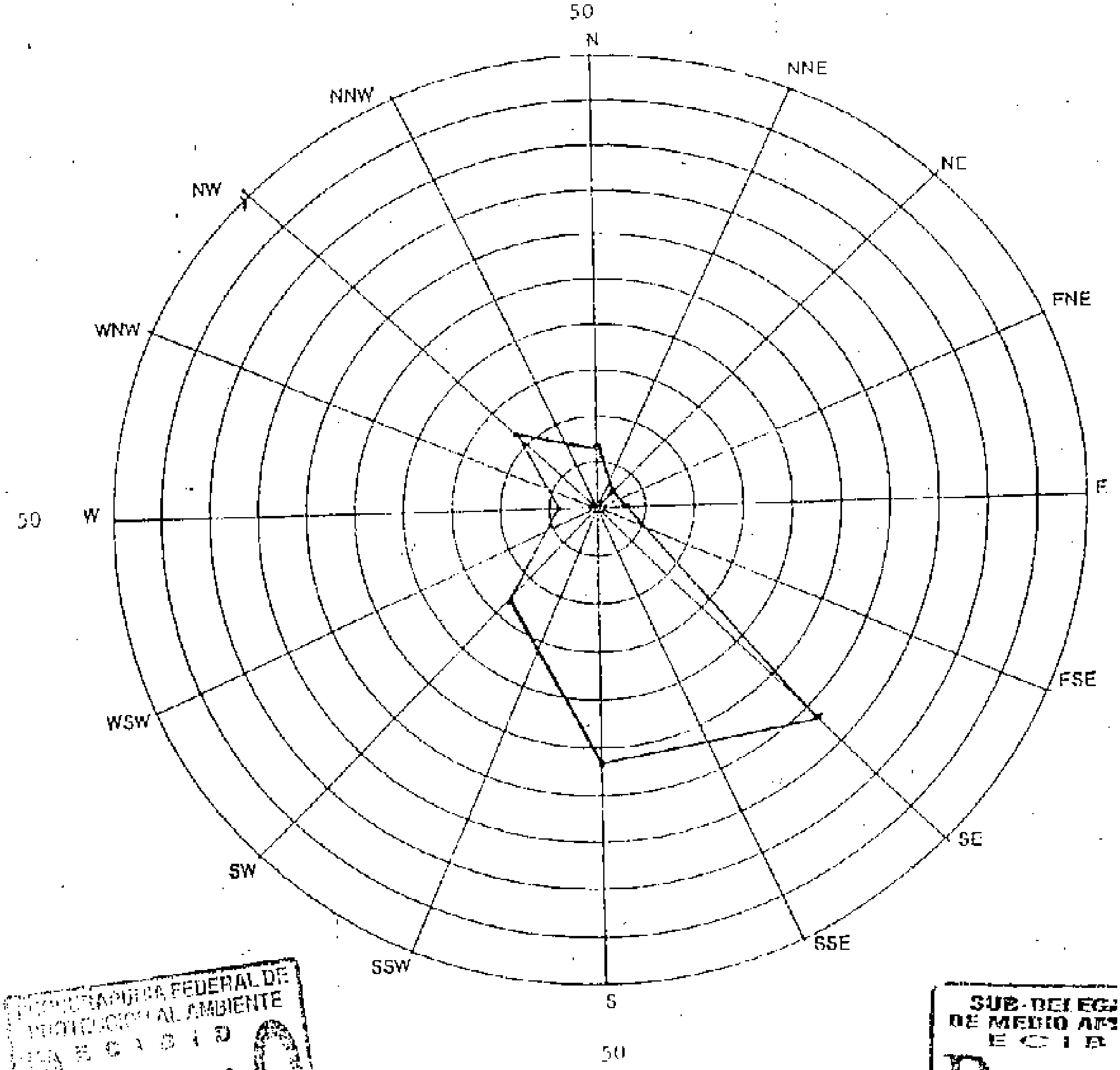
D=DESPEJADO MN=MEDIO NUBLADO N=NUBLADO

MEXICANA DE COBRE S.A. DE C.V.

UNIDAD LA CARIDAD

ESTACIONES METEOROLOGICAS

ECOLOGIA



ROSA DE LOS VIENTOS. MES JULIO

Appendix F

Monthly/Quarterly Emission Summary Reports: U.S. Smelters in Border States Located Greater Than 100 Kilometers from Border

Eric Priel

CYPRUS MIAMI MINING CORPORATION

AIR QUALITY AFFAIRS
MONTHLY REPORT

JUNE 1995

CYPRUS
Miami Mining

Cyprus Miami Mining Corporation
Post Office Box 4444
Claypool, Arizona 85532

July 5, 1995

Nancy Wrona, Director
Arizona Department of Environmental Quality
Division of Air Quality
3033 N. Central Ave. T-5
Phoenix, Arizona 85012

Dear Ms. Wrona:

The following report is submitted to summarize the operation of Cyprus' smelter, acid plant and associated equipment during the month of June, 1995.

Sincerely,

RK Watkins

R. K. Watkins, Manager
Copper Products Division

002653

for R.F. Ressler

Robert F. Ressler, Manager
Environmental Affairs & Land

95 JUL 17 AM11:57
OFFICE OF AIR QUALITY

/jer

W. Doepken
J. Daniels
R. Ressler
File

TABLE OF CONTENTS
MONTHLY REPORT

SECTION A

(a) DAILY SULFUR BALANCE JUN-1995

DATE	SULFUR IN FEED(T/D)	SULFUR IN ACID(T/D)	SULFUR IN SLAG(T/D)
1	600.	584.	12.5
2	578.	603.	15.4
3	519,	561.	11.1
4	558.	608.	12.9
5	419.	401.	9.0
6	0.	34.	0.0
7	0.	21.	0.0
8	0.	23.	0.0
9	0.	27.	0.0
10	303.	317.	6.1
11	572.	496.	12.2
12	572.	556.	12.2
13	607.	586.	12.2
14	536.	565.	12.5
15	666.	624.	16.8
16	662.	644.	15.4
17	574.	582.	11.5
18	502.	515.	10.7
19	641.	627.	14.0
20	605.	632.	17.5
21	574.	592.	11.8
22	632.	647.	12.9
23	599.	638.	11.8
24	605.	600.	7.2
25	518.	544.	11.5
26	592.	614.	13.6
27	492.	414.	10.0
28	585.	634.	13.2
29	624.	604.	14.7
30	649.	642.	15.4

Section A

(b) 3-MONTH SULFUR BALANCE

April – June 1995

	APR	MAY	JUNE	3-Month Period
Sulfur in Slag and Byproducts (Tons)	505	525	332	1,362
Sulfur in Acids (Tons)	16,865	18,059	14,935	49,859
Sulfur Increase In Secondaries (Tons)	0	0	0	0
Total Sulfur Recovered (Tons)	17,370	18,584	15,267	51,221
Sulfur in NMBM (Tons)	16,285	18,178	14,784	49,247
Sulfur in Decreased Secondaries (Tons)	751	63	122	936
Sulfur in Non--NMBM Materials (Tons)	412	581	652	1,645
Unaccounted Sulfur (Tons/Day)	2.6	7.7	11	6.9
Number of Operating Days	30	31	27	88

MONITOR STATISTICS

June 1995

	(a) Excursions		(b) Ambient Maximums			
Monitor	#3-hour	#24-Hour	Highest 3-Hour Average (ug/m3)	Date/Hours	Highest 24-Hour Average (ug/m3)	Date
JR	0	0	153	6-19/07-10	25	6/12/95
MI	0	0	213	6-19/07-10	32	6/22/95
BU	0	0	0	*	0	*

* No SO2 concentrations observed.

(c) During the month of June, 1995, there were no exceedances of the ambient air quality standards for SO2.

SECTION C

CONTINUOUS EMISSION MONITORING SYSTEM REPORT for 9/95

A) DAILY ANNUAL AND SOURCE AVERAGES

DAY	ANNUAL LBS.SO2/HR	MONTHLY UPTIME %	DAILY VENT AVG.LB/HR	DAILY TAIL STACK AVG.LB/HR	DAILY BYPASS AVG.LB/HR
1	349.	100.0	20.	255.	71.
2	346.	100.0	29.	321.	0.
3	347.	100.0	18.	295.	0.
4	347.	100.0	27.	310.	0.
5	348.	100.0	46.	304.	0.
6	348.	100.0	24.	72.	266.
7	347.	99.4	0.	0.	0.
8	347.	99.5	0.	0.	6.
9	348.	99.5	7.	2.	87.
10	348.	99.6	66.	376.	92.
11	348.	99.6	40.	219.	0.
12	348.	99.7	31.	336.	0.
13	347.	99.7	32.	312.	31.
14	347.	99.7	35.	320.	0.
15	347.	99.7	18.	395.	0.
16	347.	99.7	16.	420.	0.
17	347.	99.8	19.	345.	0.
18	347.	99.8	22.	283.	0.
19	347.	99.8	20.	392.	0.
20	347.	99.8	27.	395.	0.
21	347.	99.8	75.	367.	0.
22	347.	99.8	76.	444.	0.
23	347.	99.8	24.	396.	0.
24	347.	99.8	33.	391.	0.
25	347.	99.8	35.	359.	0.
26	346.	99.8	22.	357.	0.
27	346.	99.8	23.	199.	0.
28	346.	99.9	20.	246.	0.
29	346.	99.9	22.	341.	0.
30	347.	99.9	22.	338.	0.

Section C

CONTINUOUS EMISSIONS MONITORING REPORT

June, 1995

(b) CEM SYSTEM DOWN PERIODS

DATE	TIME	DURATION	REASON
6/7/95	1100-1200	1 hour	90 inch duct CEM data lost due to a power outage.
Total Down Time		1 hour	

CEM system data recovery $= 100 - \frac{11*100}{30*24} = 99.9$

(c) 3 HOUR CUMULATIVE OCCURRENCE EXCEEDENCES

During the month of June, 1995, there were no 3 hour emission exceedences.

LEVEL	NMBR	LEFT		LEVEL	NMBR	LEFT
3800	0	2240		8700	0	130
4100	0	1910		9250	0	94
4500	0	1610		9750	0	68
4800	0	1340		10250	0	48
5200	0	1100		10800	0	32
5500	0	890		11500	0	20
5800	0	710		12250	0	12
6300	0	560		13100	0	7
6750	0	435		13900	0	4
7200	0	330		14750	0	2
7600	0	245		15800	0	1
8200	0	180		16900	0	0

Section C

(d) Bypass Reports

Bypass Number 1

Beginning: 1548, 6/1/95

Ending: 1608, 6/1/95

1. Causes and Corrections:

The Smelter and Acid Plant were shutdown due to the A and B cold gas blowers accidently kicking out. Once the blowers were restarted, the Smelter and Acid Plant resumed normal operations.

All maintenance and repairs were performed in an expeditious fashion and all personnel were utilized where practical, to insure a timely completion.

All air pollution control equipment, process equipment, and processes are maintained and operated employing best operating practices, to the maximum extent practicable, for the minimization of emissions.

During the period, there were no measured violations of the national ambient air quality standards.

2. Emissions during the bypass.

Date	Period	Duration Minutes	Bypass Stack (lbs SO2)
6/1/95	1548-1608	20	1,704

Total Stack SO2 Emissions (lbs SO2)

1,704

Section C

(d) Bypass Reports

Bypass Number 2

Beginning: 0500, 6/6/95

Ending: 0409, 6/10/95

1. Causes and Corrections:

The Smelter and Acid Plant were shutdown due to an acid leak in C cooler. Due to extensive acid damage, a longer than anticipated shutdown was required. During the shutdown, new larger capacity acid coolers were connected to replace the older coolers. An Acid Plant shutdown was scheduled for approximately 6/14/95 for this connection. Once the new coolers were connected and repairs completed, the Smelter and Acid Plant resumed normal operations.

All maintenance and repairs were performed in an expeditious fashion and all personnel were utilized where practical, to insure a timely completion.

All air pollution control equipment, process equipment, and processes are maintained and operated employing best operating practices, to the maximum extent practicable, for the minimization of emissions.

During the period, there were no measured violations of the national ambient air quality standards.

2. Emissions during the bypass.

Date	Period	Duration Minutes	Bypass Stack (lbs SO2)
6/6/95	0500-	5,709	8,808
6/10/95	409		

Total Stack SO2 Emissions (lbs SO2)

8,808

Section C

(d) Bypass Reports

Bypass Number: 3

Beginning: 1259, 6/13/95

Ending: 1411, 6/13/95

1. Causes and Corrections:

The Smelter and Acid Plant were shutdown to repair a gas leak at the outlet of the 202B heat exchanger. Once repairs were completed, the Smelter and Acid Plant resumed normal operations.

All maintenance and repairs were performed in an expeditious fashion and all personnel were utilized where practical, to insure a timely completion.

All air pollution control equipment, process equipment, and processes are maintained and operated employing best operating practices, to the maximum extent practicable, for the minimization of emissions.

During the period, there were no measured violations of the national ambient air quality standards.

2. Emissions during the bypass.

Date	Period	Duration Minutes	Bypass Stack (lbs SO2)
6/13/95	1259-1411	72	744

Total Stack SO2 Emissions (lbs SO2)

744

Section C

(e) EXCESS OPACITY REPORT

During the month of June, 1995, no excess opacity was observed.

On June 17, 1995 at approximately 1315, the concentrate dryer baghouse caught fire. Black smoke was observed at the beginning of the fire until the dryer was shutdown and isolated. Intermittent periods of opacity greater than 40% were observed but a Method 9 reading was not taken.

The baghouse was immediately shutdown and isolated upon discovery of the fire to minimize opacity > 40%. Repairs were initiated as soon as possible. The dryer was not operated while the baghouse was being repaired. Once repairs were completed, the dryer and baghouse were brought back on-line. This occurred at approximately 0430, 6/27/95.

Section C

(f) EXCESS SO_2 EMISSIONS REPORT

Report Number: 1

Emission Point: Acid Plant Tailstack

Emission Period: 6-10-95,0000 - 0600

SO_2 Emission Limits for this Point: 650 ppm/6 hrs

Resultant SO_2 Emissions 705 ppm

Causes and Corrections:

The Acid Plant was in a start-up mode after being shutdown for approximately 4 days. Due to cooler than normal operating temperatures in the converter beds at the Acid Plant, the tailstack SO2 concentration exceeded the 650 ppm/6hr limit.

While on start-up, the one converter that was operating was rolled in and out to try to control the tailstack SO2 concentration. Also, furnace feed was turned on and off to help control the SO2 concentration. Once normal operating temperatures were achieved at the converter beds at the Acid Plant, the Smelter and Acid Plant resumed normal operations.

ECTION D

LEVELS OF INPUT MATERIALS (TONS)

(a) 12–Month Rolling
Material Input Levels
July 1994 – June 1995

	JULY	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	12 MONTH TOTAL
NEW METAL BEARING MATERIAL (TONS)	34,910	50,195	41,281	44,778	39,042	38,403	20,367	20,361	63,208	53,513	58,570	48,020	512,648
RECYCLABLE HAZARDOUS WASTE (TONS)	249	155	261	101	64	124	15	46	184	460	744	711	3,114
TOTAL FEED (TONS)	35,159	50,350	41,542	44,879	39,106	38,527	20,382	20,407	63,392	53,973	59,314	48,731	515,762

Please Note: In the May 1995 monthly report, the Total Feed tons for May 1995 should be 59314.

LEVELS OF INPUT MATERIALS (TONS)

(b) 12–Month Rolling Trace Element Input
Levels in Recyclable Hazardous Waste (tons)

June 1994 – May 1995

ELEMENT	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	12 MONTH TOTAL
S	18.3650	15.2700	7.0500	17.3150	5.2600	3.2300	8.1150	2.1200	4.3250	12.0500	22.4900	34.1350	149.7250
Sb	0.0165	0.0200	0.0045	0.0375	0.0030	0.0000	0.0000	0.0020	0.0075	0.1170	0.0865	0.2160	0.5105
As	0.0000	0.0005	0.0000	0.0000	0.0000	0.0005	0.0015	0.0000	0.0025	0.0130	0.0700	0.1015	0.1895
Ba	0.1245	0.0910	0.0835	0.1190	0.0345	0.0195	0.0295	0.0025	0.0190	0.0785	0.4230	0.6225	1.6470
Be	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0015	0.0015
Cd	0.1740	0.0780	0.0815	0.1460	0.0240	0.0000	0.0175	0.0000	0.0005	0.0530	0.3770	0.9020	1.8535
Cr	4.1525	3.0425	1.0270	2.7820	0.4615	0.7860	0.7840	0.0045	0.4790	1.0045	5.3910	11.4065	31.3210
Pb	1.0495	1.0000	0.6425	1.7485	0.3950	0.3610	0.7175	0.1320	0.2335	4.6010	3.0795	7.9130	21.8730
Hg	0.0005	0.0005	0.0005	0.0010	0.0005	0.0000	0.0000	0.0000	0.0000	0.0020	0.0005	0.0000	0.0055
Ni	2.9675	2.1460	0.8415	1.8550	0.9195	0.6615	1.4420	0.0765	0.1245	1.9610	6.2320	11.8200	31.0470
Se	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0005	0.0000	0.0005	0.0090	0.0085	0.0085	0.0270
Ag	0.0294	0.0260	0.0681	0.0795	0.0191	0.0033	0.0104	0.0215	0.0336	0.0749	0.0617	0.3076	0.7351
Tl	0.0015	0.0020	0.0000	0.0010	0.0000	0.0000	0.0015	0.0000	0.0000	0.0000	0.0045	0.0010	0.0115

MONTHLY STACK EMISSIONS (lbs\hr)
VENT FUME STACK
MAY 1994 – APRIL 1995

LEMENT	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	12 MONTH AVG
Sb	0.0790	0.1487	0.1408	0.1287	0.0820	0.0444	0.1077	0.1137	0.0231	0.0455	0.1244	0.0153	0.088
As	0.2360	0.3000	0.4153	0.3194	0.2991	0.2165	0.6314	0.8013	0.1178	0.1358	0.2678	0.0640	0.317
Ba	0.0190	0.0032	0.0191	0.0000	0.0164	0.0462	0.0218	0.0256	0.0255	0.0222	0.0182	0.0404	0.021
Cd	0.1410	0.1772	0.2194	0.0731	0.2394	0.1885	0.2402	0.3050	0.0110	0.0183	0.2181	0.0546	0.157
Cr	0.0140	0.0013	0.0435	0.0055	0.0029	0.0547	0.0055	0.0005	0.0046	0.0742	0.0418	0.0142	0.022
Pb	1.0630	1.1860	1.4508	0.8947	1.5684	0.7266	3.0929	3.1927	1.3277	0.9024	1.9572	0.5238	1.491
Mn	0.0470	0.0006	0.0753	0.0087	0.0017	0.0007	0.0039	0.0099	0.0110	0.0080	0.0568	0.1114	0.028
Hg	0.0010	0.0001	0.0005	0.0028	0.0006	0.0016	0.0047	0.0006	0.0009	0.0010	0.0028	0.0003	0.001
Ni	0.0320	0.0039	0.0255	0.0065	0.0028	0.0193	0.0087	0.0002	0.0062	0.0438	0.0373	0.0339	0.018
Se	0.0030	0.0024	0.0021	0.0078	0.0026	0.0025	0.0096	0.0056	0.0011	0.0148	0.0181	0.0027	0.006
Ag	0.0070	0.0138	0.0038	0.0006	0.0037	0.0048	0.0026	0.0007	0.0026	0.0030	0.0019	0.0017	0.004
Zn	3.9970	0.6228	0.6189	0.3792	0.8337	0.4083	0.7987	0.7232	0.2444	0.3220	0.6611	0.2106	0.818

CYPRUS MIAMI END

SECTION E

MONTHLY STACK EMISSIONS (lbs\hr)
ACID PLANT TAILSTACK
MAY 1994 – APRIL 1995

ELEMENT	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	12 MONTH AVG
Sb	0.0000	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0000	0.000
As	0.0040	0.0001	0.0005	0.0002	0.0015	0.0007	0.0008	0.0007	0.0008	0.0117	0.0021	0.0017	0.002
Ba	0.0020	0.0008	0.0006	0.0000	0.0000	0.0001	0.0015	0.0022	0.0023	0.0004	0.0007	0.0026	0.001
Cd	0.0030	0.0005	0.0002	0.0000	0.0000	0.0002	0.0005	0.0001	0.0002	0.0003	0.0000	0.0001	0.000
Cr	0.0060	0.0009	0.0052	0.0017	0.0034	0.0027	0.0045	0.0454	0.0084	0.0038	0.0009	0.0197	0.009
Pb	0.0300	0.0007	0.0002	0.0000	0.0005	0.0005	0.0018	0.0014	0.0021	0.0018	0.0034	0.0216	0.005
Mn	0.0090	0.0016	0.0023	0.0008	0.0004	0.0005	0.0244	0.0076	0.0084	0.0026	0.0446	0.0364	0.012
Hg	0.0040	0.0016	0.0254	0.0888	0.0593	0.0138	0.1822	0.0928	0.0564	0.0018	0.0592	0.0481	0.053
Ni	0.0100	0.0016	0.0044	0.0033	0.0038	0.0030	0.0171	0.0525	0.0057	0.0048	0.0015	0.0285	0.011
Se	0.0030	0.0000	0.0000	0.0003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0216	0.0110	0.0001	0.003
Ag	0.0000	0.0000	0.0001	0.0000	0.0000	0.0001	0.0004	0.0001	0.0000	0.0003	0.0001	0.0000	0.000
Zn	0.9310	0.0356	0.0049	0.0010	0.0010	0.0015	0.0107	0.0062	0.0058	0.0004	0.0032	0.0160	0.085

MAGMA
MAGMA COPPER COMPANY
SAN MANUEL OPERATIONS

Sm)

May 13, 1994

MAY

Arizona Department of Environmental Quality
Air Quality Division
3033 North Central Avenue, 12T
Phoenix, AZ 85012
Attn: Director, Air Quality Division

VIA: Certified Mail

RE: Magma Copper Company Operating Permit No. 0355-88

Dear Ms. Wrona:

Enclosed is Magma Copper Company's monthly compliance report for April, 1994. Magma was in compliance with the terms and conditions contained in its smelter operating permit during the month of April.

Ambient and Emission Monitoring

There were no exceedances of any applicable sulfur dioxide emission limits or National Ambient Air Quality Standards during April. Ambient and emissions monitoring produced excellent data during the month. Pursuant to the April 20, 1994 correspondence from Mr. Gary Neuroth of your staff, Magma has permanently discontinued the operation of the dorm, mine 3-C and Oracle air monitor stations. Subsequent monthly reports will contain data from the remaining hospital, elks, golf course, and townsite monitors.

Sulfur Removal Equipment

Plantwide sulfur recovery was 98.95 percent for the month of April.

Sincerely,

Jerry C. May

Jerry C. May
Division Manager of
Environmental Control

JCM:pg

cc: Mr. David Howekamp, EPA Region IX

P.O. Box M ■ San Manuel, Arizona 85631 ■ (602)385-3100

Month April 1994

MAGMA COPPER COMPANY
MONTHLY SULFUR BALANCE

INPUT

New:	104,495	*	32.76	Tons Sulfur (Conc.)	34,232.5
Recycled:	5,674	*	15.78	Tons Sulfur (Conc.)	895.3
	(Smelted Conc.)		(Avg. % S)		
	21,335	*	0.00	Tons Sulfur (Conv. Flux)	0.0
	(converter Flux)		(Avg. % S)		
	12.796	*	10.89	Tons Sulfur Secondaries	1,393.2
	(Tons)		(Avg. % S)		
				Total	36,521.1

OUTPUT

70,337	*	4.06	Tons Sulfur Slag	2,853.8
(Slag)		(Avg. % S)		
1,444	*		Tons Sulfur Weak Acid	472.1
(As 100% Acid Produced)		(32.69% S)		
95,982	*		Tons Sulfur Strong Acid	31,376.6
(100% Acid Produced)		(32.69% S)		
29,907	*	0.004	Tons Sulfur New Cu	1,2
(New CU)		(Avg. % S)		
13,112	*	10.93	Tons Sulfur Secondaries	1,433.0
(Tons)		(Avg. % S)		
			Total	36,136.8
			Monthly % Sulfur Recovery*	98.95

*Total output divided by total input

MAGMA DAILY EMISSION RATES
TONS OF SO2 PER DAY
APRIL 1994

DATE	ACID PLANT TAIL STACK	FLASH FUGITIVE STACK	CONVERTER SECONDARY STACK	FLASH EMERG. VENT STACK	ROOF EMISSION	TOTAL
1	11.87	4.45	8.91		17.87	43.10
2	12.83	4.77	10.20		10.27	38.07
3	12.47	4.76	9.07		17.05	43.35
4	9.80	2.45	6.90	5.72	9.80	34.67
5	11.63	3.81	8.15	0.76	5.47	29.82
6	9.07	3.20	6.67	2.92	8.07	29.93
7	8.52	3.68	5.79	1.24	3.04	22.27
8	6.26	4.20	5.47		3.89	19.82
9	10.50	4.03	6.85		9.98	31.36
10	5.56	4.14	7.87		3.36	20.93
11	7.42	4.09	6.23		5.63	23.37
12	4.90	4.20	6.15		2.87	18.12
13	5.49	4.50	6.10		2.38	18.47
14	6.07	4.93	7.48		3.28	21.76
15	8.69	4.98	6.88		4.28	24.83
16	7.48	4.35	6.20		3.63	21.66
17	7.63	4.53	8.53		3.16	23.85
18	6.05	4.07	7.15		3.85	21.12
19	6.39	4.07	6.80		3.27	20.53
20	6.92	4.57	5.89		3.65	21.03
21	7.14	3.82	5.64		4.69	21.29
22	7.01	2.17	4.61	2.39	6.96	23.14
23	5.56	3.70	5.21		8.72	23.19
24	6.29	3.73	10.40		5.65	26.07
25	4.47	3.19	5.52		3.54	16.72
26	5.72	3.81	6.13		6.15	21.81
27	6.43	3.49	4.47		5.64	20.03
28	9.71	3.28	7.61		12.35	32.95
29	8.75	4.10	8.26		5.38	26.49
30	5.52	3.66	8.43		3.09	20.70
	232.15	118.73	209.57	13.03	186.97	760.45

One hour calculated on Acid Plant, Train 2, April 01

MAGMA COPPER COMPANY
Sulfur Dioxide (SO2) Compliance Information
APRIL 1994

Date	Cumulative Average Emission Rate	Maximum Three–Hour Average Emission Rate
1	2229	5933
2	2230	4143
3	2231	4791
4	2230	4610
5	2229	3413
6	2227	3786
7	2223	2384
8	2219	1916
9	2219	4471
10	2217	2339
11	2215	2628
12	2210	2405
13	2206	2047
14	2203	2238
15	2200	2708
16	2195	2512
17	2193	2845
18	2190	2118
19	2186	2354
20	2184	2503
21	2185	2991
22	2186	3847
23	2185	2946
24	2186	3629
25	2184	2176
26	2184	2412
27	2183	2489
28	2185	4989
29	2186	4037
30	2184	2496

MAGMA COPPER COMPANY
Sulfur Dioxide (SO2) Compliance Information
April 1994 30 Operating Days
E Max = 18275 lb/hr

SO2 Emission Limits (E)*	Cumulative Occurrence LIMIT (N)	Number of Three Hour Averages in Excess of E
72,000	0	0
68,000	1	0
64,000	2	0
61,000	4	0
57,800	7	0
54,800	12	0
52,000	20	0
49,500	32	0
47,500	48	0
45,500	68	0
43,500	94	0
41,200	130	0
39,200	180	0
37,200	245	0
35,200	330	0
33,770	435	0
32,000	560	0
30,200	710	0
28,700	890	0
27,200	1,100	0
25,700	1,340	0
24,500	1,610	0
23,000	1,910	0
21,700	2,240	0

*Pounds of SO2 per hour

MAGMA COPPER COMPANY
CEM SYSTEM AVAILABILITY
April 1994

Date	Time	Number of Hrs Lost	CEM Affected	Parameter (SO_2 or Flow)	Reason
01	0000-0700A	7	Train 2	Flow	Lost flow signal
28	1300-1600A	3	Flash Fugitives	SO_2	Auto zero actuator bad

$$\%\text{Data Recovery (Roof)} = 100 * \frac{(720-0)}{720} = 100\%$$

$$\%\text{Data Recovery (Converter Secondary)} = 100 * \frac{(720-0)}{720} = 100\%$$

$$\%\text{Data Recovery (Flash Fugitives)} = 100 * \frac{(720-3)}{720} = 99.6\%$$

$$\%\text{Data Recovery (Flash Emergency)} = 100 * \frac{(24-0)}{24} = 100\%$$

$$\%\text{Data Recovery (Tail 1)} = 100 * \frac{(720-0)}{720} = 100\%$$

$$\%\text{Data Recovery (Tail 2)} = 100 * \frac{(720-7)}{720} = 99.0\%$$

$$\%\text{Data Recovery (Tail 3)} = 100 * \frac{(612-0)}{612} = 100\%$$

$$\%\text{Data Recovery (System)} = 100 * \frac{(720-10)}{720} = 98.6\%$$

MAGMA COPPER COMPANY
AMBIENT SO2 CONCENTRATIONS
APRIL 1994

STATION	CUM. SO2 AVG JAN 01,94 APR 30,94	MONTH AVG	MO. DATA RECOVERY %	MAX 3-HR AVG DATE-TIME	NO. 3-HR AVGS >1300 ug/m	MAX 24-HR AVG DATE-TIME	NO. 24-HR AVGS >365 ug/m
TOWNSITE	20	8	99.0%	225 13/1300A	0	38 15/2400A	0
GOLF COURSE	15	16	100.0%	275 15/1000A	0	55 16/2400A	0
ELKS	23	14	100.0%	262 21/2000A	0	70 20/2400A	0
DORM	22	15	100.0%	201 21/2100A	0	47 19/0500A	0
MINE	13	6	99.7%	191 03/0600A	0	42 03/1000A	0
ORACLE	5	3	99.9%	12 25/0800A	0	7 12/2400A	0
HOSPITAL	27	22	99.7%	394 09/0700A	0	79 20/2400A	0
3C'S	4	5	100.0%	80 09/0700A	0	16 09/2400A	0

TIME PERIODS WHEN VALID DATA IS UNAVAILABLE (INCLUDING CALIBRATION)

TOWNSITE:	28/1100-1500A (AUDIT OF METEOROLOGICAL EQUIPMENT) 30/0500-0600A (ANALYZER DOWN)
GOLF COURSE:	NONE
ELKS:	NONE
DORM:	NONE
MINE:	26/1000-1200A (STATE AUDIT)
ORACLE:	26/1100-1200A (CALIBRATION)
HOSPITAL:	26/0800-1000A (STATE AUDIT)
3C'S:	NONE

ONE–HOUR SO2 AVERAGES GREATER THAN 0.50 ppm (1300 ug/m)

APRIL 1994

Ambient SO2 Data (ug/m)				SO2 Emissions Data (lbs)							
Date	Monitor	1–Hour SO2 Avg	Ending Time	Flash Fug.	Flash Prev. Hr	Tail Stacks	Tail Prev. Hr	Roof	Roof Prev. Hr	Conv. Fug.	Conv. Prev. Hr
NO ONE HOUR PERIODS GREATER THAN 0.5 PPM											

SIX–MINUTE SO2 AVERAGES GREATER THAN 1.0 ppm (2600 ug/m)
AND ONE–HOUR SO2 AVERAGES GREATER THAN 0.50 ppm (1300 ug/m)
NOVEMBER 1992

Ambient SO2 Data (ug/m)					SO2 Emissions Data (lbs)								
Date	Monitor	6 – MIN SO2 Avg	Ending Time	1 – Hour SO2 Avg	Flash Fug.	Flash Prev. Hr	Tail Stacks	Tail Prev. Hr	Roof	Roof Prev. Hr	Conv. Fug.	Conv. Prev. Hr
07	HOSP	4679	1342	732	443	427	945	618	864	468	4228	334
09	DORM	2615	1148	966	351	332	1073	1258	3912	3808	899	475
09	HOSP	1914	1130	1125	351	332	1073	1258	3912	3808	899	475
09	HOSP	2557	1136	1125	351	332	1073	1258	3912	3808	899	475
09	HOSP	2622	1154	1125	351	332	1073	1258	3912	3808	899	475
09	HOSP	2300	1206	506	481	351	610	1073	4972	3912	1653	899
13	HOSP	2274	1324	480	3	2	614	614	1036	1127	1557	2058
15	ELKS	2069	1348	531	272	350	921	1147	3935	3848	1214	837
15	HOSP	2127	1248	736	350	349	1147	1001	3848	3872	837	484
15	HOSP	3785	1348	583	272	350	921	1147	3935	3848	1214	837
15	HOSP	2821	1636	411	395	298	1419	958	5640	2111	2458	1719
16	TOWN	2223	1242	723	433	220	1395	760	2685	725	302	1208
16	ELKS	2274	1218	1123	433	220	1395	760	2685	725	302	1208
16	ELKS	1947	1236	1123	433	220	1395	760	2685	725	302	1208
16	HOSP	2197	1212	1501	433	220	1395	760	2685	725	302	1208
16	HOSP	2808	1218	1501	433	220	1395	760	2685	725	302	1208
16	HOSP	2634	1236	1501	433	220	1395	760	2685	725	302	1208
16	HOSP		1300	1501	433	220	1395	760	2685	725	302	1208
18	GOLF	3978	0848	423	241	424	781	933	3251	4144	1585	1922
19	TOWN	1985	0948	743	508	323	1012	929	1707	2372	1010	855
19	TOWN	2712	1600	271	450	511	707	514	596	3493	705	1142
19	TOWN	2422	2354	245	209	473	887	907	1178	752	930	846
20	GOLF	3933	1054	953	352	231	1281	438	1761	2577	2456	1149
20	GOLF	5599	1100	953	352	231	1281	438	1761	2577	2456	1149
21	TOWN	2075	1006	302	493	427	753	1014	3872	1237	1021	3587

MAGMA

Appendix G

July 1995 EPA Report on Copper Smelter HAP Emission Estimates

FINAL SUMMARY REPORT

Primary Copper Smelters
National Emission Standard for Hazardous Air Pollutants (NESHAP)

ESD Project No. 91/61

EMISSION STANDARDS DIVISION
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
U.S. ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

JULY 1995

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1. EXECUTIVE SUMMARY

There are presently eight primary copper smelters operating in the United States: three in Arizona, two in New Mexico, and one each in Utah, Texas, and Michigan.

Several of the smelters have undergone changes that have significantly lowered hazardous air pollutant (HAP) emissions since passage of the 1990 Clean Air Act Amendments. In particular, the ASARCO-El Paso, Texas smelter has installed a fluidized bed concentrate dryer and CONTOP cyclone reactors in place of roasters and a reverberatory furnace. Additionally, modifications in 1993 and 1994 at the ASARCO-Hayden and Magma Copper Company smelters in Arizona probably resulted in decreases in HAP emissions. Further changes are planned at other smelters, which will result in significant reductions of HAP heavy metal emissions. These changes include the construction of a modernized smelter by Kennecott in Utah, which will eliminate ladle transfers of molten metal. The Copper Range Company smelter in White Pine, Michigan, is planning installation of acid plants and extensive particulate controls as part of a consent agreement with the State of Michigan and EPA Region 5. In 1994, the Phelps Dodge-Hidalgo smelter installed telescoping converter secondary collection hoods, and baghouses on captured fugitive gas streams. Baghouse utilization has resulted in a 90% reduction in HAP emissions from the main stack, and secondary converter hoods are currently operating between 60-65% efficient. These results are based on EPA draft method 29 for heavy metals testing and EPA methods 5 and 8 which was conducted on all stacks, converter primary offgas, and converter secondary offgas. An extensive HAP material balance around converter operations was utilized to indicate hood efficiencies.

A wide variety of smelting processes are utilized at the seven operating primary copper smelters. These smelting processes are centered around several furnace/reactor types, including Outokumpu flash furnaces (two plants), Inco flash furnaces (two plants), CONTOP reactors (one plant), Noranda reactors (one plant), and an Isa vessel (one plant). Six of the seven operating smelters have Pierce-Smith converters (the Cyprus Miami smelter in Arizona has Hoboken converters). The modernized smelter at Kennecott will use flash converters and eliminate hot matte metal transfers by granulation of the matte.

Anode copper production at the plants in 1992 ranged from 370,913 tons to 81,361 tons, a ratio of 4.5 to one. The total 1992 anode copper production for the eight plants was 1,360,000 tons.

Hazardous air pollutants emissions from primary copper smelters consist primarily of compounds of lead and arsenic. In fact, lead and arsenic represent approximately 80 percent, by mass, of the total heavy metal HAP emissions from primary copper smelters. Other metallic HAP emissions include compounds of antimony, beryllium, cadmium, chromium, cobalt, manganese, mercury, nickel, and selenium.

At present (December 1993), the Copper Range Company smelter and the Kennecott Utah Copper smelter have the highest HAP emissions in the primary copper smelting industry. Both smelters have emissions greater than 10 tons per year of any one HAP, and 25 tons per year of all HAPs combined, definitely identifying them as a "major" source of hazardous air pollutants. However, by July 1995 (when the Kennecott Utah modernized copper smelter and other plant modifications at other smelters are projected to be completed) it appears that possibly there may not be any primary copper smelters with actual emissions greater than 10 tons per year of any one HAP, or 25 tons per year of all HAPs combined.

Due to possible changes in input impurity levels at each of the smelters, several of the smelters may have the "potential to emit" greater than 10 tons per year of lead compounds, or 25 tons per year of all HAPs combined. Additionally, it is known that at least two smelters currently have permits that allow for HAP emissions greater than 10 tons per year of any one HAP, and 25 tons per year of combined HAPs, indicating the "potential to emit" greater than 10 tons per year of any one HAP, and 25 tons per year of combined HAP's.

All of the smelters except the Copper Range smelter in Michigan have acid plants to convert sulfur dioxide into sulfuric acid. The particulate controls used to protect the catalyst beds in acid plants are extremely effective in removing heavy metals HAPs. (Note: Copper Range is planning to install, in 1995, an acid plant, an Isasmelt reactor, and particulate controls on all fugitive collection systems.) The particulate/heavy metals controls at the inlets to acid plants are so effective that virtually all the heavy metal HAP emissions from primary copper smelters are from non-process gas streams (gas streams that are not treated in the acid plant), and uncaptured fugitive emissions (primarily from converter buildings). Controls for non-process gas streams (such as gases captured by converter secondary hoods, and furnace matte tapping and slag tapping hoods) include baghouses, electrostatic precipitators, and (sulfur dioxide) scrubbers. Some plants do not have controls for non-process gas streams.

There is a wide variation in amounts (concentrations) of input impurities (HAP-forming metals, such as lead, arsenic, antimony, etc.) in the concentrates and other materials charged to primary copper smelters. In 1992, the highest input impurity levels were found at the two ASARCO smelters, and the lowest input impurity levels were found at the two Phelps Dodge smelters, and Copper Range-White Pine. At the two ASARCO smelters, certain input materials contributed significantly to the input impurity load, but not to the total plant mass input.

Based on the data submitted by the smelters (December 1993), the ASARCO-El Paso, Phelps Dodge-Chino Mines and Phelps-Dodge Hildago plants have HAP emissions that are among the lowest in the primary copper smelting industry. The low HAP emissions are achieved in distinctly different ways. ASARCO-El Paso, despite having the highest input impurity percentages in the industry (in 1992), achieves low HAP emissions by virtual elimination of converter building fugitive emissions (with a totally enclosed building, ventilated to a baghouse), and by baghouse control of converter secondary hood and furnace matte and slag tapping hood gases. Phelps Dodge-Chino Mines, despite having approximately average converter building fugitive particulate emissions (as indicated by sulfur dioxide emissions data), and no control of secondary hood or matte and slag tapping gases, achieves low HAP emissions through use of low-input-impurity feeds (1992 impurity data). The Phelps Dodge-Hildago smelter also has very low levels of HAPs in ore concentrate feeds (1992 impurity data).

2. THE COPPER SMELTER INDUSTRY

2.1 Location

There are eight primary copper smelters in the United States. The smelter names and locations are given in Table 1. There are three smelters in Arizona, two in New Mexico, and one each in Texas, Utah, and Michigan.

ASARCO-El Paso: The plant is located within the city of El Paso, Texas. Of the eight primary copper smelters, ASARCO-El Paso is located closest to a major population center. The other seven smelters are located in much more remote locations.

ASARCO-Hayden: The ASARCO-Hayden smelter is located near the town of Hayden, Arizona. The smelter is co-located with a copper mine, and the combined facility is known as the ASARCO Ray Complex.

Copper Range-White Pine: The Copper Range smelter is located in Ontonagon County, on the Upper Peninsula of Michigan, approximately one half mile north of the town of White Pine, and approximately five miles from the shore of Lake Superior.

Cyprus-Miami: The Cyprus-Miami smelter is located in Claypool, Arizona, approximately ~~65~~ 85 miles east of Phoenix, Arizona. Nearby towns include the towns of Miami and Globe, Arizona.

Kennecott-Utah: The Kennecott Utah Copper smelter is located approximately 15 miles west of Salt Lake City, Utah, and five miles west of Magna, Utah. Other Kennecott facilities in

Table 1. Primary Copper Smelters in the United States

Owner/Operator	Location
ASARCO, Incorporated	El Paso, Texas
ASARCO, Incorporated	Hayden, Arizona
Copper Range Company (1)	White Pine, Michigan
Cyprus Miami Mining Corporation	Claypool, Arizona
Kennecott Utah Copper Corporation	Magna, Utah
Magma Copper Company	San Manuel, Arizona
Phelps Dodge-Chino Mines Company	Hurley, New Mexico
Phelps Dodge Mining Company	Playas, New Mexico (Hidalgo County) (2)

(1) Copper Range has shut down its existing shelter in early 1995.

(2) Although the mailing address of the Phelps Dodge-Hidalgo smelter is Playas, New Mexico, the smelter is actually located in Hidalgo County, New Mexico, 15 miles south of New Mexico Highway 9, at the Playas turn-off.

the general area with the smelter include the Bingham Canyon Copper Mine, a concentrator near Copperton, Utah, a concentrator and a power plant near Magna, Utah, and a copper refinery two miles east of the smelter.

Magma-San Manuel: The Magma Copper Company smelter is located in San Manuel, Arizona, approximately 25 miles northeast of Tucson, Arizona.

Phelps Dodge-Chino Mines: The Phelps Dodge-Chino Mines smelter is operated by Chino Mines Company, which is a subsidiary of Phelps Dodge Corporation and Heisei Minerals Corporation. The copper smelter is located in the town of Hurley, New Mexico. Other nearby towns include Bayard, Tyrone, and Silver City, New Mexico.

Phelps Dodge-Hidalgo: The Phelps Dodge-Hidalgo smelter is located in Hidalgo County, New Mexico, approximately 30 miles from Arizona, and 25 miles from the border to Mexico. The nearest town to the smelter is the company-built town of Playas, New Mexico.

2.2 Current Status

Several of the eight smelters have recently undergone, or will soon undergo, modifications that will significantly reduce hazardous air pollutant (HAP) emissions. A brief discussion of the March 1995 status of each of the smelters is given below:

ASARCO-El Paso: Replaced roasters and a reverberatory furnace with a fluidized bed dryer and CONTOP cyclone reactors. Equipment installation was completed in March of 1993. This modification resulted in significant reductions in plant HAP emissions. For example, ASARCO-El Paso reported emissions for arsenic and lead in 1992 were 27.8 tons and 20.1 tons, respectively. Emissions testing completed in December 1993 found the post-CONTOP lead and arsenic emissions to be 8.8 tons per year and 2.6 tons per year, respectively.

ASARCO-Hayden: In several steps, over a period of several months, ASARCO has rebuilt the Ventilation Gas Cottrell (electrostatic precipitator). These modifications reduced particulate emissions from the Ventilation Gas Cottrell, as measured by a continuous particulate monitoring system located at the outlet of the Ventilation Gas Cottrell.

Copper Range White Pine: Under a Consent Agreement with the State of Michigan and EPA Region 5, Copper Range-White Pine shut down in early 1995 to install major renovations at their smelter. An acid plant(s) will be built to control high concentration SO_2 gases from the new flash furnace and the converters. Additional controls will be installed to control and capture both SO_2 and particulate in low concentration SO_2 gas streams.

Cyprus-Miami: Installed the Isasmelt® system in 1992. The system included installation of an Isa vessel and several pollution control devices. The modifications were permitted under a no-net-increase clause for sulfur dioxide and lead emissions. Because the area is still a non-attainment area, the no net increase rule was applied to SO_2 emissions. The area is an attainment area for lead so no increase in excess of significant levels was allowed.

Kennecott Utah Copper: Construction and startup of a modernized smelter, which will include both flash smelting and recently developed flash converting, is scheduled for completion in July 1995. Both the flash smelting furnace and the flash converter will operate continuously (not in batches) and will produce a steady, high-strength offgas, which will enable the new double-contact acid plant to achieve very high sulfur capture efficiency. The flash converter will eliminate ladle transfers of molten metals, because its feed is cooled, granulated matte. Both the flash furnace and flash converter will be connected directly to the gas handling system, preventing most fugitive emissions and eliminating the need for separate primary hoods. Potential secondary emission sources (for example, launders, matte and slag taphole, slag pot stations) will be hooded and ventilated to further minimize fugitive emissions. Gases captured by these hoods will be treated by a baghouse and a wet scrubber.

Magma-San Manuel: In 1994, Magma increased the smelter capacity by adding a third acid plant train and replacing a 13' x 35' Pierce-Smith converter with a 15' x 35' unit. As a condition of State acceptance of these modifications, the permitted plant-wide sulfur dioxide emissions were reduced to 4,010 pounds per hour, annual average, in May of 1994. The average plant-wide sulfur dioxide emission rate during 1992 was 5,800 pounds per hour. Magma is also required to perform stack testing for total particulate and metals.

Phelps Dodge-Chino Mines: Phelps Dodge-Chino Mines installed particulate controls for gases captured by the flash furnace matte and slag tapping hoods, and converter secondary hoods. Emissions from the converter secondary hoods and furnace slag- and matte-tapping hoods are currently directed, uncontrolled, out the main stack. Chino Mines is preparing to install particulate controls.

Phelps Dodge-Hidalgo: In 1994, Phelps Dodge-Hidalgo installed improved converter secondary hooding, improved furnace slag- and matte-tapping hoods, and baghouses to collect the material captured by the improved hooding. (Emissions from the converter secondary hoods and furnace slag- and matte-tapping hoods were previously directed, uncontrolled, to the main stack.) To confirm the reduction in HAP emissions, Phelps Dodge Hidalgo conducted EPA methods 5, 8, and 29 sampling on the main stack and the acid plant stacks.

2.3 Stack List

Table 2 is a complete list of all known stacks at each smelter.

Table 3 lists only those stacks that contribute 10 percent or more of the plant stack HAP emissions. Table 3 also includes the processes and controls which feed these stacks.

2.4 Solids Flow Diagrams

All eight of the primary copper smelters currently produce anode copper from sulfur-bearing ores with the same basic processes: 1) matte smelting, 2) converting, and 3) refining in an anode furnace.

Copper "concentrates" are received by the smelter. These concentrates typically contain 24-30 percent copper, 30 percent sulfur, 25 percent iron, and 10-20 percent oxides of silicon, calcium, aluminum, magnesium, and zinc. (Copper-bearing ores typically contain 0.5 to 1 percent copper by mass. A froth-flotation process is utilized to produce the "concentrate". This froth-flotation process may or may not be performed at the smelter site.) Concentrates also contain input impurities, such as lead, arsenic, antimony, cadmium, chromium, cobalt, manganese, mercury, nickel, and selenium. These input impurities are typically found in combined concentrations of less than one percent. The smelter may also receive copper scrap (for direct input into the converters), or may receive other non-concentrate inputs, such as precipitates, or copper "speiss".

Incoming concentrates are typically dried before input into a smelting furnace or reactor. Several types of smelting

Table 2. Complete List of Stacks at Primary Copper Smelters

Plant	Stack Designation
Asarco-El Paso	1. Main Stack Annulus 2. Main Stack Core 3. Acid Plant Stack 4. Copper Concentrates Unloading Building Stacks (2) 5. Transfer Baghouse Stack at Unloading* 6. Concentrate Storage Building Ventilation Stacks (2) 7. Pug Mill Baghouse Stack 8. RCC WTP Spray dryer Stack
Asarco-Hayden	1. Main Stack Annulus 2. Main Stack Core 3. Electric Slag Cleaning Vessel (ESCV) Stack 4. Revert Crusher
Copper Range	1. Main Stack 2. Matte/Slag Tapping Stack (East Side) 3. Matte/Slag Tapping Stack (West Side) 4. Dryer Stack 5. Anode Furnace Stacks (2) 6. Holding Furnace Stack 7. Anode Cutting Stack 8. Anode Cooling Water Stack 9. Crushing/Grinding Vent Stack* 10. Mill Building Vent Stack* 11. Power Plant Stacks (2)*
Cyprus Miami	1. Vent Fume Stack 2. Acid Plant Tail Stack 3. Dryer Stack* 4. Acid Plant Bypass Stack

Table 2. (Continued)

Plant	Stack Designation
Kennecott Utah Copper	1. Main Stack 2. Dryer Stack 3. Vent Stacks (2) ** 4. Feed Hopper Vent 5. Transfer Tower #3 6. Transfer Tower #4 7. #7 Acid Plant Preheater 8. #8 Acid Plant Preheater 9. Powerhouse Boilers (2) 10. Powerhouse Superheaters 11. Shop Dust Collector 12. Lab Baghouse
Magma-San Manuel	1. Acid Plant Stack I 2. Acid Plant Stack II 3. Converter Secondary Hoods Stack 4. Flash Furnace Fugitives Stack 5. Dryer Stack 6. Emergency Vent Stack * 7. Acid Plant Stack III
Phelps Dodge-Chino Mines	1. Main Stack 2. Dryer Stack #1 3. Dryer Stack #2 4. Flash Furnace Vent Stack
Phelps Dodge-Hidalgo	1. Main Stack 2. Lurgi Acid Plant Stack #1 3. Chemico Acid Plant Stack #2 4. Electric Slag Cleaning Furnace Stack 5. Material Handling Baghouses

* Indicates that stack is not included in Information Request response Table 1.

** Discontinued 1/15/93. Emissions now go to the main stack.

Table 3. Partial Stack List, With Associated Processes and Controls

Plant	Stack Designation	Processes (Controls)
Asarco - El Paso	1. Main Stack Annulus	1A. Furnace Matte/Slag Tapping Hoods, Converter Secondary Hoods, Converter Building Evacuation (Baghouse) 1B. Fluidized Bed Dryer (Cyclone, Baghouse) 1C. Feed System (Double Baghouse) (through the converter building Evacuation baghouse)
Asarco - Hayden	1. Main Stack Annulus	1A. Furnace/Electric Slag Cleaning Vessel Matte/Slag Tapping Hoods, Converter Secondary Hoods (ESP)[1] 1B. Fluidized Bed Dryer (Baghouse, ESP)
Copper Range	1. Main Stack	1A. Reverb Furnace Process Gas (ESP)[2], Converter Primary Hood (Uncontrolled)[2]
	2. Matte/Slag Tapping Stack (East)	2A. Furnace Matte/Slag Tapping (Uncontrolled)
	3. Matte/Slag Tapping Stack (West)	3A. Furnace Matte/Slag Tapping (Uncontrolled)
Cyprus Miami	1. Vent Fume Stack	1A. Isa Vessel Slag/Matte Tapping, Electric Furnace Slag Tapping , Electric Furnace return Launder Hoods (scrubber)
Kennecott	1. Main Stack	1A. Reactor Matte/Slag Tapping, Converter Secondary Hoods (Uncontrolled)[3] 1B. Noranda Reactor Process Gas and Converter Primary Hoods (Acid Plant)
Magma	1. Flash Furnace Fugitives Stack 2. Converter Stack	1A. Furnace Slag/Matte Tapping (ESP) 2A. Converter Secondary Hoods (ESP)
Phelps Dodge - Chino Mines	1. Main Stack	1A. Furnace and Primary Hoods (acid plant) 1B. Furnace Matte/Slag Tapping, Converter Secondary Hoods (uncontrolled)[4]
Phelps Dodge - Hidalgo	1. Main Stack	1A. Furnace/ESCV Matte/Slag Hoods, Converter Secondary Hoods (uncontrolled)[5] 1B. Rotary Kiln Dryer (ESP)

1) ESP = Electrostatic Precipitator; ESCV = Electric Slag Cleaning Vessel.
2) Copper Range is planning to upgrade the reverberatory furnace ESP in 1994. Additional planned controls include routing the gases from the existing ESP through a scrubber and parallel wet ESP's. Gases from the converter will pass through a high-energy radial scrubber and wet ESP.
3) Kennecott is planning to complete a modernized smelter in July 1995, which will completely eliminate ladle transfers of molten metal
4) Phelps Dodge - Chino Mines is considering particulate controls on these streams.
5) Phelps Dodge-Hidalgo is planning to Install baghouses in 1994.

furnaces/reactors are currently utilized in the United States, including two plants with Outokumpu flash furnaces, two plants with Inco flash furnaces, one with CONTOP reactors, one with Noranda reactors and one with an IsaSmelt reactor. The smelting furnace/reactor produces molten copper matte, typically containing 55-75 percent copper, which is tapped from the furnace, and transferred by ladles to converters. The smelting furnace/reactor also produces slag, containing relatively low amounts of copper (typically less than two percent). This slag may be discarded directly, if less than 1 percent copper, or may be transferred to an electric slag cleaning vessel (for further copper removal), or may be cooled and reconcentrated (again, in an attempt for further copper removal).

Molten copper matte is transferred by ladles from the furnace/reactor, and poured into the converters. In the converters, further sulfur is removed from the matte, and in addition, iron is oxidized and separated by skimming. The output from the converters is "blister" copper, generally containing greater than 98 percent copper.

Molten blister copper is poured from the converter, and transferred by ladles to anode furnaces, where further refining by removal of oxygen and other impurities takes place. The resulting "anode" copper is generally greater than 98.5 percent pure. It is cast into anodes for use in the final electrolytic refining step.

Further refining of "anode" copper into "cathode" copper (greater than 99.9 percent purity) is performed by electrolytic means in a "tank house." Production of cathode copper may or may not take place at the smelter site.

Solids flow diagrams for each of the eight smelters are shown in Figures 1 through 8. In the Section 114 Information Requests sent to the plants in July 1993, the plants were requested to supply data on the mass flow (in tons per hour), and the percentages of primary constituents (copper, sulfur, and iron) and trace constituents (arsenic, lead, antimony, etc.) at each of the points, corresponding to operation at the maximum plant production rate. A brief description of the processes involved at each plant is given below.

ASARCO-El Paso (Figure 1): The ASARCO-El Paso smelter utilizes CONTOP (Continuous Top-feed Oxygen Process) reactors for smelting.

Incoming concentrates are stored in a bedding building prior to being dried in a fluidized bed dryer. The dried concentrates, in the form of small particles, are captured in a dryer cyclone and baghouse. The dried concentrates from the cyclone and baghouse are injected into the top of the CONTOP cyclone reactors. The resulting matte, slag and gases, are discharged into an oxy/fuel-fired holding furnace. Slag from the CONTOP holding furnace is dumped at an on-site slag dump to solidify.

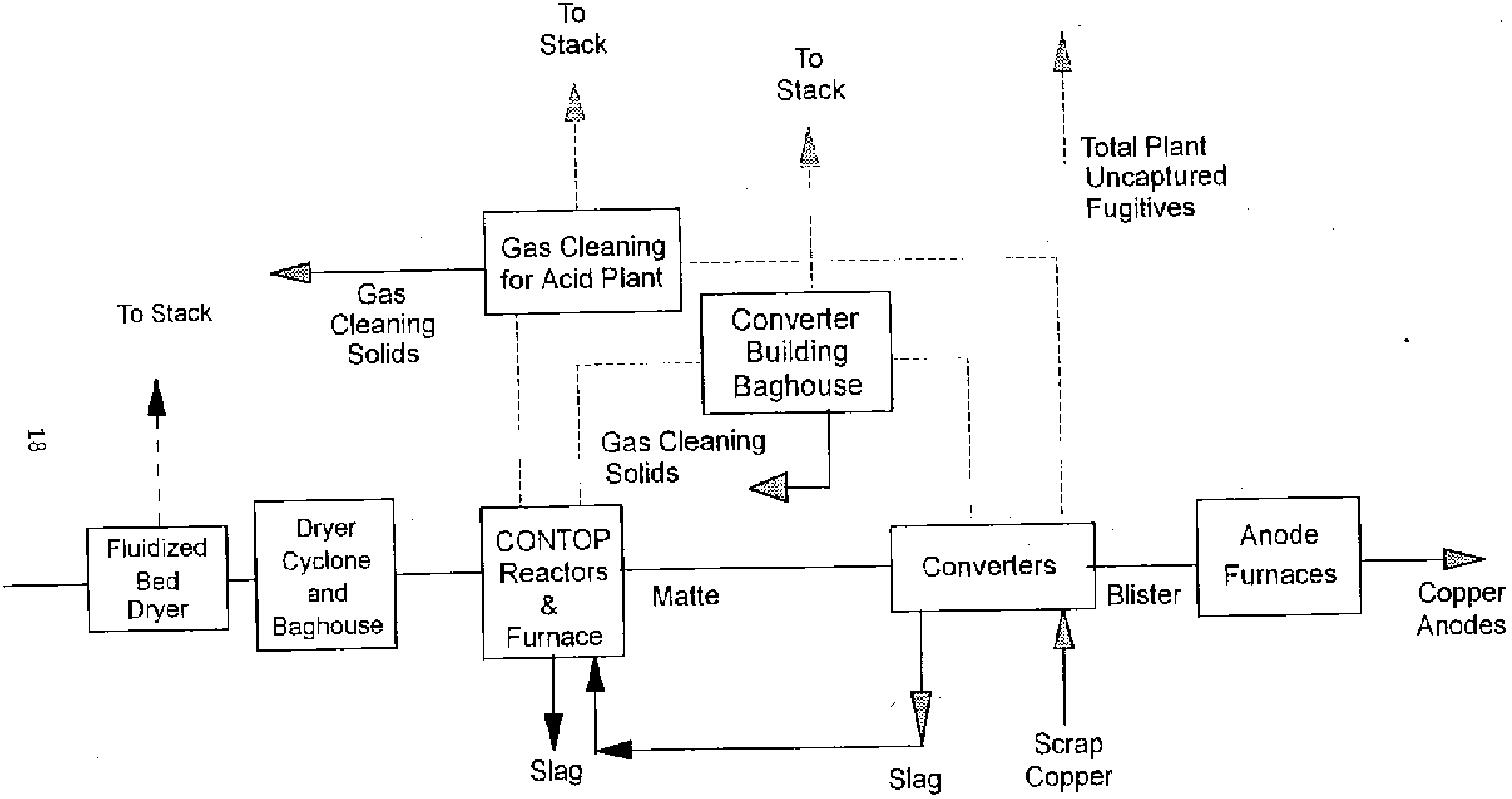

Figure 1 - Solids Flow Diagram for ASARCO, Incorporated Copper Smelter in El Paso, Texas. (September 1993)

Figure 1.pre

The solid slag is then removed and crushed for use as a railroad ballast, sandblasting agent, and aggregate for asphalt.

Matte tapped from the CONTOP holding furnace is transferred by ladle to Pierce-Smith converters. There are three converters at the ASARCO-El Paso plant. The design copper content for the copper matte is 58.5 percent copper. Based on this copper content, one-converter operation is expected to be practiced during normal CONTOP operation. In addition to matte being charged to the converters, copper scrap, representing less than 15 percent of the total converter input, is also directly charged to the converters.

Blister copper from converter operation is transferred by ladle for refining in one of two anode furnaces. Converter slag is transferred back to the CONTOP holding furnace.

Acid plant gas cleaning solids, consisting of spray chamber solids and water treatment sludge are both sent to the bedding building, for recycle into the smelting process. Converter building baghouse and CONTOP Cottrell (ESP) solids are conveyed directly back to the fluidized bed dryer feed system, for input back into the smelting process.

ASARCO-Hayden (Figure 2): The ASARCO-Hayden complex utilizes an Inco flash furnace.

Incoming materials are dried in a fluidized bed dryer. The dried concentrates, in the form of small particles, are captured in a dryer baghouse. The dried concentrates from the cyclone and baghouse are injected into the Inco flash furnace. In addition

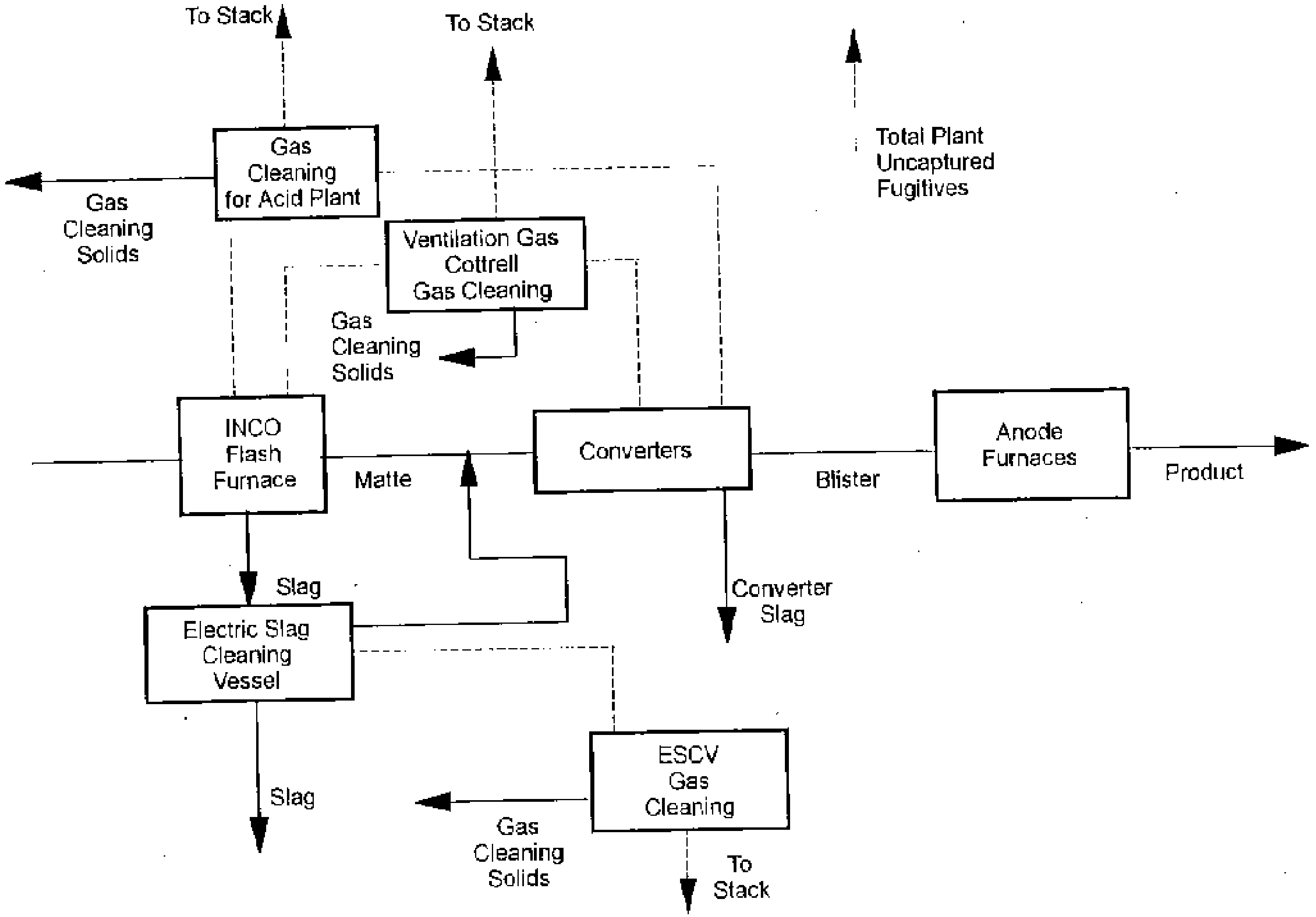

Figure 2 - Solids Flow Diagram for the ASARCO, Incorporated Copper Smelter in Hayden, Arizona. (September 1993)

Figure_2.pre

to concentrates, in 1992, the ASARCO-Hayden plant received other input materials, including lead speiss from the ASARCO-East Helena lead smelter.

Molten matte (containing approximately 58 percent copper) is transferred by ladles to the Pierce-Smith converters. Molten slag from the Inco furnace is transferred by launder to an Electric Slag Cleaning Vessel (ESCV). The function of the ESCV is to recover additional copper, which would otherwise be lost in the slag. Matte from the ESCV is transferred by ladle to the converters. Molten slag from the ESCV is transferred by Kress slag haulers to a slag dump.

There are five converters at ASARCO-Hayden. Three are typically operating (with one blowing, one skimming, and one charging), one is on (hot) standby, and one down (cold) for maintenance.

Blister copper from converter operation is transferred by ladle to anode furnaces. Molten converter slag is transferred by ladle back to the Inco furnace.

Acid plant gas cleaning solids are sent to Mixes/Unloading for recycle into the smelting process. Flue dust from the Ventilation Gas Cottrell (ESP) is also sent to Mixes/Unloading for recycle into the smelting process.

Copper Range (Figure 3): Prior to shut down for modifications, the Copper Range-White Pine smelter utilized a reverberatory furnace for smelting.

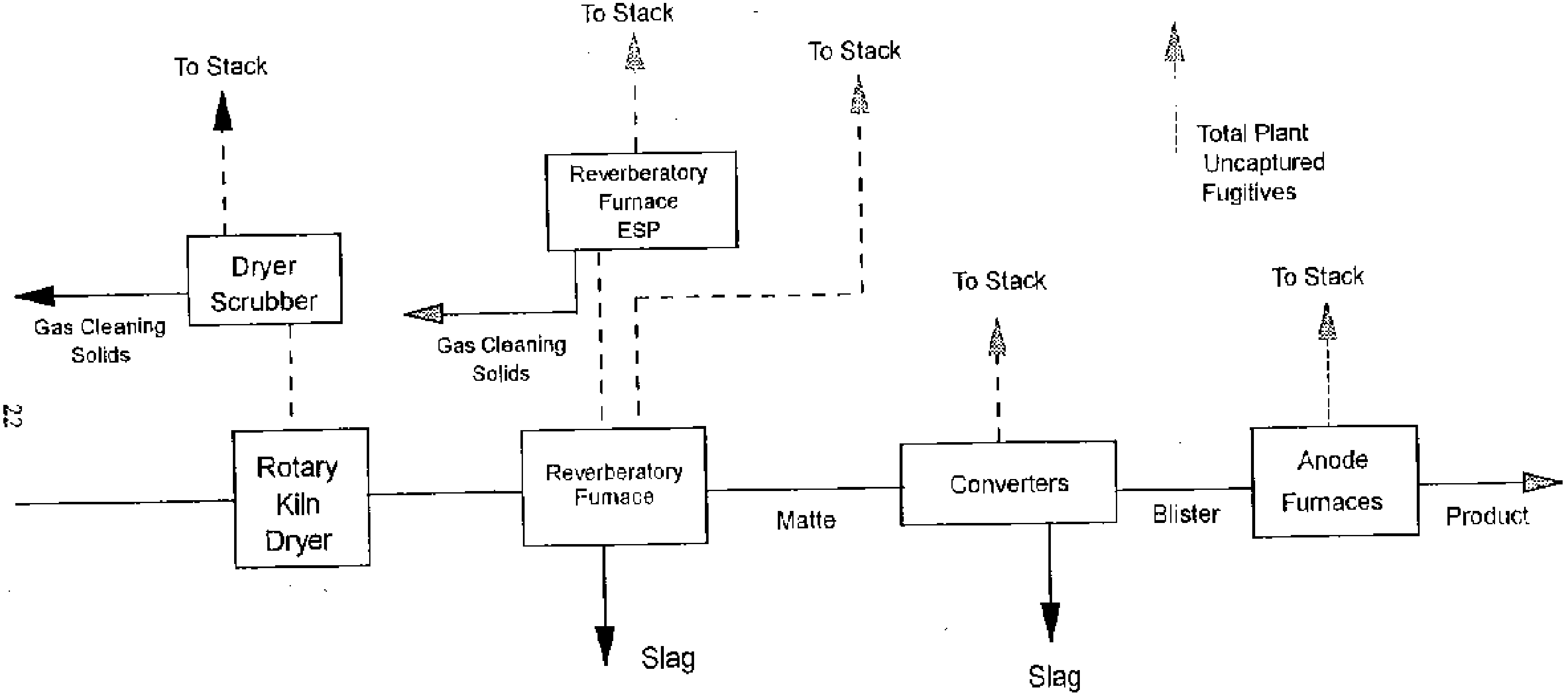

Figure 3 - Solids Flow Diagram for the Copper Range Company Copper Smelter in White Pine, Michigan. (September 1993)

Inlet concentrate was dried in a rotary kiln dryer before entering the reverberatory furnace. Matte from the reverberatory furnace contained approximately 62 percent copper, and was transferred by ladle to a converter. Slag from the reverberatory furnace went to an on-site slag dump.

There were two converters at Copper Range-White Pine, but only one converter was ever blowing at one time. Blister copper from the converters was transferred by ladle to reverberatory-type anode furnaces.

Flue dust from the reverberatory furnace ESP was recycled back to the reverberatory furnace. The plant went down in early 1995 and will come back on stream only after major modifications required in the Consent Decree.

Cyprus Miami (Figure 4): The Cyprus Miami plant added an Isa smelting vessel to its existing electric furnace smelting system in 1992. The plant can therefore be run in two distinct modes. In the first and primary mode, concentrates are added directly to the Isa vessel (no concentrate dryer is utilized). Molten material from the Isa vessel is launder-transferred to the electric furnace for matte and slag separation. The electric furnace thus serves as a settling vessel for molten material from the Isa vessel. In the second mode of operation, the electric furnace serves as the smelting vessel. In this mode of operation, inlet concentrate is run through a rotary kiln dryer, prior to smelting.

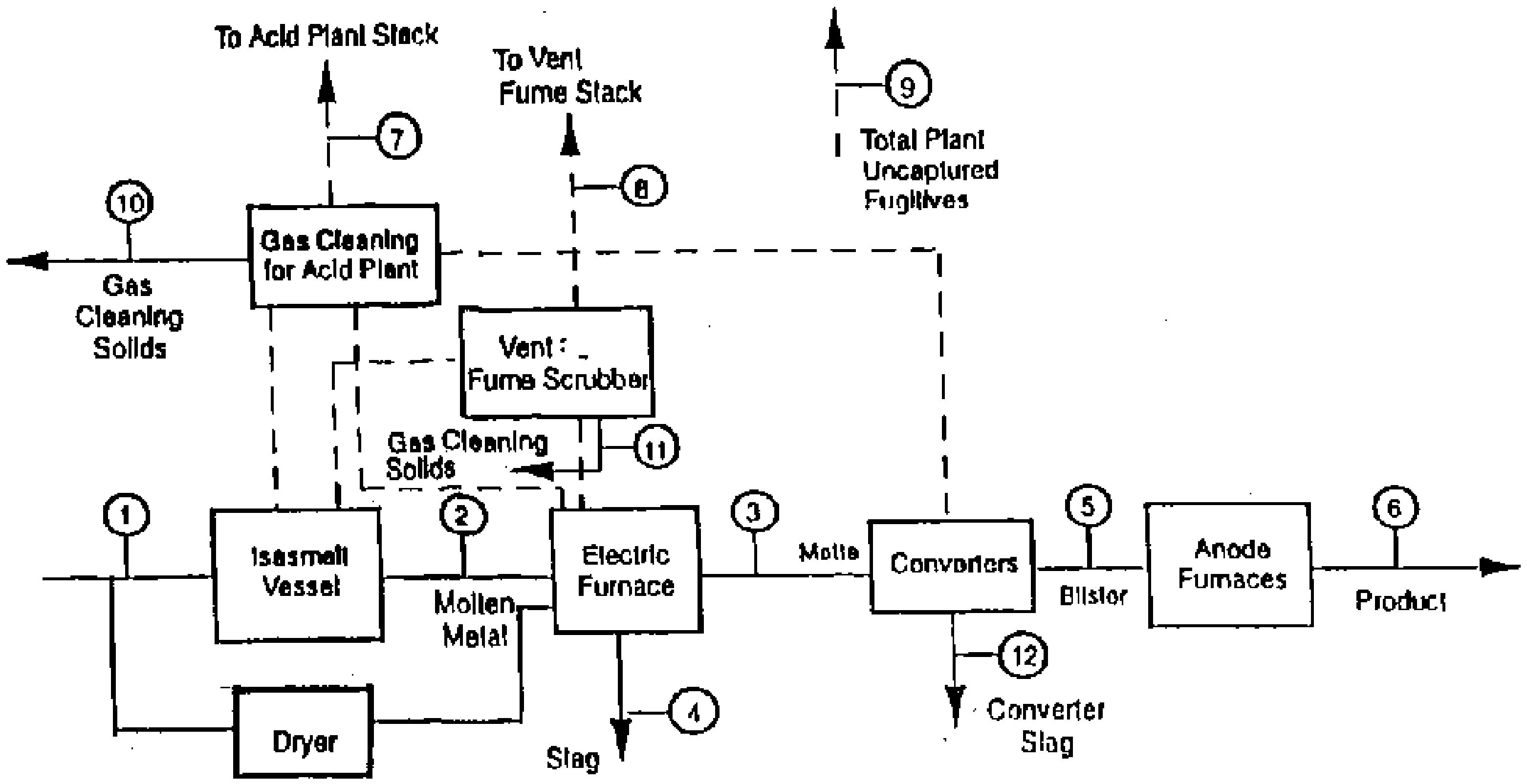

Figure 4 - Solids Flow Diagram for Cyprus Miami Copper Smelter in Claypool, Arizona. (September 1993)

Copper matte is tapped from the electric furnace, and transferred by ladles to converters. The Cyprus Miami smelter utilizes four Hoboken (syphon) converters, rather than the Pierce-Smith converters utilized at other smelters. (The Cyprus Miami smelter also has one Inspiration converter, but this converter is used infrequently.) Normally, three of the Hoboken converters are kept hot, with one converter down for repairs. Out of the three "hot" converters, two are usually blowing, while one is on turnaround.

Kennecott-Utah (Figure 5): The current Kennecott Utah Copper smelter utilizes Noranda reactors for smelting.

Kennecott copper facilities in Utah include the smelter, the Bingham Canyon Mine, the Copperton Concentrator, the Magna Concentrator, a refinery, and a power plant. In 1992, all of the concentrates processed in the Kennecott Utah Copper smelter were produced from ore that came from the Bingham Canyon mine.

Incoming concentrates either pass through a rotary kiln dryer, or enter the Noranda reactors directly, depending on initial moisture content. Normally one reactor (and one converter) is operating. The Noranda reactor produces a very high-copper content matte, approximately 76 percent copper. This matte is transferred by ladle to the converters. Molten slag from the Noranda reactor is transferred outside the smelter building by Kress slag haulers, then water-quenched while still in slag pots. The solidified slag is then crushed and processed

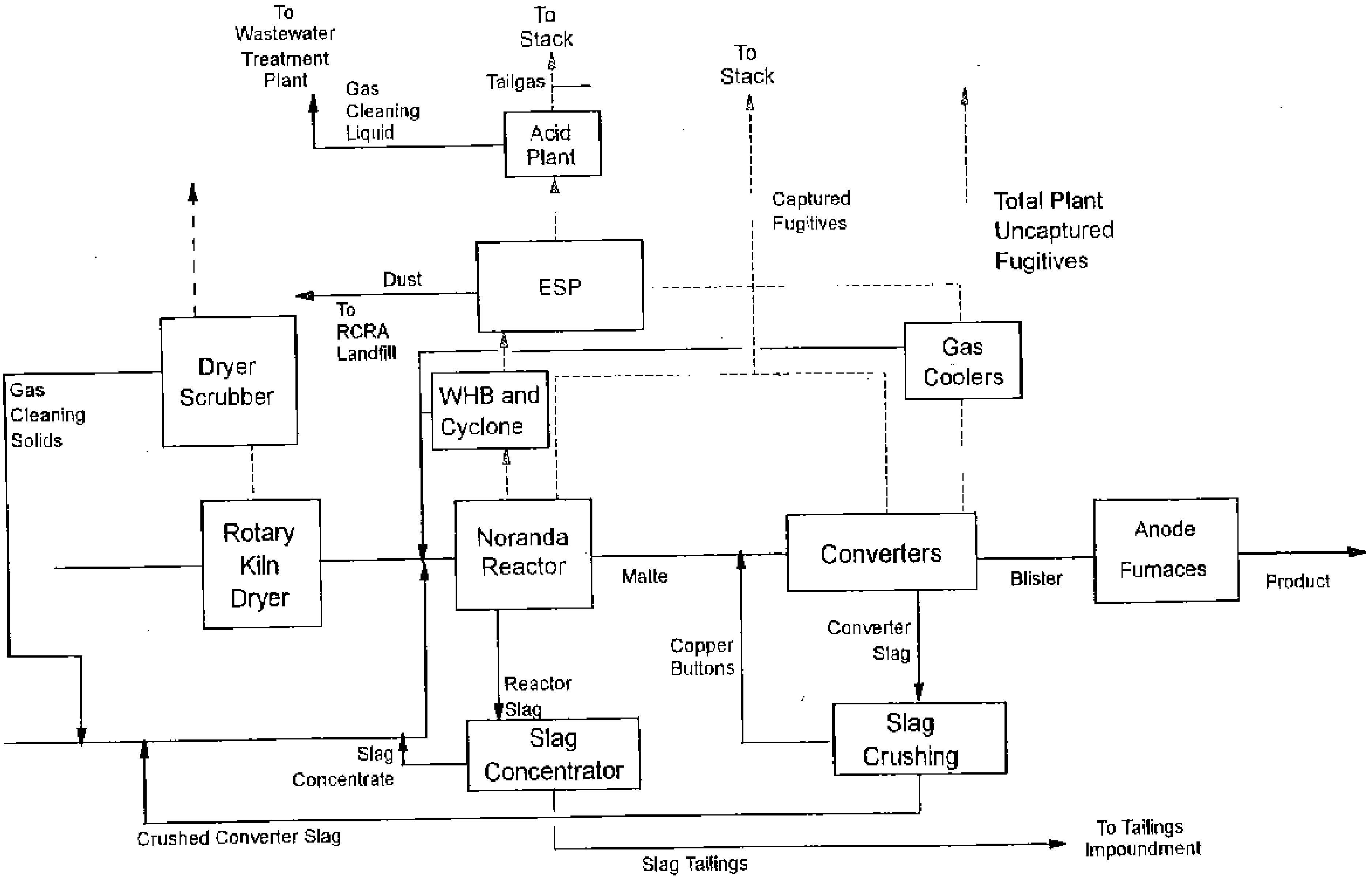

Figure 5 - Solids Flow Diagram for the Kennecott Utah Copper Smelter in Magna, Utah. (September 1993)

in a special on-site slag concentrator (a froth-flotation cell designed to process slag). Outputs from the slag concentrator include slag concentrate, which is recycled back to the Noranda reactor, and slag tailings, which are sent to the tailings impoundment.

Molten matte (containing approximately 76 percent copper) is transferred by ladles to the Pierce-Smith converters. There are four converters at the Kennecott Utah Copper smelter. During normal operation, one converter is operating (in copper blow or slag blow). If neither of the Noranda reactors is operating, at times two converters may be blowing simultaneously. One of the four converters is normally down for maintenance. One converter is operating (on copper or slag blow). One converter is on standby (or down for preventative maintenance and matte storage). One converter is receiving matte, in preparation to operating (preparing for copper blow).

Blister copper from converter operation is transferred by ladle to anode furnaces. Molten converter slag is transferred by ladle outside the converter building, then water quenched. The solidified converter slag is then crushed. Copper "buttons" (pieces of metallic copper) are sent back to the converters, and the rest of the crushed slag is sent to the Noranda reactor.

Flue dusts collected in the Joy plate/wire ESPs upstream of the acid plant (i.e., flue dusts from the Noranda reactor and converter primary hood) are sent to a RCRA (Resource Conservation and Recovery Act) landfill. Liquids from the Acid Plant gas cleaning equipment are sent to the wastewater treatment plant. Solids (particulate) captured by the dryer scrubber are sent to the Noranda reactor.

This operation has been modernized and is in the process of moving to the new flash smelter and flash converting technology. The transition to the new technology is expected to be complete in 1995. The existing operation will be phased out at that time.

Magma Copper Company (Figure 6): The Magma-San Manuel plant uses an Outokumpu flash furnace for smelting.

Incoming materials are dried in a rotary kiln dryer, with dried concentrates fed to the flash furnace. The furnace produces matte containing approximately 55 percent copper, which is transferred by ladles to Pierce-Smith converters. The furnace also produces slag, which is transferred by Kress slag haulers to cooling pits, and then to a concentrator. The concentrate from the concentrator is recycled back to the flash furnace.

There are four converters at the Magma San Manuel plant. Three are operated (hot) at any one time, with the fourth converter down for campaign repair. Typically, one converter is operating on slag blow, one on copper blow, and one on turnaround/receiving matte.

Blister copper from converter operation is transferred by ladle to anode furnaces. Molten converter slag, like Outukumpu furnace slag, is transferred by ladle to cooling pits, and then to a concentrator.

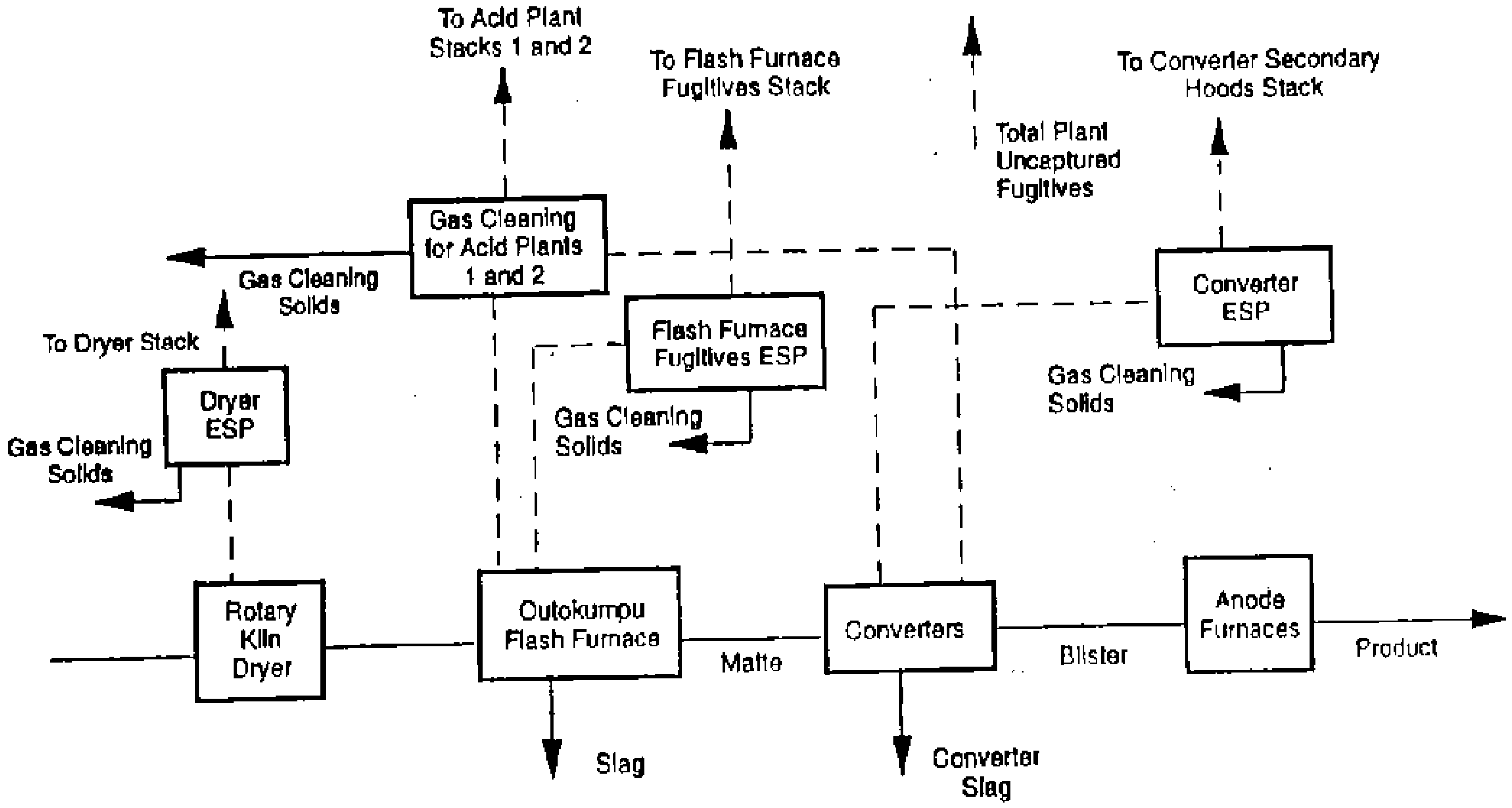

Figure 6 - Solids Flow Diagram for Magma Copper Company Copper Smelter in San Manuel, Arizona. (September 1993)

Acid plant gas cleaning solids are sent to the concentrator, with the majority of solids ending up as tailings. Converter secondary hood gas cleaning solids and flash furnace gas cleaning solids are recycled to the flash furnace.

Phelps Dodge-Chino Mines (Figure 7): The Phelps Dodge-Chino Mines smelter utilizes an Inco flash furnace.

Incoming concentrate is dried in two fluidized bed dryers, operating in parallel. All of the concentrate is entrained in the dryer gases, and is collected in the two fluidized bed dryer baghouses, before being introduced into the flash furnace. The flash furnace produces copper matte, and slag, which is discarded.

Copper matte from the Inco furnace is transferred by ladles, either to one of three receiving (holding) vessels, or to one of the four Pierce-Smith converters. Blister copper from the converters is ladle-transferred to one of two anode furnaces, for refining.

Particulate material caught by the acid plant gas-cleaning equipment goes to a metal recovery plant, and is recycled back to the flash furnace.

Phelps Dodge-Hidalgo (Figure 8): The Phelps Dodge-Hidalgo plant uses an Outokumpu flash furnace for smelting.

Incoming materials are dried in a rotary kiln dryer, with dried concentrates fed to the flash furnace. The furnace produces matte containing approximately 61 percent copper, which

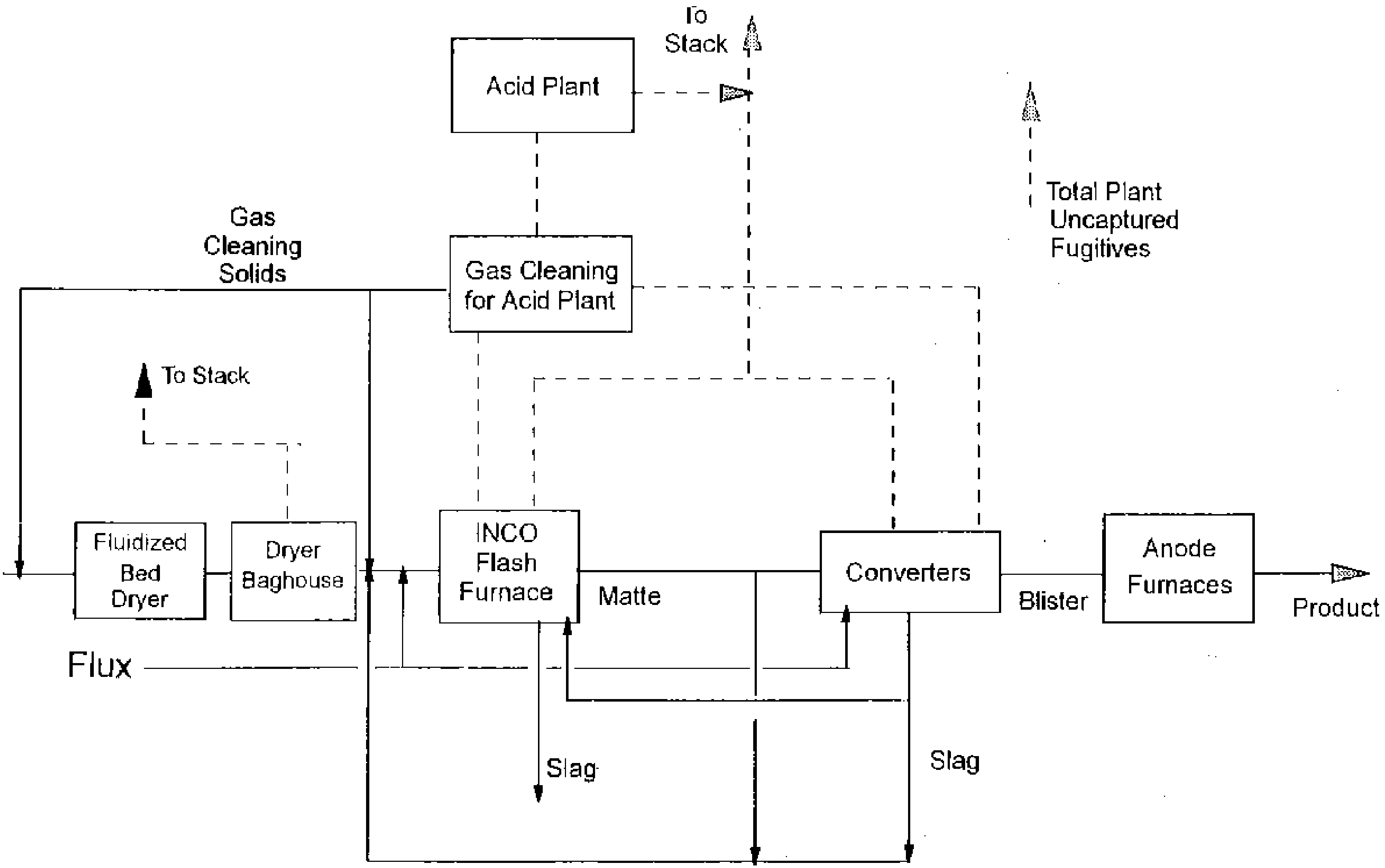

Figure 7 - Solids Flow Diagram for the Phelps Dodge-Chino Mines Copper Smelter in Hurley, New Mexico. (September 1993)

Figure_7.pre

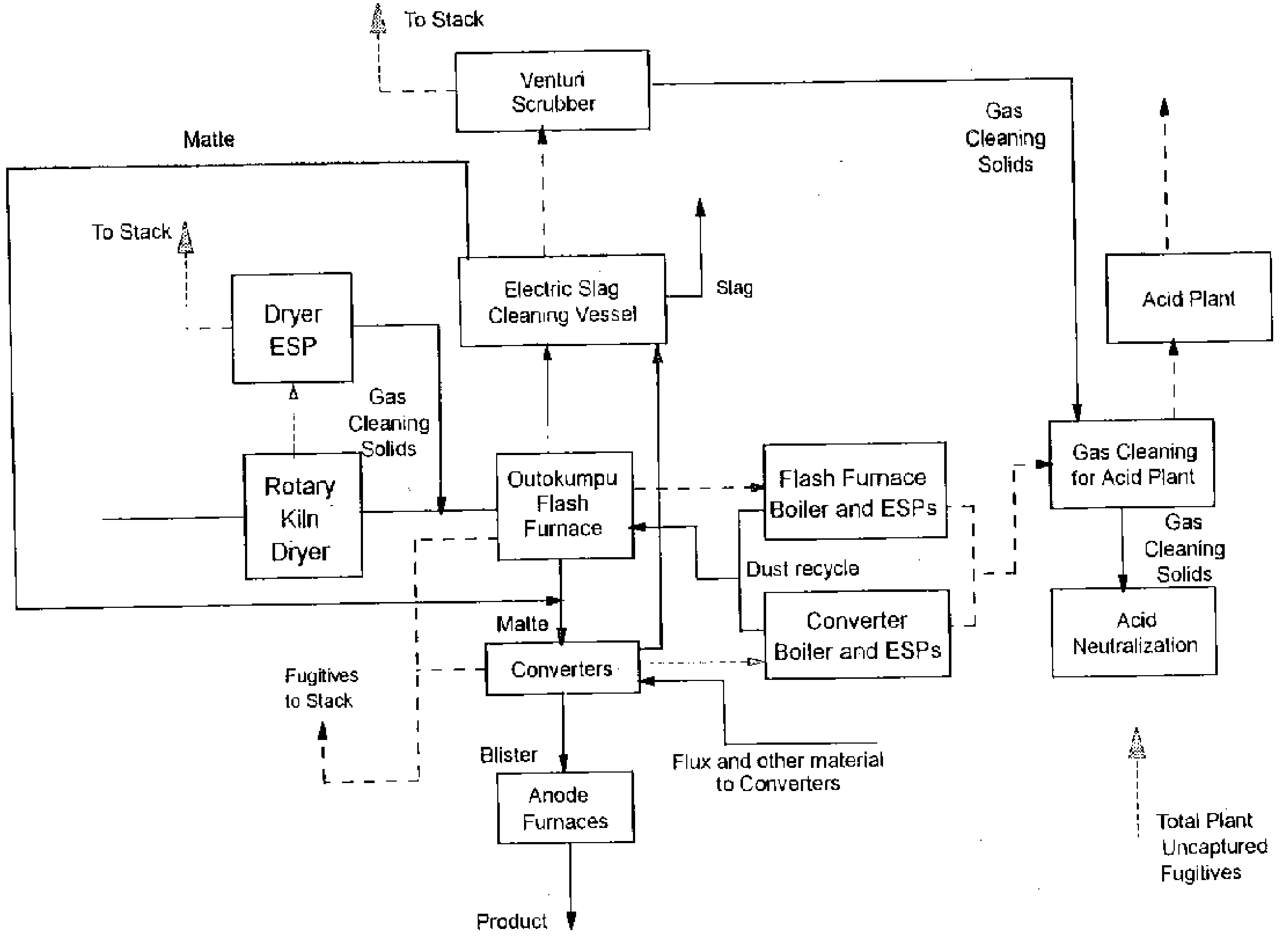

Figure 8 - Solids Flow Diagram for the Phelps Dodge Copper Smelter in Hidalgo County (Playas), New Mexico. (September 1993)

Figure_8.pre

is transferred by ladles to Pierce-Smith converters. The furnace also produces slag, which is transferred by launders (water-cooled troughs) to an electric slag cleaning furnace.

The electric slag cleaning furnace produces matte (containing approximately 66 percent copper), which is transferred by ladle to the converters. The electric slag cleaning furnace also produces slag, which is transferred by Kress slag haulers to a slag dump.

There are three converters at Phelps Dodge-Hidalgo. Approximately 75 percent of the time, all three are operated hot. One converter is operated on copper blow, one on slag blow and one on turnaround/receiving matte. The other 25 percent of the time, one converter is down for major repair, and the other two converters are operated hot.

Blister copper from converter operation is transferred by ladle to anode furnaces. Molten converter slag is poured into ladles, then poured into a slag return launder to the electric slag cleaning furnace.

Acid plant gas cleaning solids are sent to a neutralization pond.

2.5 Gas Flow Diagrams

Gas flow diagrams for ducted flows at the eight smelters are shown in Figures 9 through 16. In the Section 114 Information Requests sent to the smelters in July 1993, the smelters were requested to provide gas flow rates (in cubic feet per minute), temperatures, and mass flows for sulfur dioxide (SO_2), particulate, arsenic, lead, and cadmium at any points for which this information was available. The smelters were also requested to provide locations of sulfur dioxide, opacity, and continuous particulate sampling monitors by designating the points with "S", "O", and "P", respectively.

A summary of the origins, control devices, and destinations of ducted gas flows at each smelter is given in Table 4. Ducted gas flows at primary copper smelters can be generalized to include the following streams:

1) High-sulfur-dioxide-concentration "process" streams, such as those from furnaces/reactors and converter primary hoods, are usually sent to an acid plant. (Only one plant, Copper Range-White Pine, does not have an acid plant.)

2) Low-sulfur-dioxide-concentration "non-process" streams, such as those captured by converter secondary hoods, or furnace/reactor matte and slag tapping hoods, may be sent to particulate control devices (ESPs or baghouses), sulfur dioxide control devices (scrubbers), or may be directed, uncontrolled, to

Table 4. Summary of the Origins, Control Devices, and Destinations[1] of Gas Flows (December 1993)

Plant I.D.	Smelter Furnace Process Gas	Smelter Furnace Non-Process Gases (e.g., from launder transfers)	Converter Process Gas	Converter Gases That Escape Primary Hoods	Converter Gases That Escape Secondary Hoods
ASARCO - El Paso	Acid Plant (A.P.) A.P. Stack	Hooding / Baghouse Main Stack Annulus	Acid Plant A.P. Stack	Secondary Hoods/Baghouse Main Stack Annulus	Bldg. Enclosure/Baghouse Main Stack Annulus
ASARCO - Hayden	Acid Plant (A.P.) Main Stack Core	Hooding / ESP Main Stack Annulus	Acid Plant Main Stack Core	Secondary Hoods / ESP Main Stack Annulus	Bldg. Fugitives (Uncontrolled) Natural Draft Ventilation
Copper Range	ESP[2] Main Stack	Hooding / Uncontrolled Two Tapping Stacks	Uncontrolled [2] Main Stack	Bldg. Fugitives (Uncontrolled) Forced Draft Ventilation	Bldg. Fugitives (Uncontrolled) Forced Draft Ventilation
Cyprus Miami	Acid Plant (A.P.) Acid Plant Tailstack	SO2 Scrubber Vent Fume Stack	Acid Plant Acid Plant Tailstack	Bldg. Fugitives (Uncontrolled) Bldg. Natural Ventilation	Bldg. Fugitives (Uncontrolled) Natural Draft Ventilation
Kennecott	Acid Plant (A.P.) Main Stack	Hooding / Uncontrolled [3] Main Stack	Acid Plant Main Stack	Secondary Hoods / Uncontrolled [3] Main Stack	Partial Tertiary Hood/ Uncontrolled [3] Main Stack
Magma	Acid Plant (A.P.) Three A.P. Stacks	Hooding / ESP Furnace Fugitives Stack	Acid Plant Three A.P. Stacks	Secondary Hoods / ESP Converter Stack	Bldg. Fugitives (Uncontrolled) Forced Draft Ventilation
Phelps Dodge - Chino	Acid Plant (A.P.)	Hooding / Uncontrolled [4] Main Stack	Acid Plant	Secondary Hoods / Uncontrolled [4] Main Stack	Bldg. Fugitives (Uncontrolled) Natural Draft Ventilation
Phelps Dodge - Hidalgo	Acid Plant (A.P.)	Hooding / Uncontrolled Main Stack	Acid Plant		Bldg. Fugitives (Uncontrolled) Natural Draft Ventilation

(1) Table is presented with the capture and control devices listed above the destination of the gas flow, i.e. Secondary Hoods/Baghouse
Main Stack Annulus

(2) Copper Range is planning to upgrade the ESP on the reverberatory smelting furnace in 1994. Copper Range is also planning t install a scrubber and parallel acid mist ESP's downstream of the reverberatory furnace ESP, and to install a scrubber and acid mist ESP for captured converter gases.

(3) Kennecott is constructing a modernized smelter, planned for completion in July 1995, which will eliminate ladle transfers of molten metals.

(4) Phelps Dodge - Chino Mines is considering particulate controls for these streams.

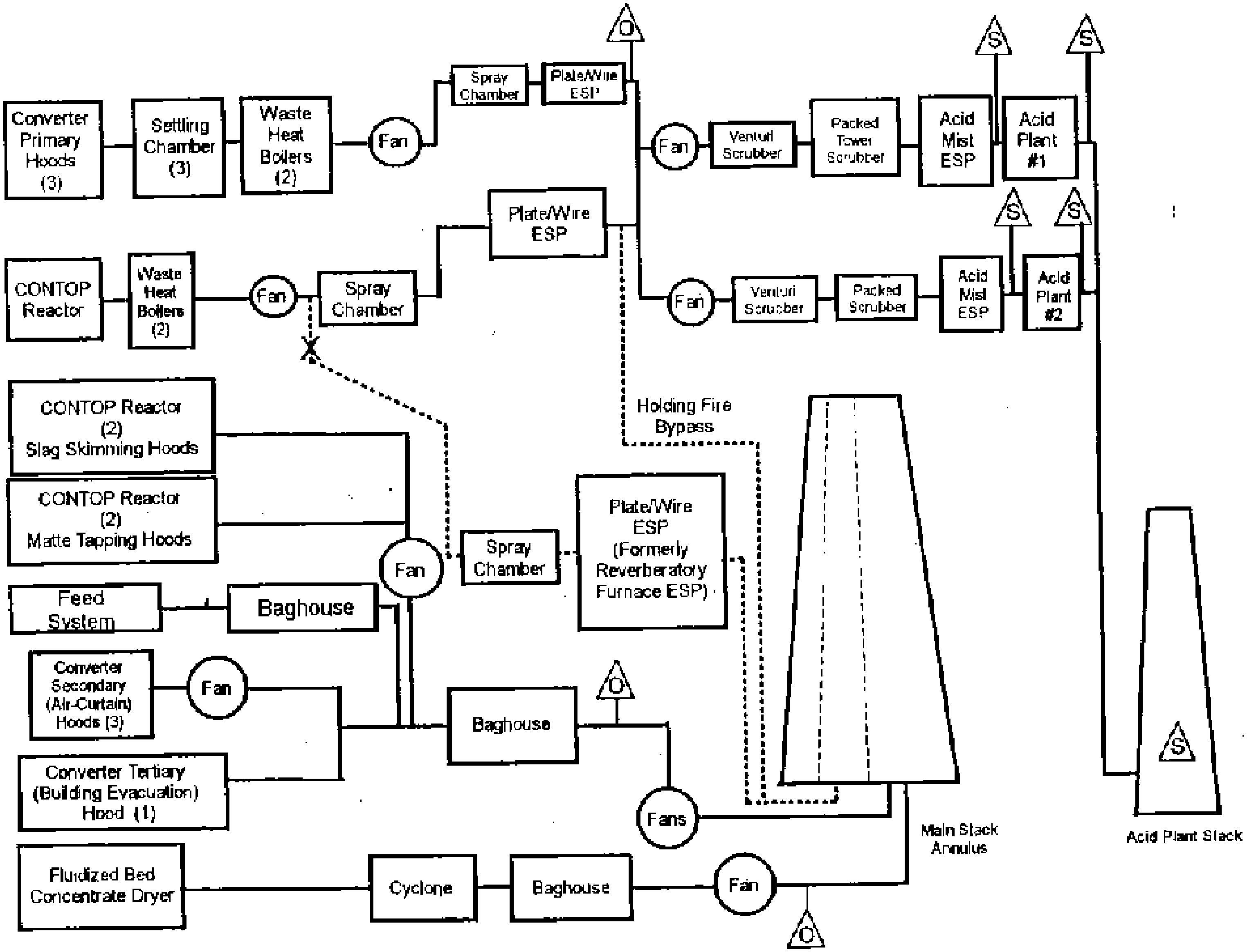

Figure 9 - Gas Flow Diagram for ASARCO, Incorporated Copper Smelter in El Paso, Texas. (June 1995)

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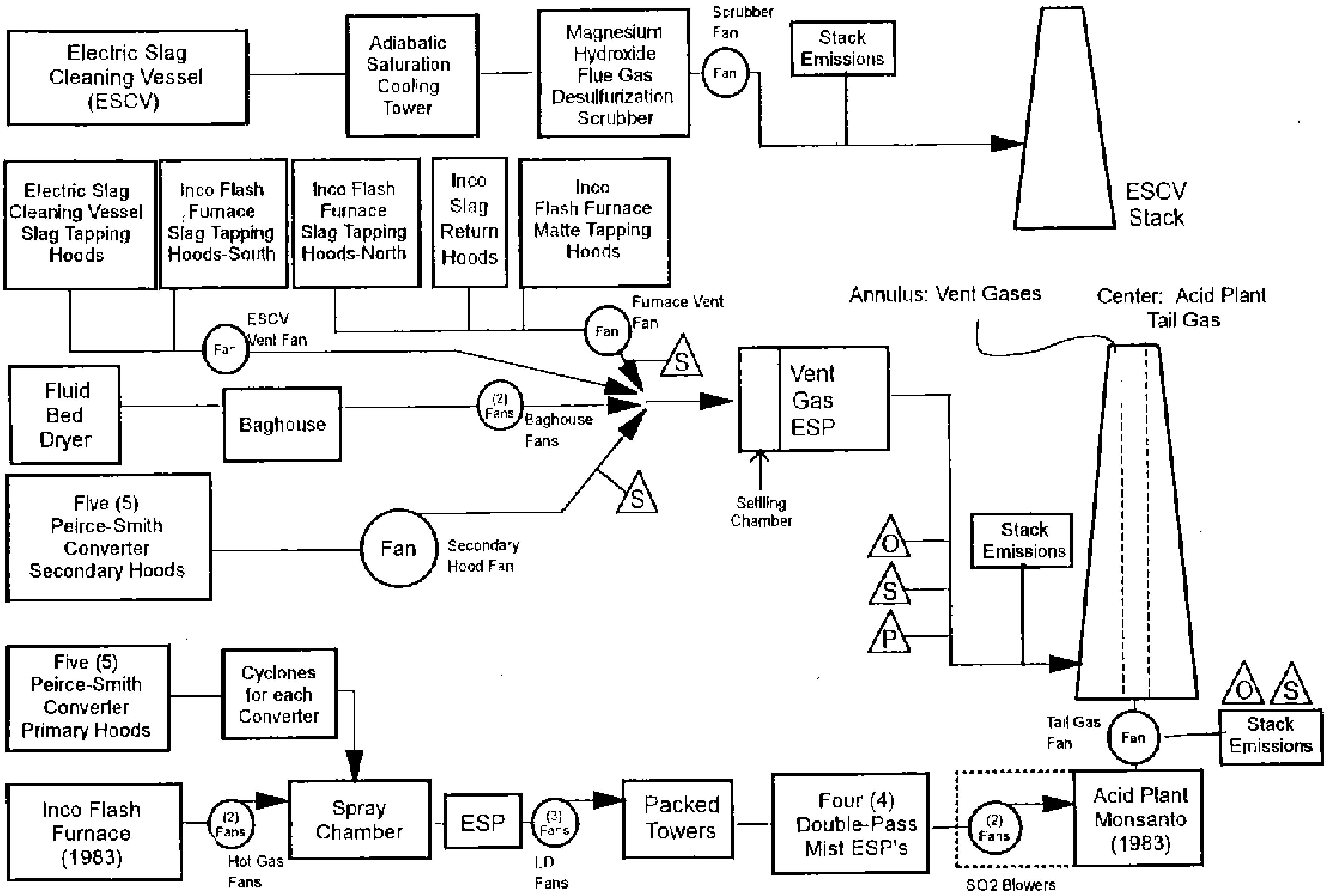


Figure 10 - Gas Flow Diagram for ASARCO, Incorporated Copper Smelter in Hayden, Arizona. (September 1993)

Figure10.pre

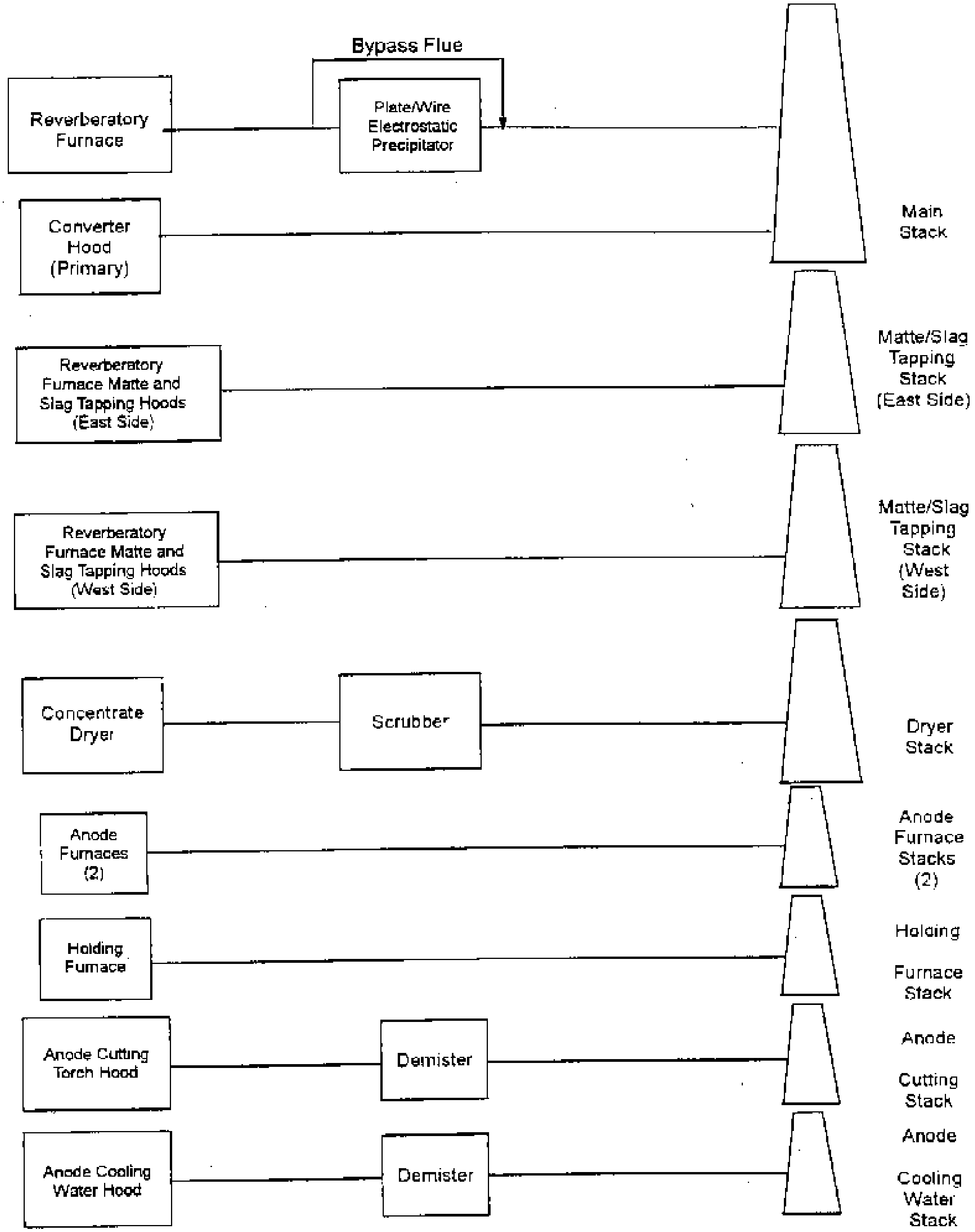


Figure 11 - Gas Flow Diagram for the Copper Range Company Copper Smelter in White Pine, Michigan. (September 1993)

Figure11.pre

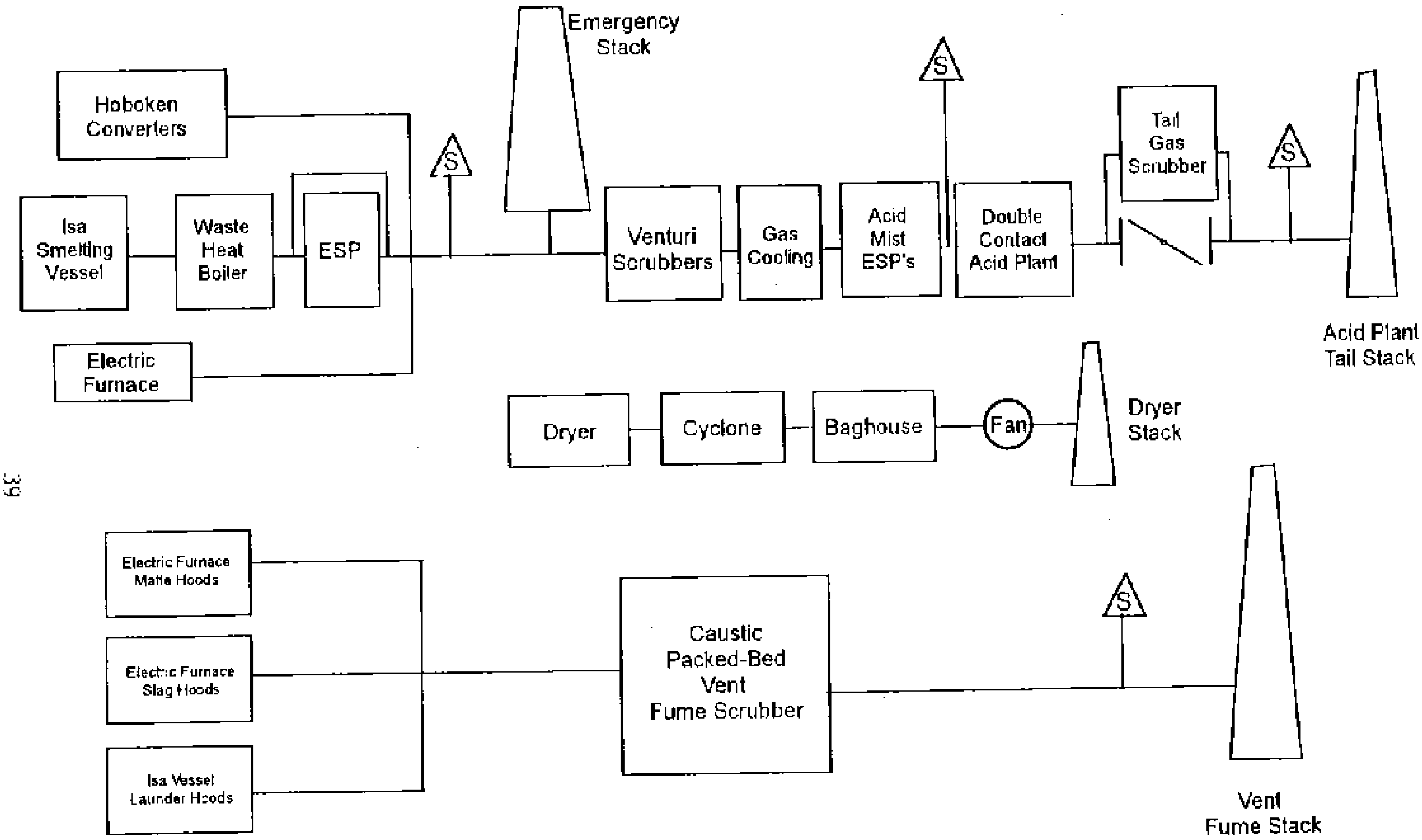


Figure 12 - Gas Flow Diagram for Cyprus Miami Copper Smelter in Claypool, Arizona. (September 1993)

Figure12 pre

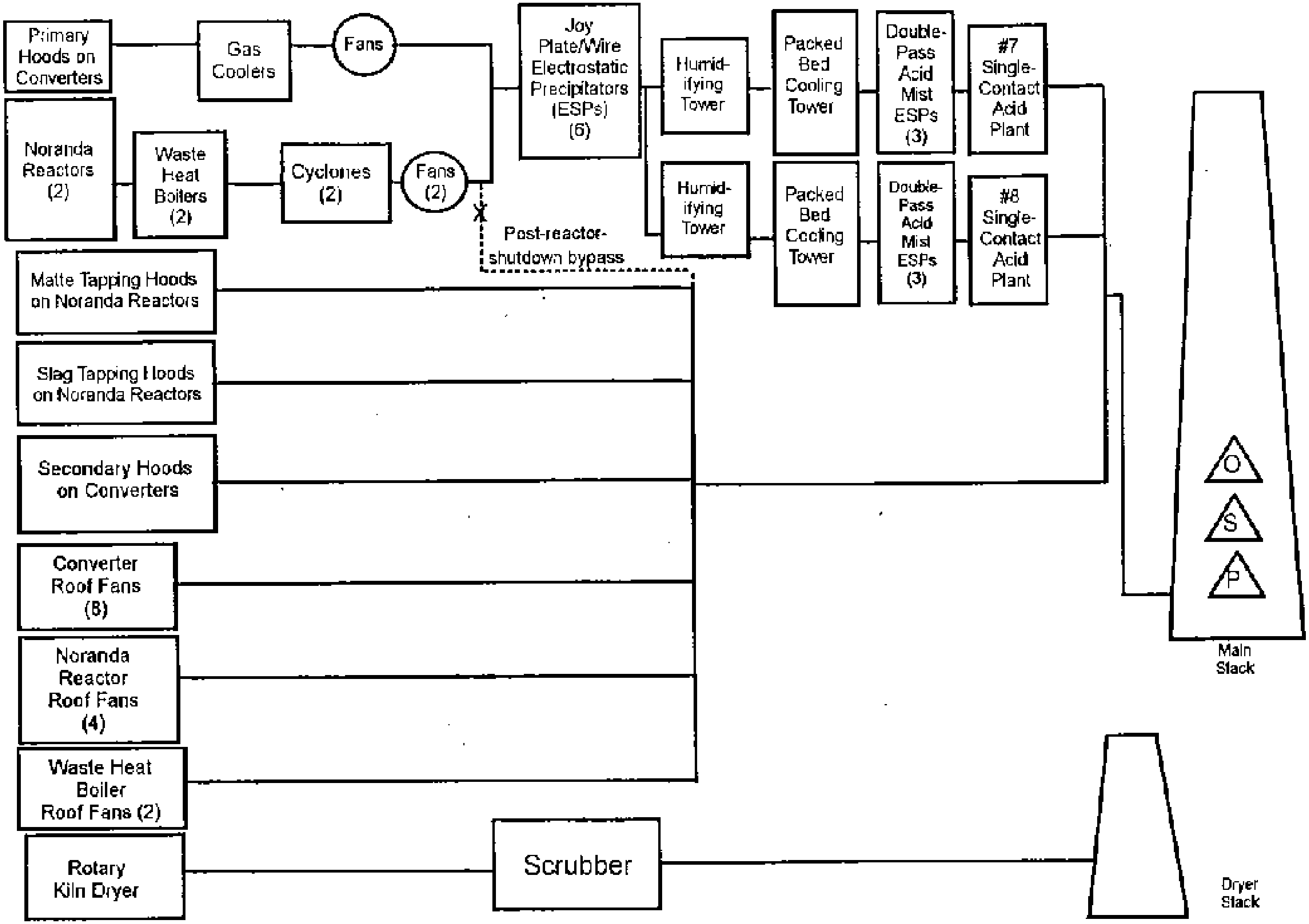


Figure 13 - Gas Flow Diagram for the Kennecott Utah Copper Smelter in Magna, Utah. (September 1993)

Figure13.pre

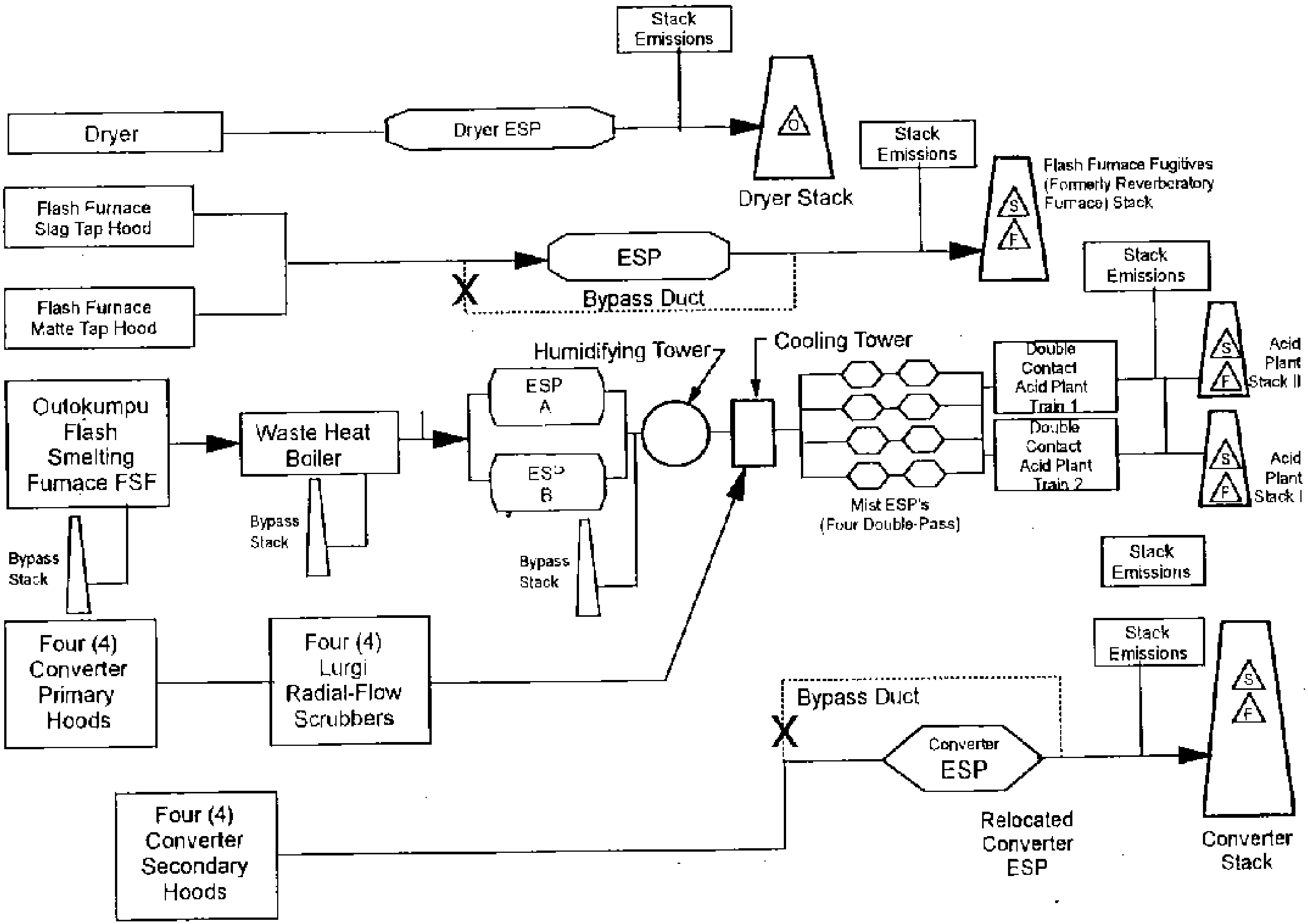


Figure 14 - Gas Flow Diagram for Magma Copper Company Copper Smelter in San Manuel, Arizona. (September 1993)

Figure14.pre

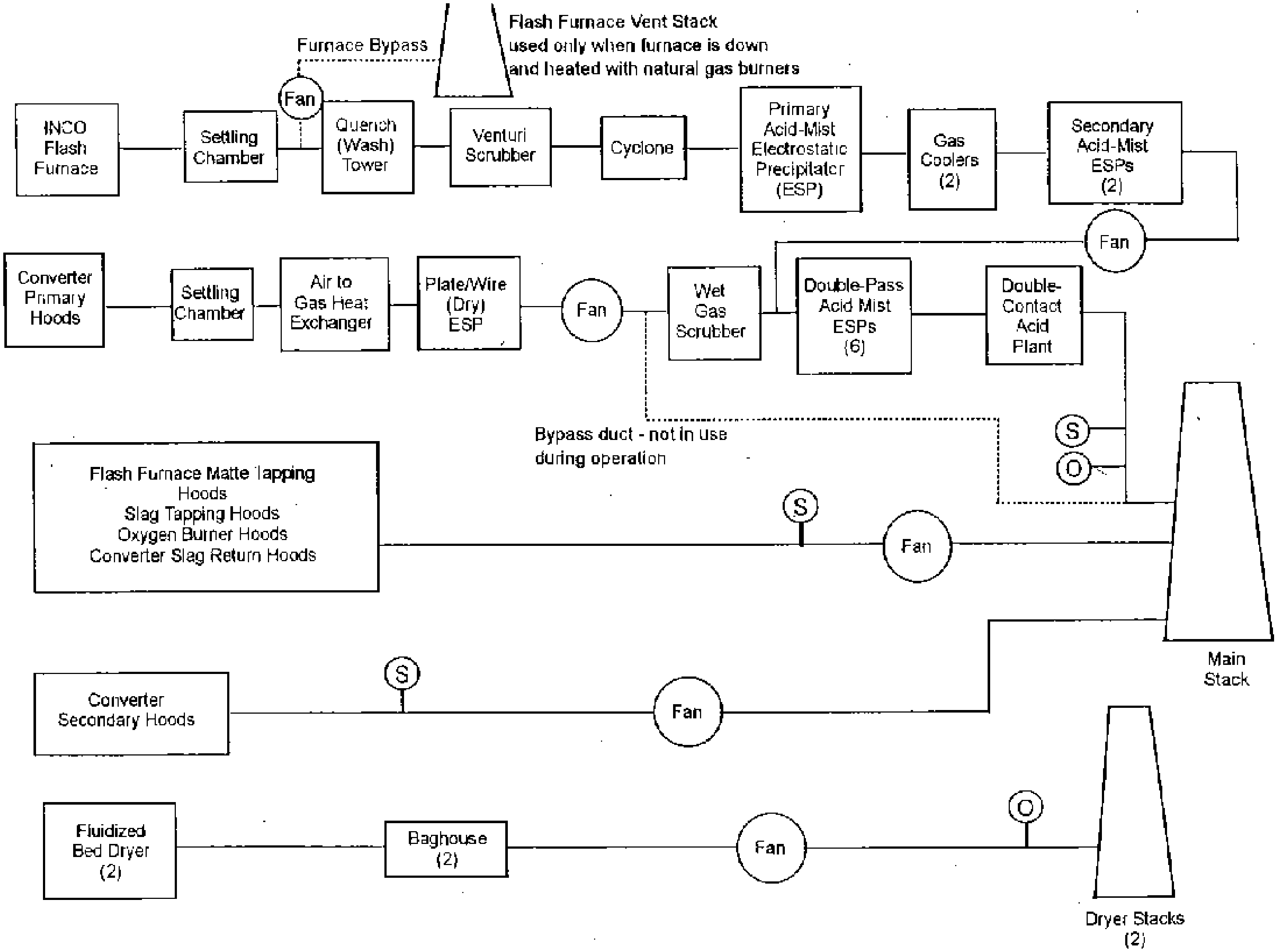


Figure 15 - Gas Flow Diagram for the Phelps Dodge-Chino Mines Primary Copper Smelter in Hurley, New Mexico. (September 1993)

Figure15 pre

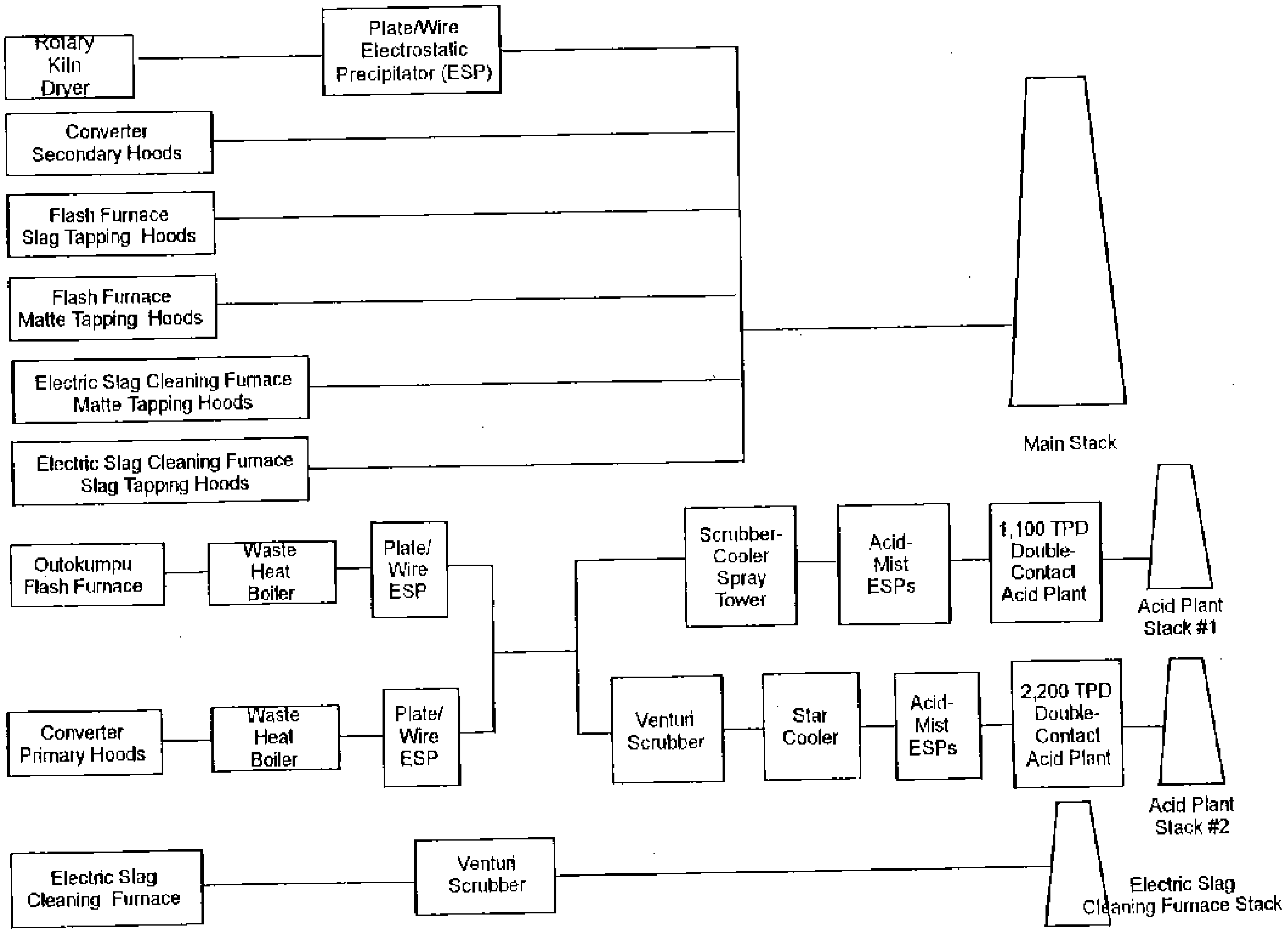


Figure 16 - Gas Flow Diagram for the Phelps Dodge Copper Smelter in Hidalgo County (Playas), New Mexico. (September 1993)

a stack.

3) Low-sulfur-dioxide-concentration process streams, such as those from an electric slag cleaning vessel, or concentrate dryer (rotary kiln or fluidized bed). Process gases from electric slag cleaning vessels are handled by scrubbers or an acid plant. Process gases from rotary kiln dryers may be handled by ESPs baghouses or scrubbers. Process gases from fluidized bed dryers are handled by baghouses.

2.6 Production

In responses to Section 114 information requests sent in July-September 1993, each smelter reported three values for anode production: 1) Production capacity; 2) Production during calendar year 1992, and 3) Anode production during stack testing reported by the smelters. The production capacity and 1992 anode copper production values reported by each of the smelters are presented in Table 5.

3. PLANT EMISSIONS

3.1 Reported by Smelters

All eight primary copper smelters were asked to report emissions of HAPs and criteria pollutants (total suspended particulate and sulfur dioxide) from all stacks and all fugitive emissions locations (including the converter building). The smelters were asked to report the emissions in pounds per hour (lb/hr). The smelters were also asked to provide values for the number of operating hours per year that would convert the hourly

Table 5. Anode Copper Production

Plant	Production Capacity (Tons/year)	Production During 1992 (Tons/year)
ASARCO-El Paso	133,000	107,787
ASARCO-Hayden	> 210,093 (1)	210,093
Copper Range	110,093	81,361
Cyprus Miami	256,800 (3)	104,290
Kennecott (Existing)	160,000	156,934
Kennecott (New)	310,000 (2)	Not Applicable
Magma	> 368,000 (1)	370,913
Phelps Dodge - Hurley	215,000	148,000
Phelps Dodge - Hidalgo	232,237	181,283
Industry Total	> 1,688,136 (1993) > 1,838,136 (1995)	1,360,661

Notes:

1) Both ASARCO-Hayden and Magma-San Manuel stated that 1992 production values were t highest achieved to date, and exceeded the rated capacities of the respective furnaces.

2) Production capacity (refined copper) for the modernized Kennecott smelter and refinery, as reported in the Wall Street Journal, March 13, 1992.

3) Theortical capacity associated with maximum permitted through put of 850,000 of NMBM

emissions into annual emissions. The values that were provided ranged from 6683 hours per year (Kennecott Utah Copper) to 8760 hour per year (Magma and Copper Range Company), with a mean value of 7733 hours per year. The summary of all of the emissions data submitted is shown in Table 6. Table 6 shows the annual emissions as reported by the smelters for the actual operating hours at each facility

ASARCO-El Paso: The smelter followed up on the original 1993 ICR submissions with the results of a comprehensive emissions test effort that was conducted for the State of Texas in 1993. This data was reported to EPA in a April 15, 1994 letter from the smelter. The testing program included testing of all stack emission points which included captured fugitive emissions from the converter building.

ASARCO-Hayden: Particulate and metals emissions from the Main Stack Annulus are based on particulate and metals testing conducted in November, 1992, by EEMC (Energy and Environmental Measurement Corporation). This testing was conducted before completion of a rebuilding program on the Ventilation Gas Cottrell (ESP). The rebuilding program on the ESP resulted in much lower outlet particulate levels in the main stack annulus. The effects of the rebuilding program on particulate emissions are described in Section 4.2.4. and illustrated in figure 23. Because the reported particulate and metals emissions represent

Table 6. Emissions Reported by Smelters in September 1993
(actual 1992 emissions)

	ASARCO - EL PASO (1)			ASARCO - HAYDEN			COPPER RANGE			CYPRUS - MIAMI		
	TOTAL STACKS (TPY)	TOTAL FUGITIVES (TPY)	TOTAL PLANT (TPY)	TOTAL STACKS (TPY)	TOTAL FUGITIVES (TPY)	TOTAL PLANT (TPY)	TOTAL STACKS (TPY)	TOTAL FUGITIVES (TPY)	TOTAL PLANT (TPY)	TOTAL STACKS (TPY)	TOTAL FUGITIVES (TPY)	TOTAL PLANT (TPY)
TOTAL SUSPENDED PARTICULATE	236	85	245	186	775	961	1894	0	1894	199	0	199
SULFUR DIOXIDE				19331	9708	29059	62057	0	62057	1663	3797	5460
ARSENIC COMPOUNDS	2.57	0.04	2.61	0.92	1.69	2.61	19.04	0.00	19.04	0.42	0.21	0.63
LEAD COMPOUNDS	8.76	0.05	8.81	6.16	4.84	11.00	21.60	0.00	21.60	5.05	12.61	17.66
ANTIMONY COMPOUNDS	0.23	0.01	0.23	0.12	0.90	1.02	0.27	0.00	0.27	0.16	0.84	1.00
BERYLLIUM COMPOUNDS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CADMIUM COMPOUNDS	0.24	0.00	0.24	0.37	0.21	0.58	3.36	0.00	3.36	0.40	1.68	2.08
CHROMIUM COMPOUNDS	0.06	0.01	0.07	0.21	0.00	0.21	2.60	0.00	2.60	0.01	0.09	0.10
COBALT COMPOUNDS	0.27	0.00	0.27	0.00	0.00	0.00	0.16	0.00	0.16	0.00	0.00	0.00
MANGANESE COMPOUNDS	0.00	0.00	0.00	0.07	0.00	0.07	0.56	0.00	0.56	0.08	0.00	0.08
MERCURY COMPOUNDS	0.00	0.00	0.00	0.02	0.00	0.02	0.67	0.00	0.67	0.02	0.00	0.02
NICKEL COMPOUNDS	0.09	0.00	0.09	0.44	0.21	0.65	2.55	0.00	2.55	0.03	1.68	1.71
SELENIUM COMPOUNDS	0.15	0.00	0.15	0.10	0.00	0.10	0.51	0.00	0.51	0.04	0.21	0.24
TOTAL HAPS	12.32	0.82	12.45	9.58	7.85	16.24	51.32	0.00	51.32	6.21	17.33	24.26

(1) ASARCO-El Paso results are 1993 test results reported to EPA on April 15, 1994

		KENNECOTT UTAH			MAGMA - SAN MANUEL			PHELPS DODGE - HURLEY			PHELPS DODGE - HIDALGO	
	TOTAL STACKS (TPY)	TOTAL FUGITIVES (TPY)	TOTAL PLANT (TPY)	TOTAL STACKS (TPY)	TOTAL FUGITIVES (TPY)	TOTAL PLANT (TPY)	TOTAL STACKS (TPY)	TOTAL FUGITIVES (TPY)	TOTAL PLANT (TPY)	TOTAL STACKS (TPY)	TOTAL FUGITIVES (TPY)	TOTAL PLANT (TPY)
TOTAL SUSPENDED PARTICULATE	393	347	740	217	38	254	513	113	626	434	59	493
SULFUR DIOXIDE	13921	4331	18302	10394	3211	13604	14502	7534	22036	25887	2097	27984
ARSENIC COMPOUNDS	7.24	1.36	8.60	3.95	3.36	7.31	0.65	0.15	0.79	0.93	0.28	1.21
LEAD COMPOUNDS	19.21	2.92	22.13	5.99	6.87	12.86	0.28	0.03	0.32	0.56	0.16	0.72
ANTIMONY COMPOUNDS	0.15	0.03	0.18	0.85	1.59	2.44	0.08	0.02	0.09	0.03	0.01	0.04
BERYLLIUM COMPOUNDS	0.05	0.01	0.06	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00
CADMIUM COMPOUNDS	0.10	0.05	0.15	0.34	0.76	1.10	0.40	0.08	0.46	2.44	0.75	3.19
CHROMIUM COMPOUNDS	0.07	0.02	0.09	0.01	0.00	0.01	0.03	0.01	0.05	0.03	0.01	0.04
COBALT COMPOUNDS	0.10	0.03	0.13	0.00	0.00	0.00	0.01	0.00	0.01	0.03	0.01	0.04
MANGANESE COMPOUNDS	0.07	0.02	0.09	0.00	0.01	0.01	0.00	0.00	0.01	0.05	0.01	0.06
MERCURY COMPOUNDS	0.00	0.00	0.00	0.02	0.01	0.03	0.00	0.00	0.00	0.00	0.00	0.00
NICKEL COMPOUNDS	0.08	0.02	0.10	0.02	0.00	0.02	0.56	0.11	0.68	0.02	0.00	0.02
SELENIUM COMPOUNDS	2.84	0.37	3.21	0.04	0.01	0.05	0.15	0.03	0.19	0.01	0.00	0.02
TOTAL HAPS (TPY)	29.92	4.83	34.75	11.22	12.61	23.82	2.15	0.45	2.61	4.10	1.23	5.33

values prior to the ESP rebuild, the particulate and metals emissions for the Main Stack Annulus reported by ASARCO-Hayden are almost certainly too high.

Copper Range: Values for the Main Stack at Copper Range-White Pine were based on an emissions characterization test program conducted for Copper Range Company by TRC Environmental Corporation in September of 1992 (final report issued on October 15, 1992).

Copper Range Company reported as "unknown" emissions from many stacks, including the two stacks carrying gases captured by the reverberatory furnace matte and slag tapping hoods (uncontrolled). Copper Range Company also reported converter building fugitive emissions as being unknown. The unknown values appear as "zeros" in Table 6.

Cyprus Miami: Cyprus Miami reported stack emissions (from the Vent Fume Stack and Acid Plant Stack) on the basis of nine monthly tests for particulate and metals conducted on the stacks from August, 1992 to April, 1993. The results of this testing are presented in Table 7.

Converter building fugitive emissions reported by Cyprus Miami were based on worst-case emissions estimates submitted with the installation permit for the Isa furnace, ratioed down by Cyprus Miami to reflect more normal operating conditions.

Kennecott-Utah Copper: Kennecott Utah Copper stack emissions (from the Main Stack) were based on analyses for metals conducted on the particulate sampling filters which are part of

Table 7. Cyprus Miami Emission Test Program Results (August 1992 - April 1993)
(Hourly Emissions Projected to 8760 hours/year)

CYPRUS MIAMI MINING CORPORATION

TRACE METAL EMISSION RATES

VENT FUME STACK TON/YR

ELEMENT	AUG 92	SEP 92	OCT 92	NOV 92	DEC 92	JAN 93	FEB 93	MAR 93	APR 93	Aug 92 to Apr 93 AVERAGE
Sb	0.09	0.00	0.14	0.10	0.64	0.11	0.11	0.05	0.02	0.14
As	0.00	0.17	0.80	0.74	0.94	0.21	0.35	0.77	0.71	0.52
Cd	0.22	0.29	0.49	0.18	0.64	0.15	0.23	0.66	0.04	0.32
Cr	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pb	1.80	1.59	7.74	3.94	12.82	5.12	3.96	4.13	3.42	4.94
Mn	0.09	0.10	0.09	0.18	0.00	0.00	0.00	0.00	0.25	0.08
Hg	0.00	0.00	0.00	0.10	0.02	0.00	0.00	0.04	0.01	0.02
NI	0.00	0.00	0.11	0.04	0.01	0.00	0.00	0.52	0.22	0.10
Se	0.00	0.02	0.01	0.04	0.13	0.01	0.00	0.00	0.00	0.02
Total HAPs	2.19	2.17	9.39	5.31	15.20	5.61	4.64	6.17	4.66	6.15
Total Particulate	47.4	32.4	59.6	66.9	136.7	45.7	26.1	71.9	140.0	69.7

ACID PLANT TAIL STACK TON/YR

ELEMENT	AUG 92	SEP 92	OCT 92	NOV 92	DEC 92	JAN 93	FEB 93	MAR 93	APR 93	AVERAGE
Sb	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
As	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Cd	0.00	0.00	0.00	0.73	0.00	0.00	0.00	0.00	0.01	0.08
Cr	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.01	0.00	0.01
Pb	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.01	0.00	0.01
Mn	0.04	0.03	0.02	0.00	0.00	0.00	0.00	0.02	0.02	0.02
Hg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.01	0.00
Se	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00
Total HAPs	0.04	0.03	0.02	0.84	0.02	0.01	0.00	0.07	0.05	0.12
Total Particulate	23.7	10.3	24.8	57.1	71.0	11.3	13.4	10.4	10.6	25.8

the continuous particulate sampling system at Kennecott Utah Copper. The main stack HAP emission values reported by Kennecott Utah Copper were based on the average of all the values obtained from the metals analyses on the filters, not on the maximum of the values.

Converter building HAP emissions reported by Kennecott Utah Copper are based on informal testing conducted at the discharge of the converter building ventilation fans.

Magma Copper Company: Stack HAP emissions reported by Magma Copper Company are based on stack total particulate testing conducted in 1994, and engineering estimates for HAP metals concentrations measured at the roof fan emissions.

Converter building fugitive HAP emissions that are reported are based on measurements of emissions through the roof ventilators.

All sulfur dioxide emissions reported by Magma Copper Company in the Section 114 Information Request response were based on average values recorded by continuous emissions monitors for the 1992 calendar year. Magma Copper Company is the only primary copper smelter that has continuous emission monitors for measuring converter building fugitive sulfur dioxide emissions.

Subsequent to transmitting the original Section 114 Information Request response in 1993, Magma Copper Company overhauled the gas cooling tower. This work was performed in late 1993 and early 1994 and resulted in a significant decrease in sulfur dioxide emissions from the converter building, and also resulted in a decrease in sulfur dioxide emissions from the Converter (secondary hoods) Stack. The effects of the modification on sulfur dioxide emissions can be seen in Table 8.

A further major modification in the form of the start up of a third sulfuric acid plant occurred in April 1994. With the added capacity, Magma increased the draft flow in their converter primary hoods significantly by pulling all of the dilution air needed for maintaining the SO_2 concentrations going to the three acid plants. Magma has monitored SO_2 concentrations flowing through the seven ventilation fans in the roof of their converter building for several years and have fugitive emissions data before and after the increase in primary hood flows. The before and after data indicate that a 60+% decrease in fugitive SO_2 emissions and associated HAP containing particulate occurred with the increase in primary hood draft. Table 8 shows the monthly data for both SO_2 and associated metal HAPs before and after the change in April 1994.

Phelps Dodge-Chino Mines: Reported stack emissions of HAPs were based on particulate and metals testing conducted on the Main Stack by SEACOR in July 1993.

Reported fugitive emissions of HAPs were based on the assumption that fugitive HAP emissions were equal to 21 percent of the HAP emissions measured in the Main Stack. The 21 percent value was based on 1988 and 1989 sulfur dioxide fugitive emissions studies that indicated that 21 percent of fugitive

TABLE 8

EMISSIONS DATA FROM MAGMA COPPER

MONTH	CONV STACK SO_2 LBS/HR	ROOF SO_2 LB/HR	TOTAL TPY As	TOTAL TPY Pb
February 93	2250	1372	3.3	4.4
March 93	1089	1288	4.3	5.9
April 93	1389	1994	5.6	8.0
May 93	911	1887	6.2	8.9
June 93	617	1556	5.6	8.0
July 93	892	1519	5.0	7.1
August 93	696	1503	4.9	7.0
September 93	1053	2208	8.8	12.9
October 93	1032	2379	10.6	15.8
November 93	978	1700	4.3	6.0
December 93	1226	1124	3.6	4.9
January 94	1086	1207	4.8	6.7
February 94	750	1241	4.5	6.3
March 94	492	874	6.6	9.5
April 94	583	519	3.1	4.1
May 94	634	409	2.6	3.4
June 94	594	311	2.2	2.7
July 94	411	288	2.6	3.2
August 94	589	309	2.1	2.6
September 94	492	685	6.5	9.6
October 94	614	583	6.8	5.2
November 94	558	883	5.9	9.4
December 94	553	553	2.3	1.9
January 95	519	550	6.8	7.3

NOTE: All monthly arsenic and lead emissions, except October 1994 are based on actual dust tonnages and estimated dust and stack assays. The November and December 1994, and January 1995 values are based on actual assays of captured dust.

TABLE 8 (CON'T)

Reductions in Emissions Related to Increased Primary Hood Flow Beginning April 1994

	Prior to 4/94	**After 4/94**	**% Reduction**
Roof SO_2	1390 lb/hr	509 lb/hr	63
Converter stack SO_2	1033 lb/hr	555 lb/hr	46
Total As	5.6 ton/yr	4.1 ton/yr	27
Total Pb	7.9 ton/yr	4.9 ton/yr	38

(i.e., non-process) sulfur dioxide streams at Phelps Dodge-Chino Mines are not captured.

Phelps Dodge-Hidalgo: Phelps Dodge-Hidalgo reported stack emissions of HAPs based on stack sampling for total suspended particulate conducted in June 1989, and engineering judgement of HAP content.

Phelps Dodge-Hidalgo reported sulfur dioxide emissions from the main stack based on sulfur dioxide continuous emission monitoring (CEM) data, and sulfur dioxide emissions from the converter building based on sulfur dioxide mass balances.

3.2 Evaluation of Major Source Status

Title III, Section 112 of the 1990 Clean Air Act Amendments lists 189 Hazardous Air Pollutants. Section 112 of the Amendments further defines a "major source" of hazardous air pollutants as "... a stationary source or group of stationary sources located within a contiguous facility and under common control that emits or has the potential to emit considering controls, in the aggregate, 10 tons per year or more of any hazardous air pollutant or 25 tons per year or more of any combination of hazardous air pollutants."

There are several issues in this definition which are pertinent to the primary copper smelting industry. These issues are discussed below.

1) Lead Compounds as a Hazardous Air Pollutant (HAP) Versus Elemental Lead as a Criteria Pollutant: Title III, Section 112

identifies "Lead Compounds" as a Hazardous Air Pollutant. However, elemental lead is a criteria pollutant, for which a National Ambient Air Quality Standard (NAAQS) exists. This fact is recognized by additional wording in Section 112 which states that "The Administrator may not list elemental lead as a hazardous air pollutant under this subsection."

2) Emissions of Metallic Compounds Versus Emissions of Metallic Elements: All metals listed as hazardous air pollutants in the 1990 Clean Air Act Amendments are listed as metallic compounds. For instance, Cadmium is listed as "Cadmium Compounds," Chromium as "Chromium Compounds," Manganese as "Manganese Compounds," etc. However, no EPA testing Reference Method currently exists to identify the actual form of an emitted metallic compound. Instead, the emission rates of metallic compounds are typically expressed in terms of the elemental metal emission rate, such as "two (2) tons per year of cadmium compounds, expressed as elemental cadmium."

3) Actual Emissions Versus "Potential to Emit:" There is no question, if a source has actual emissions greater than 10 tons per year of any one hazardous air pollutant or 25 tons per year of any combination of hazardous air pollutants, that the source is a "major source." However, if a source has actual emissions less than 10 tons per year of any one HAP or 25 tons per year of any combination of HAPs, it might still be considered to have the "potential to emit" greater than 10 tons per year of any one HAP, or 25 tons per year of any combination of HAPs. In

other words, the "potential to emit" is greater than or equal to actual emissions.

Historically, a source's "potential to emit" has been defined in terms of the source's air pollution permit. Sources have been considered to have the "potential to emit" at rates up to whatever is allowed in the source's air permit.

The exact status and contents of air permits for all eight primary copper smelters has not been determined. However, partial copies of the installation permits for the Cyprus Miami Isasmelt® modification and the ASARCO-El Paso CONTOP® modification were obtained and reviewed.

Attachment C-1 to the Cyprus Miami Mining Corporation Installation Permit (Number 1232, dated 3/13/92) allows total plant-wide (stacks plus fugitives) emissions of 149.77 tons per year (TPY) of lead. The total allowable emissions for this lead is 149 TPY, which is greater than 10 TPY of a single HAP. Therefore, from a review of the permit, the Cyprus Miami permit allows for the "potential to emit" greater than 10 TPY any one HAP or 25 TPY of any combination of HAPs.

The ASARCO-El Paso permit (Number 20345, dated 5/1/92) contains a Special Provision number 58, which summarizes the allowable emissions after CONTOP installation to include a 14 TPY limit on lead emissions. Therefore, from a review of the permit, the ASARCO-El Paso permit allows for the "potential to emit" greater than 10 TPY of any one HAP.

4. DISCUSSION OF CONTROLS

4.1 Description

4.1.1 Acid Plants (Acid Plant Particulate Controls)

All plants, including future modifications at Copper Range, have acid plants for sulfur dioxide control. Acid plants, which utilize catalysts to transform sulfur dioxide into sulfuric acid, have extensive particulate controls in order to protect the catalysts from particulate fouling. These particulate controls typically consist of a dry (plate/wire) ESP, a scrubber (to further remove particulate and to lower gas temperature to 120-160 degrees Fahrenheit), and a wet (tube/wire) acid mist ESP (to remove sulfuric acid and volatile heavy metals that condense during the cooling process). The result of the particulate controls utilized to protect the acid plant catalyst is essentially "perfect" control of HAP metals. In almost all cases, combined emissions of all HAP metals in acid plant tail gases are less than 0.1 tons per year.

Acid plants are utilized to control process gases from smelting furnaces/vessels, and from converter primary hoods. Cyprus-Miami also controls process gas from its electric furnace with acid plant controls.

4.1.2 Electric Slag Cleaning Vessel (ESCV)

Two plants (ASARCO-Hayden and Phelps Dodge-Hidalgo) have electric slag cleaning vessels. ASARCO-Hayden has a scrubber. Phelps Dodge-Hidalgo used to route ESCV gases through a scrubber, but the gases are now routed to the acid plant.

Uncontrolled slag cleaning furnaces are not significant sources of sulfur dioxide, particulate, or HAPs, compared to converter operations.

4.1.3 Hooding

All plants have hooding at all smelting furnace/vessel matte and slag tapping points.

Six of the eight plants have both primary and secondary hoods on Pierce-Smith converters. Cyprus-Miami has Hoboken (siphon) converters, which do not have hooding associated with them. The modified Kennecott plant is using flash converting which eliminates the converter primary and secondary hoods. Copper Range converters will have both primary and secondary hoods installed as part of the planned modifications. A summary of converter hooding arrangements, and controls associated with converter hooding, is given in Table 9.

4.1.4 Controls for Non-Process Gases

Table 10 summarizes controls associated with non-process gases. Non-process gases include those associated with slag- and matte-tapping for the smelting furnace/vessel, and converter secondary hood gases. Notes about controls at specific plants are given below.

Table 9. Converter Hooding and Associated Controls at Primary Copper Smelters

Plant	Primary Hood Type Control	Secondary Hood Type Control	Tertiary Hood Type Control	Converter Building Ventilation to Atmosphere
ASARCO - El Paso	Vertical Sliding Acid Plant (1)	Fixed Air Curtain Baghouse	Full Building Baghouse	Forced Draft thru Baghouse
ASARCO - Hayden	Vertical Sliding Acid Plant (1)	Vertical Sliding ESP	None	Natural Draft
Copper Range, White Pine	Vertical Sliding None (2)	None (3)	None	Forced Draft
Cyprus Miami	None (4)	None (4)	None (4)	Natural Draft
Kennecott (5)	Vertical Sliding Acid Plant (1)	Fixed None	Part Building None	Forced Draft
Magma	Vertical Sliding Acid Plant (1)	Vertical Sliding ESP	None	Forced Draft
Phelps Dodge - Chino Mines	Vertical Sliding Acid Plant (1)	Horizontal Sliding None (6)	None	Natural Draft
Phelps Dodge - Hidalgo	Vertical Sliding Acid Plant (1)	Fixed (7) None (7)	None	Natural Draft

(1) Prior to an acid plant, gases typically pass through dry electrostatic precipitators (ESPs), scrubbers (or coolers), and acid mist-ESPs.

(2) Copper Range plans to intall a high-energy scrubber and acid mist ESP to control converter hood gases in 1994.

(3) Copper Range does not have a secondary hood. However, due to the relatively high primary hood flowrate, and the distance of the primary hood from the converter, the primary hood probably performs somewhat like a secondary hood.

(4) Cyprus Miami has Hoboken (siphon) converters, rather than the Peirce-Smith converters utilized at the other seven plants. Hoboken converters are designed such that the converter itself functions as a hooding system. Process gases from the converter go (through ESPs and coolers) to an acid plant.

(5) Kennecott is constructing a new smelter, which will have flash-converting, and will eliminate ladle transfers of molten metal. Completion is planned for July 1995.

(6) Phelps Dodge-Chino Mines is considering particulate controls for secondary hood gases.

(7) Phelps Dodge - Hidalgo is planning an upgrade of converter hooding (in 1994) that will include movable secondary hoods, with captured gases controlled by a baghouse.

ASARCO-El Paso: ASARCO-El Paso has a baghouse that receives combined flows from the converter secondary hoods and converter building evacuation system (tertiary hood).

ASARCO-Hayden: ASARCO-Hayden has a single electrostatic precipitator, the Ventilation Gas Cottrell, which receives gases from the secondary hoods, matte- and slag-tapping hoods, and from the outlet of the fluidized bed dryer baghouse.

The Ventilation Gas Cottrell underwent a series of modifications and a rebuild during 1992 and 1993. The rebuild consisted of replacing all the existing carbon steel collecting plates with heavier-gauge stainless steel plates. Also, the high-voltage wire electrodes were replaced with a special shrouded electrode design, intended to reduce wire breakage. The cost of this rebuild was $800,000. Other modifications included replacement of (PCB-containing) transformer/rectifiers and replacement of transformer/rectifier controls.

At present, ASARCO-Hayden and Magma-San Manuel utilize ESPs to control particulate matter (PM) in the gases captured by the converter secondary hoods and furnace matte and slag tapping hoods. A comparison of design characteristics of the ASARCO-Hayden Ventilation Gas Cottrell (ESP) with ESPs at Magma-San Manuel is given in Table 11.

Copper Range Company: Copper Range Company had no controls for slag- or matte-tapping hoods; emissions captured by these hoods were vented directly out individual stacks. Copper Range Company also had no secondary hooding system. However, the

Table 10. Controls Associated with Non-Process Gas Streams

Plant	Non-Process Gas Stream(s)	(Current) Control Device Identification	Comments
ASARCO- El Paso	1) Converter secondary hooding. 2) Converter Tertiary (Converter Building Evacuation) hooding 3) Contop Reactor Matte and Slag Tapping Hooding.	Converter Building Baghouse	The outlet from the feed system baghouse also enters the converter building baghouse.
ASARCO- Hayden	1) Converter Secondary Hooding. 2) Inco Furnace Slag and Matte Tapping Hooding. 3) Inco Slag Return Hooding. 4) Electric Slag Cleaning Vessel Hooding.	Ventilation Gas ESP (Cottrell)	Rebuilt in March 1993. Post-rebuild particulate emission rate of 12 lb/hr represents a collection efficiency of 95 percent (for an input rate of 256 lb/hr).
Copper Range	1) Matte and Slag Tapping Hooding.	Uncontrolled	Have two stacks (East and West) for captured matte and slag tapping gases.
Cyprus Miami	1) Electric Furnace Matte and Slag Tapping Hooding. 2) Isa Smelting Vessel Launder Hooding.	40 Caustic Packed-Bed Ventilation Fume Scrubber	Low differential pressure (approximately 3 inches). Intended for sulfur dioxide (not particulate) removal.
Kennecott	1) Converter Secondary Hooding. 2) Partial Tertiary (Reactor/Converter Building Roof) Hooding. 3) Noranda Reactor Matte and Slag Tapping Hooding.	Uncontrolled	Modernized smelter (scheduled for completion in July, 1995) will eliminate need for converter hooding.
Magma	1) Converter Secondary Hooding. 2) Outokumpu Furnace Matte and Slag Tapping Hooding.	1) Converter ESP 2) Flash Furnace Fugitives ESP	Calculated (December 1993) inlet particulate mass flow rates to the Converter ESP and the Flash Furnace Fugitives ESP of 36 and 53 lb/hr, respectively. Magma will be performing outlet tests on these ESPs, possibly in late-1994.
Phelps Dodge - Chino Mines	1) Converter Secondary Hooding. 2) Inco Furnace Matte and Slag Tapping Hooding. 3) Converter Slag Return Hooding. 4) Oxygen Burner Hooding.	Uncontrolled	Considering particulate controls for gases captured by the converter secondary hooding, and furnace matte and slag tapping hooding.
Phelps Dodge - Hidalgo	1) Converter Secondary Hooding. 2) Flash Furnace Matte and Slag Tapping Hoods. 3) Electric Furnace Matte and Slag Tapping Hoods.	1) Converter Baghouse 2) Flash Furnace/ESCV Baghouse	Converter secondary hooding, and matte and slag tapping hooding, will be controlled by (separate) baghouses, beginning in 1994.

converter hoods at Copper Range Company probably served, to some extent, as both primary and secondary hoods.

Gases captured by the converter hoods at Copper Range Company were currently vented directly to the atmosphere (without control), through the main stack. However, Copper Range shut down in 1995 to install major modifications as part of a Consent Decree with EPA and the State of Michigan.

Cyprus Miami: Cyprus Miami has a ventilation gas scrubber that handles gases from the Isa vessel launder-hoods, and the electric furnace matte- and slag-tapping. The scrubber was designed for sulfur dioxide removal, rather than particulate removal. The scrubber differential pressure is nominally 3 inches of water, which would be classified as a "low-energy" scrubber (not expected to be very efficient for particulate removal).

Kennecott Utah Copper: There are no controls for non-process gases at the Kennecott Utah Copper smelter. Gases from the matte- and slag-tapping hoods, converter secondary hoods, and building roof fans above the converters, Noranda reactors, and waste heat boilers are all vented directly (without controls) to the main stack.

The modernized Kennecott Utah Copper smelter, which is anticipated to be operating in 1995, will include both flash smelting and recently developed flash converting. Both the flash smelting furnace and the flash converter will operate continuously (not in batches) and will produce a steady, high-strength offgas, which will enable the new double-contact acid plant to achieve very high sulfur capture efficiency. The flash converter will eliminate ladle transfers of molten metals, because its feed is cooled, granulated matte. Both the flash furnace and flash converter will be connected directly to the gas handling system, preventing most fugitive emissions and eliminating the need for separate primary hoods and converter secondary hoods. Potential secondary emissions sources will be hooded and ventilated to further minimize fugitive emissions. Gases captured by these hoods will be treated by a baghouse to remove particulate matter and a wet scrubber to remove SO_2.

Magma: Magma-San Manuel has one ESP for secondary converter hood gases, and one ESP for flash furnace fugitive gases.

At present, ASARCO-Hayden and Magma San Manuel are the only plants that utilize ESPs to control particulate matter in the gases captured by the converter secondary hoods and furnace matte and slag tapping hoods. Table 11 summarizes the design characteristics of the Magma Converter (Secondary Hoods) ESP, the Magma Flash Furnace Fugitives ESP, and the ASARCO-Hayden Ventilation Gas Cottrell (ESP).

Phelps Dodge-Chino Mines: There are no controls for the gases captured by the secondary hoods, or matte- and slag-tapping hoods. Gases captured by these hoods are vented directly to the atmosphere through the main stack. Chino is considering adding controls to the secondary hood system.

Table 11. Comparison between non-process ESPs at Magma-San Manuel and ASARCO-Hayden

ESP Location and Description	Gas Flowrate (DSCFM)	Total Collection Area (sq ft)	Corona Power (Watts)	Specific Collection Area (sq ft/ 1000 DSCFM)	Specific Corona Power (Watts/ 1000 DSCFM)	Number of Fields	Number of Transverse Chambers	Comments
ASARCO-Hayden Ventilation Gas Cottrell (ESP)	433,500	83,328	96,900	192	224	3	8	Rebuilt, March 1993. Post-rebuild particulate emission rate of 12 lb/hr represents collection efficiency of 95 percent, (for inlet of 256 lb/hr).
Magma-San Manuel Converter (Secondary Hoods) ESP	230,000 (AVERAGE)	59,940	10,500	261	46	3	1	Calculated inlet particulate load of 38 lb/hr (December 1993). Magma will be testing outlet, possibly late-1994.
Magma-San Manuel Flash Furnace Fugitives ESP	150,000	101,520	45,000	677	300	4	1	Calculated an inlet particulate load of 53 lb/hr. Magma will be testing outlet, possibly late-1994.

Comments:

1) In general, larger specific collection areas promote higher collection efficiencies.
2) In general, higher specific corona powers promote higher collection efficiencies.
3) In general, more fields promote higher collection efficiencies.
4) ASARCO-Hayden's eight transverse chambers allow the Ventilation Gas Cottrell to be serviced while the ESP is still on-line. Both Magma ESPs must be bypassed during servicing.
5) Flow through the Magma Converter ESP was reported to be 160,000 to 300,000 dscfm. An average value of 230,000 dscfm was utilized to calculate specific collection area and specific corona power.
6) Corona power for Magma-San Manuel ESPs was calculated based on a secondary voltage of 30 kV.
7) Corona power for ASARCO-Hayden was based on measurements made by ASARCO on 11/3/93.

Phelps Dodge-Hidalgo: Gases captured by the converter secondary hoods, are treated by lime injection followed by a baghouses for particulate removal prior to venting to the main stack. Matte- and slag-tapping hoods gases are passed through a separate baghouse and vented to the main stack. ASARCO-El Paso and Phelps Dodge-Hidalgo are two plants that use baghouses to control converter secondary hood emissions.

4.2 Evaluation of Effectiveness

4.2.1 Acid Plant Particulate Controls

As is discussed in Section 4.1.1, all smelters with acid plants have extensive particulate controls, in order to protect the catalysts from particulate fouling. These particulate controls typically consist of a dry (plate/wire) ESP, a scrubber (to further remove particulate and to lower gas temperature to 120-160 degrees Fahrenheit), and a wet (tube/wire) acid mist ESP (to remove sulfuric acid and volatile heavy metals that condense during the cooling process). The result of the particulate controls utilized to protect the acid plant catalyst is essentially "perfect" control of HAP metals, with HAP metal control efficiencies of greater than 99.9 percent. In almost all cases, combined emissions of all HAP metals in acid plant tail gases are less than 0.1 tons per year. This can be seen in Table 7, presented earlier, which presents the results of 9 sets of monthly tests for HAP metals in the Acid Plant Tailstack at Cyprus Miami. The average combined HAP emission rate for the nine monthly tests is 0.057 tons per year, and only one of the nine monthly tests has combined HAP metal emission rates greater than 0.1 tons per year.

4.2.2 Electric Slag Cleaning Vessel Scrubber

Two of the eight plants have electric slag cleaning vessels (ASARCO-Hayden and Phelps Dodge-Hidalgo). The ASARCO-Hayden plant uses a scrubber, but the Phelps Dodge-Hidalgo plant sends the gases to the acid plant. Uncontrolled emissions from ESCV's are not significant in terms of HAPs, when compared to converter operations.

4.2.3 Hooding

Hooding capture efficiencies for furnace matte- and slag-tapping hoods are not available at any of the smelters. However, based on observations of the furnace matte and slag tapping hoods at all of the smelters, it is believed that the capture efficiencies are probably greater than 90 percent. This is because all matte and slag tapping hoods have a "doghouse" directly above ladle parking areas, as well as hooding or covers for launder transfers. It should also be noted that furnace/reactor matte tapping and slag tapping processes are not large sources of sulfur dioxide and particulate emissions, when compared to converter processes. For example, particulate and sulfur dioxide measurements on the matte tapping and slag tapping ducts at ASARCO-Hayden indicated mass flows of 35.6 and 238 lb/hr, respectively. This compares with converter secondary hood mass flows of 172 and 4871 lb/hr, respectively.

Converter hooding capture efficiencies may be calculated for many of the smelters. Table 12 presents calculated converter hooding capture efficiencies for smelters for which information is available. Hooding capture efficiencies have been calculated based on sulfur dioxide emissions from the converter building, and sulfur dioxide mass flows in the converter secondary and primary hooding ducts. Calculated sulfur dioxide flows in the primary hood ducts are based on copper matte input rates and sulfur concentrations, minus sulfur dioxide flows in the secondary hood ducts, tertiary hood ducts, and building fugitives. Secondary hood duct sulfur dioxide mass flows were typically based on continuous emission monitoring data.

Table 12 shows that ASARCO-El Paso has the highest overall converter hooding sulfur dioxide capture efficiency of any of the smelters, with an overall capture calculated at 99.99 percent (i.e. a penetration of 0.01 percent). This is not surprising, because ASARCO-El Paso has converter "tertiary" hooding consisting of total converter building enclosure and converter building ventilation, in addition to primary hoods and air curtain secondary hoods. The next highest calculated overall

TABLE 12. SULFUR DIOXIDE (SO$_2$) MASS FLOW IN DUCTS, AND RESULTANT CALCULATED HOOD CAPTURE EFFICIENCIES

Smelter	Primary Hoods SO$_2$ Flow (lb/hr)	Secondary Hoods SO$_2$ Flow (lb/hr)	Tertiary Hoods SO$_2$ Flow (lb/hr)	Building Fugitives SO$_2$ Flow (lb/hr)	Pri Hood Capture Efficiency (percent)	Sec Hood Capture Efficiency (percent)	Tert Hood Capture Efficiency (percent)	Overall Capture Efficiency (percent)
Asarco - El Paso	Unknown	Unknown	Unknown	1	Unknown	Unknown	Unknown	Unknown
Asarco - Hayden	64,000	2,848	N/A	2,703	92	51	N/A	96.1
Copper Range	14,623	N/A	N/A	Unknown	Unknown	N/A	N/A	Unknown
Cyprus - Miami	Unknown	N/A	N/A	903	Unknown	Unknown	N/A	Unknown
Kennecott	Unknown	Unknown	Unknown	1,305	Unknown	Unknown	Unknown	Unknown
Magma	56,690	1,008	N/A	733	97	58	N/A	98.7
PD - Chino	33,000	2,400	N/A	2,000	88	55	N/A	94.7
PD - Hidalgo (rev)	32,300	3,115	N/A	2,076	86	60	N/A	94.4

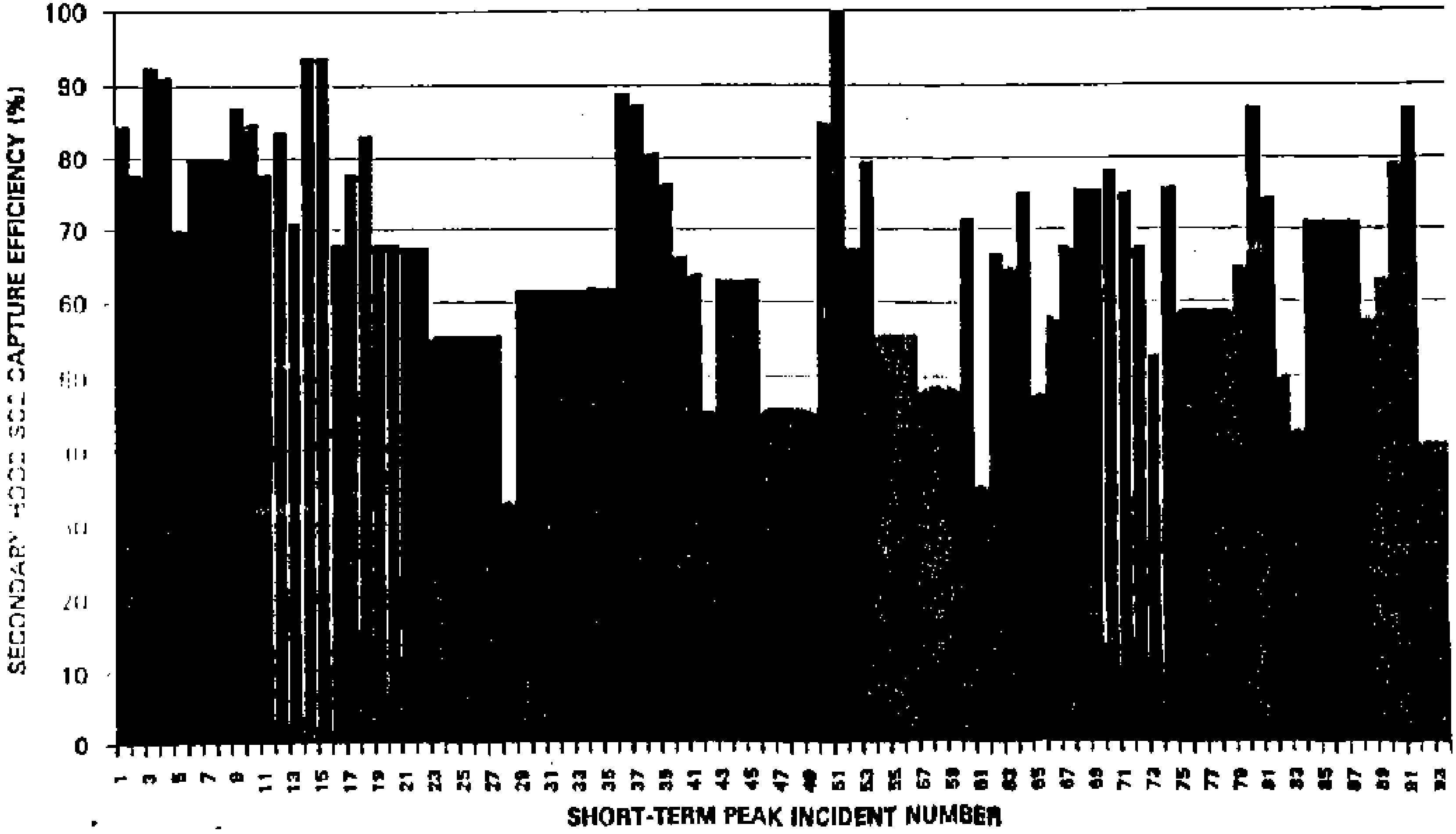
converter hooding capture efficiency is for Magma Copper Company, from 11/21/93 to 11/30/93, with a capture efficiency of 98.5 percent (penetration of 1.5 percent). It should be noted that the high overall sulfur capture efficiency exhibited by Magma is due to the significant increase in converter primary hooding capture efficiency that resulted from cleaning the gas cooling tower from November 15-20, 1993. Further improvements in capture efficiency are evident with the introduction of the third sulfuric acid plant, and the accompanying increase in primary hood draft rate.

It should be noted that hooding capture efficiency is not constant, but changes over time. Figure 17 shows the secondary hooding capture efficiencies for Magma during selected periods in the 1989-1991 time period. The selected periods represent 93 one-hour measurements. The capture efficiencies were calculated by RTI from data supplied by Magma to the State of Arizona. Magma reported hourly sulfur dioxide emissions from all emissions locations (including the converter building and converter secondary hoods stack), for incidents in which the ambient (off-site) sulfur dioxide concentrations exceeded one part per million for six minutes. The secondary hood capture efficiency was calculated by dividing the sulfur dioxide emissions from the converter (secondary hoods) stack by the sum of the emissions from the converter stack and the converter building. The average capture efficiency over these periods was approximately 67 percent.

4.2.4 Controls for Non-Process Gases

ASARCO-El Paso: ASARCO-El Paso has a baghouse that treats streams from the converter secondary hoods, converter tertiary hood (converter building evacuation system), and matte- and slag-tapping hoods. The baghouse particulate and HAP collection efficiency is not specifically known, but would be expected to be 99% or greater. Based on December 1993 performance testing, the average outlet particulate flow was 23 lb/hr from the converter building baghouse.

Figure 17- Magma Converter Secondary Hood Capture Efficiency
During Short-Term Ambient SO2 Peaks
(February 1989 - September 1991)



ASARCO-Hayden: ASARCO-Hayden has a Ventilation Gas Cottrell (ESP) that handles flows from the converter secondary hoods, INCO furnace and electric slag cleaning vessel matte- and slag-tapping hoods, and from the fluidized bed dryer baghouse outlet. In in-house testing conducted by EEMC in September 1991, ASARCO measured the total suspended particulate flows from these streams to be 172.5, 35.6, 34.5, and 13.5 lb/hr, respectively. These values result in a calculated input to the ESP of 256 lb/hr.

The ASARCO-Hayden plant has a continuous particulate sampling system at the outlet of the Ventilation Gas Cottrell. From the sampling system, monthly-average particulate emissions can be determined. Figure 18 presents both the monthly-average particulate emissions (reported in lb/hr), and the calculated efficiency, based on an inlet particulate mass flow of 256 lb/hr. Over the six months from April 1993 to September 1993, the average particulate emission rate was approximately 12 lb/hr, representing a collection efficiency of approximately 95 percent, based on 256 lb/hr at the ESP inlet.

Copper Range: Copper Range does not have controls for the reverberatory furnace matte or slag tapping hoods.

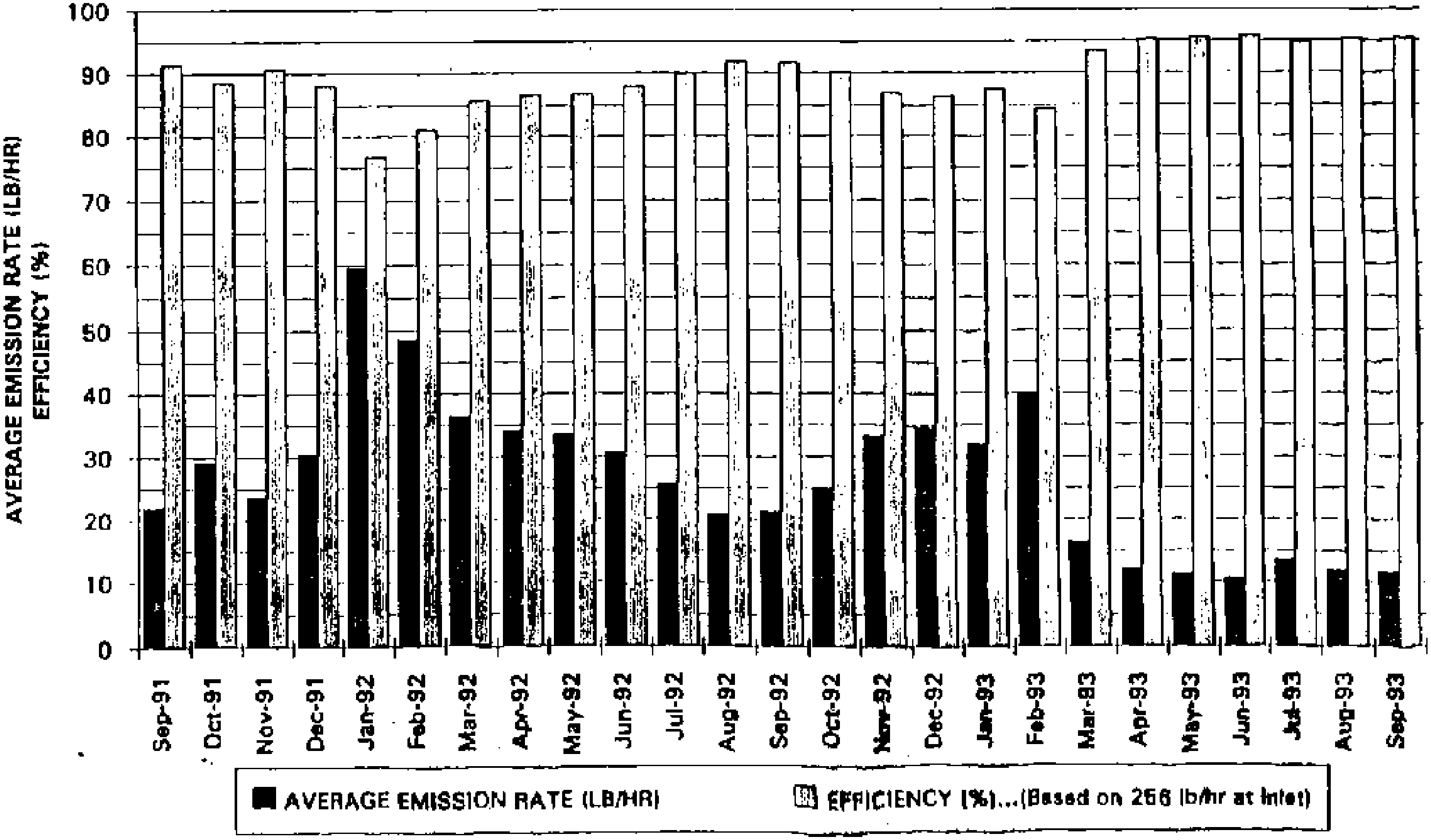
At present, Copper Range also does not have controls for the converter hoods. However, the modernized plant will have controls when it starts back up, based on the Consent Decree.

Cyprus Miami: The Ventilation Gas Scrubber at Cyprus Miami handles gases from the Isa vessel launder hooding and electric furnace matte and slag tapping hooding.

Kennecott-Utah: Gases captured by the converter secondary hoods, partial tertiary hood (i.e., partial converter building evacuation) and Noranda reactor slag- and matte-tapping hoods are sent to the main stack without controls at the existing Kennecott Utah Copper smelter.

The modified Kennecott smelter that is expected to be operating in 1995 will have no ladle transfers of molten metal, and will therefore not require converter secondary hoods.

Figure 18- Ventilation Gas Electrostatic Precipitator (Cottrell) Performance at ASARCO - Hayden.



Magma Copper Company: Magma has one ESP to control gases captured by the converter secondary hoods, and one ESP to control gases captured by the flash furnace fugitives (matte tapping and slag tapping) hoods. The collection efficiencies of these ESP's have not been measured.

Phelps Dodge-Chino Mines: Non-process gases (including those captured by the matte- and slag tapping hoods, and converter secondary hoods) are currently sent to the Main Stack without controls. However, Phelps Dodge-Chino Mines is considering particulate controls for these gas streams.

Phelps Dodge-Hidalgo: In 1994, Phelps Dodge-Hidalgo installed separate baghouses to treat gases from both the converter secondary hoods, and matte and slag tapping hoods. Both these baghouses are expected to have overall particulate collection efficiencies greater than 99 percent.

5. PLANT INPUT IMPURITIES

Table 13 summarizes the plant input impurity data for the 1992 calendar year. The data are expressed in terms of total input impurity mass inputs. Also included (in parentheses) in Table 13 are the total mass inputs to the smelters. In both cases the reported masses do not include internal plant recycle streams. The data in Table 13 can be expressed in terms of input impurity percentages, as shown in Table 14. All plant input impurity values in Table 14 represent data for the 1992 calendar year, except for data from Cyprus Miami. The Cyprus Miami data reflect input impurities during Performance Testing performed at the plant on December 8-9, 1992. In all cases, plant input impurities include all inputs to the smelters from outside sources, but do not include internal plant recycle impurities.

In the Section 114 Information Request, all smelters were asked to provide breakdowns of plant input impurities on a per-mine, or per-source, basis. Analysis of these breakdowns indicated that certain input sources could significantly affect total plant impurity inputs. An example of how a single high-impurity source can significantly impact overall plant impurity inputs is illustrated by ASARCO-Hayden. In 1992, ASARCO-Hayden received lead "speiss" from the ASARCO-East Helena, Montana lead smelter. Although the lead speiss represented only 0.7 percent of the total plant mass input (5,084 tons of 767,253 tons), it represented 80 percent of the lead input (681 tons of 851 tons), 61 percent of the arsenic input (523 tons of 851 tons), and 74 percent of the antimony input (430 tons of 578 tons).

Plant input impurities can change over time. These input impurity changes can vary over any length of time, from hourly to annually. One way to get an idea of the variations in input impurities over time is to examine reports submitted under the current (Primary Copper Smelter) Arsenic NESHAP. The current Arsenic NESHAP requires all the smelters to submit annual summaries of arsenic contained in matte charged to the converters.

Table 15 summarizes 1992 arsenic charge reports for most of the smelters (the arsenic charge reports for both Phelps Dodge plants were claimed to be Confidential Business Information). Multi-year arsenic charge data were available for Copper Range Company and Kennecott Utah Copper. These data are summarized in Table 16. From Tables 15 and 16, it can be seen that there are monthly and annual variations in arsenic inputs to smelters. Similarly, it can be expected that other (potential HAP-generating) input impurities vary over time.

Table 13. 1992 Smelter Concentrate Input Impurities

	AS (TONS)	PB (TONS)	SB (TONS)	BE (TONS)	CD (TONS)	CR (TONS)	CO (TONS)	MN (TONS)	HG (TONS)	NI (TONS)	SE (TONS)
ASARCO - EL PASO (366,269 TONS)	760	1861	385	N	78	N	N	N	N	134	22
ASARCO - HAYDEN (787,259 TONS)	851	1420	578	77	70	88	201	94	1	121	1
COPPER RANGE (240,742 TONS)	31	33	25	25	26	27	8	139	1	6	19
CYPRUS MIAMI (2)											
KENNECOTT (580,238 TONS)	(880)	(934)	(69)		(9)	(207)					(1)
MAGMA (1,300,000 TONS) (3)	1169	871	287	3	42	61	149	80	3	42	137
PHELPS DODGE - CHINO MINES (876,697 TONS)	58	276	31	33	101	5	131	90	0	41	66
PHELPS DODGE - HIDALGO (783,340 TONS)	184	360	49	1	67	121	87	132	1	32	4

(1) Values in parenthesis are total plant mass inputs (concentrates, reverts from other plants, flux, coal, etc.).

Table 14. 1992 Smelter Concentrate Input Impurities

	AS	PB	SB	BE	CD	CR	CO	MN	HG	NI	SE
	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
ASARCO - EL PASO	0.207	0.451	0.100		0.021					0.037	0.006
ASARCO - HAYDEN	0.111	0.186	0.075	0.010	0.009	0.011	0.026	0.012	0.000	0.016	0.000
COPPER RANGE	0.012	0.013	0.010	0.010	0.010	0.011	0.003	0.056	0.000	0.002	0.008
CYPRUS MIAMI	0.033	0.100	0.060	0.004	0.010	0.030	0.010	0.060	0.000	0.020	0.001
KENNECOTT	0.189	0.161	0.012		0.002	0.036					
MAGMA	0.088	0.065	0.020	0.000	0.003	0.004	0.011	0.008	0.000	0.003	0.010
PHELPS DODGE - CHINO	0.008	0.041	0.005	0.005	0.016	0.001	0.019	0.013	0.000	0.006	0.008
PHELPS DODGE - HIDALGO	0.021	0.046	0.008	0.000	0.009	0.016	0.011	0.017	0.000	0.004	0.001

(1) Cyprus Miami percentages from Particulate Performance Testing, December 8-9, 1992.

(2) Magma percentages based on estimated total plant input.

TABLE 15. Summary of Converter Arsenic Charge Reports for 1992

	1992		1992		1992		1992		1992		1992	
	ASARCO - EL PASO		ASARCO - HAYDEN		COPPER RANGE		CYPRUS MIAMI		KENNECOTT		MAGMA	
	PERCEN	KG/HR	PERCENT	KG/HR	PERCENT	KG/HR	PERCENT	KG/HR	PERCENT	KG/HR	PERCENT	KG/HR
JANUARY	0.1	17.0	0.069	16.8	0.028	3.9	NOT OP.	NOT OP.	0.009	2.7	0.087	44.6
FEBRUARY	0.11	19.1	0.063	15.0	0.027	4.1	NOT OP.	NOT OP.	0.024	8.5	0.132	73
MARCH	0.13	21.2	0.058	14.0	0.023	3.8	0.012	3.9	0.02	6.2	0.128	67.4
APRIL	0.11	17.5	0.057	13.6	0.025	3.6	0.01	3.9	0.026	9.4	0.115	61.1
MAY	0.13	19.8	0.053	12.8	0.028	4.3	0.015	5.8	0.026	8.3	0.083	43.8
JUNE	0.1	14.9	0.060	14.4	0.021	3.3	0.003	1.2	0.073	21.9	0.093	49.5
JULY	0.1	15.4	0.063	15.7	0.017	3	0.018	6.5	0.07	24.3	0.148	77.6
AUGUST	0.11	17.0	0.063	14.7	0.027	4.6	0.02	6.5	0.076	28.5	0.12	83.7
SEPTEMBER	0.13	21.4	0.061	14.1	0.036	5.5	0.015	5.4	0.04	14.5	0.095	39.6
OCTOBER	0.126	18.5	0.065	15.1	0.033	5.3	0.016	5.9	0.07	21.2	0.088	48.8
NOVEMBER	0.126	17.8	0.063	14.3	0.046	7.3	0.018	6.5	0.049	19.8	0.062	32.5
DECEMBER	0.129	20.5	0.059	13.4	0.031	5.2	0.017	5.4	0.03	12.5	0.065	33
AVERAGE	0.117	18.3	0.061	14.5	0.029	4.5	0.014	5.1	0.043	14.8	0.101	62.9

1) Arsenic charge reports for Phelps Dodge-Hidalgo and Phelps Dodge-Chino Mines were claimed as Confidential Business Information (CBI).

Table 16- Multi-Year Arsenic Charge Reports for Copper Range Company and Kennecott Utah Copper

1992		1991		1990		1989		1988		1987			1992		1991	
COPPER RANGE		COPPER RANGE		COPPER RANGE		COPPER RANGE		COPPER RANGE		COPPER RANGE			KENNECOTT		KENNECOTT	
PERCENT	KG/HR	PERCENT	KG/HR	PERCENT	KG/HR	PERCENT	KG/HR	PERCENT	KG/HR	PERCENT	KG/HR		PERCENT	KG/HR	PERCENT	KG/HR
0.028	3.9	0.047	6.3	0.047	6.3	0.039	4.1	0.094	11	0.042	4.3		0.009	2.7	0.016	4.8
0.027	4.1	0.049	7.4	0.048	6.6	0.037	4.1	0.085	8.6	0.034	4.2		0.024	8.6	0.02	6.5
0.023	3.8	0.048	6.4	0.034	4	0.057	5.3	0.088	8.3	0.032	3.8		0.02	8.2	0.005	1.7
0.025	3.6	0.051	6.4	0.032	3.7	0.059	6.4	NOT OP.	NOT OP.	0.048	4.8		0.026	9.4	0.005	1.8
0.028	4.3	0.04	5.1	0.03	3.2	0.073	8	0.062	7.2	0.046	4.6		0.026	8.3	0.045	13.5
0.021	3.3	0.028	3.9	0.036	4.5	0.059	6.9	0.06	7.9	0.048	5.9		0.073	21.9	0.03	12.3
0.017	3	0.03	4.1	0.044	5.6	0.045	5.8	0.052	6	0.047	5.3		0.07	24.3	0.086	30.7
0.027	4.6	0.024	3.6	0.047	5.9	0.052	6.6	0.077	8.9	0.066	6.8		0.076	28.5	0.065	18.4
0.036	5.5	0.022	3.2	0.045	5.7	0.049	6.4	0.081	8.8	0.054	6.6		0.04	14.5	0.024	8
0.033	5.3	0.02	3.3	0.049	5.4	0.06	7.3	0.04	4.3	0.086	10.2		0.07	21.2	0.075	24.6
0.046	7.3	0.021	3.3	0.044	6	0.05	6	0.039	3.9	0.085	10		0.049	19.8	0.039	12.9
0.031	5.2	0.028	4	0.05	7	0.049	4.7	0.021	2.2	0.062	7.1		0.03	12.5	0.038	11.3
0.029	4.5	0.034	4.8	0.042	5.2	0.052	5.9	0.064	6.8	0.053	6.1		0.043	14.8	0.037	12.2

6. CONCLUSIONS AND RECOMMENDATIONS

An evaluation of all of the emissions data submitted from the smelters indicates that the stack emissions data was in all cases derived from actual measurements. However in the case of the fugitive HAP emissions, these are in most cases estimates and not actual measurements. The two current exceptions are the 1993 testing completed at ASARCO-El Paso as reported to EPA April, 1994 and the measurements being conducted at Magma at the converter building roof ventilators.

In order to make a determination of the major source status of the remaing smelters, more accurate measurements of fugitive HAPs must be made. Accurate fugitive measurements combined with the current stack testing results will allow EPA to determine the major source status of each plant and the industry.

Thus it is recommend that fugitive emissions measurements protocols be established at all operating smelters, measurements be made of HAP emissions and the results of this testing be reported to EPA.

Appendix H

Representative Copper Smelter Fugitive HAP Quantification Reports

TRC North American Weather Consultants

RESULTS OF A FUGITIVE PARTICULATE EMISSION STUDY AT ASARCO HAYDEN SMELTER

Report AQ 95-17

Project No. 16596

Prepared for

ASARCO, Inc.

By

George W. Wilkerson, CCM
and
William J. Hauze

TRC North American Weather Consultants
1293 West 2200 South
Salt Lake City, Utah 84119

November, 1995

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APPENDIX G

Metals Emission Estimates

Metal	Area	1995 tons/yr*
Antimony	Furnace (F)	0.39
	Converter (C)	0.93
	Anode (A)	0.37
	F + C	1.32
	F + C + A	1.70
Arsenic	Furnace (F)	5.75
	Converter (C)	10.12
	Anode (A)	16.71
	F + C	15.87
	F + C + A	32.58
Beryllium	Furnace (F)	0.05
	Converter (C)	0.19
	Anode (A)	0.03
	F + C	0.25
	F + C + A	0.28
Cadmium	Furnace (F)	0.28
	Converter (C)	0.54
	Anode (A)	0.30
	F + C	0.82
	F + C + A	1.13
Chromium	Furnace (F)	0.07
	Converter (C)	0.20
	Anode (A)	0.20
	F + C	0.26
	F + C + A	0.47
Cobalt	Furnace (F)	0.07
	Converter (C)	0.19
	Anode (A)	0.05
	F + C	0.27
	F + C + A	0.32
Lead	Furnace (F)	9.75
	Converter (C)	35.57
	Anode (A)	13.04
	F + C	45.32
	F + C + A	58.35
Manganese	Furnace (F)	0.08
	Converter (C)	0.22
	Anode (A)	0.06
	F + C	0.29
	F + C + A	0.35
Nickel	Furnace (F)	0.09
	Converter (C)	0.33
	Anode (A)	0.18
	F + C	0.43
	F + C + A	0.61
Selenium	Furnace (F)	1.15
	Converter (C)	6.34
	Anode (A)	16.04
	F + C	7.49
	F + C + A	23.53

* Based on 316 working days per year, ratio of emissions from two-week study and new dimensions for anode, converter and general roof monitors

File

CYPRUS
Miami Mining

ADEQ
AIR QUALITY DIVISION
96 DEC 30 PM 2:27

Cyprus Miami Mining Corporation
Post Office Box 4444
Claypool, Arizona 85532

December 30, 1996

Ms. Nancy Wrona, Director
Arizona Department of Environmental Quality
Division of Air Quality
3033 N. Central Ave. T-5
Phoenix, Arizona 85012

Dear Ms. Wrona:

The enclosed report and data summarize the operations of the Cyprus Miami Mining Corporation PM$_{10}$ network during April - June, 1996. This report is late due to problems with the XRF machine at Desert Research Institute. (Please see copies of enclosed letters) There were no PM$_{10}$ concentrations greater than 150 ug/m$_3$.

One special 24- hour was required during this period due to Acid Plant downtime. The special sample was not used in the quarterly averaging. Six samples were lost due to equipment malfunctions or technician errors.

If you have any questions, please call me at (520) 473-7016 or John Reichenbach at (520) 473-7418.

Sincerely,

for

Robert F. Ressler, Manager
Environmental and Land

RFR/jer

Copies:
W. Leipold
file

CYPRUS MIAMI MINING CORPORATION

PM10 CONCENTRATION DATA

Sample Date		PM10 Concentration (ug/m3)		
		Golf Course	Colocated	Ridgeline
4/3/96		25	30	10
4/6/96		37	8	5
4/9/96		38	49	19
4/12/96		35	40	**
4/15/96		31	***	9
4/18/96		36	35	13
4/21/96		37	35	17
4/24/96		56	53	24
4/27/96		44	55	15
4/30/96		64	67	24
5/3/96		41	48	16
5/6/96		46	40	19
5/9/96		38	37	18
5/10/96	*	36		19
5/12/96		**	**	20
5/15/96		39	38	13
5/18/96		32	32	19
5/21/96		62	56	24
5/24/96		27	29	21
5/27/96		18	18	***
5/30/96		35	39	14
6/2/96		31	34	17
6/5/96		55	51	17
6/8/96		32	31	19
6/11/96		56	47	24
6/14/96		20	20	15
6/17/96		39	39	18
6/20/96		45	44	22
6/23/96		29	29	13
6/26/96		22	24	***
6/29/96		24	33	15

* - Special sample due to Acid Plant shutdown

**- Sample lost due to equipment malfunction

***- Sample lost due to technician error

Table 2 (continued)

Cyprus Miami Mining 2nd Quarter 1996 Dichotomous Sampler Analysis Results

Site: Golf Course Date: 04/27/96 Start time: 0

Duration: 24 hrs

	Filter IDs Teflon	Filter IDs Quartz	Volume (m^3) Teflon	Volume (m^3) Quartz	Flags Tefln	Flags Qrtz	Mass	Anions	NH_4^+	K^+	Carbon	XRF
Fine:	GCDT1454		18.9	0.0	U2							
Coarse:	GCDT1493		21.0	0.0	U2							S4

Fine, Coarse, and PM_{10} Concentrations ($\mu g/m^3$)

	Fine			Coarse			PM_{10}		
Mass	10.1319	±	0.6442	34.1701	±	1.8700	44.3020	±	1.9779
Cl^-	-99.0000	±	-99.000	-99.0000	±	-99.000	-99.0000	±	-99.000
NO_3^-	-99.0000	±	-99.000	-99.0000	±	-99.000	-99.0000	±	-99.000
$SO_4^=$	-99.0000	±	-99.000	-99.0000	±	-99.000	-99.0000	±	-99.000
NH_4^+	-99.0000	±	-99.000	-99.0000	±	-99.000	-99.0000	±	-99.000
K^+	-99.0000	±	-99.000	-99.0000	±	-99.000	-99.0000	±	-99.000
OC	-99.0000	±	-99.000	-99.0000	±	-99.000	99.0000	±	-99.000
EC	-99.0000	±	-99.000	-99.0000	±	-99.000	-99.0000	±	-99.000
TC	-99.0000	±	99.000	-99.0000	±	-99.000	-99.0000	±	-99.000
Al	0.3524	±	0.0197	3.5601	±	1.0592	3.9125	±	1.0594
Si	0.9787	±	0.0497	6.6115	±	2.7287	9.5902	±	2.7292
P	0.0000	±	0.0063	0.0117	±	0.0147	0.0117	±	0.0160
S	0.3664	±	0.0192	0.3632	±	0.1320	0.7296	±	0.1334
Cl	0.0307	±	0.0052	0.1171	±	0.0351	0.1478	±	0.0355
K	0.1764	±	0.0097	1.0890	±	0.2170	1.2654	±	0.2172
Ca	0.2084	±	0.0114	1.1619	±	0.1963	1.3703	±	0.1966
Ti	0.0202	±	0.0135	0.1089	±	0.0136	0.1291	±	0.0192
V	0.0025	±	0.0076	0.0014	±	0.0083	0.0039	±	0.0113
Cr	0.0005	±	0.0026	0.0009	±	0.0030	0.0014	±	0.0040
Mn	0.0059	±	0.0017	0.0313	±	0.0024	0.0372	±	0.0029
Fe	0.2643	±	0.0134	1.4032	±	0.0723	1.6675	±	0.0735
Co	0.0006	±	0.0045	0.0000	±	0.0222	0.0006	±	0.0227
Ni	0.0004	±	0.0015	0.0009	±	0.0015	0.0013	±	0.0021
Cu	0.1634	±	0.0083	0.2120	±	0.0153	0.3754	±	0.0174
Zn	0.0356	±	0.0022	0.0169	±	0.0028	0.0525	±	0.0036
Ga	0.0006	±	0.0022	0.0006	±	0.0014	0.0012	±	0.0026
As	0.0064	±	0.0233	0.0017	±	0.0050	0.0081	±	0.0238
Se	0.0015	±	0.0007	0.0003	±	0.0008	0.0018	±	0.0011
Br	0.0045	±	0.0008	0.0001	±	0.0009	0.0046	±	0.0012
Rb	0.0007	±	0.0005	0.0047	±	0.0005	0.0054	±	0.0007
Sr	0.0021	±	0.0006	0.0098	±	0.0007	0.0119	±	0.0009
Y	0.0002	±	0.0016	0.0009	±	0.0006	0.0011	±	0.0017
Zr	0.0005	±	0.0011	0.0037	±	0.0008	0.0042	±	0.0014
Mo	0.0008	±	0.0019	0.0041	±	0.0013	0.0049	±	0.0023
Pd	0.0000	±	0.0068	0.0014	±	0.0065	0.0014	±	0.0094
Ag	0.0000	±	0.0076	0.0001	±	0.0072	0.0001	±	0.0105
Cd	0.0022	±	0.0081	0.0035	±	0.0077	0.0057	±	0.0112
In	0.0000	±	0.0091	0.0003	±	0.0087	0.0003	±	0.0126
Sn	0.0049	±	0.0117	0.0021	±	0.0108	0.0070	±	0.0159
Sb	0.0011	±	0.0136	0.0014	±	0.0127	0.0025	±	0.0186
Ba	0.0000	±	0.0490	0.0350	±	0.0335	0.0350	±	0.0594
La	0.0000	±	0.0664	0.0043	±	0.0613	0.0043	±	0.0904
Au	0.0023	±	0.0029	0.0000	±	0.0025	0.0023	±	0.0038
Hg	0.0000	±	0.0020	0.0006	±	0.0018	0.0006	±	0.0027
Tl	0.0000	±	0.0045	0.0001	±	0.0019	0.0001	±	0.0049
Pb	0.1472	±	0.0077	0.0106	±	0.0101	0.1578	±	0.0127
U	0.0000	±	0.0017	0.0006	±	0.0017	0.0006	±	0.0024
Sum	2.7814	±	0.1099	16.7760	±	2.9469	19.5574	±	2.9489

Field:Forest fire at Four

Peaks.Gravimetry: C-33

Gravimetry: C-33

Field:Forest fire at Four

Peaks.Gravimetry: C-33

Gravimetry: C-33

ASARCO

Ray Complex

Neil A. Gambell
Environmental Services Manager

March 2, 1998

Mr. Eugene Crumpler
Emissions Standards Division (MD-13)
Office of Air Quality Planning and Standards
U. S. Environmental Protection Agency
Research Triangle Park, NC 27711

Dear Mr. Crumpler:

Enclosed is a report entitled Data Re-evaluation - Fugitive Emission Study, Particulate and Metals Emissions, ASARCO Incorporated, Hayden Smelter, prepared by TRC Environmental Corporation. This new report evaluates the six-month fugitive particulate emission study done by TRC-NAWC in late 1994 and early 1995 and concludes that the fugitive emissions were overstated due primarily to the use of an erroneous sampler flow rate in the emission calculations.

Sincerely,

Neil A. Gambell

NAG:mbp

Enclosure

pc: Nancy Wrona, ADEQ, w/encl.
T. E. Erskine, w/o encl.
J. A. Wilhelm, w/o encl.

98EPAFUGES.LTR

Table 3
Fugitive Emission Program Overall Summary
Metals Emission Summary by Month and Source Contribution
Emissions in Pounds per Day

	Month	Furnace Building	Converter Building	Anode Building	Total Emissions
	October 1994	380.29	65.62	124.34	570.25
	November 1994	178.20	103.38	193.12	474.70
PM	December 1994	208.25	166.32	409.77	784.34
	January 1994	247.19	172.13	477.10	896.42
	February 1994	208.49	185.19	548.64	942.33
	Average	244.48	138.53	350.59	733.61
	October 1994	0.088	0.024	0.181	0.294
	November 1994	0.072	0.041	0.419	0.532
Ag	December 1994	0.060	0.084	0.530	0.673
	January 1994	0.124	0.095	0.924	1.143
	February 1994	0.065	0.051	0.946	1.061
	Average	0.082	0.059	0.600	0.741
	October 1994	2.412	0.385	5.599	8.396
	November 1994	2.222	1.197	8.085	11.504
As	December 1994	3.526	4.551	14.467	22.544
	January 1994	4.682	3.672	18.134	26.487
	February 1994	4.919	7.196	19.927	32.042
	Average	3.552	3.400	13.242	20.195
	October 1994	0.296	0.029	0.020	0.345
	November 1994	0.152	0.108	0.102	0.362
Cd	December 1994	0.191	0.244	0.231	0.666
	January 1994	0.207	0.139	0.268	0.614
	February 1994	0.139	0.181	0.037	0.358
	Average	0.197	0.140	0.132	0.469
	October 1994	88.528	11.934	18.984	119.446
	November 1994	34.719	18.797	26.231	79.747
Cu	December 1994	32.505	23.242	133.682	189.429
	January 1994	50.650	37.378	171.900	259.928
	February 1994	33.664	19.687	208.516	261.867
	Average	48.013	22.208	111.862	182.083

Table 3
Fugitive Emission Program Overall Summary
Monthly Metals Emission Summary
Emissions in Pounds per Day
(continued)

	Month	Furnace Building	Converter Building	Anode Building	Total Emissions
	October 1994	30.354	3.028	0.740	34.122
	November 1994	16.418	5.173	1.107	22.698
Fe	December 1994	14.506	5.725	4.635	24.866
	January 1994	18.745	6.065	2.569	27.380
	February 1994	15.354	6.044	2.795	24.193
		=	=	=	=
	Average	19.075	5.207	2.369	26.652
	October 1994	3.852	0.918	3.113	7.883
	November 1994	5.371	4.289	5.379	15.038
Pb	December 1994	7.375	11.641	10.142	29.158
	January 1994	7.410	8.850	12.850	29.109
	February 1994	7.406	20.606	13.674	41.686
		=	=	=	=
	Average	6.283	9.261	9.031	24.757
	October 1994	0.079	0.028	0.064	0.171
	November 1994	0.114	0.090	0.140	0.344
Sb	December 1994	0.245	0.589	0.404	1.238
	January 1994	0.356	0.477	0.476	1.308
	February 1994	0.362	2.004	0.418	2.784
		=	=	=	=
	Average	0.231	0.637	0.300	1.169
	October 1994	0.780	0.320	4.494	5.594
	November 1994	0.787	0.566	7.698	9.051
Se	December 1994	1.269	1.989	11.396	14.653
	January 1994	1.286	1.956	18.351	21.594
	February 1994	0.616	0.681	17.417	18.714
		=	=	=	=
	Average	0.948	1.102	11.871	13.921
	October 1994	4.179	0.897	2.203	7.278
	November 1994	3.021	3.667	2.229	8.916
Zn	December 1994	3.011	14.391	4.966	22.367
	January 1994	3.178	5.852	2.858	11.888
	February 1994	2.152	18.358	2.180	22.690
		=	=	=	=
	Average	3.108	8.633	2.887	14.628

phelps
dodge
Corporation 2600 N. Central Avenue, Phoenix, AZ 85004-3014 • (602) 234-8308

Shawn B. Kendall
Executive Assistant

March 25, 1996

HAND DELIVERED

Mr. Gene Crumpler
Industrial Studies Branch
Emission Standards Division (MD-13)
Office of Air Quality Planning and Analysis
U.S. Environmental Protection Agency
Research Triangle Park, North Carolina 27711

Dear Mr. Crumpler:

Attached are the reports from Goodfellow Consultants Texas Inc. summarizing the results of fugitive emission field surveys that were performed at the Phelps Dodge Mining Company's Chino and Hidalgo Smelters. These reports summarize the field survey methods and results found during the testing.

In reviewing the reports, management personnel from the smelters determined that certain figures which contain process specific descriptions about our operating practices may not be known to the industry as a whole, and must therefore be treated as Confidential Business Information (CBI) of Phelps Dodge Corporation. These figures are referred to as Figures 6-11 and 6A-11A in the text of the Chino Report, and Figures 6-9 and 6A-9A of the Hidalgo Report. These figures will be provided to you under separate cover to ease in your handling of the CBI protection of these materials.

Also, in reviewing the Hidalgo report, Ms. C. Viecelli noted that the sampling was performed during a period when one of the converters was not fully operational. She prepared a supplemental Table 3 for the Hidalgo report which scales up the results of the Goodfellow report to reflect full 3 converter operation (attached after the original Table 3 in the Hidalgo report).

In summary, we found no process units which individually or collectively would qualify as a major source of HAPS.

If you have any questions related to these reports please feel free to contact me at (602)-234-8308.

Sincerely,

Shawn B Kendall

Shawn B. Kendall
Executive Assistant

cc w/enclosure:
    Mr. W. Chen
    Mr. E. Humphrey
    Mr. W. Mitchell
    Mr. E. Partelpoeg
    Mr. L. Pruett
    Ms. C. Viecelli

SBK/sbk
Enclosures

GOODFELLOW
CONSULTANTS
TEXAS INC.

4950 North O'Connor Blvd., Suite 250,
Irving, Texas 75062 U.S.A.
(214) 717-5175
Fax (214) 717-4310

Phelps Dodge Mining Company
Hidalgo Smelter
Smelter Fugitive Emission Field Survey

Project Report
January 4, 1996

Distribution

B. Belew	PD
R. Reed	PD
A.D. Wilcox	PD
C. Viecelli	PD
P. Safe	GCTI

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The above figures indicate that the emissions from the anode section of the roof monitor represent about 47% of the dust emissions and about 16% of the SO_2 emissions. The length of the roof monitor above the converter section is about 260' and the length above the anode section is about 80'.

The fugitive emissions that escape the pollution control systems and report to the smelter roof line are primarily a result of the following activities:

- converter process gas escaping from the converter primary hoods during the blowing cycle
- flash furnace secondary emissions (matte tapping, slag pour backs and process gas fugitives)
- matte ladle transfer
- revert handling
- charging converters with matte and reverts
- slag skimming and tapping blister
- anode furnace operations since they are vented directly to the building

The above activities contribute to the background SO_2 and dust loading in the smelter building. Based on the field survey results, the background SO_2 concentration and emission rates at the roof level and flow conditions through the roof monitor are as follows:

	SO_2 Conc. (ppm)	**Avg. Temp.** (° F)	**Avg. Vel.** (fpm)	**Air Flow** (scfm)	**SO_2 Emission Rate** (lb/hr)
Converter section	40	84	291	636,000	252
Anode section	34	98	473	301,000	102
Total				937,000	354

The above figure represents the SO_2 emission rate through the roof monitor based on the background SO_2 concentration. However, individual converter aisle activities which result in significantly higher instantaneous emissions cause the average emission rates to be higher than the background levels. The background emission rate represents about 77% of the total emissions from the roof line. The remainder is due to the emissions associated with various converter aisle activities.

The emission rates and typical duration of these activities, based on the field observation during the test period, are given below:

Activity	**Typical Duration** (min)	**Typical Emission Rate** (lb/hr)
Converter Charging	5 - 10	52
Pour Blister/Skim Slag	5 - 10	40
Anode Fce. Operation	10 - 60	17
Other	5	1
Total		**110**

2.0 Field Survey

2.1 Field Survey Description

A field survey was conducted to quantify particulate and SO_2 emission rates through the converter aisle roof monitor and to relate the emissions to the smelter activities.

Figure 1 presents the outline of the PD Hidalgo smelter converter aisle section including the measurement points for SO_2 and particulates. SO_2 was measured using a continuous analyzer and EPA Method 6. EPA Method 6 is used for determination of SO_2 emissions from stationary sources. A gas sample is extracted from the sampling point and the SO_2 is absorbed in an H_2O_2 solution. The SO_2 fraction is determined by the titration method. Particulate emission rates were determined using EPA Method 5.

SO_2 was measured continuously over an 8-hour period on each of four consecutive test days. A manifold system was used to draw a composite sample from five points approximately 12 feet apart centered over each sampling location. The particulate sampling train was located at the center point of the 5-point manifold for the duration of the 8-hour test.

The following lists the four roof monitor sample locations and the dates they were tested for SO_2, particulate, gas volumetric flow rate and temperature.

Day 1	November 28	Converter #2
Day 2	November 29	Converter #3
Day 3	November 30	Anodes
Day 4	December 1	Converter #1

Note that Converter #1 was not in operation during the test program as it was undergoing routine re-bricking maintenance. Also, converter secondary hoods were not operational during the field survey.

The smelter building ventilation rates were quantified through a series of ventilation surveys conducted on the following dates:

November 28	10:30 am - 12:05 pm
	1:30 pm - 2:30 pm
	4:30 pm - 5:00 pm
November 29	8:30 am - 9:00 am
	1:00 pm - 2:00 pm
November 30	8:40 am - 10:30 am
	10:30 am - 11:00 am
	3:30 pm - 4:15 pm
December 1	6:45 am - 11:00 am

Ventilation rates were determined by measuring air velocity and temperature through each building opening and along the smelter roof monitor. The above time represents the measurement duration for the openings in the building walls. The lengths of the individual surveys vary depending on the accessibility of the various building openings. At different times, GCTI personnel could not reach certain openings due to the movement of trucks and other vehicles or to the pouring of slag.

2.2 Field Survey Results

Table 1 presents the average SO_2 and particulate emission rates through the converter aisle roof monitor from various sources for an 8-hour test period. The SO_2 emission rates based on both methods of measurements are presented for comparison purposes.

The emission rates presented below are based on the average volumetric flow measurements through the roof monitor. Flow measurements were taken during the ventilation survey on November 28 - December 1, 1995. The average flow rates were as follows:

Converter Section:	636,000 scfm
Anode Section:	301,000 scfm
Total:	937,000 scfm

It is assumed that the flow through the roof monitor can be divided evenly to obtain the flow rates above each converter at 122,300 scfm (converter section divided into five sections) and above the anode furnace at 188,100 scfm (anode section divided into one and a half sections).

Table 1

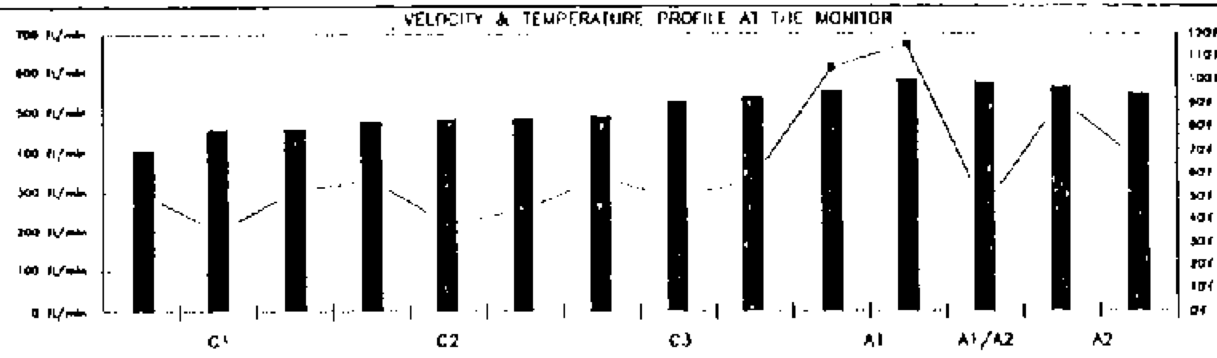
Summary of Emission Rates

Location	**Dust Loading** (gr/scf)	**Dust Emission** (lb/hr)	**SO_2 Analyzer** (ppm)	(lb/hr)	**SO_2 Method 6** (ppm)	(lb/hr)
Converter #2	0.0099	10.4	118	143	102	124
Converter #3	0.00822	8.6	102	124	81	99
Anodes	0.01507	17.5	34	73	18	34
Converter #1	0.00631	6.6	62	75	45	55
Conv. side (est.)		8.8	40	106.9	40	106.9
Anode side (est.)		13.6	34	41.6	34	41.6
Total		65.5		564		461

The results of the ventilation surveys are presented in Figures 2 - 5. These figures include the ventilation flow rates through various building openings, temperature and velocity profiles at the roof monitor and the calculated building heat release rates. The results clearly indicate that the flow through the roof monitor above the converters is higher than the flow through the roof monitor above the anode furnaces, due to the difference in lengths. The following comments can be made:

- Total ventilation rate ranges from 1,922,000 scfm to 2,063,000 scfm.
- Calculated heat release rate ranges from 478,000 Btu/min to 742,000 Btu/min.
- Average temperature at the roof monitor at the anode section is about 98 °F as compared to 84 °F on the converter section.
- Average air velocity through the roof monitor on the anode side is about 473 ft/min as compared to 291 ft/min for the converter section.

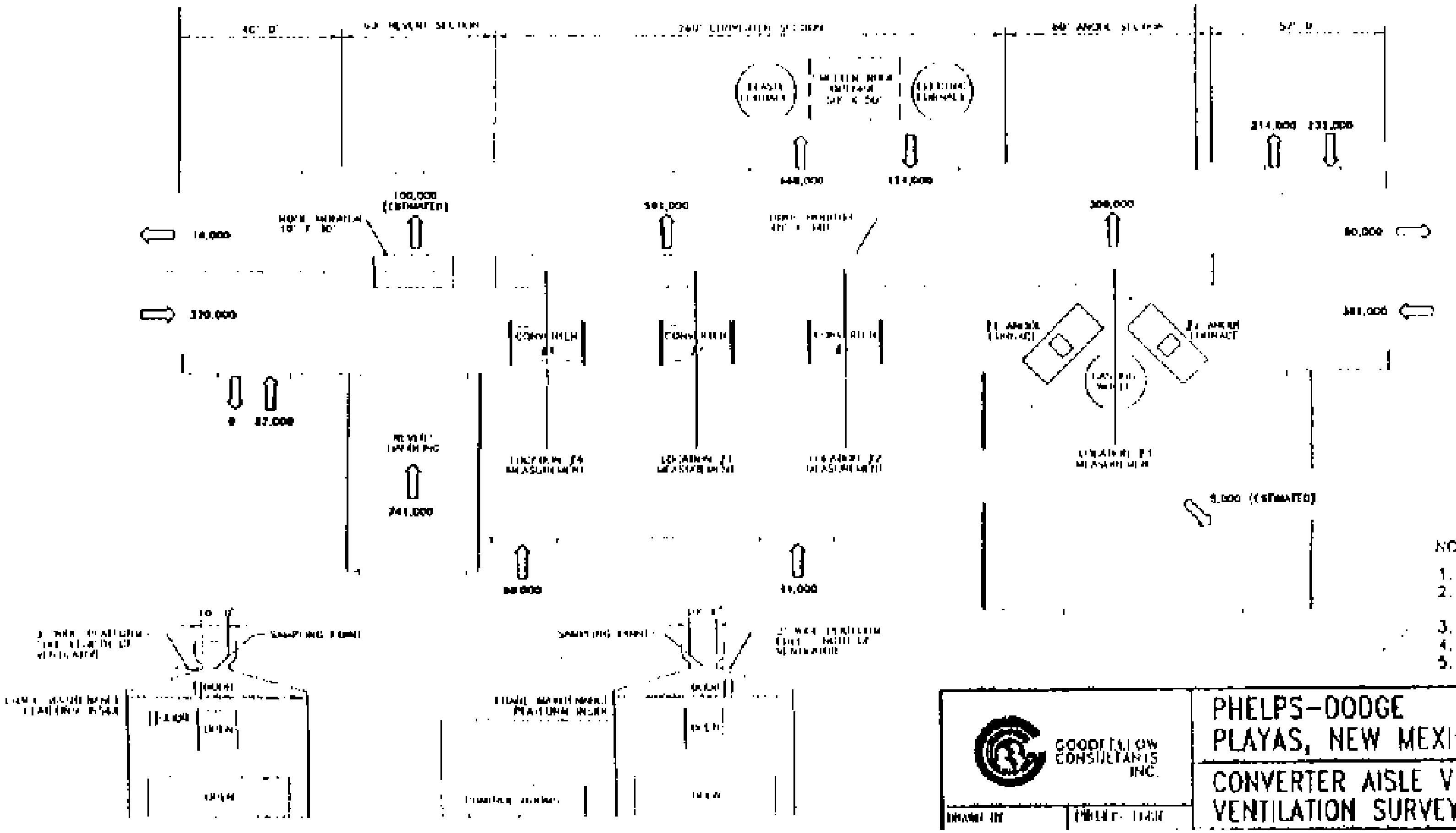
The SO_2 profile at the converter aisle roof monitor above each source is presented in Figures 6 - 9. Figures 6A-9A are included to provide better resolution for the determination of background



NOTE: CONVERTER C1 WAS NOT IN OPERATION DURING THE TESTING PROGRAM.

LEGEND
- VELOCITY
- ▬ TEMPERATURE

FLOW IN 1,881,000 SCFM
FLOW OUT 1,887,000 SCFM
TEST DATE NOVEMBER 29, 1995



NOTES:

1. TOTAL FLOW:
2. MEASUREMENTS TAKEN AT NOVEMBER 29, 1995
3. AMBIENT TEMPERATURE = 61°F
4. WINDS FROM THE: SOUTHEAST
5. HEAT RELEASE RATE: 742,000 btu/

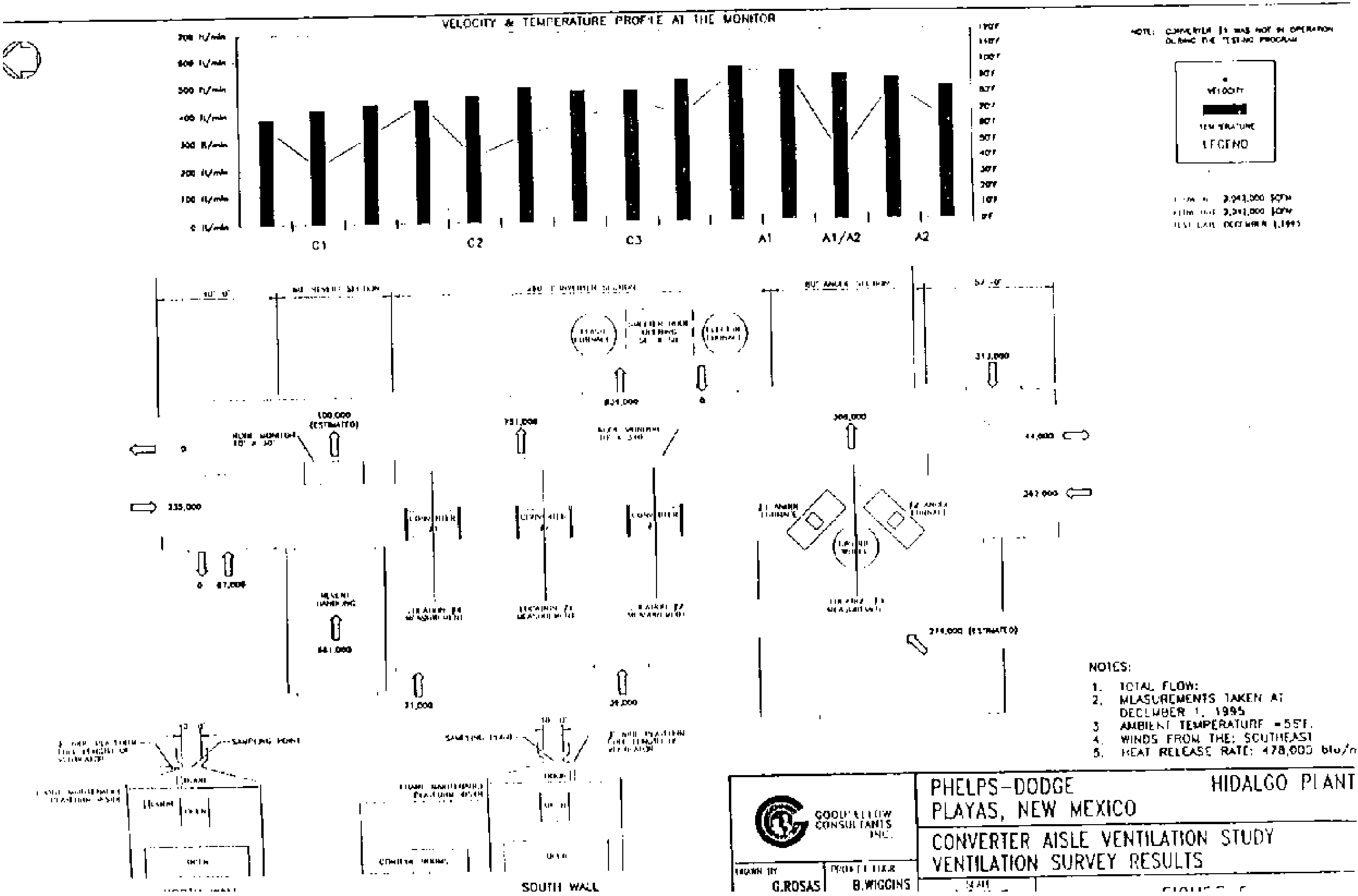
GOODFELLOW CONSULTANTS INC.

PHELPS-DODGE
PLAYAS, NEW MEXICO

HIDALGO PLANT

CONVERTER AISLE VENTILATION STUDY
VENTILATION SURVEY RESULTS

DRAWN BY
CHECKED BY



NOTE: CONVERTER #1 WAS NOT IN OPERATION DURING THE TESTING PROGRAM

NOTES:

1. TOTAL FLOW:
2. MEASUREMENTS TAKEN AT DECEMBER 1, 1995
3. AMBIENT TEMPERATURE =55F.
4. WINDS FROM THE: SOUTHEAST
5. HEAT RELEASE RATE: 478,000 btu/m

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HIDALGO PLANT

CONVERTER AISLE VENTILATION STUDY
VENTILATION SURVEY RESULTS

DRAWN BY	PROJECT LEADER	SCALE
G.ROSAS	B.WIGGINS	

Location	Background Conc. (ppm)	Average Conc. (ppm)
Converter #2	35	118
Converter #3	50	102
Anodes	34	34
Converter #1	35	62

- Table 3 presents the metals analysis based on the particulate samples collected from the roof line at various locations. These results are average values based on collected data for two sampling repetitions.

TABLE 3
Dust Sample Collected at Roof Level
METALS ANALYSIS

OCATION	Cu	Pb	Si	Cd	As	Co	Mn	Ni	Se	Sb	Be	Hg	Metals Total	Total Measur Particul
onverter #1 [lb/hr]	6.80E-01	9.00E-02	1.70E-02	2.50E-02	2.60E-02	1.40E-04	1.70E-03	5.50E-03	1.04E-02	7.40E-04	-	-	9.00E-01	1.05E+
onverter #2 [lb/hr]	6.30E-01	1.50E-01	5.40E-02	3.40E-02	2.00E-02	9.10E-05	9.50E-04	2.10E-03	1.20E-02	7.80E-04	-	-	9.00E-01	1.04E+
onverter #3 [lb/hr]	1.00E+00	2.00E-01	1.70E-02	3.20E-02	7.60E-02	1.00E-04	7.00E-04	9.80E-04	7.80E-03	1.50E-03	-	-	1.30E+00	8 50E+
nodes [lb/hr]	5.87E+00	1.40E-01	2.40E-02	6.50E-03	1.20E-01	-	7.50E-04	3.20E-03	3.60E-02	-	-	-	6.20E+00	1 75E+

7,1 lb/hr 0.59 0.11 0.097 -0.24 lb/hr - 0.0024
3.5 t/hr Pb 0.44 t/y Si 0.43 t/yr Cd 1.06 t/yr As

9.3 lb/hr
- 9.2 Cu
1.1 lb/hr
4.91 t/yr

Note: Revisions made to original Goodfellow report to account for operation of 3 converters.
When testing was done, only 2 converters were operational.

GOODFELLOW
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Phelps Dodge Mining Company
Chino Smelter
Smelter Fugitive Emission Field Survey

Project Report
November 15, 1995

Distribution

E. Partelpoeg	PD Chino
M. King	PD Chino
P. Safe	GCTI
B. Allan	GCTI

Table of Contents

The above data is generally illustrative of the magnitude of emissions from the smelter during the test period. They do not include SO_2 and particulate emissions to the atmosphere which escape through openings in the smelter walls. It should be noted that Converter # 3 was down during the field survey for routine maintenance and no measurements were conducted above that converter. The estimated values are based on the measured average background concentration levels.

The above figures indicate that the emissions from the anode/receiver section of the roof monitor represent about 70% of the dust emissions and about 60% of the SO_2 emissions. The length of the roof monitor above the converters extends about 250' and above the anode/receiver section is about 170'.

The fugitive emissions that escape the pollution control systems and report to the smelter roof line are primarily a result of the following activities:

- converter process gas escaping from the Obenchain enclosure during the blowing cycle
- flash furnace secondary emissions (matte tapping, slag pour backs and process gas fugitives)
- matte ladle transfer
- revert handling
- charging converters with matte and reverts
- slag skimming and tapping blister
- anode furnace and receiver operations since they are vented directly to the building

The above activities contribute to the background SO_2 and dust loading in the smelter building. Based on the field survey results, the background SO_2 concentration and emission rates at the roof level and flow conditions through the roof monitor are as follows:

	SO_2 Conc. (PPM)	Avg. Temp. (F)	Avg. Vel. (ft/min)	Air Flow (SCFM)	SO_2 Emission Rate (lb./hr)
Converter Section :	25	100	300	588,000	160
Anode/Receiver Section:	40	160	550	731,000	315
Total				**1,319,000**	**475**

The above figure represents the SO_2 emission rate through the roof monitor based on the background SO_2 concentration. However, individual converter aisle activities which result in significantly higher instantaneous emissions cause the average emission rates to be higher than the background levels. The background emission rate represents about 70% of the total emissions from the roof line. The remainder is due to the emissions associated with various converter aisle activities.

2.0 Field Survey

2.1 Field Survey Description

A field survey was conducted to quantify particulate and SO_2 emission rates through the converter aisle roof monitor and to relate the emissions to the smelter activities.

Figure 1 presents the outline of the PD Chino smelter converter aisle section including the measurement points for SO_2 and particulates. SO_2 was measured using a continuous analyzer and EPA Method 6. EPA method 6 is used for determination of SO_2 emissions from stationary sources. A gas sample is extracted from the sampling point and the SO_2 is absorbed in an H_2O_2 solution. The SO_2 fraction is determined by the titration method. Particulate emission rates were determined using EPA Method 5.

SO_2 was measured continuously over an 8-hour period on each of six consecutive test days. A manifold system was used to draw a composite sample from five points approximately 12 feet apart centered over each sampling location. The particulate sampling train was located at the center point of the 5-point manifold for the duration of the 8-hour test.

The following lists the six roof monitor sample locations and the dates they were tested for SO_2, particulate, gas volumetric flow rate and temperature.

Day 1	October 16	Converter # 4
Day 2	October 17	Converter # 1
Day 3	October 18	Converter # 2
Day 4	October 19	Receiver # 3
Day 5	October 20	Anode Furnaces
Day 6	October 21	Receiver # 1

Note that Converter # 3 was not in operation during the test program as it was undergoing routine re-bricking maintenance.

The smelter building ventilation rates were quantified through a series of ventilation surveys conducted on the following dates :

October 19	14:55 - 15:25
October 19	16:00 - 16:25
October 20	09:00 - 09:20
October 21	10:30 - 11:10

Ventilation rates were determined by measuring air velocity and temperature through each building opening and along the smelter roof monitor. The above time represents the measurement duration for the openings in the building walls.

2.2 Field Survey Results

Table 1 presents the average SO_2 and particulate emission rates through the converter aisle roof monitor from various sources for an 8-hour test period. The SO_2 emission rates based on both methods of measurements are presented for comparison purposes.

The emission rates presented below are based on the average volumetric flow measurements through the roof monitor. Flow measurements were taken during the ventilation survey on October 18 - 20, 1995. The average flow rates were as follows:

Converter Section :	588,000 SCFM
Anode Section :	731,000 SCFM
Total	1,319,00 SCFM

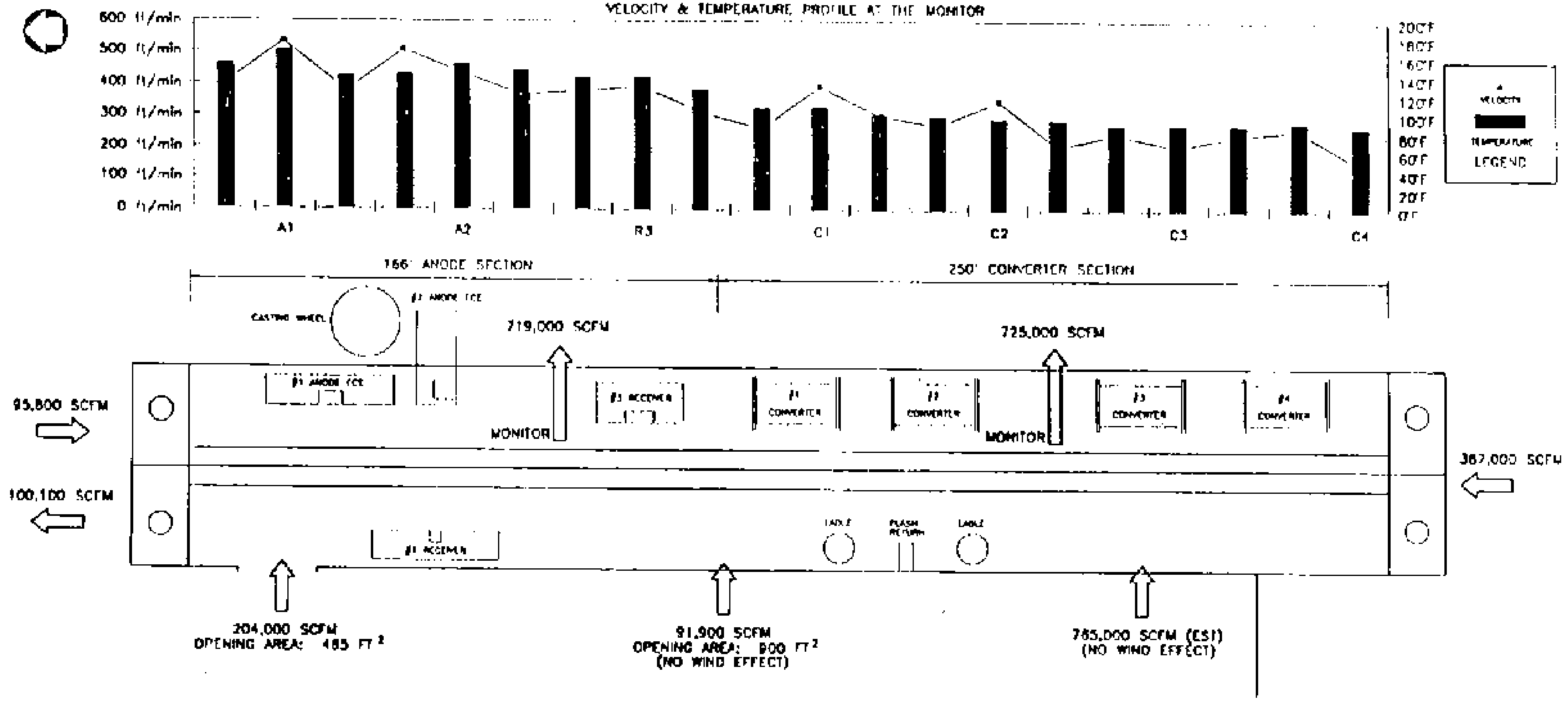
It is assumed that the flow through the roof monitor can be divided evenly to obtain the flow rates above each converter at 147,000 SCFM (converter section divided into four sections) and above the anode furnaces/receivers at 243,700 SCFM (anode/receiver section divided into three sections).

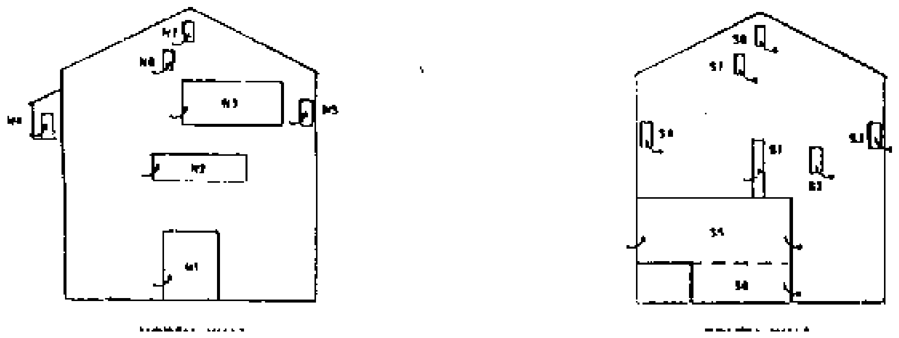
Table 1
Summary of Emission Rates

Location	Dust Loading (gr/scf)	Dust Emiss. (lb./hr)	SO_2 Analyzer		SO_2 Method 6	
			(PPM)	(lb./h)	(PPM)	(lb./h)
Converter #4	0.0075	9.5	55	81	62	91
Converter #1	0.0072	9.0	72	105	65	95
Converter #2	0.0051	6.4	31	45	38	55
Estimate Conv. #3		5	25	40	25	40
Receiver #3	0.0091	18.9	65	156	92	225
Anode Fces	0.0099	20.7	39	94	26	63
Receiver #1	0.0102	21.2	46	111	36	88
Total		90.7		632		657

The results indicate that the particulate emission rates at the roof monitor for the anode furnaces/receiver sections are considerably higher compared to the converter side. Also, the SO_2 emission associated with Receiver #3 (matte holding receiver) is significantly higher than the other sources.

The results of the ventilation surveys are presented in Figures 2 - 5. These figures include the ventilation flow rates through various building openings, temperature and velocity profile at the roof monitor and the calculated building heat release rates. The results clearly indicate that the flow through the roof monitor above the anode furnaces/receivers is higher compared to the





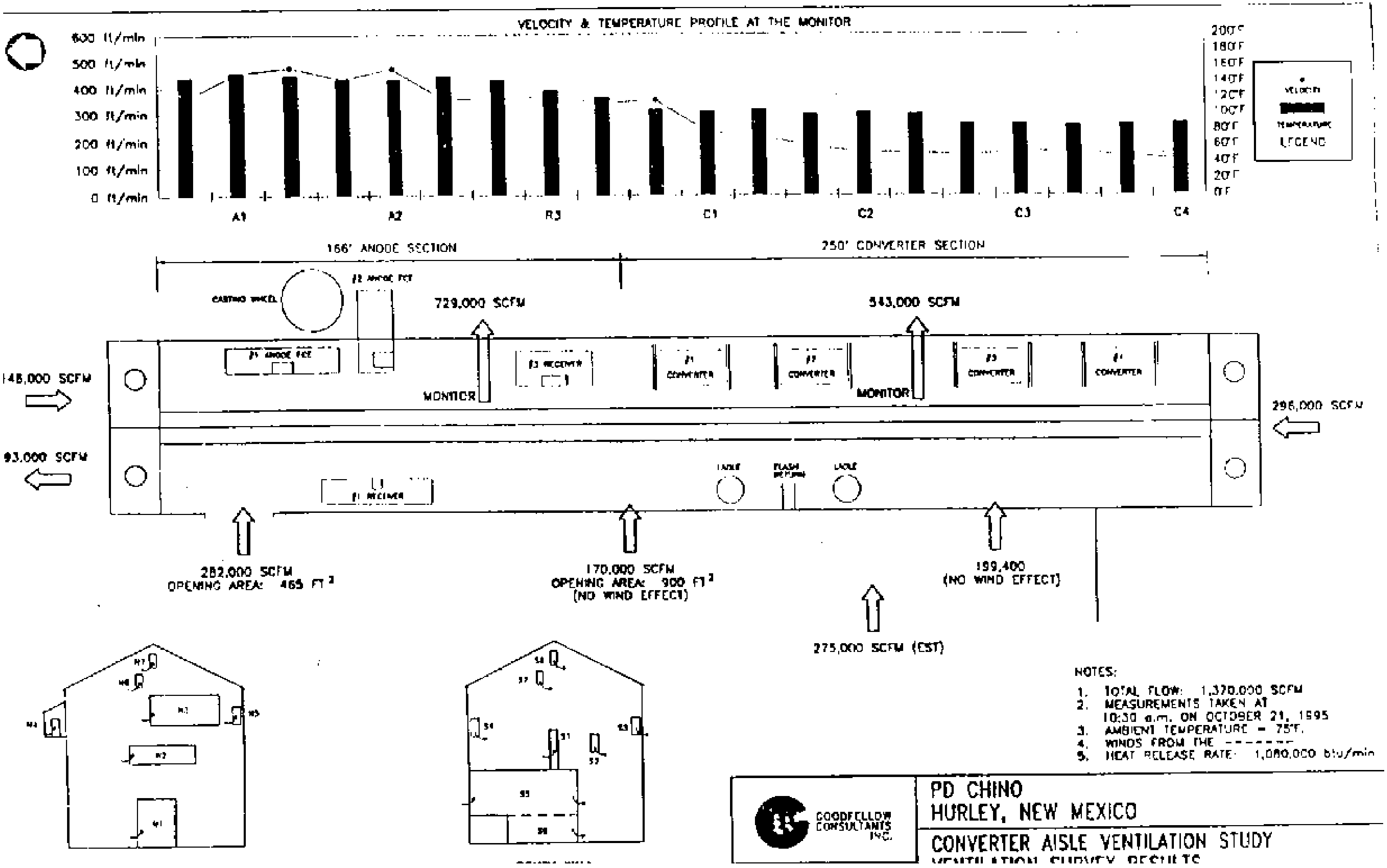
NOTES:

1. TOTAL FLOW: 1,500,000 SCFM
2. MEASUREMENTS TAKEN AT 4:00-4:23 p.m. ON OCTOBER 19, 1995
3. AMBIENT TEMPERATURE = 85°F.
4. WINDS FROM THE -------
5. HEAT RELEASE RATE: 937,000 btu/min

GOODFELLOW CONSULTANTS INC.

PD CHINO
HURLEY, NEW MEXICO

CONVERTER AISLE VENTILATION STUDY



NOTES:

1. TOTAL FLOW: 1,370,000 SCFM
2. MEASUREMENTS TAKEN AT 10:30 a.m. ON OCTOBER 21, 1995
3. AMBIENT TEMPERATURE = 75°F.
4. WINDS FROM THE -------
5. HEAT RELEASE RATE: 1,080,000 btu/min

GOODFELLOW CONSULTANTS INC.

PD CHINO
HURLEY, NEW MEXICO

CONVERTER AISLE VENTILATION STUDY
VENTILATION SURVEY RESULTS

Instantaneous emission rates for various activities were calculated by determining the areas under the SO_2 profile curve generated by the continuous analyzer while those activities were occurring. Converter logsheets and field observations were used to determine the typical duration and number of events per day, in order to determine the average daily emission rates for various activities.

The following observations can be summarized based on the field survey results :

- Converter operation and receiver emissions, in particular the matte holding receiver, represent the major sources of SO_2 fugitive emissions in the converter aisle.
- Based on the presented SO_2 profile curves, instantaneous SO_2 concentrations at the roof line can be as high as 3500 PPM during converter charging operations.
- The background and average SO_2 concentrations at the roof level at various locations are listed below :

Location	Background Conc. (PPM)	Average Conc. (PPM)
Converter # 4	20 PPM	55
Converter # 1	30 PPM	72
Converter # 2	20 PPM	31
Receiver # 3	50 PPM	65
Receiver #1	40 PPM	46
Anodes	30 PPM	39

- Table 3 presents the metals analysis based on the particulate samples collected from the roof line at various locations. These results are based on the combined samples that were collected through two sampling repetitions.

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Receiver #1	40 PPM	46
Anodes	30 PPM	39

- Table 3 presents the metals analysis based on the particulate samples collected from the roof line at various locations. These results are based on the combined samples that were collected through two sampling repetitions.

Appendix I

Relationship Between 1-Hour Ambient SO_2 Concentrations and 5-Minute Peak Concentrations

Texas Sulfur Dioxide 5-Minute Values > 0.6 ppm
(May - October, 1994)

AIRS #	Date	Time	Hour PPM	Hi Voltage	Slope	Intercept	5-min PPM
481410037	**940605**	**7**	**0.339**	**1159**	**956**	**5**	**1.207**
482450009	**940904**	**3**	**0.046**	**1403**	**1881**	**9**	**0.741**
482450009	**941024**	**15**	**0.027**	**1413**	**1909**	**3**	**0.739**
482450009	**941017**	**21**	**0.067**	**1225**	**1894**	**9**	**0.642**
481410037	**940609**	**11**	**0.193**	**625**	**975**	**3**	**0.638**
481410037	**940605**	**4**	**0.102**	**585**	**956**	**5**	**0.607**
482450009	**941024**	**14**	**0.063**	**1054**	**1909**	**3**	**0.551**
481410037	940606	9	0.235	474	956	5	0.491
481410037	940509	23	0.099	460	992	4	0.460
482450009	941024	13	0.079	876	1909	3	0.457
482450009	940316	8	0.134	979	2056	39	0.457
481410037 - El Paso CAMS 12							
482450009 - Beaumont CAMS 2							

Texas Natural Resource Conservation Commission

Appendix J

Supporting Calculations for Comparison of SO_2, NO_x, Particulate Emissions from Power Plants Meeting Mexican and U.S. National Emission Standards

SECRETARIA DE DESARROLLO SOCIAL – NORMA OFICIAL MEXICANA

NOM-085-ECOL-1994

Contaminación Atmosférica - **Fuentes fijas - para fuentes fijas que utilizan combustibles fósiles sólidos, liquidos o gaseosos o cualquiera de sus combinaciones, que establece los niveles máximos permisibles de emisión a la atmósfera de humos, partículas suspendidas totales, bióxido de azufre y óxidos de nitrógeno y los requisitos y condiciones para la operación de los equipos de calentamiento indirecto por combustión, así como los niveles máximos permisibles de emisión de bióxido de azufre en los equipos de calentamiento directo por combustión.**

1. OBJETO.

Norma Oficial Mexicana para fuentes fijas que utilizan combustibles fósiles sólidos, liquidos o gaseosos o cualquiera de sus combinaciones, que establece los niveles máximos permisibles de emisión a la atmósfera de humos, partículas suspendidas totales, bióxido de azufre y óxidos de nitrógeno y los requisitos y condiciones para la operación de los equipos de calentamiento indirecto por combustión; así como los niveles máximos permisibles de emisión de bióxido de azufre en los equipos de calentamiento directo por combustión.

2. CAMPO DE APLICACION.

Norma Oficial Mexicana para fuentes fijas que utilizan combustibles fósiles sólidos, liquidos y gaseosos o cualquiera de sus combinaciones, será de observancia obligatoria para el uso de los equipos de calentamiento indirecto por combustión, así como para los equipos de generación eléctrica que utilizan la tecnología de ciclo combinado. Sera obligatoria igualmente sólo en emisiones de bióxido de azufre, para el uso de los equipos de calentamiento directo por combustión.

Se exceptúan los equipos domésticos de calentamiento de agua, de calefacción y las estufas utilizados en casas habitación, escuelas, hospitales y centros recreativos, en las industrias cuando estos equipos sean utilizados en las areas de servicios al personal, sin embargo, aplicará para el caso de industrias, comercios y servicios, cuando los equipos y sistemas de combustión en lo individual o la suma de varios rebasen los 10 cc de capacidad nominal en cada instalación.

También se exceptúan los quemadores industriales de campo; el sistema de regeneración de las plantas de desintegración catalítica; las plantas recuperadoras de azufre y los procesos de calentamiento directo que producen bióxido de azufre adicional al proveniente del combustible.

LIMITES. NOM-085-ECOL-1994
1994 AL 31 DE DICIEMBRE DE 1997

CAPACIDAD DEL EQUIPO DE COMBUSTIÓN MJ/h	TIPO DE COMBUSTIBLE EMPLEADO	DENSIDAD DEL HUMO	PARTÍCULAS (PST) mg/m³ (kg/10⁶ kcal) (1) (2)			BIÓXIDO DE AZUFRE ppm V (kg/10⁶ kcal) (1) (2)			ÓXIDOS DE NITRÓGENO ppm V (kg/10⁶ kcal) (1) (2)			EXCESO DE AIRE DE COMBUSTIÓN % volumen (4)
		Número de mancha u opacidad	ZMCM	ZC	RP	ZMCM	ZC (5)	RP	ZMCM	ZC (3)	RP	
Hasta 5,250	Combustóleo o gasóleo	4	NA	NA	NA	1100 (4.08)	2100 (7.80)	2600 (9.81)	NA	NA	NA	60
	Otros líquidos	3	NA	NA	NA	1100 (4.08)	2100 (7.81)	2600 (9.81)	NA	NA	NA	
	Gaseosos	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	
De 5,250 a 43,000	Líquidos	NA	100 (0.142)	425 (0.604)	600 (0.852)	1100 (4.08)	2100 (7.80)	2600 (9.81)	220 (0.588)	300 (0.801)	400 (1.064)	50
	Gaseosos	NA	NA	NA	NA	NA	NA	NA	220 (0.563)	300 (0.767)	400 (1.023)	
De 43,000 a 110,000	Líquidos	NA	100 (0.142)	425 (0.604)	550 (0.781)	1100 (4.08)	2100 (7.81)	2600 (9.81)	180 (0.481)	300 (0.801)	400 (1.069)	40
	Gaseosos	NA	NA	NA	NA	NA	NA	NA	180 (0.460)	300 (0.767)	400 (1.023)	
Mayor de 110 000	Sólidos	NA	70 (0.105)	325 (0.496)	435 (0.664)	1100 (4.32)	2100 (8.24)	2600 (9.81)	160 (0.449)	280 (0.785)	400 (1.122)	30
	Líquidos	NA	70 (0.099)	325 (0.462)	500 (0.710)	1100 (4.12)	2100 (7.81)	2600 (9.81)	160 (0.427)	280 (0.748)	400 (1.069)	[5 % O_2]
	Gaseosos	NA	NA	NA	NA	NA	NA	NA	160	280	400	

LIMITES. NOM-085-ECOL-1994
1° ENERO DE 1998 EN ADELANTE

CAPACIDAD DEL EQUIPO DE COMBUSTION MJ/h	TIPO DE COMBUSTIBLE EMPLEADO	DENSIDAD DE HUMO	PARTÍCULAS (PST) mg/m^3 [kg/10^6 kcal] (1) (2)			BIÓXIDO DE AZUFRE ppm V (kg/10^6 kcal) (1) (2)			ÓXIDOS DE NITRÓGENO ppm V (kg/10^6 kcal) (1)			EXCESO DE AIRE DE COMBUSTIÓN % volumen (5)
		Número de mancha u opacidad	ZMCM	ZC (3)	RP	ZMCM	ZC (3)	RP	ZMCM	ZC (4)	RP	
Hasta 5,250	Combustóleo o gasóleo	3	NA	NA	NA	550 (2.04)	1,100 (4.08)	2,200 (8.16)	NA	NA	NA	50
	Otros líquidos	2	NA	NA	NA	550 (2.04)	1,100 (4.08)	2,200 (8.16)	NA	NA	NA	
	Gaseosos	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	
De 5,250 a 43,000	Líquidos	NA	75 (0.106)	350 (0.497)	450 (0.639)	550 (2.04)	1,100 (4.08)	2,200 (8.16)	190 (0.507)	190 (0.507)	375 (1.0)	40
	Gaseosos	NA	NA	NA	NA	NA	NA	NA	190 (0.486)	190 (0.486)	375 (0.959)	
De 43,000 a 110,000	Líquidos	NA	60 (0.085)	300 (0.426)	400 (0.568)	550 (2.04)	1,100 (4.08)	2,200 (8.16)	110 (0.294)	110 (0.294)	375 (1.0)	30
	Gaseosos	NA	NA	NA	NA	NA	NA	NA	110 (0.281)	110 (0.281)	375 (0.959)	
Mayor de 110,000	Sólidos	NA	60 (0.090)	250 (0.375)	350 (0.525)	550 (2.16)	1100 (4.31)	2200 (8.16)	110 (0.309)	110 (0.309)	375 (1.052)	25 [4 % O_2]
	Líquidos	NA	60 (0.085)	250 (0.355)	350 (0.497)	550 (2.04)	1100 (4.08)	2200 (8.16)	110 (0.294)	110 (0.294)	375 (1.0)	
	Gaseosos	NA	NA	NA	NA	NA	NA	NA	110 (0.281)	110 (0.281)	375 (0.959)	

NOM-085-ECOL-1994
MEDICION Y ANALISIS DE GASES DE COMBUSTION

CAPACIDAD DEL EQUIPO DE COMBUSTIÓN MJ/h	PARÁMETRO	FRECUENCIA MÍNIMA DE MEDICIÓN	TIPO DE EVALUACIÓN	TIPO DE COMBUSTIBLE
Hasta 5,250	densidad de humo	1 vez cada 3 meses	puntual (3 muestras) mancha de hollin	líquido y gas
	CO_2, CO, O_2, N_2	1 vez cada 3 meses	puntual (3 muestras); ver anexo 3	líquido y gas
	SO_2	1 vez cada 3 meses	medición indirecta a través de certificados de calidad de combustibles que emita el proveedor	líquido
De 5,250 a 43,000	Partículas suspendidas totales	una vez por año	isocinético (mínimo durante 60 minutos); 2 muestras definitivas (2)	líquido
	NO_x	una vez por año	continuo (4); quimiluminiscencia o equivalente	líquido y gas
	SO_2	una vez por año	medición indirecta a través de certificados de calidad de combustibles que emita el proveedor	líquido
	CO_2, CO, O_2, N_2	diario	puntual (3 muestras); ver anexo 3 o equivalente	líquido y gas
De 43,000 a 110,000	Partículas suspendidas totales	una vez por año	isocinético (mínimo durante 60 minutos); 2 muestras definitivas	líquido
	NO_x	1 vez cada 6 meses	continuo (4); quimiluminiscencia o equivalente	líquido y gas
	SO_2	una vez por año	medición indirecta a través de certificados de calidad de combustibles que emita el proveedor	líquido
	CO_2, CO, O_2, N_2	una vez por turno	puntual (3 muestras); ver anexo 3 o equivalente	líquido y gas
Mayor de 110,000	Partículas suspendidas totales	1 vez cada 6 meses	isocinético (mínimo durante 60 minutos); 2 muestras definitivas	sólido, líquido
	NO_x	permanente (3)	continuo (4); quimiluminiscencia o equivalente	sólido,líquido y gas.
	O_2	permanente	continua; campo magnético o equivalente, con registrador como mínimo ó equivalente	líquido y gas
	SO_2	una vez por año	medición indirecta a través de certificados de calidad de combustibles que emita el proveedor	sólido, líquido

NOTAS:

(1) Ver 6.1.1.4

(2) Ver 6.1.1.5

(3) El monitoreo continuo de NO_x será permanente en las zonas metropolitanas de las ciudades de México, Guadalajara y Monterrey; con una duración de cuando menos 7 días una vez cada 3 meses en las zonas críticas; y con una duración de cuando menos 7 días una vez cada seis meses en el resto del país.

(4) Ver 4.13

(5) Deberán realizarse las mediciones correspondientes a equipos de calentamiento industriales del ambiente de cualquier capacidad en

— U.S. EPA NSPS LIMITS —

Table 1.1-15 (Metric And English Units). NEW SOURCE PERFORMANCE STANDARDS FOR FOSSIL FUEL-FIRED BOILERS

Standard/ Boiler Types/ Applicability Criteria	Boiler Size MW (Million Btu/hr)	Fuel Or Boiler Type	PM ng/J (lb/MMBtu) [% reduction]	SO_2 ng/J (lb/MMBtu) [% reduction]	NO_x ng/J (lb/MMBtu) [% reduction]
Subpart D	>73 (>250)	Gas	43 (0.10)	NA[d]	86 (0.20)
Industrial-Utility		Oil	43 (0.10)	340 (0.80)	129 (0.30)
Commence construction after 8/17/71		Bit./Subbit. Coal	43 (0.10)	520 (1.20)	300 (0.70)
Subpart Da	>73 (>250)	Gas	13 (0.03) [NA]	340 (0.80) [90][a]	86 (0.20) [25] 160 PPM
Utility Commence construction after 9/18/78		Oil	13 (0.03) [70]	340 (0.80) [90][a] 440 PPM	130 (0.30) [30] 230 PPM
		Bit./Subbit. Coal	13 (0.03) [99]	520 (1.20) [90][a]	260/210[c] (0.60/0.50) [65/65]
POWERS EQL. CONVERSIONS[a] [BITUMINOUS COAL]			40 mg/m^3	620 PPM	430 PPM
Subpart Db	>29 (>100)	Gas	NA[d]	NA[d]	43[f] (0.10)
Industrial-Commercial Institution		Distillate Oil	43 (0.10)	340[n] (0.80) [90]	43[f] (0.10)
Commence construction after 6/19/84[m]		Residual Oil	(Same as for distillate oil)	(Same as for distillate oil)	130[g] (0.30)
		Pulverized Bit./Subbit. Coal	22[e] (0.05)	520[e] (1.20) [90]	300 (0.70)
		Spreader Stoker & FBC	22[e] (0.05)	520[e] (1.20) [90]	260 (0.60)
		Mass-Feed Stoker	22[e] (0.05)	520[e] (1.20) [90]	210 (0.50)

NOTE (a): ALL CONVERSIONS ASSUME 25% EXCESS AIR, TO PERMIT A DIRECT COMPARISON WITH MEXICAN NOM-085-ECOL-1994 LIMITS. TEMP = 25 °C

1 OF 3

SO_2 EMISSION LIMITS – NOM-085
"ZONAS CRÍTICAS", JAN. 1, 1998

8/30
B.P.

GIVEN:

a.) 500 MW PLANT

b) 34% THERMAL EFF. (η)

c) $MW = \dfrac{3{,}415{,}000\ \text{BTU}}{\eta} \cong 10{,}000{,}000\ \text{BTU}$

d) EXHAUST GAS GENERATION RATES: 0% O_2

i) BIT. COAL: 9,820 FT^3/MMBTU @ 0% O_2
ii) OIL : 9,220 " / " " " "
iii) GAS : 8,740 " / " " " "

e) EXHAUST GAS GEN. RATES: 4% O_2 [25% EXCESS AIR]

i) BIT COAL: 12,144 FT^3/MMBTU OR 344 m^3/MMBTU
ii) OIL : 11,402 FT^3/MMBTU OR 323 m^3/MMBTU
iii) GAS : 10,809 FT^3/MMBTU OR 306 m^3/MMBTU

f) $$Q_{IN}/hr = 500\frac{MW}{hr}\left(\frac{10\ \text{MMBTU}}{MW}\right) = 5{,}000\ \frac{\text{MMBTU}}{hr}$$

g) $$SO_2\ \underset{\text{PURE GAS}}{\text{DENSITY}} = \frac{64\ \text{lb/lb-M}}{385\ \text{FT}^3/\text{lb-M}} = 0.166\ \frac{\text{lb}}{\text{FT}^3}$$

h) NOM-085 SO_2 LIMIT (COAL & OIL) = 1,100 PPMV @ 4% O_2
"ZONAS CRÍTICAS"

ALLOWABLE SO_2 EMISSION RATES:

1.a COAL (lb/hr): $$(1{,}100\cdot 10^{-6})\left(0.166\ \frac{\text{lb}}{\text{FT}^3}\right)\left(5{,}000\ \frac{\text{MMBTU}}{hr}\right)\left(12{,}144\ \frac{\text{FT}^3}{\text{MMBTU}}\right) = 11{,}087\ \text{lb/hr}$$

1.b. COAL (TON/YR): $$\left(11{,}087\ \frac{\text{lb}}{hr}\right)\left(\frac{\text{TON}}{2{,}000\ \text{lb}}\right)\left(8{,}760\ \frac{hr}{YR}\right) = 48{,}563\ \frac{\text{TON}}{YR}$$ (SMO

2.a. OIL: $$(1{,}100\cdot 10^{-6})\left(0.166\ \frac{\text{lb}}{\text{FT}^3}\right)\left(5{,}000\ \frac{\text{MMBTU}}{hr}\right)\left(11{,}402\ \frac{\text{FT}^3}{\text{MMBTU}}\right) = 10{,}410\ \text{lb/hr}$$

2.b. OIL ..: (10,410 lb)(TON/2,000 lb)(8760 hr/yr) = 45,596 TON (SM

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B.P.

NO$_x$ EMISSION LIMITS NOM-085
"ZONAS CRÍTICAS", JAN. 1, 1998

GIVEN: ALL FACTORS ON PREVIOUS PAGE, AND

$$NO_2 \text{ DENSITY (PURE GAS)} = \frac{46 \text{ lb/lb-M}}{385 \text{ FT}^3\text{/lb-M}} = 0.119 \frac{\text{lb}}{\text{FT}^3}$$

NOM-085 NO$_2$ LIMIT (COAL, OIL & GAS) = 110 PPMV @ 4% O$_2$
ZONAS CRÍTICAS

ALLOWABLE NO$_x$ EMISSION RATES:

1.a. COAL (lb/hr): $(110 \cdot 10^{-6})\left(0.119 \frac{\text{lb}}{\text{FT}^3}\right)\left(5{,}000 \frac{\text{MMBTu}}{\text{hr}}\right)\left(12{,}144 \frac{\text{FT}^3}{\text{MMBTu}}\right) = 795 \frac{\text{lb}}{\text{hr}}$

1.b. COAL (TON/YR): $\left(795 \frac{\text{lb}}{\text{hr}}\right)\left(\frac{\text{TON}}{2{,}000 \text{ lb}}\right)\left(8{,}760 \frac{\text{hr}}{\text{YR}}\right) = 3{,}482 \frac{\text{TON}}{\text{YR}}$ (SNAR

2.a. OIL (lb/hr): $(110 \ 10^{-6})(0.119)(5{,}000)(11{,}402) = 746 \frac{\text{lb}}{\text{hr}}$

2.b. OIL (TON/YR): $\left(746 \frac{\text{lb}}{\text{hr}}\right)\left(\frac{1}{2000}\right)(8{,}760) = 3{,}267 \frac{\text{TON}}{\text{YR}}$

3.a. GAS (lb/hr): $(110 \cdot 10^{-6})(0.119)(5{,}000)(10{,}809) = 707$ lb/hr

3.b. GAS (TON/YR): $(707)\left(\frac{1}{2000}\right)(8{,}760) = 3{,}097 \frac{\text{TON}}{\text{YR}}$

GAS NO$_x$ ER ADJUSTED FOR CC GAS TURBINE EFFICIENCY (50%):

$$NO_x \ ER = (\text{ER SIMPLE CYCLE})\left(\frac{\text{EFF. SIMPLE CYCLE}}{\text{EFF. COMBINED CYCLE}}\right)$$

$$= 3{,}097 \ \left(\frac{0.34}{}\right) \qquad = 2{,}106 \ \text{TON}$$

PARTICULATE EMISSION LIMITS: NOM-085
"ZONAS CRÍTICAS", JAN. 1, 1998

8/30
B.P.

NOM-085 PARTICULATE LIMIT (COAL & OIL) = $250 \frac{mg}{m^3}$

ALLOWABLE PARTICULATE LIMITS:

1.a. COAL $\left(\frac{lb}{hr}\right)$: $\left(\frac{250\ mg}{m^3}\right)\left(\frac{lb}{454{,}000\ mg}\right)\left(\frac{344\ m^3}{MMBTu}\right)\left(\frac{5{,}000\ MMBTu}{hr}\right) = 947 \frac{lb}{hr}$

1.b. COAL $\left(\frac{TON}{YR}\right)$: $\left(947 \frac{lb}{hr}\right)\left(\frac{TON}{2{,}000\ lb}\right)\left(8{,}760 \frac{hr}{YR}\right) = 4{,}148 \frac{TON}{YR}$

2.a. OIL $\left(\frac{lb}{hr}\right)$: $(250)\left(\frac{1}{454{,}000}\right)(323)(5{,}000) = 889 \frac{lb}{hr}$

2.b. OIL $\left(\frac{TON}{YR}\right)$: $\left(889 \frac{lb}{hr}\right)\left(\frac{1}{2000}\right)(8{,}760) = 3{,}894 \frac{TON}{YR}$

8/30
B.7

NSPS SUBPART Da UTILITY BOILER
SO_2, NO_x AND PM LIMITS (1978)

GIVEN:

a. 500 MW PLANT (5,000 MMBtu/hr)
b. 34% THERMAL EFF., THEREFORE 1 MW = 10 MMBtu

SUBPART Da LIMITS (lb/MMBtu)

	SO_2	NO_x	PM
1. GAS	0.80	0.20	0.03
500 MW (lb/hr)	4,000	1,000	150
500 MW (TON/YR)	17,520	4,380	657
2. OIL	0.80	0.30	0.03
500 MW (lb/hr)	4,000	1,500	150
500 MW (TON/YR)	17,520	6,570	657
3. COAL (BIT.)	1.20	0.60	0.03
500 MW (lb/hr)	6,000	3,000	150
500 MW (TON/YR)	26,280	13,140	657

NO_x EMISSION RATE FOR 135 MW
SIMPLE CYCLE GAS TURBINE POWER PLANT w/ CONVENTIONAL COMBUSTOR(S)
[PLANNED INSTALLATION, SAN LUIS COLORADO, SONORA]

8/3
E

GIVEN:

a. THREE 45 MW LM6000 GE SIMPLE CYCLE GTs

b. NO_x EFs FROM EPA ACT DOCUMENT FOR GTs (1993):

i) GAS: 0.88 lb/MMBtu (LM6000) UNCONTROLLED

ii) OIL: 1.53 lb/MMBtu (LM6000) UNCONTROLLED

c. THERMAL EFF = 34%. THEREFORE, 1 MW = 10 MMBtu

NO_x EMISSION RATES:

1.a. $$\text{GAS}\left(\frac{lb}{hr}\right):\left(\frac{0.88\ lb}{MMBtu}\right)\left(135\ MW\right)\left(\frac{10\ MMBtu}{MW}\right)=1{,}188\ \frac{lb}{hr}$$

1.b. $$\text{GAS}\left(\frac{TON}{YR}\right):\left(1{,}188\ \frac{lb}{hr}\right)\left(\frac{1\ TON}{2{,}000\ lb}\right)\left(8{,}760\ \frac{hr}{YR}\right)=5{,}203\ \frac{TO}{YR}$$

2.a. $$\text{OIL}\left(\frac{lb}{hr}\right):\left(\frac{1.53\ lb}{MMBtu}\right)\left(135\ MW\right)\left(\frac{10\ MMBtu}{MW}\right)=2{,}066\ \frac{lb}{hr}$$

2.b. $$\text{OIL}\left(\frac{TON}{YR}\right):\left(2{,}066\ \frac{lb}{hr}\right)\left(\frac{1}{2000}\right)\left(8760\right)=9{,}049\ \frac{TON}{YR}$$

ANNUAL EMISSION RATES ADJUSTED TO 500 MW OUTPUT:

$$\text{GAS}\left(\frac{TON}{YR}\right):\left(5{,}203\ \frac{TON}{YR}\right)\left(\frac{500\ MW}{135\ MW}\right)=19{,}270\ \frac{TON}{YR}$$

$$\text{OIL}\left(\frac{TON}{YR}\right):\left(9{,}049\ \frac{TON}{YR}\right)\left(\frac{500\ MW}{135\ MW}\right)=33{,}515\ \frac{TON}{YR}$$

NSPS SUBPART GG GAS TURBINE 8/30
SO_2 & NO_x LIMITS (1977) B.P.

GIVEN:

a. 135 MW (1,350 MMBtu/hr)

b. η = 34%, THEREFORE 1MW = 10 MMBtu

c. 20,000 Btu/lb_{oil} (.020 MMBtu/lb_{oil})

d. FUEL CONSUMPT. $= \frac{1{,}350 \text{ MMBtu/hr}}{.020 \text{ MMBtu/lb}} = 67{,}500$ lb/hr

SO_2 EMISSION LIMIT: FUEL S LIMIT OF 0.8%

$$\therefore \quad S_{LIMIT} = \left(67{,}500 \frac{lb_{oil}}{hr}\right)\left(.008\right) = 540 \frac{lb\ S}{hr}$$

$$SO_2\ LIMIT = \left(\frac{64\ MW\ SO_2}{32\ MW\ S}\right)\left(540 \frac{lb\ S}{hr}\right) = 1{,}080 \frac{lb}{hr} SO_2$$

$\left[4{,}730 \frac{TON}{YR} SO_2\right]$

NO_x LIMIT: 75 PPM @ 15% O_2 & 25% THERMAL EFF.
102 PPM @ 15% O_2 & 34% THERMAL EFF.

1.a. GAS NO_x $\left(\frac{lb}{hr}\right)$: $\left(102 \cdot 10^{-6}\right)\left(0.119 \frac{lb_{NO_2}}{FT^3}\right)\left(1{,}350 \frac{MMBtu}{hr}\right)\left(30{,}960 \frac{FT^3}{MMBtu}\right) = 507 \frac{lb}{hr}$

1.b. GAS $\left(\frac{TON}{YR}\right)$: $\left(507 \frac{lb}{hr}\right)\left(\frac{1}{2000}\right)\left(8760\right) = 2{,}220 \frac{TON}{YR}$

2.a. OIL $\left(\frac{lb}{hr}\right)$: $\left(102 \cdot 10^{-6}\right)\left(0.119\right)\left(1{,}350\right)\left(32{,}661\right) = 535 \frac{lb}{hr}$

2.b. OIL $\left(\frac{TON}{YR}\right)$: $\left(535\right)\left(\frac{1}{2000}\right)\left(8760\right) = 2{,}343 \frac{TON}{YR}$

GAS TURBINE SO_2 EMISSION RATE USING NSPS GG 9/2/9
SO_2 LIMIT OF 150 PPM @ 15% O_2 -BP

I. SIMPLE CYCLE :

GIVEN :

A. 500 MW UNIT (5,000 MMBtu/hr)
B. 34% THERMAL EFF. (1 MW = 10 MMBtu)
C. 8,740 $\text{FT}^3_{\text{EXH. GAS}}$ / MMBtu @ 0% O_2
D. 30,960 $\text{FT}^3_{\text{EXH GAS}}$ / MMBtu @ 15% O_2

$$\text{EXHAUST GAS FLOW}\left(\text{FT}^3/\text{HR}\right) = \left(5{,}000\ \frac{\text{MMBtu}}{\text{hr}}\right)\left(30{,}960\ \frac{\text{FT}^3}{\text{MMBtu}}\right) = 154.8\cdot10^6\ \frac{\text{FT}^3}{\text{HR}}$$

$$SO_2\ \text{EXH. GAS FLOW}\left(\text{FT}^3/\text{HR}\right) = \left(150\cdot10^{-6}\right)\left(154.8\cdot10^6\ \frac{\text{FT}^3}{\text{HR}}\right) = 23{,}220\ \frac{\text{FT}^3}{\text{HR}}$$

$$SO_2\ \text{EMISSION RATE}\left(\text{lb/hr}\right) = \left(\frac{64\ \text{lb/lb-M}}{385\ \text{FT}^3/\text{lb-M}}\right)\left(23{,}220\ \frac{\text{FT}^3}{\text{HR}}\right) = 3{,}860\ \frac{\text{lb}}{\text{HR}}\ SO_2$$

$$\left(16{,}907\ \frac{\text{TON}}{\text{YR}}\right)$$

II. COMBINED CYCLE:

GIVEN: A. 50% THERMAL EFF. (1 MW = 6,800,000 Btu/hr)
B. 500 MW UNIT (3,400 MMBtu/hr)

USE EFF. RATIO TIMES SIMPLE CYCLE EMISSION RATE TO CALC CC EMISSION RATE:

$$SO_2\left(\frac{\text{lb}}{\text{hr}}\right) = \frac{0.34}{0.50}\left(3{,}860\ \frac{\text{lb}}{\text{hr}}\right) = 2{,}625\ \frac{\text{lb}}{\text{hr}}\ SO_2$$

$$SO_2\left(\frac{\text{TON}}{\text{YR}}\right) = \left(2{,}625\ \frac{\text{lb}}{\text{hr}}\right)\left(\frac{1\ \text{SHORT TON}}{2{,}000\ \text{lb}}\right)\left(8{,}760\ \frac{\text{hr}}{\text{YR}}\right) = 11{,}498\ \frac{\text{TON}}{\text{YR}}$$

TABLE 2-1. UNCONTROLLED NO_x EMISSION FACTORS FOR GAS TURBINES

Manufacturer	Model No.	Output, MW	NO_x emissions, ppmv, dry and corrected to 15% O_2		NO_x emissions factor, lb NO_x/MMBtu[a]	
			Natural gas	Distillate oil No. 2	Natural gas	Distillate oil No. 2
Solar	Saturn	1.1	99	150	0.397	0.551
	Centaur	3.3	130	179	0.521	0.658
	Centaur "H"	4.0	105	160	0.421	0.588
	Taurus	4.5	114	168	0.457	0.618
	Mars T12000	8.8	178	267	0.714	0.981
	Mars T14000	10.0	199	NA[b]	0.798	NA[b]
GM/Allison	501-KB5	4.0	155	231	0.622	0.849
	570-KA	4.9	101	182	0.405	0.669
	571-KA	5.9	101	182	0.405	0.669
General Electric	LM1600	12.8	144	237	0.577	0.871
	LM2500	21.8	174	345	0.698	1.27
	LM5000	33.1	185	364	0.742	1.34
→	LM6000	41.5	220	417	0.882	1.53
	MS5001P	26.3	142	211	0.569	0.776
	MS6001B	38.3	148	267	0.593	0.981
	MS7001EA	81.5	154	228	0.618	0.838
	MS7001F	123	179	277	0.718	1.02
	MS9001EA	150	176	235	0.706	0.864
	MS9001F	212	176	272	0.706	1.00
Asea Brown Boveri	GT8	47.4	430	680	1.72	2.50
	GT10	22.6	150	200	0.601	0.735
	GT11N	81.6	390	560	1.56	2.06
	GT35	16.9	300	360	1.20	1.32
Westinghouse	W261B11/12	52.3	220	355	0.882	1.31
	W501D5	119	190	250	0.762	0.919
Siemens	V84.2	105	212	360	0.850	1.32
	V94.2	153	212	360	0.850	1.32
	V64.3	61.5	380	530	1.52	1.95
	V84.3	141	380	530	1.52	1.95
	V94.3	203	380	530	1.52	1.95

[a] Based on emission levels provided by gas turbine manufacturers, corresponding to rated load at ISO conditions. NO_x emissions calculations are shown in Appendix A.

[b] Not available.

FROM:

"ALT. CONTROL TECHNIQUES DOCUMENT
NO_x EMISSIONS FROM STATIONARY
GAS TURBINES," EPA, JANUARY 199
EPA-453/R-93-007