

SUMMARY OF TECHNICAL DATA
RELATED TO FUGITIVE EMISSIONS OF
LEAD, ARSENIC, COPPER AND SULFUR DIOXIDE
FROM THE 16 U.S. COPPER SMELTERS

by

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INTRODUCTION AND METHODOLOGY

This report presents a summary of the technical data which INFORM has gathered and analyzed over the past three years related to fugitive emissions from the sixteen domestic primary copper smelters.

Basic information on the nature of the process used at each smelter was obtained primarily from published materials (company publications, journal articles, EPA reports, papers presented at professional conferences, etc.), from site visits by INFORM personnel, from inspection reports prepared by the U.S. Occupational Safety and Health Administration on file at the agency's area offices, from interviews with workers, and from companies cooperating with the INFORM study (Anaconda, ASARCO and Copper Range).

The data on the effectiveness of fugitive emission controls, in particular in-plant monitoring and personnel sampling data, was gathered primarily from the following sources:

- (1) Regulatory agency inspection reports. These include reports obtained from U.S. Occupational Safety and Health Administration Area Offices, from OSHA state plan designees, such as the Washington Industrial Safety and Health Administration, from other relevant state safety and health agencies, such as the Arizona Office of the State Mine Inspector, and from the U.S. Mining Enforcement and Safety Administration. (See complete list of these agencies following this section.)
- (2) Surveys sponsored by the National Institute for Occupational Safety and Health.

- (3) Company data and expert testimony presented at U.S. OSHA hearings on the agency's proposed arsenic standard (held during 1975-76) and on the proposed sulfur dioxide standard (held during 1977).
- (4) Data supplied directly to INFORM by companies cooperating with the INFORM study (Anaconda, ASARCO, Copper Range).

Information on corporate programs and policies relating to these hazards was gathered primarily through interviews with workers and union officials, from the arsenic and sulfur dioxide hearings cited above, and from company management in the companies cooperating with the INFORM study.

The "Fact Sheets" on each smelter which follow were prepared at various dates between January, 1978 and November, 1978. They incorporated the most up-to-date information available from the above sources, as of the date of their preparation.

REGULATORY AGENCIES
FROM WHICH
SMELTER INSPECTION DATA WAS OBTAINED

Arizona

U.S. OSHA Phoenix Area Office
Office of the State Mine Inspector, Phoenix Office

New Mexico

U.S. OSHA, Albuquerque Area Office
Environmental Improvement Agency, Santa Fe

Nevada

U.S. OSHA, Carson City Area Office
Nevada Industrial Commission, Carson City
U.S. MESA (presently MSHA)
State Mine Inspector, Carson City

Montana

U.S. OSHA, Billings Area Office

Michigan

U.S. OSHA, Detroit Area Office
Michigan Department of Labor, Lansing
Michigan Department of Public Health, Lansing

Tennessee

Tennessee Department of Labor, Nashville
Tennessee Department of Public Health, Nashville
U.S. OSHA, Nashville Area Office

Utah

U.S. OSHA, Salt Lake City
Utah Industrial Commission, Salt Lake City

Washington

U.S. OSHA, Bellevue Area Office
Department of Labor and Industries, Olympia

FACT SHEET

FACILITY: The Anaconda Reduction Works

COMPANY: ARCO, Inc.

INFORM
25 Broad Street
New York City
10004

(212) 425-3550

GENERAL

Name: Anaconda Reduction Works

Location: Anaconda, Montana

Description:

- 1) Combination of receiving facilities, fluo-solids reactor, electric furnace, converters (3 operating), anode furnaces (4), casting wheels (2), and supportive facilities.
- 2) Present feed structure is 60% Weed, 30% Twin Buttes, and 10% precipitates. Yerington and Britannia have been shut down. Considerable future production from Carr Fork will reduce the average arsenic content of the smelter feed. Arsenic content estimated at 0.97% , lead content estimated at 0.28%.
- 3) Reserves are estimated at 800 million tons.
- 4) 1,300 employees (approximately ___ in copper production). Payroll approximately \$28 million.
- 5) Plant is main source of tax revenue, and principal purchaser of fuel, power, freight, and supplies in Anaconda area.

6) Production	1972	1973	1974	1975	1976	1977
Anode Copper	242,955	208,110	197,543	193,000	185,000	
Sulfuric Acid			91,000	108,000	84,000	

Comments:

PROCESS AND HAZARDS--SMELTER

NOTE: Throughout the following remarks, the phrase "poorly characterized" or "uncharacterized" is used to indicate that we have found no evidence that either the company or the regulatory agencies have sufficiently characterized the exposures to permit proper evaluation and corrective action.

NOTE: All documented arsenic exposures are expressed in terms of OSHA's new 10 $\mu\text{g}/\text{m}^3$ standard. Copper dust exposures are expressed in terms of OSHA's 1 mg/m^3 standard. Lead exposures are expressed in terms of OSHA's .1 mg/m^3 standard (to be promulgated October 1978). Sulfur dioxide exposures are expressed in terms of OSHA's proposed 2 ppm standard. Noise exposures are expressed in terms of OSHA's 90 dBA standard.

NOTE: In most areas of the plant, workers wear company-supplied and maintained respirators on a need basis. The following comments evaluate TWA exposures independent of respirator usage.

A. Material Handling Areas (___ workers)

1. Process materials--concentrate slurries, dry concentrates, and precipitates are received, weighed, sampled, blended and stored in the smelter's material handling areas. Slurried concentrates are received by rail, unloaded and pumped to thickening tanks. Dry concentrates are received by rail, unloaded at one of two unloading facilities, and transferred to roaster bins for storage. Additional dry concentrates are stored in an outside storage area--Coal Pile--until needed. The dry concentrates are then fed into a repulping system and mixed with the slurried concentrates and additional water to form a pulp, which is then pumped to surge tanks prior to transfer to the fluo-solids reactor.
 - a. Dry Concentrate Unloading (___ workers)-- Car shaker and air lance use create visible dust and high noise levels during railroad car unloading. Arsenic exposures ranging from slightly above to 20 times the standard. Potential copper and lead dusts are poorly characterized. Noise levels exceeding 115 dBA reported during shaker operation; company requires mandatory use of hearing protection. Operator booth for noise control has been reported impractical during unloading operations.
 - b. Roaster #2 (storage bins and transfer areas) (27 workers)-- Documented arsenic exposures ranging from the standard to 18 times the standard. Copper dust documented ranging from slightly above to 11 times the standard. Lead dust exposures slightly above the proposed standard. Company has reported that engineering controls in this area--hoods on all bins and belt transfer points, fresh air booth and rest station, and a centralized vacuum system--have substantially reduced dust exposures; however, intermittent exposures require mandatory respirator use throughout this area.
 - c. Slurried Concentrate Unloading and Handling (31 workers)-- Exposures in this area uncharacterized. All materials are wet, reducing potential dust exposures. However, spills can dry on floors and eventually become airborne causing potential worker exposure.
2. Flux materials--limestone and silica rock--are also used in the smelting process. Crushed and sized limestone is purchased from a nearby quarry, received by rail, and treated in the smelter's lime plant for use in the smelting process and to produce milk of lime (calcium hydroxide) for use in the concentrating process and for pollution control at various Anaconda operations. Silica rock--for use in the converting process--is purchased from another quarry near the smelter site. The company also purchases some concentrates with high silica content, thus precluding the need for silica flux in the electric furnace process.

- a. Potential exposures to lime dust, free silica, and calcium hydroxide mist in the flux handling and treatment areas, and during transfer, are uncharacterized. (___ workers)

Comments:

B. Fluo-Solids Reactor Area (60 workers)

1. The blended slurried concentrates are pumped to a distributor tank located at the top of the fluo-solids reactor. This feed is then distributed through air-aspirated feed guns into the reactor's roasting zone. Fluxes are fed into the same area through a series of bins, conveyors, and a sealed screw conveyor. Preheated air is introduced under pressure through the reactor floor where it reacts with the feed materials to produce calcine and sulfur dioxide. Most of the calcines leave the reactor entrained in the offgas stream and are collected in primary and secondary cyclones, from which they are removed by screw conveyors which discharge into drag flight conveyors that feed the electric furnace. Some of the calcines are discharged from the reactor through two bed overflow valves directly into the drag-flight conveyors.
2. While the reactor operation is enclosed, the operation is under pressure and seal leakage occurs intermittently. There have also been problems with the cyclone seals which on occasion "blow out," releasing dust and fumes into adjacent areas. Workers in this area are also potentially exposed to fugitive emissions from the electric furnace, since the reactor is located adjacent to the furnace and in the same building.
3. Number of workers in this area and their respective duties are unknown. Company reports average sulfur dioxide & arsenic exposures above current standards.

Comments:

C. Electric Furnace Area (60 workers)

1. Upper Furnace Levels

- a. Feed Levels (drag flight conveyor and slag launder/furnace roof levels)-- Calcines from the reactor, as well as recycled flue dust, molten converter slag, and cold slag accretions from the converters and ladles, serve as feed for the electric furnace. Calcines and flue dust are fed to the furnace through multiple discharge points along the length of two parallel drag-flight conveyors located above the furnace. Converter slag is introduced into the furnace through two converter slag launders located at the converter aisle end of the furnace. The revertable slag--converter accretions, skulls, etc.--is loaded into portable hoppers, which are then placed directly over chutes located along one side of the furnace.
- b. Paste and Storage Levels-- The uppermost level of the electric furnace is used for storage--i.e., electrode paste. Just below the storage level is the paste level, where paste is added to the six electrodes--daily, usually during each afternoon shift.
- c. Worker exposures in upper furnace levels:
 - 1) Documented arsenic exposures ranging three to seven times the standard. Copper dust exposures documented at slightly above the standard to greater than eight times the standard. Documented lead exposures twice the proposed standard.
 - 2) The company reported that it has identified the sources that were contributing to dust exposures in this area and is now in the process of implementing engineering and administrative controls to reduce these exposures. Extent and effectiveness of controls are unknown.
 - 3) Company reported sulfur dioxide levels ranging from greater than twice to twenty times the proposed standard. Peak levels up to 100 ppm.
 - 4) Engineering attempts presently being implemented may reduce some of the sulfur dioxide emission points and resulting worker exposures; however, it has been reported that converter aisle fugitive emissions drift into electric furnace building and contribute to worker exposures in this area.
 - 5) Potential aromatic hydrocarbon exposures, resulting from the "baking" of the electrodes; and subsequent leakage around the electrodes' seals.

2. Tapping Areas

- a. Matte Tapping-- Matte is tapped from the converter aisle end of the furnace into ladles located underneath the tapping floor in a semi-enclosure (short tunnel). After ladle is full, it is pulled out of this area into the center of the converter aisle, where it is picked up by an overhead bridge crane. Doghouse hoods cover the matte tapping points for collecting the gaseous and particulate fugitive emissions during tapping operations. The matte launders are covered.

- 1) Documented arsenic levels of 1,500 to 2,100 $\mu\text{g}/\text{m}^3$. Company reports personal TWA arsenic exposures uncharacterized of 87 $\mu\text{g}/\text{m}^3$
 - 2) It has been noted that the matte tapper gets his head in heavy smoke when checking the level of the ladles. Documented sulfur levels of 45 ppm. Personal TWA exposures are uncharacterized.
 - 3) Other potential exposures--i.e., lead--are uncharacterized.
- b. Slag Tapping-- Slag is tapped in one of two tapping bays located on the opposite ends of the furnace. This operation utilizes rubber-tired slag pot carriers which accept the slag directly from the furnace. The slag is then transported to a disposal area. Similar to the matte area, the tapping points are hooded by doghouses and the launders are covered.
- 1) Personal TWA arsenic exposures are poorly characterized. One three-hour level of 10 times the standard has been documented.
 - 2) Sulfur dioxide and other potential exposures--i.e., lead--are uncharacterized.

Comments:

D. Converter Area (69 workers)

1. Matte from the electric furnace is transferred to one of three Peirce-Smith converters. Silica is added to the converters to form an iron silicate slag which is returned to the electric furnace for additional processing. The current practice is to have two converters operating with the other one on hold. There are three additional converters in the converter aisle; however, they are no longer used. All converters have primary water-cooled hoods which capture the offgases and vent them to the plant's baghouse. At the completion of the converter cycle, blister copper is transferred to the anode area by overhead crane.

- a. A consultant assisting Anaconda in a survey of potential arsenic problem areas after the start-up of the electric furnace stated that the arsenic and sulfur dioxide levels in the converter aisle would not change after the elimination of the reverberatory furnaces. During the OSHA Arsenic Hearings the company reported average arsenic exposures in the converter area at almost five times the standard with arsenic area levels of up to $2,194 \mu\text{g}/\text{m}^3$. The company recently reported that converter employees' arsenic exposures ranged up to twice the standard.
 - b. OSHA found high sulfur dioxide levels (35-40 ppm) that intermittently occur and cause converter employee eye irritation. In 1978, the company reported that converter employees' exposures ranged up to $1\frac{1}{2}$ times the proposed standard.
2. Crane cabs are under positive pressure and air conditioned. A worker reported that the company wanted cranemen to work with respirators when air conditioning failed. Complaints about crane cab conditions are still heard during Joint Safety and Health Committee meetings.
 3. Skimmer-- Documented arsenic exposures of five to seven times the standard and very high episodic levels of sulfur dioxide prior to the insulating of the skimmer shacks and fitting them with positive-pressure fans and duct heaters. Effectiveness of these controls is unknown.
 4. Puncher-- Documented noise exposures of $1\frac{1}{2}$ times the standard with intermittent noise levels exceeding 115 dBA prior to the installation of insulated soundproof punching cabs on the active converters. Effectiveness of these controls is unknown.
 5. Potential exposures of arsenic, lead, and copper dusts, and sulfur dioxide to converter aisle employees--ladle chasers, cat operator, etc.--from converter aisle activities--skull breaking, cleaning of aisle with bulldozer, ladle emissions, etc.--are poorly characterized.

Comments:

E. Anode Casting Area (35 workers)

1. Overhead bridge cranes transfer the blister copper from the converters to one of four anode furnaces. the refining cycle--oxidation and reduction (using natural gas)--usually takes four hours, after which the anode copper is cast on one of two casting wheels, each containing 26 anode molds. Gases emitted by the anode furnaces are not captured, but are vented directly into the building. A fume exhaust system, which encloses the new airless spray system--used to cool the anodes on the casting wheels--collects gases, vapors, and particulate emissions. These emissions are exhausted via a stack through the building roof line to the atmosphere. After cooling, the anodes are placed into rack cars and shipped to Anaconda's Great Falls Refinery for electrolytic refining.
 - a. Documented arsenic exposures ranging from slightly above to 10 times the standard.
 - b. The company recently reported sulfur dioxide exposures below the proposed standard. During the 1977 OSHA Sulfur Dioxide hearings, employee exposures were reported ranging from at to three times the proposed standard.
 - c. After a 1975 OSHA noise citation, the company installed soundproof pourer's booths equipped with electric heaters, ventilating fans, and air conditioners. In addition, the open furnace burners were converted to a closed type and the moldwash sprayers were converted to an airless spray. Present noise exposures are reported at the standard.
 - d. Poling generates "black smoke"--unburned hydrocarbons--which is released uncollected into the anode area. Worker exposures, if any, are uncharacterized. It is unknown whether the company has reduced the amount of unburned hydrocarbons by mixing air with the reducing gas in the tuyeres.
 - e. Potential heat exposures are uncharacterized.

Comments:

F. Baghouse (14 Workers)

1. A new particulate control facility that incorporates a baghouse was installed to replace the plant's old Cottrell units. Major components of this facility include two spray chambers to cool the offgases, three centrifugal fans, and an eighteen-chamber baghouse. After cleaning, the gases are routed to the main stack or to the acid plant. Dust collected in this facility is either returned to the electric furnace by screw conveyor--to lower the furnace's roof temperature and to reduce the rapidity of gasing in the furnace--or dumped. The dusts that are dumped are first transferred to ventilated tanks where lime is added to fixate the arsenic and then pumped to a retention pond where it is stockpiled.
 - a. Arsenic exposures reported ranging from at to 47 times the standard. Area levels of up to $1,570 \mu\text{g}/\text{m}^3$ have been documented.*
 - b. Sulfur dioxide levels of up to 300 ppm have been reported, personal TWA exposures are poorly characterized.
 - c. Lead exposures have been reported from slightly above to seven times the proposed standard.*
 - c. Cadmium exposures have been documented ranging from above to twice the standard recommended by the National Institute for Occupational Safety and Health (NIOSH).*

Comments:

*Many exposures documented in the baghouse area were for employees who carried out repair tasks in the area and only worked there intermittently.

G. Acid Plant (16 Workers)

1. A single contact 660 ton per day sulfuric acid plant was enlarged to a 990 tons per day double contact plant in 1977. The company now intends to add an additional plant to increase air pollution control.
 - a. Data on worker exposures in this area was not available to INFORM. Hazardous exposures have been reported in acid plant areas at other copper smelters.

Comments:

COMPANY SAFETY AND HEALTH ACTIVITIES

A. History

1. Anaconda's Industrial Hygiene Department was first formed in 1943 and remained at the smelter until 1958 when operations were switched to the Butte Environmental Department. Industrial hygiene operations were reorganized in 1969 under the Department of Environmental Affairs. Since the ARCO takeover of Anaconda operations, industrial hygiene activities were established at the corporate level under the auspices of the Vice President of Environment, Health, and Technology. At the smelter the program is overseen by the Director of Industrial Health and Safety. In addition, the Industrial Health and Safety Program is completely independent of the plant's environmental program.
2. History of Anaconda's Safety Program not available to INFORM.

B. Staff (smelter)

1. Director of Industrial Health and Safety
 - a. Industrial Health Staff
 - 1) Industrial Hygiene Engineer
 - 2) Industrial Hygiene Technician
 - 3) Respirator cleaning and maintenance (3)
 - b. Safety Staff
 - 1) Safety Engineers (2)

C. Industrial Hygiene Activities

1. Environmental (inplant) Sampling
 - a. Until recently, personal sampling was performed on a "rule of thumb" basis, basically in high risk areas such as the baghouse. A routine sampling schedule has recently been implemented as a result of regulatory actions--i.e., new arsenic standard. The company has recently completed a comprehensive sampling protocol of all job categories at the smelter, even workers in outlying areas where exposures were not thought to occur in the past. After documentation of each job category's exposures, the company expects to adhere to the required sampling provisions as provided for in the new arsenic standard. Air contaminants monitored for include arsenic, sulfur dioxide, copper, lead, and cadmium.
 - b. Area sampling has been performed in many areas of the plant to evaluate control approaches--i.e., concentrate blending area and electric furnace.
 - c. All area and personal samples collected at the plant are sent to Anaconda's industrial hygiene lab in Tucson, Arizona. This laboratory was certified by the American Industrial Hygiene Association in February, 1977.

2. Noise Sampling
 - a. The company performs, on an annual basis, both area level (sound level meters) and personal (dosimeters) noise sampling surveys.
3. Ventilation and engineering control systems are checked by the plant engineering maintenance crews and environmental engineering technicians on an "as needed" basis.
4. No formal reports or education are given to workers regarding the need, objectives, and results of industrial hygiene activities.

Comments:

D. Respirator Program

1. Training, education, and supervision of respirator is the responsibility of the Director of Health and Safety.
2. All workers are assigned and fitted with their own respirators according to the hazards present in their work area. Respirators are worn on an as needed basis, except in designated mandatory-use areas.
3. All workers at the plant have received extensive respirator training which includes viewing of a film produced at the plant, and individual fitting/leak testing of each respirator.
4. Workers in the smelting areas of the plant are furnished with a clean, individually marked respirator at the beginning of each work shift. Other workers are issued unmarked respirators which can be exchanged any time cleaning or maintenance is required.

E. Safety Activities

1. Plant safety engineers conduct routine inspections (monthly, bi-monthly, annually) of the plant, in addition to those performed by the Joint Safety and Health Committee. No specific checklists are used. Results of inspections are prepared in memorandum format.
2. Accident investigations, for all compensated accidents, ambulance calls, fatalities, and near misses with potential serious injury are conducted jointly by the company and the union. In all cases, written reports are prepared and a copy is forwarded to the union in memorandum format.

3. New employees are instructed as to the safety aspects, the associated hazards, and the proper safety practices of their particular job through an indoctrination orientation. After initial orientation, the worker is assigned to work with an experienced worker. The length of training period is dependent on the hazard of the job.
4. Formal safety refresher courses for all employees are not available.
5. Safety and health implications of new equipment and/or process changes are first discussed with Joint Safety and Health Committee. Safety training is then provided for those employees involved with the change/addition.
6. Accident frequency rates are computed by prescribed MESA methods (adopted from American National Standards Institute [ANSI] methods). These rates were not available to INFORM.
7. OSHA 102 data is available for 1973 through 1976.
8. Identification of accident factors is a normal part of the plant's safety program; however, these efforts have not resulted in any publicly available findings.
9. Yearly estimated cost of the plant's safety program--labor and equipment--was \$360,000 in 1977.
10. Company reports that they are not engaged in any formal system of safety information exchange outside the company.

Comments:

F. Health Care

1. Smelter complex has its own onsite clinic which is staffed by four Industrial Medics--enabling 24-hours-per-day availability.
2. All serious injuries and illnesses are treated at Anaconda Community Hospital--a 60-bed facility--located two miles from smelter. Ambulance is available at smelter site.
3. Emergency medical equipment--first aid/burn kits, stretchers--are located at various locations throughout the smelter.
4. All employees receive pre-employment medical and audiometric exams as required by Montana state law.
5. Annual audiometric exams are given all employees. Evaluation of these tests is performed by a local otologist.
6. Until recently, company only provided annual physicals for baghouse employees and those exposed to asbestos. While the company paid for the examination--no company physicians at the plant--they were only available to the employees on their own time. Company also provided urine analyses (arsenic) for every person who is monitored for arsenic exposure.
7. A new medical screening program--including chest x-ray, sputum cytology, pulmonary function, and blood and urinary analysis for heavy metals--was recently made available, on a voluntary basis, to all plant employees. Results of the exams will only be available to the individual worker; company officials will not receive the results of these individual tests. These exams were performed by an independent medical consulting firm--Tabershaw Occupational Medicine Associates. After completion of and analysis of all the workers' examinations, the consulting firm will report to the company any trends that management should address. The company presently plans to make this screening program available on an annual basis.
8. Until the above program was implemented, there was no evidence of a formal education program regarding the need, objectives, and results of medical activities.
9. Epidemiological and medical research studies have been performed at the Anaconda smelter. These studies have included the Lee and Fraumeni study, a University of Utah study of Sputum cytology testing and a study of smelter workers' urinary arsenic levels.

Comments:

SAFETY AND HEALTH COMMITTEE

- A. The Joint Safety and Health Committee was established in compliance with contract provisions in 1971.
- B. Committee includes five management representatives and five union representatives. One member from each group serves as a co-chairman for a one-year period.
- C. Committee meets once a month to discuss safety and health conditions and to make recommendations for corrective action. Inspection tours are conducted if any member so requests. A written report (minutes) is prepared at the conclusion of the meeting by the company and forwarded to all committee members and the union.
- D. Other safety and health topics may be discussed, such as any new process changes and/or additions. The union also uses the committee to air any safety and health complaints.
- E. The safety and health provisions of the union contract address other matters, such as:
 - 1. Right to refuse unsafe work. Specific procedures for handling disputed cases have been incorporated into the contract.
 - 2. Right of the International to enter areas of the plant if any dispute arises over safety and health issues.
 - 3. Right to retain wage rates if worker is forced to change jobs as a result of toxic substance exposures.
- F. There is no company policy which would allow the union to review the results of the company's industrial hygiene monitoring.

Comments:

REGULATORY HISTORY

A. Pre-1970

1. Safety

a. Industrial Accident Board

- 1) Smelters designated as hazardous workplace, 1961.
No inspection records available to INFORM.

2. Health

a. Montana State Department of Health

- 1) 1943 established methods of determining and monitoring air contaminants.
- 2) Periodic monitoring of Anaconda Reduction Works re: arsenic, lead, zinc, sulfur dioxide, etc., beginning in 1943 --inspections on file at INFORM.
- 3) Passed statutory inspection provision for Industrial Hygiene, 1967.

B. Post-1970

1. Safety

a. Bureau of Safety and Health, Division of Workers' Compensation

- 1) Drafted OSHA State Plan
- 2) State never passed enabling legislation; plan withdrawn 6/30/74.
- 3) No longer inspect.

2. Health

a. Department of Health and Environmental Sciences

- 1) 1971 passed comprehensive occupational health regulations and standards.
- 2) Bureau of Occupational Health presently answers complaints and requests.

C. OSHA Activities

1. Sole jurisdiction over state occupational safety and health activities

2. Inspections (see Table 3)

Comments:

PROCESS EQUIPMENT--Anaconda

NAME	AGE	POLLUTION CONTROLS	COMMENTS
Fluo-Solid Reactor	1975	1° + 2° Cyclones → Spray Chamber Baghouse → Acid Plant or Stack	
Electric Furnace	1975	Balloon Flue → Spray Chamber Baghouse → Acid Plant or Stack	Matte and slag tap hoods (dog-houses). Semi-enclosed matte ladle bay.
Converters (6-- 3 active)	3 - 1941 1 - 1968 2 - 1972	Primary Hoods → Balloon Flue → Spray Chamber-Baghouse → Acid Plant or Main Stack	Skimmer booths enclosed. Punching cabs enclosed.
Refining Furnaces (4)	2 - 1941 2 - 1972	Furnace offgases not collected vented through roof monitor.	Closed-type burners.
Casting Wheels (2)		Fume exhaust system which encloses airless spray--cools anodes and collects gases, vapors, and particulate emissions	Enclosed pourers booths.
Baghouse	1976		Collected dusts returned to furnace or mixed with lime and dumped.
Acid Plant	Enlarged in 1976	No controls needed.	Presently controls 35% of total sulfur input.

SUMMARY OF HEALTH HAZARDS--Anaconda

PLANT AREA	Number of Employees in Area	TWA Exposures * (area levels)			Sulfur dioxide (ppm)	Noise Levels (dBA)	NOTES
		Copper (mg/m ³)	Arsenic (μg/m ³)	Lead (mg/m ³)			
Dry Concentrate Receiving & Handling	35	.25-11.8	10-450	.01-.13	----	109 - 117	High dust exposures occur intermittently (e.g., large spills). Mandatory respirator use area.
Slurried Concentrate Receiving & Handling	?	?	?	?	----	?	Potential exposures from spills (drying on floors), return side of belts. Exposures, if any, unknown.
Fluo-Solids Roaster/ Electric Furnace Area	64	10-210 1.21-8.29	10-210 [30-2,100]	.03-.24	5-39.4 [20-100]	92	Re-engineering partly underway: feeding operations, flues, draft.
Converter Area	102	.05-.22	46 [up to 2,199]	.01-.02	.04-3 [35-40]	115	
Refining & Casting	53	.06-.8	11-100	.005-.05	.1-5.7 [16]	90	
Baghouse	16	.05-.20	10-470 [770-1,570]	.01-.74	[up to 300]	?	High exposures occurring intermittently during repair
Acid Plant	?	?	?	?	?	?	Exposures unknown

*Independent of respirator usage

SOURCES: Arsenic OSHA hearings 1975. Company data
Sulfur dioxide OSHA hearings 1975.
OSHA inspections
NIOSH surveys
State Department of Health Inspections
Company data

OSHA INSPECTIONS--Anaconda

DATE	TYPE	FINDINGS	PENALTIES	FOLLOW-UP	COMMENTS
5/26-27/71	complaint - health	NO SPECIFIC STANDARDS IN EFFECT AT THE TIME			
12/26/72 - 4/17/73 case completed 2/4/74	general schedule - health	19 non-serious violations	\$235 Contested - "controls not feasible" for dust & noise	NONE As per terms & conditions set forth in settlement, abatement dates were extended.	Cu, Pb, As dusts sampling; noise; asbestos storage, handling, monitoring.
6/26/73	complaint - health	1 serious violation	\$800	Violation abated 7/2/73	Guardrails in crane areas. No violations pertaining to complaints which were for excessive noise, SO ₂ , dusts, & fume.
7/2/73	Follow-up	In Compliance	NONE	NONE	Follow-up on crane guardrails.
3/4-7/75 case completed 9/15/75	general schedule - safety	21 non-serious violations	\$535 - contested. 1 citation vacated 2 reduced by \$15 Final penalty -- \$475	Violations abated 9/15/75	Various safety violations - guardrails, shields, etc.
3/7-11/75	complaint - health: gases & dusts	In Compliance	NONE	NONE	
9/9/75 - 2/13/76 case completed 1/24/77	general schedule - health	4 wilful 6 repeated 9 serious 16 non-serious	\$45,055 - contested. Final penalty \$28,645. Repeated violations reduced to non-serious.	Interim inspections as per terms & conditions set forth in settlement.	Cited for Cu, Pb, As dusts greater than unity; respirator violations; asbestos storage, handling, & monitoring; noise.

DATE	TYPE	FINDINGS	PENALTIES	FOLLOW-UP	
12/06/76	Accident Fatality	1 other violation	\$140	Company submitted abatement.	Cited for failure to complete a written engineering survey prior to starting demolition work. CSHO concluded that accidental death was due to employee insubordination.
12/14-14/76	Complaint Health	1 other violation	\$0	Company submitted abatement.	Cited for not providing PPE to prevent occasional eye irritation from SO ₂ . Company enclosed and ventilated skimmer shacks.
3/2/77	Complaint Safety	1 serious and 8 other violations	\$280	OSHA follow-up inspection.	Serious violation for not having access gates in place on one of the converter cranes. Other violations for various crane violations including lack of load markings, guardrails & electrical violations.
3/29/77	Follow-up of 3/2/77	--	---	----	OSHA found all violations of 3/2/77 have been abated.
4/8/77	Complaint [accident] Safety	3 other violations	\$0	Company submitted abatement.	Accident occurred during rebuild of converter. Injury sustained was a fracture and dislocation of bones in hand. Complainee stated that no one accompanied him to first aid, poor procedure to take care of injured. Cited for three scaffold violations.

DATE	TITLE	FINDINGS	FEES	REMARKS	COMMENTS
9/19/77 - 11/3/77	Follow-up Health of 9/9/75 [#7]	2 other violations	\$60	Company sub- mitted abate- ment.	Copper exposures in the belt areas of Ro. #2 and Serpentix building ranging between 1.9 to 11.8 mg/m3.
11/1/77 - 3/20/78	Complaint Health	4 other violations	\$0	Unless PMA is granted, all violations are to abated by 09/27/78	Citations for copper and lead exposures. Area sampling for arsenic [up to 2,100 ug/m3] & sulfur dioxide [up to 45.5 ppm] All sampling performed in electric furnace dept., after worker complaint stating that electric furnace workers are exposed to dusty, hot, gaseous conditions.
12/22/77	Complaint Health	No violations	---	---	Worker complaint in re to asbestos exposures in converter, boiler, and reverb shops, compl- aint was informal since worker would not release his name. CSHO found that physicals were given to exposed employees(44) air sampling was performed (with in limits), areas were posted. asbestos materials labeled, and asbestos materials properly stored. -- no violations observed.

FACT SHEET

FACILITY: El Paso Copper Smelter

COMPANY: ASARCO, Inc.

INFORM
25 Broad Street
New York, New York
10004

(212) 425-3550

I. GENERAL

Name: El Paso Copper Smelter

Location: El Paso, Texas

Description:

- 1) Custom non-ferrous smelter complex producing lead, zinc, copper and cadmium. Facilities to extract autimony from a complex copper ore will soon go into operation. INFORM has researched only the copper circuit of the complex. Copper has been smelted since 1916.
- 2) Copper concentrates are mostly from Arizona. Company reported in communications to INFORM in 1977 that the arsenic content of the copper feed is 0.01%. In mid-1975, a consultant retained by ASARCO presented testimony of the OSHA arsenic hearings which placed the arsenic content at 0.20%. Lead content is reported by the company at 0.4%.
- 3) Entire operation involves 900 to 1,000 employees. Copper circuit production employees number approximately 150, excluding the yard gang and the ore unloading departments which are shared by the different smelter processes.
- 4) Plant is located in a relatively large metropolitan area (population ~400,000) with diverse sources of employment. Smelter is an important area employer, but not the predominant one.
- 5) Production
 - a) Approximately 30% of ASARCO's total copper production.
 - b)

	1972	1973	1974	1975	1976
Copper	78,000	98,000	78,479	88,706	83,793

Comments:

II. PROCESS AND HAZARDS

NOTE: In most areas of the plant, workmen wear company-supplied respirators. The following comments refer to exposures independent of respirator usage.

NOTE: The El Paso area is subject to strong winds several months during the year. Since many of the areas of the smelter are semi-open, exposures can be seriously influenced by the windy conditions.

NOTE: Throughout the following remarks, the phrase "poorly characterized" is used to indicate that we have found no evidence that either the company or the regulatory agencies have sufficiently characterized the exposures to permit proper evaluation and corrective action.

A) Receiving and Bedding Areas

- 1) Concentrates are received in bottom-drop railroad cars or unloaded with clamshell buckets into grate and underground belt conveyor. Occasional exposures to excessive noise (R.R. car vibrators) and dust. Potential arsenic and lead exposures. A report by an ASARCO consultant in 1975 estimated the percentage of arsenic in pavement dust to be 0.9%.
- 2) Concrete ore bins. Materials distributed by automatic tripper conveyor into appropriate bins. Both lead and copper concentrates are housed in same building. Potential lead and arsenic exposure hazards. High dust exposures occur particularly when men use air lances in bins to dislodge concentrate for delivery to hoppers below. Company reports plans to remodel entire receiving and bedding areas, automating and enclosing much of the operation. Plans are a response to local and state pressures to control fugitive emissions of particulates.

B) Roasters

- 1) Four wedge roasters.
- 2) Operating decks
 - a) Arsenic exposures documented in a range ten times the proposed standard. Sulfur dioxide exposures are variable but in a range between the present and the proposed standard. Dust exposures, if any, are poorly characterized.
 - b) Exposures occur from "puffs" that exceed the draft in the roaster, from the need to use access doors on all decks for maintenance and repair, and from emissions during loading of larry cars.
- 3) Unloading areas--larry car
 - a) Calcine is discharged at 1,000° F.
 - b) Company reports a "ventilation tunnel" for the loading area is in operation.
 - c) Larry cars are not covered during rail transfer to top of reverb, thus becoming an intermittent source of air contaminants.
 - d) Larry motorman has a very high documented exposure to sulfur dioxide (four to five times the present standard). Excessive arsenic exposures are almost certain, but they are not available to INFORM. Dust and lead exposures are not characterized.
 - e) Larry motorman exposures occur both in the roaster area and above the reverbs while feeding calcine.

C) Reverb

- 1) One sprung-arch reverb furnace, charged with Wagstaff guns along the sidewalks.
- 2) Slag is tapped into holding furnace, where residual copper settles out. Tapping operation into slag cars from holding furnace is not hooded.

- 3) Matte tapping ports and launders are hooded and ventilated. Matte ladle is exhausted with hinged hood while filling.
- 4) Compressed air is used for "blowing" the top of the furnace. No vacuuming has been attempted.
- 5) Airborne arsenic levels in the entire area are eight to ten times the proposed standard. Personal exposures for different job categories are probably characterized by the company, but not available to INFORM.
- 6) Sulfur dioxide levels in the charge deck area are reported variable between 1 to 50 ppm. Personal exposures to sulfur dioxide in this and other reverb areas are poorly characterized.
- 7) Copper dust and/or fume exposures are poorly characterized.
- 8) There are reported airborne lead levels in the charge deck area in the range of the proposed standard.

D) Converter Aisle

- 1) Three Pierce-Smith converters with primary water-cooled hoods.
- 2) Company presently building nearly complete enclosure around converter building. Together with roof fans and collection equipment, however, these changes are in response to local and state pressures to control fugitive emissions. Company statements indicate uncertainty and some apprehension regarding the impact of this enclosure on workplace exposures.
- 3) Zinc fuming furnace is in converter aisle area. It receives slag from the lead circuit, containing zinc as well as lead. This furnace is probably the main source of airborne lead in the converter and reverb areas, although some copper matte from the lead blast furnace is fed to the reverb and probably results in airborne lead as well.
- 4) Arsenic exposures in the aisle average approximately ten times the proposed standard. Personal exposures in different job categories are probably characterized by company but not available to INFORM.
- 5) Sulfur dioxide exposures in the aisle and platforms are reported close to the proposed standard. Exposures to cranemen are reported in the same range.
- 6) Crane cabs are not enclosed and ventilated. Cranemen wear respirators. Company reports plans to modify cabs.
- 7) Airborne lead levels reported to be around the proposed standard in the platform area and around the present standard for cranemen.
- 8) Exposures to copper fumes are not characterized.
- 9) Converter punchers and skimmers are exposed to noise levels in excess of the standard. Efforts to enclose the operator's cab were made and abandoned. Company now reports steps to try out tuyere mufflers.

E) Anode Casting

- 1) Two anode furnaces, one casting wheel.
- 2) Company estimates arsenic levels to be two to ten times the proposed standard. Personal exposures are not characterized.
- 3) Other potentially hazardous exposures are not characterized (e.g., heat, unburned hydrocarbons, burner noise).

F) Other Areas

- 1) Coarse and fine crushing areas. Very dusty conditions with ineffective engineering controls.
- 2) Cadmium operation near the smelter, coupled with strong winds and semi-open smelter areas may result in hazardous exposures to cadmium in areas remote from actual handling.
- 3) Dust handling from flues, baghouses and precipitators is in the hands of outside crews, under contract, according to company hygienist. Exposures are poorly characterized. Company respirator program requires supplied air for man entering baghouses during operation.
- 4) Exposures to other maintenance personnel have only recently begun to be studied by the company. Details not available to INFORM.
- 5) Exposures, if any, in the acid plant are not available to INFORM.

G) General

- 1) Potential engineering controls applicable to the El Paso smelter are discussed in some detail in three documents which were introduced as testimony at the arsenic and sulfur dioxide hearings. They are:
 - a) Testimony by Edwin S. Godsey of ASARCO at OSHA arsenic hearings in 1975.
 - b) Feasibility and Cost Study prepared by Industrial Health Engineering Associates, Inc., for ASARCO, and presented at the OSHA arsenic hearings in 1975.
 - c) Feasibility and Cost Study prepared by Industrial Health Engineering Associates, Inc., and presented at the OSHA sulfur dioxide hearings in 1977.

INFORM may utilize these materials in its final smelter profile.

- 2) The El Paso smelter has been involved in a continuing controversy/dialogue with city and state air pollution authorities in relation to stack and fugitive emissions of heavy metals, sulfur dioxide, and particulates. The record of the controversy (studies, legal decisions, articles, etc.) is voluminous and largely available to INFORM. The matter is particularly important in relation to in-plant conditions because many of the controls which have been installed in the last few years, as well as those now being installed, have been the result of enforcement of air pollution regulations, particularly through a court case in the city of El Paso.

- 3) A number of areas in the smelter have never been inspected by a regulatory agency. The sampling building, the receiving areas, the bedding areas, and the crushing plant are reportedly under MESA's jurisdiction; yet MESA has never inspected them, probably because there is no mine at the site. OSHA did not touch these areas during its two inspections.

Comments:

I. COMPANY SAFETY AND HEALTH ACTIVITIES

A) Staff

1) Environmental and Industrial Hygiene

Since late 1976, El Paso has had a resident environmental scientist who performs duties related to both occupational health and air pollution.

2) Safety

- a) Program is directed by a Personnel and Safety Director who devotes approximately 40% of his time to safety matters.
- b) In addition, the company reports another full-time employee in the safety program. ("Safety Officer")

B) Respirator Program

- 1) Training, education and supervision is the responsibility of smelter's environmental scientist.
- 2) Storage and facilities for daily cleaning are provided. Workmen turn in their respirators at the end of each shift and a full-time employee is in charge of daily maintenance.

C) Industrial Hygiene

- 1) Yearly sampling of some areas and work stations for SO₂ and arsenic since before OSHA. Extent of yearly monitoring increased significantly in 1976, with more personal sampling carried out.
- 2) No monitoring conducted in areas under MESA jurisdiction.
- 3) Ventilation systems are checked "as needed" by department superintendents.
- 4) No formal reports or education are given to the workmen regarding the need, objectives and results of air monitoring.

- 5) The company has provided a substantial amount of industrial hygiene-related data to OSHA in the course of the arsenic and sulfur dioxide hearings. No data is routinely exchanged with the union.

D) Safety Activities

- 1) Plant safety staff conducts regular safety inspections. No checklist is used but written reports are prepared.
- 2) Plant safety staff conducts investigations of accidents and near misses with written reports. Labor is not invited to participate in accident investigations.
- 3) Company reported to NIOSH in 1972 that corporate safety engineer services were provided to the plant 8 hours/month. INFORM has not determined whether this arrangement still exists.
- 4) There are no formal safety training procedures for new employees. Foremen and fellow employees introduce new employees to area hazards.
- 5) Initial safety training is provided to new foremen.
- 6) Refresher safety training is provided to supervisors.
- 7) Monthly departmental safety meetings take place under the direction of foremen.
- 8) Monthly safety meeting is conducted by the safety officer with two representatives from each department.
- 9) Safety training for new equipment and changed processes is provided.
- 10) Company reports that certain "informal studies" have been conducted to investigate the relationship of accidents to plant areas, worker seniority, overtime, and different shifts. Written findings of these studies are not available.
- 11) There has been no study of cost-benefit considerations in relation to the safety program or related matters.
- 12) Safety statistics (frequency rates) are kept according to the traditional system of the National Safety Council. Data available to INFORM for years 1972 to 1976.
- 13) Company reports that information exchange regarding safety issues takes place in a formal way within the company.
- 14) OSHA 102 data available for 1973, 1975, and 1976.
- 15) INFORM has calculated incidence rates for 1973, 1975, and 1976, according to OSHA methods.

E) Health Care

- 1) Smelter uses local health care facilities for major health services, including emergency care.
- 2) Plant clinic is staffed by a full-time nurse and a practical nurse as well as physicians on a part-time basis (12 hours/week).
- 3) In excess of 100 employees are trained in first aid, with the emphasis on foremen.

- 4) There is a fairly comprehensive system of pre-placement and periodic health monitoring, including general exams, audiometric tests, blood tests, x-rays, and pulmonary function tests.
- 5) Company estimates the cost of its medical program at \$60,000 per year (personnel, testing and equipment).

Comments:

V. SAFETY COMMITTEE

- A) According to the company questionnaire responses, no joint safety and health committee exists at El Paso.
- B) Contract language specifies a joint safety and health committee with three employee representatives and specific functions (monthly meetings, safety inspections, paid time).
- C) Union reports a joint safety committee with three union representatives. Committee meets monthly to discuss safety matters. It also conducts inspections of different departments each month with subsequent discussion and write-up of recommendations for the supervisory personnel in the area inspected. The committee does not address health issues, and the smelter's environmental scientist does not take part in its activities.
- D) The Safety and Health provisions of the contract address other matters, such as:
 - 1) Right to refuse unsafe work. Reports to INFORM indicate that no such instances have required arbitration.
 - 2) Right of joint committee members to review monitoring records "required by the Department of Labor." Individual workers do not have the right to review their own monitoring results.
 - 3) Right of international union representatives to enter the plant for safety and health issues. The right to enter depends on the plant manager's permission, and INFORM is not aware of any instances where the union has requested entrance.

Comments:

I. REGULATORY HISTORY

A) Pre-1970

As far as INFORM could determine, no state regulatory agency ever carried out any inspection activity in the El Paso smelter. The State Health Department, under the "Texas Occupational Safety Act" of 1967, had safety and health jurisdiction.

B) Post-1970

- 1) Texas made relatively feeble attempts to develop a state OSHA plan. Consequently, the state continued to play little or no role in relation to the smelter after 1970.
- 2) OSHA Activities
 - a) Three inspections. One safety. Two health. (See Table 3.)
- 3) Other
 - a) MESA reportedly has jurisdiction over the sampling, crushing, receiving and bedding areas. No inspection has ever been conducted by MESA.

Comments:

Table 1
PROCESS EQUIPMENT--El Paso, Texas

NAME	AGE	POLLUTION CONTROLS
Coarse and Fine Crushing		Some water sprays
Bedding Bins		None
Wedge Roasters (4)	1921	Spray chamber → ESP (joined with reverb offgases) → stack
Reverb Furnace Sprung Arch Wagstaff gun feed on sides	1913	2 WHB → spray chamber → ESP → stack
Reverb Holding Furnace	1970	
Converters 1 & 2 3	1916 1937	2 WHB → spray chamber → ESP → acid plant
Two cranes in aisle		
Anode Furnaces (2)	1916	
Casting Wheel (1)		

Table 2
SUMMARY OF HEALTH HAZARDS--El Paso, Texas

PLANT AREA	Number of Employees	TWA Exposures in mg/M ³			TWA Sulfur Dioxide (ppm)	NOTES
		Copper	Arsenic	Lead		
Receiving and Bedding Areas	45		.06			
Roasters	18		.01-.05	.02<	0.3-6	
Reverberatory Area	27		.10-.15	.01-.10	1-50*	*Area samples. Average SO ₂ exposure on charge deck is 9-10 ppm. Larryman exposure to SO ₂ is 23 ppm.
Converter Aisle	33		.01-.05	.10-.18	0.3-8.4	Converter punchers and skimmers are exposed to noise in excess of standard.
Anode Casting	15-20		.01-.05	.04		

SOURCES: 1) Company testimony at the OSHA arsenic and sulfur dioxide hearings
2) NIOSH industrial hygiene survey, April, 1972

Table 3
 OSHA INSPECTIONS--El Paso, Texas

DATE	TYPE	FINDINGS	PENALTIES	FOLLOW UP	COMMENTS
1/14/74	General Schedule Health	No violations	None	None	Sampling for Pb, Cd, SO ₂ . Mostly in lead circuit. Many excessive exposures found, but not cited because protective equipment was judged adequate protection by OSHA.
1/24-27/77	General Schedule Safety	2 Citations one serious one nonserious 63 items	4245	None yet	Diverse safety items. Contested. Settlement agreed upon.
1/25/77 - 4/20/77	General Schedule Health	1 Citation nonserious 5 items	None	None yet	Pb, Cd, As problems. Mostly in lead circuit. Noise in copper converter area lunchroom facilities. Citation in contest.

FACT SHEET

FACILITY: Hayden Smelter

COMPANY: ASARCO, Inc.

INFORM
25 Broad Street
New York, New York
10004

(212) 425-3550

GENERAL

Name: ASARCO

Location: Hayden, Arizona

Description:

- 1) Custom smelter, no concentrator facilities. Smelter built 1912.
- 2) Ore comes from three ASARCO mines in Arizona, from independent Arizona mines, and Speiss from ASARCO--El Paso. Arsenic content estimated variously as 0.005% and 0.04 to 0.1%. Other trace metal information on hand.
- 3) 450-500 production and maintenance employees. 65-70 administrative.
- 4) In 1974, \$6.5 million in payroll and \$1.98 million in taxes.
- 5) Production

- a) ASARCO's largest copper producer. Second only to Kennecott's Garfield, Utah operation.

b)	1972	1973	1974	1975	1976
Blister Copper	160,000	147,000	129,000	105,000	102,000
Anode Copper			43,844	101,396	
Sulfuric Acid			130,420	92,157	

Comments:

I. PROCESS AND HAZARDS--SMELTER

NOTE: In most areas of the plant, workmen wear company-supplied respirators on a need basis. The following comments evaluate TWA exposures independent of respirator use.

NOTE: Throughout the following remarks, the phrase "poorly characterized" is used to indicate that we have found no evidence that either the company or the regulatory agencies have sufficiently characterized the exposures to permit proper evaluation and corrective action.

- A) Sample Building. Three men per shift. Dust exposures despite local exhaust ventilation. Likely Arsenic exposures above proposed standard.

Poorly characterized. Vacuum cleaning and wet housekeeping indicated but not yet adopted.

- B) Unloading of Ore. Likely exposure above proposed Arsenic standard. Local exhaust and elimination of air lances indicated but not yet adopted. Four men per shift.
- C) Beds. Three men per shift. Varying dust exposures as well as general area contamination. Arsenic exposures likely above proposed standard, but poorly characterized. Local exhaust at the transfer point to the bin-conveyor system leading to the roasters is indicated, as well as better enclosure of entire bedding area to prevent wind-generated dust. These measures not yet adopted.
- D) Roasters
 - 1) 22 men per shift. Arsenic exposures two to fifty times the proposed standard. Copper dust exposures slightly above present standard. Some lead exposure in the neighborhood of the proposed limits. SO₂ exposures in the neighborhood of the present standard.
 - 2) Dust-fume characteristics and respirability of airborne particulates are not well studied.
 - 3) Company considers all except one of the twelve roasters to be too old to be repairable (for leaks).
 - 4) Maintenance tasks generally in progress in one to four roasters. Exposures to arsenic are likely to be very high. Poorly characterized.
 - 5) Hot calcine discharge point is a source of heavy arsenic, SO₂, and dust exposures to the workmen in that area, including clean-up crews. Company reports improvement of local exhaust ventilation system. Effectiveness unknown.
 - 6) Larrymen traveling between calcine loading and reverb feeding areas have the highest combined particulate and SO₂ exposures. Arsenic exposures have been reported as high as 20 times the proposed standards. Company reports that more recent data indicates exposures ranging from 4 to 5 times the proposed arsenic standard.
 - 7) Other sources of contamination are:
 - a) uncovered conveyor systems, transfer points, and bins at the top level of the roaster
 - b) Lack of ventilation at roaster feed stations
 - c) Use of poles to help move the hot calcine during loading
 - d) Poor maintenance on calcine hopper - larry car seal
- E) Reverberatory Furnaces
 - 1) Four to five larry cars carrying calcine to the furnaces.
 - 2) Charge floors of the reverbs have the highest SO₂ concentrations in the smelter, 1974 peak above 140 ppm. 1975 peak concentration 23 ppm. Larrymen and helpers (four per shift) are intermittently exposed. Arsenic exposures 20 times the proposed limits. Larry car shakers produce noise exposures twice the allowable limits.

- 3) Two large rooftop fans installed to provide dilution ventilation in charge floor area. Effectiveness unknown.
- 4) Feeding of furnace with Wagstaff guns causes positive pressure build-up and thus fugitive emissions.
- 5) Company reported to the State Mine Inspector in 1973 on efforts to modify Wagstaff guns to stationary feed guns in order to avoid dust generated while moving them from one feed hole to another. Success of efforts not known.
- 6) Matte and slag tapping and launders are hooded. Arsenic exposures exceed the proposed standard. Copper, lead, and total dust exposures are within allowable limits. Sulfur Dioxide exposures are poorly characterized. SO₂ data suggests reduction since 1975, but production was also substantially reduced from previous years; hence cause-effect is difficult to ascertain.
- 7) Slag transfer in tunnel is a source of general contamination. Negative pressure in tunnel is indicated but not yet adopted.
- 8) Reverb arches are "blown" with compressed air. Source of general contamination. Vacuuming tried slightly but failed.
- 9) Transfer of dust from the waste heat boilers, using payloaders, is a source of high-arsenic contamination and exposure. Poorly characterized. Enclosed conveyors indicated but not yet adopted.
- 10) Reverb maintenance tasks are likely to result in high dust and arsenic exposures. They are poorly characterized.

F) Roaster and Reverb Dust Control Equipment

- 1) 7% of smelter's daily roaster input is recirculated flue dust. Its arsenic content is 0.1 to 1.0%, much higher than the concentrate.
- 2) Dust exposures to the dustman and the pugmill operator, in the precipitator, are comparable to those of the larryman. Since arsenic and lead content are higher, the hazard is even more serious.
- 3) Little characterization exists for exposures of other workmen (i.e., precipitator operators and helpers)
- 4) Enclosed conveyor systems for dust handling are indicated but not yet adopted.

G) Converter Aisle

- 1) Exposure to arsenic-laden dust for the personnel involved with the dust-control equipment is variable but likely to be high. Poorly characterized. Enclosed conveyor system is indicated but not yet adopted. Company reports exposures below .5 mg/m³.
- 2) Skimmers (4 per shift) and cranemen (3 per shift) are exposed to arsenic concentrations two to four times the proposed standard.
- 3) Cranemen are likely exposed to SO₂ concentrations in excess of proposed limits inside the crane cabs. TWA are poorly characterized.
- 4) Punchers are exposed to noise levels two to four times the allowable limits. Ear muffs are worn. Company reports no efforts to silence

the punching operation except "observation" of Anaconda's experiments (cab enclosures).

- 5) A 1973 fatality resulted from a converter "blow-out." No satisfactory explanation was ever found.

H) Anode Furnaces

- 1) Furnace burners create noise exposures one to four times the allowable limits to workmen involved in casting. Company has eliminated the use of one burner per furnace to reduce noise.
- 2) Mold spraying position also results in excessive noise exposure.
- 3) Potential heat exposures in casting area. Not characterized.

Comments:

COMPANY SAFETY AND HEALTH ACTIVITIES

A) History--In corporate profile

B) Staff

Safety Director (responds to plant manager)

Environmental Scientist. Sent yearly (or as needed) from corporate Salt Lake City Labs to perform personal sampling and/or air pollution tests. His role is advisory to plant management.

- C) Yearly industrial hygiene sampling of some plant areas. No reports or education given to workmen.
- D) Respirator Program: Full-time person devoted to maintenance and proper instruction of employees. Satisfies OSHA requirements. Fairly rigid enforcement of respirator-wear requirements.
- E) Safety. Weekly meetings in all plant areas between foremen and workmen. Begun as a result of 1973 fatality. Meetings of General Superintendent with staff people take up safety and other matters. OSHA 102 reports for 1972 through 1976 on hand.
- F) Health Care
 - 1) Clinic at Hayden. One doctor. One nurse. Closed weekends and nights, when workers must go to Kennecott's Kearny hospital.
 - 2) Contract gives workers right to see own doctor. Many take advantage and see physicians in Tucson.

- 3) Pre-employment physical and audiometric exams.
- 4) Yearly blood lead tests for all production workers.
- 5) Yearly audiometric tests for all noise-exposed workers. Referrals if needed.

Comments:

V. SAFETY COMMITTEE

A) Description

- 1) Begun in 1971 contract.
- 2) Modified in 1974
- 3) Two USW representatives, 2 IBEW, and two company.
- 4) Monthly tour and discussion. Written reports to participants.
- 5) Mostly visible safety focus, but union has often brought up matters of health concern.

Comments:

VI. REGULATORY HISTORY

A) Pre-1970

- 1) Office of State Mine Inspector

B) Post-1970

1) State OSHA Plan

- a) Developmental. Headed by Arizona Industrial Commission. Approved 10/74.
- b) Jurisdiction over smelters still in hands of State Mine Inspector.

2) Office of State Mine Inspector

- a) No contractual relationship exists with Arizona Industrial Commission.
- b) Approximately two inspections per year in 1972; five per year in 1976. See Table 3.
- c) Limited industrial hygiene efforts.

C) OSHA Activities

- 1) Three inspections. None complete. See Table 3.

Comments:

NAME	AGE	POLLUTION CONTROLS	COMMENTS
Roasters 1-8 (McDouglas) Roasters 9-11 (Herreshoff) Roaster 12 (Bartlett-Snow-Pacific)	1911-1969	Settling chamber and Cottrell precipitator shared with reverberatory furnace.	6 to 10 operating.
Reverb. #2	1942	4 waste heat boilers.	
Reverb. #4	1968	Spray chamber. Settling chamber and Cottrell precipitator shared with roasters.	
Converter	1949	Water-cooled hoods.	
Converter	1965	Cyclones, spray chambers,	
Converter	1968	scrubbing towers, mist	
Converter	1975	precipitator, ESP	
Converter			
2 Anode Furnaces	1974		
2 Anode Casting Wheels	1974		
Acid Plant (single contact)	1968-1971		

*Process flowsheet, Figures 2, 4; Design and Operating Parameters for Emission Control Studies: ASARCO, Hayden, Copper Smelter.

PLANT AREA	Number of Employees	Copper	Arsenic	Lead	Dioxide (ppm)	NOTES
Unloading, Sampling, Bedding	10	2.9-7.0		0.07-0.15		
Roaster Department	36	0.25-7.82	0.01-0.34	0.006-0.18	0-732	
Reverberatory Furnace Department	54	0.24-3.87	0.03-0.36	0.02-0.21	0-700	
Converter Department	42	0.02-0.68	0.003-0.02	0.006-0.09		Noise exposures to skimmers are up to 5 times the standard
Anode Casting Plant	34					
Acid Plant	12					

*Independent of respirator usage.

Sources: Company Data.

OSHA Inspection records.

Office of State Mine Inspector. Inspection records.

Feasibility Document--David Burton Associates, 1975.

NIOSH Study, 1972.

E 3

A Inspections--ASARCO, Hayden

DATE	TYPE	FINDINGS	PENALTIES	FOLLOW-UP	COMMENTS
13/73	fatality	In Compliance	NONE	Recommended	#3 converter blow
10/75	accident	In Compliance	NONE	Not Recommended	Waste heat boiler pipe rupture
16/75	complaint	In Compliance	NONE	Not Recommended	Alleged personal harassment

zona State Mine Inspector--Inspections--ASARCO, Hayden

DATE	TYPE	FINDINGS	PENALTIES	FOLLOW-UP	COMMENTS
31/71	health	7 SO ₂ samples 9 dust counts		NONE	Grab area samples
1/72	health	7 SO ₂ samples 9 dust counts		NONE	Grab area samples
12/72	safety	7 violations		Co. abatement letter	
26/73	health	9 SO ₂ samples 9 dust counts		Co. abatement letter	Grab area samples
9/73	safety	9 violations		Co. abatement letter	
13/73	fatality	In compliance		NONE	#3 converter blow
5/6/74	safety	1 violation		NONE	acid plant
17/74	safety	8 violations		8 notices abated 2/4/75	
2/4/75	safety	9 violations		NONE	
2/4/75	health	8 SO ₂ samples 9 dust counts		NONE	Grab area samples

ona State Mine Inspector--cont'd)

DATE	TYPE	FINDINGS	PENALTIES	FOLLOW-UP	COMMENTS
3/75	safety	19 violations		Abatement letter and memo	
1/75	safety	24 violations		24 violations abated 4/22/76	
1/76-2/76	safety	11 violations		11 violations, abated 6/1/76	
1/76-2/76	health	14 SO ₂ samples 10 dust counts		NONE	Grab area samples
6/76	complaint			abated	#4 crane cab
1/76-10/76	safety & toxic gas	4 SO ₂ samples 30 safety violations		NONE	

(b)

FACT SHEET

Facility: Tacoma Smelter

Company: ASARCO, Inc.

INFORM
25 Broad Street
New York, New York
10004
(212) 425-3550

I. GENERAL

Name: ASARCO, Tacoma, Copper Smelter

Location: Tacoma, Washington

Description:

- 1) Combination of concentrate receiving facilities, coarse ore and concentrate handling and crushing facilities, roasters (10), reverberatory furnaces (2), converters (4), anode furnaces (3), and supportive facilities. The complex also has refinery facilities for producing arsenic trioxide, dore, metallic arsenic, nickel sulfate, and sodium selenite products, as well as electrolytically refined copper.
- 2) Smelter began operation in 1890; purchased by ASARCO in 1905.
- 3) Employees: 822 (approximately 300 smelter production)
- 4) Tacoma is a custom smelter, where concentrates are treated under contractual agreement. Concentrates from Philippines (Lepanto), Vancouver, British Columbia (Similkameen), and Arizona (Sierrita and Mineral Park).
- 5) ASARCO a major contributor to the economy of the surrounding area.
- 6) Production:

	1974	1975	1976
Copper (tons)	117,381	119,670	87,699
Arsenic Trioxide (tons)	9,646	10,518	9,835
Nickel Sulfate (tons)	863	943	695
Sulfuric Acid (tons)	47,657	52,895	46,509
Sulfur Dioxide (tons)	20,360	42,290	47,281
Metallic Arsenic (lbs.)	96,562	320,616	508,000
Gold (ozs.)	120,484	127,385	N/A
Silver (Ozs.)	776,289	786,789	N/A

Comments:

II. PROCESS AND HAZARDS

NOTE: Respirators are company-supplied and worker maintained. They are worn on a need basis. The following comments evaluate TWA exposures independent of respirator usage.

NOTE: Throughout the following remarks, the phrase "poorly characterized" is used to indicate that we have found no evidence that either the company or the regulatory agencies have sufficiently characterized the exposures to permit proper evaluation and corrective action.

A) Material Handling

- 1) Concentrates are received by ship at the South Dock where they are unloaded by crane. A crane hopper - conveyor belt system transports these materials to the Martin Mill. Significant airborne dusts are generated during the unloading operations and by the conveyor belt. Arsenic exposures above the proposed standard. Other dust exposures are poorly characterized.
- 2) Martin Mill. Concentrates are received, split, and sampled prior to roasting. Dusts are generated from the belts, transfer points, sampling points, and the multiple bins. Arsenic exposures are above the proposed standard. A wet collector dust control system is presently in use, but is reported inadequate to reduce arsenic levels to meet proposed standard. Other exposures, if any, are poorly characterized.
- 3) Crushing Area. A jaw crusher is used to crush and screen concentrates that are too large, so that they are amenable to roasting. Arsenic levels above the proposed standard. The crusher building is equipped with dust control (rotoclone collectors) but system is reported inadequate to reduce arsenic levels below $.10 \text{ mg/m}^3$. Other exposures, if any, are poorly characterized.
- 4) Fine Ore Storage. The concentrates, along with other raw materials (silica and lime fluxes) are stored in bunkers in the Fine Ore Shed. The materials are mixed and moved by clamshell and crawler crane and tripper belt, and finally transferred to the Roasters via a conveyor system. Railroad cars, loaded with concentrates, are also unloaded in this area. This building is wide open and a source of airborne arsenic to other plant operations. The principles of exhaust ventilation cannot be applied to this area without enclosing the entire building. The two cranes and the two operator stations are not presently enclosed. Arsenic levels are above the proposed standard. Other exposures are poorly characterized.
- 5) South Dump. Silica and lime fluxes are received and stored in this area prior to mixing with concentrates in the Fine Ore Shed. These materials are transferred by the yard personnel. Exposures, if any, are unknown.

B) Roaster Area

- 1) Ten Multi-hearth Roasters. There are usually four Roasters operating at one time.

- 2) Roaster feed materials are transferred from the Fine Ore Shed via an overhead conveyor system. The system consists of the conveyor, tripper belts, and storage bins. The belt tripper, transfer points, and the uncovered storage bins are major dust sources. Exposures are uncharacterized.
- 3) Operating decks.
 - a) Exposures from dusts generated during feeding operations and from intermittent "puffs" during roasting operations. Puffs are due to draft reduction by the ESP operator to maximize dust recovery or due to failure of the automatic draft control to respond to changing requirements. SO₂ leaks through upper hearth, refractory doors, and around doors.
 - b) Feedermen. Feeds the Roaster at the upper levels. Uses air lance to blow hoppers, also shovels feed and performs other cleaning tasks. Exposed to arsenic levels above the proposed standard. SO₂ levels are poorly characterized.
 - c) Beltmen. 5 - 6 men make up a "belt crew" Crew brings feed to hoppers during a belt run. Workers exposed to arsenic levels above the proposed standard. SO₂ levels are poorly characterized.
- 4) Unloading areas.
 - a) Calcines are discharged at 900⁰ F. into larry cars. The number of loads vary. During normal operating conditions eight loads per hour are collected and transferred to the Reverb.
 - b) During normal operations there are usually 2 larry car operators and 1 relief man. Arsenic exposures documented in a range greater than ten times the present standard. Copper dust exposures at five times the standard. SO₂ levels eight times the proposed standard. Lead levels at five times the proposed standard. Total particulate levels documented at five times the nuisance dust standard.
 - c) Larry cars presently covered during transit, however seals are not adequate to stop leakage.
 - d) Larry car operator exposures occur both in the Roaster area and above the Reverbs while feeding calcines.
 - e) Company proposes to enclose the larry car loading area to capture fugitive emissions that escape during loading operations.
- 5) Firemen. Operator of the Roaster. Controls the gas burners during roasting. Exposed to arsenic levels above the proposed standard. Other exposures are poorly characterized.
- 6) Flue dust pullers. The roaster flue is cleaned out daily by emptying the hoppers and loading the dusts into a dust car. Arsenic levels five times the present standard. Total particulate levels exceed the standard for nuisance dusts. Conditions and job will be eliminated once the new baghouse is put on stream.

C) Reverberatory Area.

- 1) One suspended silica arch furnace and one suspended arch basic brick furnace.
- 2) Reverb feed deck.
 - a) Larry car men. Exposures discussed in Roaster Area section.
 - b) Feed floor clean-up crew. Exposures similiar to larry car operators. Clean-up performed on an "as needed" basis.
- 3) Furnacemen. Controls Reverb's burners. Arsenic levels above the proposed standard. Noise levels exceed the present standard.
- 4) Tapper and Tapper Helper. The matte tap hole, the matte runner, and the ladle charging station are presently hooded and exhausted. Company reports that emissions (from this source) are normally controlled, however, strong winds blowing through the building cause SO₂ to escape from these ventilating systems. After ladles of matte are poured, they are left smoking - also contributing to background SO₂ levels. Company proposes placing ladles under a hood, but such a practice has yet to be established. Arsenic levels exceed the proposed standard. Noise levels exceed the present standard.
- 5) Skimmer and Skimmer Helper. The slag tap hole and the slag runner is hooded and exhausted. The effectiveness of this control equipment diminishes as slag skimming operations continue. During the filling of slag train cars, the filled cars continue to fume while the train changes position to fill subsequent cars. Arsenic levels at the present standard. Lead levels above the proposed standard.
- 6) Company reports that the skimmer, the tapper, and their respective helpers are exposed to severe heat during skimming and tapping operations.
- 7) Arch is blown once a week during the grave-yard shift. Company unsuccessfully attempted vacuuming.
- 8) Waste Heat Boilers
 - a) Dusts entrained in the Reverb off-gases build up in the boiler and must be frequently removed by air lancing. Dusts settle to bottom and removed via screw conveyor system. Conveyor must be cleaned out manually due to jams caused by fused chunks of ash.
 - b) The boiler lancer is exposed to arsenic levels above the present standard. Lead levels above the present standard.
 - c) Exposures to other Waste Heat Boiler employees are poorly characterized, however the company reports these employees are exposed to area arsenic levels in the 1.0 - 2.0 mg/m³ range.

D) Converter Area

- 1) Four Pierce-Smith Converters with primary water cooled hoods. Three are usually running at any one time with blowing limited to no more than two at any one time.

- 2) Usual practice is to keep a Converter, not immediately required for production, hot by use of a burner through the burner mouth. This practice results in SO₂ release into the work environment due to the oxidation of sulfur from the charge remaining in the Converter.
- 3) Cranemen. Crane cabs (2) are not enclosed. Cranemen are exposed to arsenic levels above the proposed standard. SO₂ levels are above the present standard. Lead levels are above the present standard.
- 4) Skimmers. Skimmer shacks are not enclosed. The skimmers are exposed to arsenic levels above the proposed standard. Lead levels are above the present standard. Noise levels exceed the present standard.
- 5) Punchers. Exposures to arsenic above the proposed standard. Lead levels above the proposed standard. Noise levels exceed the present standard. Company attempted to abate noise exposures by enclosing and insulating punching platforms. Company presently studying feasibility of installing tuyere silencers.
 - a) Head puncher. Rolls converter and operate automatic punchers on Converters #1, #2, and #4.
 - b) Tail puncher. Punches Converter #3 manually.
- 6) Exposures to other Converter workers are poorly characterized.

E) Anode Area.

- 1) Three Anode Furnaces and three Casting Wheels. #3 Anode is normally in use.
- 2) Blister copper is transferred via converter crane to the Anode Furnace where a final blow and subsequent deoxidation, using 20 foot logs, takes place. Anodes are poured in the Casting Wheel and after cooled with water sprays, are transported to the refinery.
- 3) Company states that many of the jobs in this area, notably the wheelmen and anode tapper, are very hot, physically demanding, and among the most hazardous in the smelter. Personal sampling results for Anode workers were not available to INFORM. Background arsenic levels reportedly above the proposed standard.
- 4) Noise levels have been reduced by burner and water spray alterations after being cited by WISHA.
- 5) Company is also planning to capture Anode emissions and send gases to the #2 ESP.

F) Cottrell Department.

- 1) Three ESP's are used for brick flues #1 and #2 to collect particulates before the gases are emitted from the main stack. The two ESP's in the #1 flue generally treat the Roaster off-gases and the single ESP in the #2 flue treats the Reverberatory off-gases.
- 2) The dust puller is exposed to arsenic levels above the present standard. Lead exposures above the proposed standard.
- 3) The treatermen are exposed to arsenic levels above the proposed standard.

G) DMA (Liquid SO₂) Plant.

- 1) The DMA Plant processes a portion of the converter off-gases. The system uses dimethylaniline to absorb the gaseous SO₂ which is then regenerated by stripping with steam - producing 100% SO₂ as a gas. The SO₂ is liquified by compression and stored under pressure.
- 2) Union complained to WISHA about conditions in the DMA Plant, resulting in inspections. One inspection documented arsenic levels above the present standard, lead levels above the present standard, and SO₂ levels five times the present standard. No violations were found during the other inspection, however five repair-crew men became ill from effects of unidentified chemical exposure.
- 3) Leaks from the poorly sealed DMA Plant cause high SO₂ levels in other areas of the smelter complex.

H) Acid Plant

- 1) The single contact acid plant, originally designed in 1950 for 100 TPD production, was recently enlarged to a 200 TPD Plant.
- 2) Exposures and job descriptions for workers in this area were not available to INFORM.

Comments:

I. COMPANY SAFETY AND HEALTH ACTIVITIES

A) History

- 1) Department of Industrial Hygiene was established in 1945 at the corporate level. In 1966 this department combined with ASARCO's Department of Agricultural Research to form the Department of Environmental Sciences. In 1975 an industrial hygienist was assigned to Tacoma on a full-time basis.
- 2) History of ASARCO's Safety Program not available to INFORM.

B) Staff

- 1) Safety Director (50% of time devoted to safety matters)
- 2) Safety Superintendent
- 3) Safety Engineer
- 4) Industrial Hygienist
- 5) Environmental Scientist (operator of Intermittent Control System)

C) Respirator Program

- 1) Training, education, and supervision of respirator usage is the responsibility of the industrial hygienist.
- 2) All workers are assigned and fitted with their own respirators according to the hazards present in their work area. Respirators worn on an "as needed" basis. Workers are responsible for cleaning and maintenance.

D) Industrial Hygiene Activities

- 1) Annual sampling of areas and personnel by corporate personnel prior to OSHA. Extent of monitoring increased with the assignment of industrial hygienist.
- 2) Annual monitoring results are compiled in a final survey report. ASARCO would not provide INFORM with copies of these materials.
- 3) Ventilation systems are checked by the mechanical superintendent on an "as needed" basis.
- 4) No formal reports or education are given to workers regarding the need, objectives, and results of industrial hygiene sampling. However, during a pre-employment indoctrination, the company informs workers of hazards they will possibly encounter while on the job.
- 5) The company has provided a substantial amount of industrial hygiene related data to OSHA during the course of the arsenic and sulfur dioxide hearings. The bulk of this material was related specifically to Tacoma. The company provides the Union with monitoring results.

E) Safety Activities

- 1) Plant safety engineer conducts a monthly inspection of the plant. No checklists are used except during crane inspections. In all cases, written reports are prepared and a copy is forwarded to the Union.
- 2) Accident investigations, for all lost-time accidents, compensated accidents, and some near misses, are conducted jointly by the Company and the Union. Written reports, which establish cause, place responsibility, and make recommendations, are prepared at the conclusion of accident investigations.
- 3) New employees are instructed as to the safety aspects, the associated hazards, and the proper safety practices of their particular job. The indoctrination includes a tour of the smelter.
- 4) Formal safety refresher courses for all employees are not available, however, safety awareness is maintained by way of safety committees.
 - a) Foremen Safety Committee includes all foremen and meets weekly.
 - b) Worker Safety Committee includes a representative from each department and a management representative, meets monthly.
 - c) These committees' activities are independent of the Joint Safety and Health Committee.
- 5) Safety training for new equipment and process changes is provided.
- 6) OSHA 102 data is available for 1973, 1974, 1975, and 1976.
- 7) Accident frequency rates, computed according to the traditional system of the National Safety Council, are available for 1972 - 1976.
- 8) Company reports that information exchange regarding safety issues takes place in a formal way within the company.
- 9) Company reported that a study to determine the relationship of accidents between new and old workers was performed at Tacoma. Written findings of this study were not made available to INFORM.
- 10) Company reports that it has never conducted any studies to estimate the indirect costs of smelter accidents.

F) Health Care

- 1) Smelter complex has its own on-site medical clinic with facilities and staff to perform preventive testing and first aid care.
 - a) Staff: 1 part-time physician (3 days a week), 1 full-time nurse, and 1 secretary.
 - b) Facilities: comprised of a waiting room, a dispensary and a 2-bed ward and equipped with an EKG, oxygen facilities, audiometry and eye-testing equipment, and an X-ray machine (used only for accident diagnosis, e.g. fractures).

- 2) All major injuries/illnesses occurring in the smelter are referred to one of three neighboring hospitals - the closest being five miles away.
- 3) Smelter does not have an on-site ambulance, readily available emergency transportation is provided by the Tacoma Fire Department.
- 4) There is a fairly comprehensive system of pre-placement and periodic health monitoring, including: general exams, audiometric tests, blood and urine analyses, and pulmonary function tests. Frequency of blood analyses (lead) and urine analyses (arsenic) is determined through industrial hygiene department's monitoring results.
- 5) Epidemiological and research studies, through contract or through its own medical department, have been conducted and were available to INFORM.

Comments:

IV. SAFETY AND HEALTH COMMITTEE

- A) The Joint Safety and Health Committee was established in 1971.
- B) Committee includes three management representatives and three Union representatives.
- C) Meets once a month for a full day. Meetings begin with a tour, after which there is a discussion on the tour findings. A written report, which includes documentation of the areas visited, subjects covered, and recommendations made, is prepared by the company and forwarded to each representative and the Union.
- D) Other safety and health topics may be discussed, such as any new process changes and/or additions. The Union also uses the committee to air any safety and health complaints.

- E) The Safety and Health provisions of the contract address other matters, such as:
- 1) Right to refuse unsafe work. A specific grievance procedure (arbitration) to handle disputed cases has been incorporated into the contract.
 - 2) Right of Union to review the results of the company's monitoring.
 - 3) Right of the International to enter all areas of the plant for safety and health issues and to review company-produced materials regarding safety and health.
- F) Workers do not retain wage rates if they are forced to change jobs as a result of an occupational injury or illness.

Comments:

V. REGULATORY HISTORY

A) Pre-1970

- 1) Washington Department of Labor and Industries has juris over safety matters since 1910. Pre-OSHA safety inspections of smelter were not available to INFORM.
- 2) An Industrial Hygiene section was established in 1963. The smelter's first health inspection was performed in 1970 - very limited due to lack of equipment.

B) Post-1970

1) State OSHA Plan (WISHA)

- a) Developmental plan approved in June 1973, allowing the Department of Labor and Industries to operate under 18(b).
- b) Developmental steps completed by March 1976. Presently operating under an operational status agreement with OSHA.
- c) Inspections: See Table 2.

2) OSHA Activities.

- a) One inspection safety.

Comments:

Table 1

PROCESS EQUIPMENT -- Tacoma

NAME	AGE	POLLUTION CONTROLS	COMMENTS
Roasters (10) Herreshoff (multi-hearth)	#1-6: 1915 #7-8: 1923 #9-10: 1929	ESP #1 (Pipe ESP → Plate ESP) → Stack	Considerable leakage through roaster and ductwork. Roaster baghouse now under construction
Reverberatory (Silica) Furnace #1	1915	#1 Waste heat boilers → #2 ESP → stack	Not normally used.
Reverberatory (Basic) Furnace #2	1929	#2 & #3 Waste heat boilers → #2 ESP → stack	Reverb emissions will be treated in #1 ESP when roaster baghouse on-stream.
Converter #1-3 Pierce-Smith 13 by 30 #4 Pierce-Smith 11 by 26	#1-2: 1916 #3: 1915 #4: 1968	Watercooled primary hooded → multicyclone → ESP → acid plants OR multicyclone → ESP → liquid SO ₂ (DMA) plant	Up to 3 used at one time. Fan system to partially capture fugitive emissions during roll-out, venting to ESPs.
Anode Furnace (3)	#1-2: 1915 #3: 1936	None	Proposed capture and treatment of anode-emissions in #2 ESP when roaster baghouse on-stream.
Acid Plant	1951		200 TPD
DMA Plant	1974		
Arsenic Plant Godfrey roasters (6)	#1-4: 1913 #5-6: 1938	Tail gases treated in baghouse.	Presently under variance from arsenic emission standards from the tall stack and low-level sources.

tions--Tacoma [WISHA], continued)

	TYPE	FINDINGS	PENALTIES	EMPLOYEES AFFECTED	FOLLOW-UP	COMMENTS
5	General Schedule Safety	2 non-serious violations	None	4	Complied	Test certificates for Cranes not displayed.
5	Complaint Health	2 non-serious violations	None	14	?	SO ₂ Plant cottrells inspected for SO ₂ , lead, and noise exposures - cited for failure to provide engineering controls to reduce SO ₂ and Lead exposures, and for failure to provide lockout system.
5	Complaint Safety	2 serious, 13 non- serious, and 1 Deminimus	\$400.	14	Complied	SO ₂ Plant - No resp- irator,program, No SOP for material handling, violations for brakes, derails, guards and sings.
5	General Schedule Safety	No violations	----	15	----	Explosive magazine section.
75	General Schedule Health	No violations	----	1	----	Medical Clinic
6	General Schedule Safety	3 non-serious violations	None	4	None	Ore Dock Cranes - Warning signals and rails needed, and posting of dock's load capacity.

TABLE 2

ACTIONS -- ASARCO, Tacoma Smelter
 Kingdon Industrial Safety and Health Administration

	TYPE	FINDINGS	PENALTIES	EMPLOYEES AFFECTED	FOLLOW-UP	COMMENTS
	General Schedule Safety	3 non-serious violations	None	50	None	Dock Area Inspection.
	Accident	No violations	----		Company abatement letter	Runaway in Anode # No injuries.
73	General Schedule Safety	1 non-serious violation	None	4	None	No fire extinguisher in Office.
4	Accident	1 serious violation	\$200.	1	Company abatement letter	Systemic blood poisoning - AsH ₃ inhalation - Nickel Plant employee.
	Asbestos Survey	Consultation	----	--	----	Evaluation of Asbestos exposures
4	General Schedule Health	5 non-serious violations	\$360.	927		Failure to provide engineering or administrative con- trol of exposures to: 1) LEAD 2) ARSENIC 3) SULFUR DIOXIDE 4) NOISE Failure to provide and use respirators for protection from ex- posure to LEAD.
	General Schedule Safety	No violations	----	10	----	Locomotive crane inspection.
	General Schedule Safety	No violations	----	10	----	Crane inspection.
4	Complaint Health	No violations	----	7	----	Liquid Sulfur Dioxide Plant inspection.
4	General Schedule Safety	6 non-serious violations	None	20	None	Labeling and warning devices needed for Cranes.

Table 3

SUMMARY OF HEALTH HAZARDS--Tacoma, Washington

PLANT AREA	Number of Employees	TWA Exposures in mg/m ³			TWA Sulfur Dioxide (ppm)	NOTES
		Copper	Arsenic	Lead		
Material Handling	60					
Roaster Area	48	.1-5.3	.2-6.7	.01-2.20		Tappers and furnacemen are exposed to noise in excess of standard.
Reverberatory Area	53	.8	.02-.5	.05-.46		Larrymen exposure to SO ₂ is > 17 ppm.
Converter Area	38	<.2	.1-.3	.01-.36		Converter punchers and skimmers are exposed to noise in excess of standard.
Anode Area	37					

SOURCES: 1) Company testimony at the OSHA Arsenic and Sulfur Dioxide Hearings
 2) WISHA health inspections

FACT SHEET

Facility: Copperhill Operations (copper smelter)

Company: Cities Service Company

INFORM
25 Broad Street
New York, New York
10004
(212) 425-3550

GENERAL

Name: Copperhill Operations, Cities Service Company

Location: Copperhill, Tennessee

Description:

- 1) Fully integrated chemical and metal producing complex including: mine, mill, copper smelter, iron roasters, power plant, copper sulfate and fungicide plant, acid plants, organic chemical plant, pelletizing plant, recovery plant, ferri-floc plant and liquid sulfur dioxide facility.
- 2) Mine begun 1850; smelter, early 1900s.
- 3) Employees approximately 2,000 with 250 to 300 in copper production.
- 4) Ore from the Ducktown converted underground mine. Exact arsenic content of concentrates unknown but likely near .003%. Other impurities if any are unknown.
- 5) Largest employer in Polk County. Annual per capita income for county--\$2,642.

- 6) Production (figures in thousand tons)

	1976	1975	1974	1973	1972
Sulfuric Acid	985.4	865.3	849.6	910.0	916.3
Other industrial chemicals	201.4	155.8	161.4	205.5	206.3
Copper (+)	86.6	46.9	30.6	39.6	44.9

(+) possible inclusion of toll concentrates sold from company complex in Miami, Arizona.

Comments:

I. PROCESS AND HAZARDS--SMELTER

NOTE: Workers in most areas are issued company-supplied respirators. Workers are responsible for maintenance and storage; however, the company has established a number of sanitary cleaning facilities.

NOTE: The following comments evaluate TWA exposures independent of respirator use.

NOTE: Throughout the following remarks, the phrase "poorly characterized" is used to indicate that we have found no evidence that either the company or the regulatory agencies have sufficiently characterized the exposures to permit proper evaluation and corrective action.

NOTE: The sole known evaluation by a regulatory agency of arsenic concentration at the Copperhill complex was made by the Tennessee Division of

Public Health in December of 1975. After initial release of the data in terms of the present arsenic standard, the levels were recalculated in light of the proposed arsenic standard. All samples were reported well below the proposed standard. The areas sampled were the electric furnace and converter areas.

A) Material Handling

- 1) Concentrates in a moist state are transferred from the nearby London Mill by open railroad cars. Dust an intermittent problem due to wind.
- 2) After storage in 450-ton open bins, flux is added to the concentrate. The mixture is conveyed uncovered to the repulping station. The concentrates are then reslurried with weak acid recycled from the copper gas-cleaning circuit. Dust an intermittent problem due to wind and spillage along conveyors, and air lance use in bin area clean-up. 16 workers.

B) Fluosolids Roaster

- 1) One 10-foot diameter slurry-fed roaster.
- 2) Slurry is gravity fed by injection nozzle in roaster dome. The approximate 4/1 (concentrate to silica sand feed) ratio yields calcines with a 38% to 40% copper content. The gases leaving the vessel contain 84% to 85% of the calcines. The calcines collected in the cyclones are combined with roaster bed calcines, for processing in the electric furnace.
- 3) INFORM has found no evidence of air monitoring by either the company or a regulatory agency in the copper roaster area. The union reports an intermittent gas and dust problem throughout the system. Additional problems include cyclone clean-up and repair. Actual exposures are uncharacterized.

C) Electric Furnace

- 1) In 1972, the company built the first electric furnace in the U.S.
- 2) Calcines pass through "drop pipes" to one of two partially enclosed pinless drag chain conveyors above electric furnace. The furnace is fed through charge points near electrodes. Matte is tapped through exhausted tap point onto unhooded launders and ladles. Slag is tapped for an hour two to three times per shift and is granulated for use and sale.
- 3) Arsenic and sulfur dioxide levels and exposures are poorly characterized throughout the entire electric furnace area. Arsenic exposures were reported below proposed standard throughout area in the single state-conducted survey. Company reports that forty workers in "smelter" are exposed to sulfur dioxide levels greater than or equal to the proposed TWA standard.
- 4) Furnace operator helper--job station is on ceiling of furnace measuring electrode paste and bath depth. Union reports gassy conditions. Actual exposures are poorly characterized. 3 workers.
- 5) Slag tapper--job station is at unhooded slag launders beyond exhausted tap points near granulation pump. Exposures, if any, in

slag area are uncharacterized. Worker also assists in matte tapping. Potential exposures during reportedly gassy tapping operation are uncharacterized.

- 6) Matte tapper--matte launders are unhooded past tapping points. Union reports gassy conditions. Actual exposures are poorly characterized. 3 workers.
- 7) Relief man--worker assists matte and slag tapping as well as feed pipe clean-out. Union reports gassy conditions at matte tap and feed pipe clean-out locations. Actual exposures are poorly characterized. 7 workers.

D) Converter Aisle

- 1) Two Pierce-Smith primary hooded converters. Only one is in use at a time, operating approximately ten hours per day. Slightly more than 50% of the blister copper produced is used internally as copper shot in the copper sulfate plant. The remainder is cast into 2,500-lb. bars and shipped to a refinery.
- 2) Arsenic and sulfur dioxide levels and exposures are poorly characterized throughout the entire converter area. Arsenic exposures reported below proposed standard in the single state-conducted survey. Company reports forty workers in "smelter" exposed to levels greater than proposed standard. Lack of positive seal between converter and hood makes fugitive sulfur emissions likely.
- 3) Crane operator--continued problem with window seals in crane cabs. Company repairs often but problem persists. Actual exposures are poorly characterized. 3 men.
- 4) Crane chaser--union reports gassy condition throughout converter area. Actual exposures are poorly characterized.
- 5) Operator/foreman--job station is "all over the entire area," and at converter control platform during pouring. Union reports gassy conditions throughout converter area.
- 6) Puncher--documented noise violations prior to installation of automatic punchers, effectiveness in reducing noise exposure unknown. Union reports high noise levels continue. Exposures are poorly characterized. 6 workers.
- 7) Flue duster--worker cleans out exhaust flues and works near open conveyor belts. Union reports spillage and dust problem. Actual exposures are poorly characterized. 2 workers.
- 8) Documented noise violation to puncher and workers near lunchroom from #2 converter blower. Company studied possibility of enclosing blower; effectiveness unknown.

E) Liquid SO₂ and Acid Plants

- 1) Company reports sixteen workers exposed to levels of 2ppm or greater in the liquid sulfur dioxide and acid plants.
- 2) State documented sulfur dioxide levels above the existing standard prior to installation of new ventilation. Company reports levels in "compliance with 5 ppm TWA." Actual levels are uncharacterized.

- 3) Reported possibility of V₂O₅ TWA violations during bed replacement
Actual exposures are uncharacterized.

Comments:

I. COMPANY SAFETY AND HEALTH ACTIVITIES

A) History--Details unavailable.

B) Staff (Safety Department)

Director--Industrial Hygiene (1)

Director--Safety Director (1)

Engineers (3)

Technical personnel (part-time)

C) Industrial Hygiene

1) Industrial hygiene functions are divided among the full-time industrial hygienist and the safety personnel.

2) The company does "occasional" evaluatory sampling for hazards.
Exact frequency of sampling unknown.

D) Respirator Program

1) Respirators are issued on a need basis, based on evaluatory sampling.

- 2) Education for use and maintenance is administered by the worker's immediate supervisor.
- 3) Workers are responsible for storage and cleaning in most areas. The company has established some sanitary cleaning facilities.

E) Safety

- 1) The company has no established pre-employment safety orientation other than safety instruction administered by experienced employees.
- 2) Weekly departmental safety meetings were re-established in 1973.
- 3) Company issues free of charge most necessary safety equipment including: hard hats, safety shoes, fire-resistant clothes (where needed) and safety glasses.

F) Health Care

- 1) Cities Service Company has established a contractual-leasing relationship with Basin General Hospital.
- 2) Medical program is administered by one full-time and three part-time physicians, as well as one nurse and several part-time technical personnel.
- 3) First aid is administered through first-aid stations located throughout the complex.
- 4) Company reports that pre-employment test include: respirator compatibility, chest x-rays, blood and urine analysis, audiometric and optometric testing, as well as history and physical.
- 5) The company in 1976 established a series of voluntary annual medical tests. Tests include chest x-rays and blood and urine analysis, and audiometric and optometric testing.

Comments:

V. SAFETY COMMITTEE

A) Description

- 1) Monthly meetings are attended by the safety director, three safety engineers, the company industrial hygienist, and one union representative from each department.

- 2) The committee is advisory in nature and has no inspection powers.
- 3) The committee assists in all accident investigations.

Comments:

I. REGULATORY HISTORY

A) Pre-1970

- 1) Tennessee Industrial Hygiene Service--1937 to 1970.

B) Post-1970

1) State OSHA Plan

- a) State plan, approved June 29, 1973, after 15-month contract period.
- b) Originally divided between Tennessee Department of Public Health and Tennessee Department of Labor; recently health function (Division of Occupational and Radiological Health) has been incorporated into Department of Labor.

2) OSHA activities

- a) Never inspected Copperhill facilities.
- b) Performs advisory and monitoring functions with inspection jurisdiction over longshoring, shipbuilding and railroads.

Comments:

Table 1

PROCESS EQUIPMENT--Copperhill*

NAME	AGE	POLLUTION CONTROLS	COMMENTS
Fluosolids Roaster (1)	1972	.	
Electric Furnace (1)	1972	Gases from all furnaces are combined and sent through a Peabody Scrubber. Gases are then added to iron roaster gases and transported to the liquid SO ₂ and acid plants.	
Converters (3) (Pierce Smith)			Cylindrical mouth shape prevents tight hood seal.
Acid Plant #4, #5	Combined 1975		1,910 TPD
Acid Plant #6	1975		2,100 TPD
Liquid SO ₂ Plant		Gases taken down stream of acid plant #6.	On-stream factor of 90% to 95%.

*Copper smelter and related facilities.

SOURCES: Engineering Evaluation of Cities Service Smelter,

Table 2

ctions--Copperhill
ssee Department of Labor

	TYPE	FINDINGS	PENALTIES	FOLLOW-UP	COMMENTS
75	complaint/ safety	no violations	----	----	walk area
75	complaint/ safety	1 non-serious violation	\$60	----	#4 acid plant
75	complaint/ safety	no violations	----	----	converter puncher blow-back

ctions--Copperhill
ssee Department of Public Health

	TYPE	FINDINGS	PENALTIES	FOLLOW-UP	COMMENTS
/73	complaint/ health	15 violations	\$0	7/1/74	liquid SO ₂ plant
4	follow-up/ health	no violations	----	----	
/74	general schedule/ health	no violations	----	----	arsenic levels
75	complaint/ health	1 violation	\$0	----	noise/ converter punchers

Table 3

SUMMARY OF HEALTH HAZARDS--Copperhill

PLANT AREA	Number of Employees	TWA Exposures*			Sulfur Dioxide (PPM)	NOTES
		Copper mg/M ³	Arsenic mg/M ³	Lead mg/M ³		
Material Handling	16					
Fluosolids Roaster	50				see noteΔ	ΔNo known surveys for sulfur dioxide by government regulatory agencies. Company reports 40 workers in "smelter" exposed to TWA levels of 2ppm or greater.
Electric Furnace			.0001-.0002		see noteΔ to Roaster	
Converters	27		.0002-.001		see noteΔ to Roaster	Noise--documented violations (>115 dBA) prior to installation of new punching system, effectiveness unknown.
Acid & DMA plants	100				see note†	†Documented levels SO ₂ (6ppm) prior to installation of new ventilation in DMA plant. Company reports 16 workers exposed to TWA levels greater than or equal to 2ppm.

SOURCES: Arsenic OSHA hearing, 1975. Company data.
Tennessee Department of Public Health inspections.

*Independent of respirator usage.

FACT SHEET

Facility: White Pine Copper Smelter

Company: Copper Range Company

INFORM
25 Broad Street
New York, New York
10004
(212) 425-3550

I. GENERAL

Name: Copper Range Company, White Pine Smelter

Location: White Pine, Michigan

Description:

- 1) Combination of concentrate receiving and mixing facilities, rotary dryer, reverberatory furnaces (2), converters (2), fire-refining furnaces (2), holding furnace (1), semi-continuous casting machines (2), casting wheel (1), and supportive facilities.
- 2) Smelter began operation in 1955.
- 3) Employees: ¹⁶⁶~~228~~ smelter production. ¹²¹⁹~~2900~~ at the White Pine complex
- 4) Ores from White Pine underground mine (Nonesuch formation) are concentrated in the White Pine Mill, adjacent to the smelter. Arsenic content of the concentrates estimated at .003%. Low sulfur content requires the addition of pyrite to make feed amenable to smelting. Other trace material information on hand.
- 5) White Pine is the second largest employer in Michigan's Upper Peninsula.
- 6) Production

	1973	1974	1975	1976
Copper (tons)	78,506	66,898	70,776	46,053

Comments:

I. PROCESS AND HAZARDS

NOTE: Respirators are company-supplied and company-maintained. They are worn on a need basis. The following comments evaluate TWA exposures independent of respirator use.

NOTE: Throughout the following remarks, the phrase "Poorly characterized" is used to indicate that we have found no evidence that either the company or the regulatory agencies have sufficiently characterized the exposures to permit proper evaluation and corrective action.

A) Material Handling

- 1) The smelter feed, in the form of filter cake (a copper bearing concentrate of ~30-32% Cu and 18% H₂O), is received at the Filter and Dryer Building. ~~Before~~ After drying in the Rotary Dryer, fluxes (limestone, pyrite, and recycle materials) are added to obtain good smelting characteristics. Exposures, if any are uncharacterized for the Rotary Dryer Operator and the Operator's Helper. Eight workers -- Company classifies these employees as Mill workers.
- 2) If the reverberatory furnace is being charged the dried materials are transferred directly to the reverberatory charge bins. If not being charged, the materials are transferred to the Smelter Feed and Bedding Building. All concentrate transfer is by enclosed conveyors. Documented copper dust exposures for bedding plant employees. The company proposed to implement certain engineering and administrative controls in this building. Effectiveness of reducing hazards by this effort unknown. Five workers.
- 3) Other material handling workers -- the conveyormen and the conveyor attendants -- are potentially exposed to copper dusts during the transfer of concentrates. Documented copper dust exposures above the standard. The company was to abate the dusty conditions during transfer by increasing moisture of materials leaving the Rotary Dryer. Effectiveness of reducing dusts is unknown. Ten Workers.

B) Reverberatory Area

- 1) Two identical suspended arch reverberatory furnaces. At the present time only one (#1) is presently in operation. The concentrate-flux mixture is fed from the charge bins by a tripper belt - shuttle conveyor system and is charged into the reverb through water cooled chutes. Approximately 50 workers.
- 2) Charge Floor
 - a) Tripperman. Operation consists of charging reverberatory furnace by operating mechanized conveyor to load furnace hoppers with feed. Loading operation takes about 2 hours, after which worker spends about 1/2 hour cleaning hoppers. Documented SO₂ and Cu dust exposures above standard. Arsenic levels above proposed standard.** Six workers.
 - b) Arch Attendant. Potential exposures similar to tripperman. Reportedly very high dust exposures during blowing of arch. Company attempted vacuuming, however proven unsuccessful. Actual exposures are poorly characterized. Four workers.
 - c) Brickmasons. Replacing refractory and maintaining furnace roof. Documented Cu dust exposures of up to 13 times the standard. Arsenic exposures above the proposed OSHA standard.** Potential SO₂ exposures poorly characterized. Twelve workers.

3) Operating Floor

- a) Furnaceman. Operator of the reverberatory furnace. Documented Arsenic exposures above the proposed standard.** Potential Cu dust and SO₂ exposures are poorly characterized. Five workers.
- b) Tapper and Tapper Helper. Matte and slag tap holes are ventilated with hoods. The slag launder is reportedly uncovered. Slag and matte is collected in a "tunnel" located beneath the operating floor. Area SO₂ reported at >15 ppm. Arsenic exposures at the proposed standard.** Eight workers.

4) Others

- a) Locomotive Engineer and Carman. Transfer matte via electrical ladle car to converter aisle and transfer slag via slag train to slag dump (located adjacent to the smelter). Workers reportedly leave tunnel during the filling of ladles. Potential SO₂ exposures are poorly characterized. Other exposures, if any, unknown. Six workers.
- b) Flue Dust Man and Flue Dust Helper. Emptying hoppers on ESP and Waste Heat Boilers, among other dust handling system tasks. Documented Cu exposures above the standard. Arsenic exposures above the proposed standard.** SO₂ exposures, if any, are unknown. Five workers.
- c) Boiler (Waste Heat) Lancers. Performs lancing of boiler tubes. Cu dust exposures above the standard. Other exposures, if any, are poorly characterized. These employees are assigned to the Power Plant -- number of boiler lancers unknown.

C) Converter Area

- 1) Matte from the reverberatory furnace is transferred in ladles to one of the two Pierce-Smith converters by an enclosed and air conditioned overhead crane. A siliceous flux is added to the converter bath to form an iron oxide slag that is skimmed off and returned to the reverb. At the completion of the converter cycle, blister copper is transferred to a holding furnace or directly to the refining area for further processing.
- 2) Crane Man. Workers report conditions in the crane cabs to be good and protective equipment (respirators) is not required. Three workers.
- 3) Crane Chaser. Directs crane man on ladle movements and other converter aisle tasks. One documented Arsenic exposure above the proposed standard.** Other exposures, if any, poorly characterized. Six workers.
- 4) Skimmer. Operator of the converter. Some Arsenic exposures above the proposed standard. SO₂ and Cu dust levels below the standards. Three workers.

GENERAL

Name: Copper Range Company, White Pine Smelter

Location: White Pine, Michigan

Description:

- 1) Combination of concentrate receiving and mixing facilities, rotary dryer, reverberatory furnaces (2), converters (2), fire-refining furnaces (2), holding furnace (1), semi-continuous casting machines (2), casting wheel (1), and supportive facilities.
- 2) Smelter began operation in 1955.
- 3) Employees: 166 smelter production. 1279 at the White Pine complex.
- 4) Ores from White Pine underground mine (Nonesuch formation) are concentrated in the White Pine Mill, adjacent to the smelter. Arsenic content of the concentrates estimated at .003%. Low sulfur content requires the addition of pyrite to make feed amenable to smelting. Other trace material information on hand.
- 5) White Pine is the second largest employer in Michigan's Upper Peninsula.
- 6) Production

	1973	1974	1975	1976
Copper (tons)	78,506	66,898	70,776	46,053

Comments:

PROCESS AND HAZARDS

NOTE: Respirators are company-supplied and company-maintained. They are worn on a need basis. The following comments evaluate TWA exposures independent of respirator use.

NOTE: Throughout the following remarks, the phrase "Poorly characterized" is used to indicate that we have found no evidence that either the company or the regulatory agencies have sufficiently characterized the exposures to permit proper evaluation and corrective action.

A) Material Handling

- 1) The smelter feed, in the form of filter cake (a copper bearing concentrate of ~30-32% Cu and 18% H₂O), is received at the Filter and Dryer Building. Before drying in the Rotary Dryer, fluxes (limestone, pyrite, and recycle materials) are added to obtain good smelting characteristics. Exposures, if any are uncharacterized for the Rotary Dryer Operator and the Operator's Helper. Eight workers -- Company classifies these employees as Mill workers.
- 2) If the reverberatory furnace is being charged the dried materials are transferred directly to the reverberatory charge bins. If not being charged, the materials are transferred to the Smelter Feed and Bedding Building. All concentrate transfer is by enclosed conveyors. Documented copper dust exposures for bedding plant employees. The company proposed to implement certain engineering and administrative controls in this building. Effectiveness of reducing hazards by this effort unknown. Five workers.
- 3) Other material handling workers -- the conveyormen and the conveyor attendants -- are potentially exposed to copper dusts during the transfer of concentrates. Documented copper dust exposures above the standard. The company was to abate the dusty conditions during transfer by increasing moisture of materials leaving the Rotary Dryer. Effectiveness of reducing dusts is unknown. Ten Workers.

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 - c) Brickmasons. Replacing refractory and maintaining furnace roof. Documented Cu dust exposures of up to 13 times the standard. Arsenic exposures above the proposed OSHA standard.** Potential SO₂ exposures poorly characterized. Twelve workers.

3) Operating Floor

- a) Furnaceman. Operator of the reverberatory furnace. Documented Arsenic exposures above the proposed standard.** Potential Cu dust and SO₂ exposures are poorly characterized. Five workers.
- b) Tapper and Tapper Helper. Matte and slag tap holes are ventilated with hoods. The slag launder is reportedly uncovered. Slag and matte is collected in a "tunnel" located beneath the operating floor. Area SO₂ reported at >15 ppm. Arsenic exposures at the proposed standard.** Eight workers.

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- a) Locomotive Engineer and Carman. Transfer matte via electrical ladle car to converter aisle and transfer slag via slag train to slag dump (located adjacent to the smelter). Workers reportedly leave tunnel during the filling of ladles. Potential SO₂ exposures are poorly characterized. Other exposures, if any, unknown. Six workers.
- b) Flue Dust Man and Flue Dust Helper. Emptying hoppers on ESP and Waste Heat Boilers, among other dust handling system tasks. Documented Cu exposures above the standard. Arsenic exposures above the proposed standard.** SO₂ exposures, if any, are unknown. Five workers.
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- 1) Matte from the reverberatory furnace is transferred in ladles to one of the two Pierce-Smith converters by an enclosed and air conditioned overhead crane. A siliceous flux is added to the converter bath to form an iron oxide slag that is skimmed off and returned to the reverb. At the completion of the converter cycle, blister copper is transferred to a holding furnace or directly to the refining area for further processing.
- 2) Crane Man. Workers report conditions in the crane cabs to be good and protective equipment (respirators) is not required. Three workers.
- 3) Crane Chaser. Directs crane man on ladle movements and other converter aisle tasks. One documented Arsenic exposure above the proposed standard.** Other exposures, if any, poorly characterized. Six workers.
- 4) Skimmer. Operator of the converter. Some Arsenic exposures above the proposed standard. SO₂ and Cu dust levels below the standards. Three workers.

- 5) Puncher. Punching the converters is performed manually by two workers using six-foot steel rods. Noise levels in punching area documented as >105 dBA. Punching operations are intermittent and 8-hour TWA's are poorly characterized. Documented Arsenic exposures at the proposed standard. SO₂ exposures below the proposed standard. Eleven workers.

D) Refining and Casting Area.

- 1) Blister copper is fire-refined in one of two fire-refining furnaces and cast into different shapes (copper ingots, wire bar, and copper cakes) in the casting wheel or in one of two semi-continuous casting machines. 35 employees.
- 2) SO₂ and Arsenic area samples throughout the Refining and Casting area are documented below the proposed standards. However, actual 8-hour TWA exposures for these employees are poorly characterized.
- 3) General dusty conditions prevailing in the Casting Area have been reported due to the spraying of bone ash (a mold lubricant) and lamp-black (a material that prevents re-oxidizing of the fire-refined copper). Actual exposures to these materials are uncharacterized.
- 4) NOTE--A uniqueness found at White Pine is that their final product, the fire-refined copper, does not need electrolytic refining. While the electrical conductivity (due to silver content) is not equivalent to electrolytic copper it carries the same classification.

E) Others.

- 1) Due to the transient nature of a selected number of smelter jobs, INFORM has created an "Others" category. While many workers on this list are permanently associated with on sub-department of the smelter -- i.e. some of the surface laborers work full-time in the Reverb department -- we have been unable to differentiate these workers from their transient counterparts. Hence they are included in this category. These workers are listed as follows:

Laborers	69 workers.
Maintenance Men	27 workers.
Technicians	3 workers.
Tool Room Man	1 worker.
Inspector	1 worker.
Janitors	2 workers.

- 2) Most exposures for these workers are poorly characterized.

****NOTE--**Due to the low arsenic content in White Pine's ore, in-plant arsenic levels have been documented as ranging between none detected and 20 µg/m³. However, many arsenic exposures, especially those of reverberatory workers, are above the proposed action level. Therefore, these workers will be subjected to the monitoring and medical surveillance requirements as set forth in the standard.

Comments:

I. Company Safety and Health Activities.

A) History

Details not available.

B) Staff

Safety Director (1)

Safety Engineer (2)

Director of Environmental Affairs (1)

Industrial Hygienist (2)

C) Industrial Hygiene

There is no regular schedule of sampling of in-plant levels of gases and vapors in the smelter. However, since January of 1976, monitoring for copper dust levels has been performed

monthly in the concentrate handling system, flue-dust handling, and the waste heat boilers. This monitoring involves the personal sampling of 16 to 20 workers.

D) Respirator Program

Respirators are company supplied and NIOSH approved. The respirators are supplied on demand and worn on an "as needed" basis. Workers are responsible for daily cleaning. Respirators are turned in weekly to be replaced, torn down and rebuilt, and/or sterilized. The maintenance and rebuilding of respirators is performed by two Safety Department technicians.

E) Safety

- 1) The company reports that a safety man is assigned to periodically (not less than once a week) inspect the smelter. If a substandard condition is noted, "He will write it up."
- 2) Personal protective safety equipment--hard hats, safety glasses, metatarsal guards--is issued to all smelter employees. Special protective equipment--aluminized clothing and gloves, face shields--is issued where required.
- 3) General Safety Committee
Aside from the Joint Safety and Health Committee, a General Safety Committee exists at this smelter. It consists of three management and three union representatives. The committee reviews the general safety policies of the company.
- 4) OSHA 100s for 1971-1976 and OSHA 102s for 1972-1974 on hand.

F) Health Care

- 1) White Pine owns and operates a 20-bed hospital located one mile from the smelter.
- 2) Hospital staff of 34 (27 full time, 7 part time), including 3 full-time physicians.
- 3) All minor injuries, are treated at hospital. Preliminary treatment only, for major injuries.
- 4) Supervisory personnel receive basic first aid training.
- 5) All employees receive a pre-employment physical. Extent of annual physicals, if any, is unknown.

Comments:

V. Safety and Health Committee

A) Description

- 1) Joint Safety and Health Committees(both underground and surface) have been in existence since the beginning of operations.
- 2) Committee consists of three management representatives and three union representatives.
- 3) A once-a-month joint inspection of the plant is made "to detect and record violations of applicable OSHA standards and to detect and record instances of non-compliance to other recommended safety practices."
- 4) At the tour's conclusion, a written report, consisting of union/management recommendations for corrections of conditions found to be hazardous, and tentative abatement dates, is prepared by the company and forwarded to the union.

B) The safety and health provisions of the contract address other matters, such as:

- 1) Right to refuse unsafe work. A specific grievance procedure (third party review) has been incorporated to handle disputed cases.
- 2) Exposure levels are made available to union.
- 3) International has access right to the plant for safety and health meeting and inspections upon advance notification of management.
- 4) After a physical examination by the company physician, each employee is furnished with the results.

Comments:

V. REGULATORY HISTORY

A) Pre-OSHA

- 1) Safety--Passage of first state safety law and the creation of the state's Department of Labor occurred in 1909. A comprehensive safety law--Occupational Safety Standards Act (Act 282)--was passed in 1967. MIDOL records show that the White Pine smelter was never inspected under this Act.
- 2) Health--Division of Occupational Health, Michigan Department of Public Health, formed in 1937. INFORM has on file health inspections performed at White Pine dating back to 1959.

B) Post-OSHA

1) State OSHA Plan

- a) Developmental plan approved in October, 1973. The enabling legislation became effective on January 1, 1975.
- b) The Michigan Department of Labor has full authority to endorse and administer the laws pertaining to occupational safety.
- c) The Michigan Department of Health is responsible for administering and enforcing laws concerning occupational health.
- d) Inspections--See Table 2.

2) OSHA activities

- a) Inspections--See Table 2.

Table 1

PROCESS EQUIPMENT -- White Pine

NAME	AGE	POLLUTION CONTROLS	COMMENTS
Rotary Dryer	1970	Two Stage Wet Scrubber → Stack	Particulate emissions are also controlled by maintaining a 9% moisture content in the mixed charge.
Reverberatory Furnaces (2)	1955	Waste Heat Boilers → ESP [Flat Plate Type] → 500' Main Stack	ESP installed in 1961. Coal fired.
Converters (Pierce-Smith) (2)	1955	Baloon Flue → 500' Main Stack	No SO ₂ control at this smelter.
Holding Furnace (1)	1955	Gases vented to 92' Stack	
Fire Refining Furnace (2)	1974	Gases vented to Separate 125' Stacks	
Casting Wheel (1)	1955		
Semi-Continuous Casting Machine	1955		

SOURCES: Design and Operating Parameters for Emission Control Studies:
White Pine Copper Smelter.

Field Study of The White Pine Copper Company NIOSH Study.

Table 2

Sections--White Pine

Michigan Department of Labor

	TYPE	FINDINGS	PENALTIES	FOLLOW-UP	COMMENTS
1/75	general schedule	5 citations (14 violations)	\$52	company abatement letter	guards, warning devices, barriers & other safety violations
./75	follow-up	-----	----	-----	Involved whether or not to issue a variance from a standard cited in 5/20/75 inspec- tion. Variance granted.
5/76	general schedule	14 citations (32 violations)	?	?	guards, electri- cal, personal protective equip- ment, other safety violations
1/76- 12/76	general schedule	7 citations (21 violations)	\$33	company abatement letter	guards, electri- cal, maintenance records, other safety violations

Michigan Department of Health

	TYPE	FINDINGS	PENALTIES	FOLLOW-UP	COMMENTS
5/75- 18/75	general schedule	1 violation	\$30	company abatement progress reports	copper dust violations
2/76	referral inspection	no violations	----	-----	referral from MIDOL calling for inspection of flux building

Sections--White Pine

	TYPE	FINDINGS	PENALTIES	FOLLOW-UP	COMMENTS
1/72	accident fatality	14 non-serious violations	\$180	company abatement letter	Death resulting from fall from roof during rest period.
1/72	health general schedule	1 non-serious violation	0	company abatement letter	Cited for SO ₂ exposures above the reverb.
'75- 2/75	health general schedule (THHP)	0	----	----	sampling for As, Cu, and SO ₂

Table 3

SUMMARY OF HEALTH HAZARDS--White Pine

PLANT AREA	Number of Employees	TWA Exposures*			Sulfur Dioxide (PPM)	NOTES
		Copper mg/M ³	Arsenic mg/M ³	Lead mg/M ³		
Material Handling	24	.7-4.7				One copper dust measurement of 245.5 mg/M ³
Reverberatory Furnace area	46	<.1-13.	<.0002-.02		SO ₂ levels above reverb range between 4 - 10 ppm. Tapping area >15 ppm.	
Converter area	23		<.001-.011			All SO ₂ sampling by either state or federal OSHA shows exposures below proposed SO ₂ standard. Noise levels 105 dBA -- punching area.
Refining and Casting	36					
Other	107					

SOURCES: OSHA inspections

*Independent of respirator usage

FACT SHEET

Facility: Inspiration Smelter

Company: Inspiration Consolidated Copper Co.

INFORM
25 Broad Street
New York, New York
10004

(212) 425-3550

GENERAL

Name: Inspiration Smelter (Inspiration Consolidated Copper Co.)

Location: Inspiration, Arizona

Description:

- 1) Part of an integrated copper producing operation which also includes three open pit mines, vat and heap leaching, a concentrator, an electrolytic refinery, and a continuous casting and rolling plant.
- 2) Smelting has been carried out since 1915. Purchased by Inspiration in 1960, the plant was modernized considerably. In 1974, a brand new smelter with an electric furnace and Hoboken converters was put in operation.
- 3) Entire complex employs approximately 2,000 people. Some 450 are employed in the smelter, including administrative and maintenance employees.
- 4) Smelter is located in the Globe-Miami area of Arizona, with a population of 17,500 people. Inspiration is the largest employer in the area.
- 5) Arsenic content of the concentrates is unknown.

6) Production

- a) Approximately 45-70% of the ore treated is on a custom basis.

b)	1972	1973	1974	1975	1976	1977
Copper (tons)				94,000	127,000	
Sulfuric Acid (tons)				175,000	237,000	

Comments:

PROCESS AND HAZARDS

NOTE: In some areas of the plant, workmen wear company-supplied respirators on a need basis. The following comments refer to exposures independent of respirator usage.

NOTE: Throughout the following remarks, the phrase "poorly characterized" is used to indicate that we have found no evidence that either the company or the regulatory agencies have sufficiently characterized the exposures to permit proper evaluation and corrective action.

A) Material Handling-Receiving, Bedding Areas, and Dryer

- 1) Concentrates and precipitates are received mostly by rail car (some by truck), unloaded to hopper with car shaker, and finally moved on conveyor belt to bedding area.
- 2) Foreman and operator (3 shifts) in unloading area are exposed to intermittent dust and noise from car shaking and unloading. Actual exposures are poorly characterized.
- 3) Sampling area has been reported in need of ventilation. Actual exposures were poorly characterized. SMI reported in late 1976 that area would be replaced. Actual status is unknown.
- 4) Bedding area is an enclosed building, with 2 doors and some windows. It was built with the new smelter. Materials are bedded by means of an overhead tripper conveyor system, then placed onto another conveyor by means of a payloader with an open cab. Intermittent dust exposures are poorly characterized.
- 5) Concentrates are conveyed to a 150 ton wet charge storage bin ahead of the dryer. Fuller rotary dryer is designed to reduce the moisture content from about 10% to less than 0.3%. The exit gases are cleaned by cyclones and a baghouse before being vented into the atmosphere. Dry material is fed directly to two 700-bins above the electric furnace. The bins are "totally enclosed structures vented into the dryer dust collection system." Dust exposures to the single operator, if any, are poorly characterized.
- 6) Cleaning of the baghouse--carried out infrequently--is reported to be "very dusty."

B) Electric Furnace

- 1) Began operations in 1974. Largest in the world.
- 2) Feed is drawn from storage bins by screw feeders which deliver the materials to two drag conveyors. Conveyor operation is reported dusty.
- 3) Potential exposures to sulfur dioxide, metal dust and fumes on all floors above the furnace roof are poorly characterized. A few grab samples of SO₂ on record indicate levels of 2-28 ppm at the smelter control room. The heat on the sixth floor of the furnace is reported "terrible." Actual levels are not characterized.

- 4) Matte is tapped from four holes on the converter aisle end of the furnace. Only one is ventilated. The launders converge onto two ladle-filling spots. There is no ventilation at these spots. The launders are reported to be partly covered, but exact extent is unknown. Potential exposures in these areas are poorly characterized.
- 5) Slag is skimmed from two tap holes in end wall of the furnace. Tapping is done with machine. There is no hooding or ventilation on tap holes, launders or slag pots. Slag is taken to dump by rubber-wheeled vehicles. Potential exposures in this area are poorly characterized.

C) Converter Aisle

- 1) Five Hoboken-Overpelt converters. Off gases are drawn from the "siphon" units on the side rather than traditional primary hoods.
- 2) Emissions into the converter aisle through converter mouths are reported frequent. These occur particularly when there are difficulties with the gas cleaning system downstream of the converters. Labor walkouts have occurred in protest of conditions in aisle when acid plant is down.
- 3) Potential exposures to sulfur dioxide and metal fumes, if any, in the converter aisle are poorly characterized.
- 4) Usually one converter is down for repairs, particularly in the "smoke box" section. Repair work by masons and others inside these is reported to be extremely dusty. Actual exposures are poorly characterized.
- 5) Crane cabs (2) are enclosed and supplied with fresh air. Maintenance of seals and fresh air equipment is reported adequate. Sulfur dioxide levels inside the crane cabs are reported near zero.
- 6) Noise levels in converter aisle reported around 95-96 dBA. Actual exposures are poorly characterized. No measures to reduce noise levels from converters have been taken.

D) Refining and Casting Area

- 1) Blister copper is either cast into 6000-pound cakes directly or refined in an anode furnace and cast into anodes in the 10-mould anode casting wheel.
- 2) There is no hooding or ventilation at the anode furnace.
- 3) Potential exposures in these areas are poorly characterized.

E) Other Areas

- 1) Transfer of revert dust from dust control devices (e.g. cyclones, flues, precipitators) is reportedly by enclosed systems (screw conveyors) back to mixing areas before rotary dryer. Potential dust exposures, if any, are poorly characterized.

- 2) Crushing plant handles silica and smelter reverts. Scant information available to INFORM suggests that wetting systems are inoperative and that there is no exhaust ventilation. Potential dust exposures are poorly characterized.
- 3) Exposures, if any, in the acid plant are poorly characterized.

Comments:

COMPANY SAFETY AND HEALTH ACTIVITIES

A) History--Not Available

B) Staff

- 1) Safety Department: Safety Director and two safety engineers working under the director of industrial relations. Activities encompass entire complex, not only smelter.
- 2) Industrial Hygiene: Former safety director now holds the position of Director of Industrial Hygiene.

C) Respirator Program

- 1) There is no specific training, education or supervision of respirator usage.
- 2) Respirators are cleaned and disinfected and repaired by the company on a monthly or weekly basis, according to areas of use. Some workmen are dissatisfied because respirators are returned at random.

Comments:

D) Industrial Hygiene

- 1) Company performs some monitoring of personal exposures. Details of monitoring program are unavailable.
- 2) Ventilation systems are not inspected according to written plan or schedule.
- 3) There is no exchange of information with the union regarding the goals or results of air sampling.
- 4) Company presented no substantive testimony regarding hazards or controls during the OSHA hearings for the proposed sulfur dioxide and arsenic standards. INFORM found no evidence of any systematic exchange of industrial hygiene data with government, unions, or other companies.

Comments:

E) Safety

- 1) Company safety inspections are the same as those conducted by the joint safety committee.
- 2) Details of accident investigation procedures are not available.
- 3) Safety training for new employees consists of
 - a) one-hour lecture
 - b) safety movie
 - c) instructions on protective equipment.
- 4) INFORM found no evidence of any refresher safety education.
- 5) Union reports that workmen were not trained in the safety aspects of the new equipment put in operation in 1974.
- 6) INFORM has available OSHA 102 data for the years 1972, 1973, 1974, and 1975.

Comments:

F) Health Care

- 1) Health care for employees and dependents is provided by private clinic set up by the company. Staff includes 7 physicians as well as other personnel.
- 2) Clinic is approximately one mile from the smelter.

JOINT SAFETY COMMITTEE

- 1) A joint safety committee exists, with representatives from each of the nine unions, as well as 3-4 management representatives. There is no contract language outlining the existence, make-up, or functions of this committee.
- 2) Committee meets monthly, when it selects one area of the smelter to inspect. Committee has no specific authority; it can only make recommendations.
- 3) There is no specific procedure for joint accident investigations and union committee members are seldom included.
- 4) Other activities of the safety committee, if any, are unknown.

Comments:

REGULATORY HISTORY

A) Pre-1970

Office of State Mine Inspector

B) Post-1970

1) State OSHA Plan

a) Developmental plan approved October 1974. Headed by Arizona Industrial Commission.

b) Jurisdiction: Still in hands of state mine inspector.

2) State Mine Inspector

a) Inspections: see table.

b) Limited industrial hygiene efforts.

3) OSHA (Federal) Activities

Four inspections. Two accidents. Two complaints.

Comments:

Table 1
PROCESS EQUIPMENT--Inspiration

NAME	AGE	POLLUTION CONTROLS	COMMENTS
Fuller Rotary Dryer	1974	Two Dracco cyclones in series followed by a baghouse	
Elkem Electric Furnace	1974	Gas coolers (with some heat recovery) → 2 Dracco dust cyclones → electrostatic precipitator (ESP) → join the converter gases on the way to the acid plant	Largest electric furnace in the world. Furnace fed by 2 drag chain conveyors.
Hoboken-Overpelt Converters (5)	1974	Gas coolers → one Duccon cyclone per converter → mixing chamber → 3 electrostatic precipitators → join furnace gases on way to acid plant	
Anode Furnace (1)	1915		
Anode Casting Wheel (1)	1915		
Acid Plant	1974		

Table 2

SUMMARY OF HEALTH HAZARDS--Inspiration

PLANT AREA	Number of Employees	TWA Exposures in Mg/M ³		Sulfur Dioxide (PPM)	NOTES
		Copper dust	Arsenic		
Material Handling ---Receiving Area --Bedding Area --Dryer					
Electric Furnace					Levels from 2-28 ppm reported. TWA exposures not available.
Converter Aisle					Noise levels 95-96 dBA in aisle. Details unavailable.
Refining and Casting Area					
Other --Crushing Plant --Acid Plant					

HA INSPECTIONS--Inspiration

TE	TYPE	FINDINGS	PENALTIES	FOLLOW- UP
18/73	Accident Death	1--non-serious. Failed to provide derail or bumper blocks on railroad spur track which would have prevented car from entering building and contacting another car.	\$90.00	No
6/74	Accident Death	In compliance. (Fall from crane while changing lights.)	--	--
/18/74	Complaint	6--non-serious.	?	No
2/77	Complaint	No violation. Complaint re use of wood brake handles at sampling and unloading area.	--	--

DATE	TYPE	FINDINGS	FOLLOW-UP	COMMENTS
10/21/74	Safety--smelter	19 violations	Co. abatement letter 11/25/74	Guards, clean-up, covers, etc. Oil spill problem & electrode control tower.
--	--	--	Co. abatement letter for acid plant in- spection. No report.	--
5/1/75	Safety--smelter	18 violations	Co. abatement letter 5/28/75	--
9/18/75	Health & safety --smelter	9 noise readings >90dbA 43 safety violations	Co. abatement letter requesting 6 delays. Others abated	Signs requiring hearing protec- tion need to be posted
3/8/76	Health--smelter	Dust. SO ₂ --4 samples >5 ppm. 2 >25 ppm.	--	--
3/16-17/76	Safety--acid plant, smelter, shops	33 violations	--	Housekeeping
5/7/76	Safety--use of explosive	3 violations	5/10-11 spot check. Co. in compliance.	1) No instruction on explosive. 2) Not directed by authorized personnel. 3) Area to be fired, not guarded. [Blasting the spill copper at the dust box at converter.]

DATE	TYPE	FINDINGS	FOLLOW-UP	COMMENTS
9/21/76	Health	2 violations	--	1) Provide respirator program. 2) SO ₂ violation at converters.
9/21/76	Health--cranes	4 dusts-- no violation		
9/21-23/76	Health & safety	40 sample plant violations 3 acid plant violations	3 3/16-17/76 violations abated; 1 3/16-17/76 extension	SO ₂ --5 above 5 ppm [4 >20 ppm]
10/29/76	Abatement	Inspection of above (9/21-23/76)		

FACT SHEET

Facility: Utah Copper Division, Garfield Copper Smelter

Company: Kennecott Copper Company

INFORM
25 Broad Street
New York, New York
10004
(212) 425-3550

GENERAL

Name: Utah Copper Division, Garfield Copper Smelter

Location: Magna, Utah

Description:

- 1) Combination (within 15-mile radius) of open pit mine, three concentrators, copper smelter and refinery, silver refinery and related facilities.
- 2) 1,350 employees. Approximately 700 in production.
- 3) Ore received from Bingham Mine, largest open pit mine in the world. Concentrate arsenic content .135-.15%. Other impurity data on hand
- 4) Kennecott, Utah Copper Division is Utah's largest taxpayer, with an annual payroll of \$100 million.
- 5) Production

	1972	1973	1974	1975	1976
Copper (net tons)	258,037	254,965	229,330	171,482	188,917
Silver					
Molybdenum					

Comments:

PROCESS AND HAZARDS

NOTE: Workers are issued company-supplied respirators. Use is not mandatory. Workers are responsible for maintenance, storage and clean-up.

NOTE: Throughout the following remarks, the phrase "poorly characterized" is used to indicate that we have found no evidence that either the company or the regulatory agencies have sufficiently characterized the exposures to permit proper evaluation and corrective action.

NOTE: The following outline attempts to define existing equipment, general operating procedures and potential problem areas associated with the new Noranda smelting system. The Garfield system is the first Noranda of its

size and the first one used to produce 70% copper matte instead of blister copper which the original continuous smelting process called for.

NOTE: Potential exposures to sulfur dioxide throughout the new system are uncharacterized. Sulfur dioxide exposures in the reactor area will depend on the percentage of sulfur that is removed at the reactor mouth, the extent of the oxygen enrichment process and the effectiveness of ventilation and hooding systems. Exposures in the remainder of the operation will be indirectly affected by the Noranda system. Process and controls in the converter area remain virtually unchanged, making sulfur dioxide exposure likely.

NOTE: Potential exposures to arsenic throughout the new system are uncharacterized. Experience with the old system and the high concentrate arsenic percentage make exposures likely. Levels in the reverberatory furnace area of arsenic ranged from .01 mg/m³ to .25 mg/m³. All other areas were uncharacterized.

NOTE: Potential exposures to lead throughout the new system are uncharacterized. Scant sampling at the old reverberatory area indicates levels above the OSHA proposed standard during some operations. Other exposures, if any, were uncharacterized.

A) Material Handling

- 1) Concentrates are received at the material handling building in a 15% wet state, which is fairly effective at reducing dust, according to the union. Despite original plans to construct new facilities as of this writing, no new receiving areas exist. Concentrates are then transferred through a new dryer on covered and underground conveyor belts to bins above one of three Noranda reactors.

B) Reactors

- 1) There are three Noranda reactors at the Garfield smelter. Two of the new reactors have been operating since December of 1977 with the third beginning production in April, 1978. The company has reported that it intends to operate two of the reactors during normal production. The Norandas will be fed a mixture of concentrate, crushed converter and reactor slag and flux by way of a slinger feed system. Heat will be provided through a combination of burners, one on each end, and oxygen enrichment by way of tuyeres. The mouth of the converter shaped furnace is hooded and the 20% sulfur off-gases are sent to one of four acid plants. Matte is tapped into ladles on the south side of the reactors and transported by motorized transfer cars underneath the reactor and out into the center of the converter aisle. The tunnel under the reactors is under negative pressure. The ladles are not covered during transfers. From the center of the aisle the ladles are carried by overhead cranes to one of four Pierce-Smith type converters. Slag is tapped into hooded ladles and cools for 24 hours in the north portion of the smelter building before it is carried by transfer haulers to the new slag concentrating plant. All tapping points are hooded. According to the company, the Noranda will be rolled out of its hooding only in emergency situation.

- 2) Crane Cabs-- The union reports that the new enclosed, charcoal-filtered cabs are not as effective as those in the old smelter. Actual exposures are uncharacterized.
- 3) Ladles-- The union reports that ladles are left smoking (after unloading) in the converter aisle. Other emissions from slag haulers and matte ladles make conditions in the aisle "much the same" as in the old reverberatory furnace building.

C) Converters

- 1) There are four converters in the new building. One of the advantages of the Noranda system when producing 70% copper matte is the need of fewer converter-hours per ton of copper. This in turn is reflected in the fact that there are only four converters connected with the new system versus nine in the old reverberatory building despite comparable production rates. Kennecott has constructed two new Pierce-Smith type converters and has retrofitted two old converters and placed them in the new smelting building. The converters are primary hooded, and gases are sent to the acid plant complex. Slag is skimmed and transported to the new slag concentrator-floatation facility before being charged into the reactors.
- 2) Punching-- The union reports that the punchers are partially enclosed and are used in conjunction with Noranda silencers. INFORM has been unable to determine if the company is experiencing any difficulties with the silencers. The union indicated to INFORM that there are intermittent noise exposures. Other exposures, to arsenic and sulfur dioxide, if any, are uncharacterized.
- 3) Skimmer-- Skimmers are, as in most smelters, in the open for extended periods of time during the work day. Exposures, if any, are uncharacterized and depend on the overall converter area levels.

D) Anode Area

Although construction on the new anode building is complete, the company does not plan to construct new furnaces or casting wheels at this time. Smelter operations continue to use the old anode furnaces. Exposures, if any, at the old anode area being used in conjunction with the new system are uncharacterized.

E) Slag Concentrator

Reactor and converter slag are transported by ladle haulers to the new slag floatation and concentrator. Slags are open-air-cooled and then "crushed, ground, and treated by floatation for the recovery of copper." The union reported early problems with workplace heat.

F) Other

- 1) The company is constructing a Zig Zag blender to treat ESP dust prior to feeding into the reactors. All other revert dusts are pneumatically conveyed to the reactor feed system.

- 2) The company is constructing a boiler to supplement the power supply at the smelter and will continue to operate one of the reverbs until construction is completed.

Comments:

COMPANY SAFETY AND HEALTH ACTIVITIES

A) History-- Details unavailable.

B) Staff

Safety Director (1)

Senior Industrial Hygienist (1)

Technicians (3)

C) Industrial Hygiene

- 1) The smelter industrial hygienist performs some industrial hygiene sampling. Exact frequency of sampling is unknown. The union reports little sampling being performed in the new smelter areas.
- 2) The smelter has limited contact with the company environmental division in Salt Lake City.

D) Respirator Program

- 1) Respirators are provided on a need basis, based on industrial hygiene sampling and workers' requests.
- 2) Workers are responsible for maintenance, cleaning and storage of respirators.
- 3) The union reports that the company provides little education for respirator use and maintenance.

E) Safety

- 1) Pre-employment safety orientation consists of the issuance of a safety booklet and approximately one-half hour of instruction.
- 2) Refresher safety education is administered through monthly department meetings. In many departments the meetings are held infrequently.
- 3) Company issues free of charge most necessary safety equipment.

F) Health Care

- 1) Most medical care is administered through the Wasatch Medical Clinic located 20 miles from the smelter.
- 2) The Clinic staff consists of two doctors and three registered nurses.
- 3) The company has also established emergency clinics on both the smelter and refinery grounds, with a full-time staff of two nurses at each and daily visits by one of the doctors.
- 4) There are first aid trained guards and foremen in all shifts.
- 5) The company performs pre-employment physicals on all employees. Blood tests, hearing tests and lung function tests are administered to appropriate employees.

Comments:

SAFETY COMMITTEE

A) Description

- 1) Joint Safety Council
 - a) Established in 1954 following a fatal accident.
 - b) The Council meets monthly with four representatives from the union and four from the company. The Council acts on safety suggestions and tours portions of the smelter.
- 2) Union representatives assist in accident investigations.

Comments:

REGULATORY HISTORY

A) Pre-1970

- 1) Utah State Industrial Commission cooperating with the State Department of Health and Welfare, Bureau of Occupational Health.

B) Post-1970

1) State OSHA Plan

- a) Utah State Industrial Commission, Occupational Safety and Health Division and the State of Utah Department of Social Services, Division of Health.
- b) The state has conducted eleven inspections of the Garfield smelter.

2) OSHA Activities

- a) OSHA has inspected Garfield on four occasions, all between 1972 and 1973.

Comments:

Table A

PROCESS EQUIPMENT--Garfield*

NAME	AGE	POLLUTION CONTROLS	COMMENTS
Noranda Reactor (3)	1977	Electrostatic precipitator (ESP) → acid plants	
	(2) 1977		
Pierce-Smith Converters (4)	(2) 1977 (retrofitted)	ESP → acid plants	
Anode Furnace (2)	1950	none	Originally scheduled to modify the anode area.
Anode Casting Wheel (2)	1950	none	
Acid Plant #8	1977		Reactor and converter gases are combined prior to acid plants.
#5,6,7	1977 (retrofitted)		

*Sources: "Emission Control Effort at Kennecott's Utah Smelter," September 21, 1974.
K. H. Matheson.

Table 2

SUMMARY OF HEALTH HAZARDS--Garfield

PLANT AREA	Number of Employees	TWA Exposures*			Sulfur Dioxide (PPM)	NOTES
		Copper mg/m ³	Arsenic mg/m ³	Lead mg/m ³		
Material Handling	41					
Smelting Department	120					
Reactors	(80)					
Converters	(40)					
Anode area	117					
Acid Plants						
Slag Concentrator						
Other						

*Independent of respirator usage

Table 3

tions--Garfield

	TYPE	FINDINGS	PENALTIES	FOLLOW-UP	COMMENTS
72	accident fatality	1 non-serious violation	\$600	recommended	
	complaint safety	22 non-serious violations	\$220	6/11/73	
73	follow-up to 4/2/73	all violations abated	----	----	
73	accident fatality	death natural causes	----	----	

tions--Garfield
OSHA

	TYPE	FINDINGS	PENALTIES	FOLLOW-UP	COMMENTS
75	general schedule health	in compliance	----	----	1973 company silica monitor- ing data cited.
	complaint safety	2 non-serious violations	\$45	----	Item #1 vacated 7/11/75
75	complaint health	in compliance	----	----	No samples taken.
75	general schedule safety	25 non-serious violations	\$290	----	Six items vacated 8/1/75
75	complaint health	in compliance	----	7/29/75	Roaster plate treater bldg.
75	complaint health	in compliance	----	----	Roaster plate treater bldg.
5	complaint safety	3 non-serious violations	\$45	----	Anode area
75	complaint health	in compliance	----	----	Acid plant

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3--cont'd]

tions--Garfield

OSHA

nued]

	TYPE	FINDINGS	PENALTIES	FOLLOW-UP	COMMENTS
	general schedule health	1 serious, 11 non-serious violations	\$875	----	1 serious and 7 non-serious violations abated 10/1/76 and 11/5/76.
	complaint health	in compliance	----	----	Catenary flue cleaning
76	complaint health	3 non-serious violations	\$90	----	Asbestos

FACT SHEET

Facility: Ray Mines Division, Hayden Smelter

Company: Kennecott Copper Corporation

INFORM
25 Broad Street
New York, New York
10004
(212) 425-3550

GENERAL

Name: Kennecott Copper Corporation, Hayden Smelter

Location: Hayden, Arizona

Description:

- 1) Combination of concentrate receiving facilities, fluo-solids roaster, reverberatory furnace, converters (3), anode casting facilities, and supportive facilities.
- 2) Smelter built 1958; mill, 1909.
- 3) Employees: 194 smelter production.
- 4) Ore from Ray mines. Concentrates from Kennecott Hayden concentrator. Arsenic content of concentrate estimated at .016%; other trace material information on hand.
- 5) Area's (Hayden-Kearny) economic base largely derived from mining, milling, and reduction of copper ores.
- 6) Production

	1973	1974	1975	1976
Copper* (tons)	98,908	74,764	42,036	88,089
H ₂ SO ₄ (tons)			175,000	
Molybdenum (lbs)	611,307	682,514	330,032	743,037
Gold (ozs)	1,213	1,468	1,188	1,016**
Silver (ozs)	234,994	244,864	153,872	107,855**

*Includes copper hydrometallurgically produced from silicate ores as follows: 1973, 24,714; 1974, 18,065; 1975, 7,336; 1976, 25,213.

**1976 gold and silver production based on refinery figures.

Comments:

PROCESS AND HAZARDS

NOTE: Respirators are company-supplied and worker-maintained. They are worn on a need basis. The following comments evaluate TWA exposures independent of respirator use.

NOTE: Throughout the following remarks, the phrase "poorly characterized" is used to indicate that we have found no evidence that either the company or the regulatory agencies have sufficiently characterized the exposures to permit proper evaluation and corrective action.

A) Material Handling

- 1) Sulfide and Leach-Precipitation-Flotation (LPPF) concentrates are received, as a slurry, at the Filter Plant where they are "de-watered." Materials are then transferred via open conveyors to a screw conveyor/dryer. A final set of conveyors transfer the material to storage areas. Potential dust exposures to filter plant and dryer operators and their helpers from open conveyors and transfer points. Poorly characterized.
- 2) Storage building provides storage and removal facilities. Removal consists of overhead cranes equipped with hoppers. Once charged, the hopper then feeds the materials via open conveyor system to the concentrate feed hopper above the fluid-bed roaster. Potential dust exposures to the craneman, binmen, secondary materials operators, and laborers. Poorly characterized.
- 3) Outside storage area. Removal by front end loader. Loader dumps materials on grizzly above a conveyor belt. Open conveyor belt system transfers materials to storage above roaster. Yard covered with 4 to 6 inches dust, which is constantly stirred by loader, general activity, and the wind. Area cited by State Mine Inspector after worker complaint.
- 4) Lime Plant. Five employees. State inspection shows SiO_2 levels below TLV's. Noise levels above present standards.

B) Fluo-Solids Reactor

- 1) Blended materials (concentrate, lime, silica, and precipitates) are fed into reactor via a screw feeder which controls feed rate and seals reactor vessel.
- 2) The "roasted" fine solids leave the reactor via the gas stream and are recovered in primary and secondary cyclone banks above the reverbs. Oversized materials (~15%) are removed from the reactor via a cone type valve located in the reactor floor. This material is transferred to the calcine bins above the reverb by drag chain conveyor.
- 3) Exposures to the reactor operators (6) and reactor utilitymen (3) are poorly characterized.
- 4) Cyclone utilitymen (3) must enter cyclones from time to time when they become plugged. Exposed to high SO_2 and dust levels due to nature and location of job. Poorly characterized.
- 5) Roaster feed ports must be cleaned out once a month. The operation takes fourteen hours and involves entering the reactor and drilling over 2,000 holes. To decrease exposures, the reactor is first heated to ~1,800°F to "burn it out." The reactor is then cooled with sonic (fog) sprays. Unions wanted a 48-hour cooling time before the reactor could be entered. However, a "sufficient cooling period" was enacted, which leaves the cooling time up to the company's discretion. (Arizona Mining Code R-11-1 1632) Workers enter in teams (substituting in and out). One worker reported entering reactor with a thermometer, and recording 300°F. Workers report entering reactor and coming out two minutes later, not being able to work for the rest of the day. Others report exiting from reactor vomiting after five minutes.

C) Reverberatory Furnace

- 1) One suspended arch furnace.
- 2) Charge bins above the reverb receive the calcines from the reactor. The calcines are intermittently fed to the reverb via Wagstaff feeders.
- 3) The cyclone man and other working in the bin area above the reverb are exposed to sizable SO₂ and arsenic levels. Employees complain that "the company does not correct the dust and fume problem [in this area] at the source, they [company] just add on safety equipment."
- 4) Furnaceman. Workers report extreme noise levels--due to air and steam blowing from the burner. They are supplied with ear plugs; however, the furnaceman cannot wear them since he "relies on his ears to notice changes in what's going on." OSHA determined noise levels within standard.
- 5) Tapper. 25-30 ladles of matte are removed from reverb per day--taking 10-20 minutes to fill a ladle. During tapping there is considerable exposure to SO₂ and fume. The tapping area is hooded. SO₂ and arsenic exposures above the present standard.
- 6) Slag Motorman. Slag is removed at an average rate of 650 TPD and transferred to the slag dump via slag cars. The launders are hooded; however, the cars themselves become fugitive emission sources. Exposures to motormen poorly characterized.
- 7) Arch Blower. One man per day in afternoon shift. Arch blown from catwalk 15-20 feet above the reverb. Company tried vacuuming; proved unsuccessful, however. Arch blower works above reverb for six out of every eight hours. Temperature exposures range from 130° to 200°F. He is equipped with safety glasses, safety shoes, overalls, respirator, and rags to keep out irritating dusts. Nature and location of job cause extreme SO₂ and dust exposures. Poorly characterized.
- 8) Waste Heat Boilers. Dusts entrained in gas stream are collected in hoppers. They are removed and transferred to converters via front end loaders. Due to nature and location of job, dust and SO₂ exposures are likely. Poorly characterized.

D) Converter Area

- 1) Matte transfer via matte ladle/cars to converter aisle. Matte then fed to converter via crane/ladle operation. Empty ladle returns to reverb.
- 2) Crane cabs (2) are under positive pressure, filtered, and air conditioned. The cranes are located 80 feet above the converters. Crane-men intermittently exposed to SO₂ levels as high as 12 times the present standard.
- 3) Three Pierce-Smith converters equipped with water cooled hoods and gas cleaning spray chamber. The spray chamber nozzles (water and air pipes join at nozzle to create spray) have to be changed, two times per shift, with the resulting exposures poorly characterized.

Workers report that the hoods leak excessively. There are no secondary hoods.

- 4) Skimmer. Skimmer has a shelter where he governs the converter operation by flame color. SO₂ exposures are likely, but poorly characterized. Due to nearby punching operation, the skimmer is intermittently exposed to excessive noise levels. Area cited by OSHA for noise.
- 5) Puncher. Noise levels of up to 16 times the standard. Cited by OSHA. Company plans to implement muffler devices as a result of this citation. Converter equipped with spark shield which provides puncher with ventilation and necessary protection from sparks.
- 6) Slag Haulage Operator. Slag is continuously "skimmed" until all iron sulfides have been removed. Slag then cooled in cooling pits, crushed, and sent to flotation mill to recover copper. The concentrate is "dewatered" and sent to roaster. Exposures poorly characterized.
- 7) Silica Flux Operation. Converter hoods are equipped with openings through which silica flux is added. Silica transferred from storage bins behind converters via an open belt system, terminating at hood. Material is discharged directly into a chute, feeding converter. Probable dust and SO₂ exposures. Poorly characterized.

E) Refining Area

- 1) Two 250-ton anode furnaces surround one common anode casting wheel.
- 2) Poling, to rid the blister copper of oxides and other impurities, is accomplished by reduction/oxidation with natural gas/compressed air. The usual practice is to 'blow' these furnaces during the night shift.
- 3) Casting furnacemen (2) control the furnaces, the pouring spoon, and the casting wheel from one of the two enclosed, air conditioned control booths. Exposures poorly characterized.
- 4) Furnace Helpers (8). Tending burners on the furnaces, among other responsibilities. Area was cited by OSHA for burner noise. Company was to have abated noise hazard by making change in burner system. Extent of correction unknown.
- 5) After anodes are cast and cooled, they are removed via a Bosh-crane and placed for further cooling in the two water filled Bosh-tanks. After cooling, anodes are removed by an overhead crane to a storage area. Anodes are shipped to refinery for additional processing.
- 6) Health hazards poorly characterized for anode casting area.

F) Auxiliary Equipment

- 1) Gas cleaning and acid plant. Fourteen employees. Job descriptions and exposures are poorly characterized. A welder was severely burned (sulfuric acid burns) at the acid plant loading station.

Comments:

COMPANY SAFETY AND HEALTH ACTIVITIES

A) History

Details not available.

B) Staff

Safety Director (1)

Safety Engineer (1)

Industrial Hygienist (1)

C) Industrial Hygiene

Company reports "Monitoring throughout plant at least once annually. --Sampling for sulfur dioxide, lead, arsenic, cadmium, mercury. Main contaminant sulfur dioxide--due to fact Ray ores are very low in concentrations of other elements." Conflicting data on hand as to actual extent of monitoring.

D) Respirator Program

No specific company details available. All workers issued respirators. "Some use them. Some do not."

Workers responsible for maintenance. Respirator program cited by OSHA 4/75--Extent of abatement unknown--No OSHA follow up.

E) Safety

1) Company details not available.

2) The number of lost workdays in 1974, as reported to State Mine Inspector by company, is three times the number that appears on 1974 OSHA 102.

F) Health Care

1) Kennecott owns and staffs a 20-bed hospital seven miles from smelter. Ambulance at smelter.

2) Hospital staff of 37, including five full-time physicians. Smelter staff consists of licensed practical nurse (1) and emergency medical technician (1) Supervisory personnel receive first aid training.

- 3) Pre-employment physical. Audiometric tests given annually to start with. Hearing conservation program for workers in high risk areas.
- 4) Discrepancy exists between availability and extent of annual medical testing that company reports giving and that workers report receiving.

Comments:

SAFETY COMMITTEE

A) Description

- 1) Established 1958.
- 2) Two management representatives (safety director and safety engineer); two United Steelworkers representatives; one representative each from other unions.
- 3) Meets once a month on company time. They decide what areas to inspect and write down what improvements should be made. Company then decides either to reject or abate.

Comments:

REGULATORY HISTORY

A) Pre-1970

- 1) Office of State Mine Inspector

B) Post 1970

1) State OSHA Plan

- a) Developmental plan--Approved October 1974--Headed by Arizona Industrial Commission.
- b) Jurisdiction over smelter still in hands of State Mine Inspector. No contractual agreement exists between SMI and Arizona Industrial Commission.

2) State Mine Inspector

a) Inspections: see table.

b) Limited industrial hygiene efforts.

3) OSHA Activities

a) Two inspections--one safety; one health.

Comments:

NAME	AGE	CONTROLS	COMMENTS
Filter Plant	1958	Cyclone Scrubber	
Storage Area	1958	DNA	Inside and outside areas
Fluid Bed Roaster	1969	1° and 2° Cyclone Banks, Venturi Scrubber, Peabody Scrubber, Mist Precipitator, Drying Tower, Mist Eliminator, Acid Plant	Reverb fed pneumatically
Reverb (Detrick-type suspended arch)	1958	Waste Heat Boilers, ESP, 600' Stack	
Converters (3) (Pierce-Smith 13' x 30')	1958	ESP, Peabody Scrubber, Mist Precipitator, Drying Tower, Mist Eliminator, Acid Plant	
Casting Furnaces (2)	1958	None	
Casting Wheel	1958	None	
Acid Plant (Double contact)	1969 Rebuilt 1974	Tail gases uncontrolled--leave via 100' Stack	950 TPD
Lime Plant and Silica Crushing Facilities	1958	DNA	

SOURCES: Design and Operating Parameters for Emission Control Studies:
Kennecott, Hayden, Copper Smelter

"The New Hayden Smelter," Journal of Metals, June 1959

AREA	Number of Employees	Copper mg/M ³	Arsenic mg/M ³	Lead mg/M ³	Sulfur Dioxide ppm	NOTES
Material Handling	78					Primary crusher and lime kilns noise levels exceed standard. Hazardous dust concentration at outside feed area. Content of dust poorly characterized.
Roaster and Reverb area	45	.003-.013	.002-.009		Reactor 10-29.5 Reverb .9-6	Arch blower subject to temperature range of 130°-200°F. Severe dust exposure--likely arsenic hazards. Reactor cleanout crew exposed to temperature exceeding 300°F. Due to nature of job, high dust exposure likely, but poorly characterized
Converter Aisle	38				0-60	Mechanical puncher exposed to 16 times allowable noise.
Anode Refining, and Casting	15					Furnace man subject to noise exceeding standard.
Acid Plant and Gas Cleaning Equipment	15					Most exposures poorly characterized.

SOURCES: OSHA data
State Mine Inspector reports
Union data

*Inspection reports consistently state "poor housekeeping" throughout plant.

	TYPE	FINDINGS	PENALTIES	FOLLOW-UP	COMMENTS
75	general schedule safety	15 non-serious violations	None	None	All violations but one abated before inspection team left premises.
					SO ₂ --cyclone man wearing non-approved respirator.
75	general schedule health	2 non-serious violations	\$90 Reduced to \$45	Recommended	Noise-- #2 & #3 conver- ter, anode furnace and casting wheel.

tions--Kennecott Hayden
of Arizona, State Mine Inspector

	TYPE	FINDINGS	PENALTIES	FOLLOW-UP	COMMENTS
72*	safety-- smelter	22 violations	**		
	spot safety-- concentrator	No violations	----		Spot inspection of reagent handling area.
4	accident	Insufficient water pres- sure for deluge shower and eye wash; no instructions for safe loading operations.	----		Welder burned over 1/3 of body due to acid plant & loading accident.
74	safety-- smelter	47 violations	----	1/2/75 SMI letter-- granting extension for 11 violations.	Handrails, guards, etc.
	safety-- smelter	6 violations	----	All violations of 10/22/74 abated.	Keep after housekeeping.

*1972-1974 State Mine Inspection not available to INFORM.

**State Mine Inspector issues no \$ penalties.

	TYPE	FINDINGS	PENALTIES	FOLLOW-UP	COMMENTS
	safety-- prep plant	67 violations	----		Toe boards, guard rails, machinery guards.
5	noise-- crusher, lime kiln	7 violations (above 90 dBA)	----		Housekeeping must be improved.
	health-- flux		----		Samples below TLV for SiO ₂ .
76	health-- smelter		----		Dust samples. All samples (7) below TLV for dusts containing SiO ₂ .
6	spot health-- lime plant		----		All samples (6) below TLV for SiO ₂ dusts.
6	safety-- smelter	30 safety violations	----		
				21 violations abated, of 4/20/76 smelter safety in- spection.	
	compliance inspection		----	5 extensions granted.	
	complaint-- flux division	2 dust violations	----		Outside feed area--dust stirred by front end loader.
6	health-- lime plant		----		All samples (5) below TLV for SiO ₂ .
6	complaint	1 violation	----		Crane Cab repairs--by September 2.
	complaint	1 violation	----		Same cab, different complaint--abate immediately.
8,	health-- smelter; SO ₂ , dust.		----	5 extensions of 4/20 abated.	No cited violations, but one area sample above TLV for SiO ₂ (14 samples taken), and five out of eight SO ₂ samples above 5 ppm TLV--one for 60 ppm.
76	complaint		----		Complaint re accident on slag train. Inspector recommendation: take up slack on hand brake.

FACT SHEET

FACILITY: Hurley Reduction Works

COMPANY: Kennecott Copper Company

INFORM
25 Broad Street
New York, New York
10004

(212) 425-3550

GENERAL

Name: Hurley Reduction Works

Location: Hurley, New Mexico

Description:

- 1) Combination of concentrator, "green-feed" smelter, fire refining and supportive facilities.
- 2) Mine begun in 1909. Smelter built 1939-1942.
- 3) 1,300 employees (total including mine); 196 (smelter production)
- 4) Ore from Chino Mine, reserves more than 50 years. Arsenic content variously estimated as smaller than 0.005%; greater than 0.025%. Other trace metal information on hand.
- 5) Largest employer in Grant County, N.M.; payroll \$20 million.
- 6) Production

a) Approximately 1/6 of Kennecott's total

b)	1972	1973	1974	1975	1976
Copper (tons)	73,403	67,836	60,557	53,193	57,202
Molybdenum (lbs)	396,671	608,098	274,563	421,596	190,200
Gold (ozs)	587	228	1,990	1,911	1,929
Silver (ozs)	12,650	5,428	39,776	55,604	
Sulfuric Acid			?	?	?

Comments:

PROCESS AND HAZARDS--SMELTER

NOTE: In most areas of the plant, workmen wear company-supplied respirators on a need basis. The following comments evaluate TWA exposures independent of respirator use.

NOTE: Throughout the following remarks, the phrase "poorly characterized" is used to indicate that we have found no evidence that either the company or the regulatory agencies have sufficiently characterized the exposures to permit proper evaluation and corrective action.

A) Material Handling

- 1) Open conveyor from mill to open pile storage in yard. Wind sometimes results in dust exposure to yard personnel and even smelter workers. Poorly characterized.
- 2) Dryer. Potential dust and arsenic exposures to operator, clean-up man, and heavy-equipment operator. No local exhaust at feed station. Poorly characterized. Approximately 3 men per shift.

B) Reverberatory Furnace Area

- 1) Two furnaces, only one operated at a time.
- 2) "Down" furnace. Refurbishing may mean excessive noise and dust exposures to jackhammerman, rebrickers, and others. Poorly characterized. "Special smelter laborer" cleans out the inside of waste heat boilers and flues when furnace is down. Likely very high exposures to arsenic, other dust. Poorly characterized.
- 3) Tripper conveyor system, though automatic, requires frequent intervention by operator. Intermittent but sizable SO₂ and dust exposures. Arsenic in excess of proposed standard likely. Poorly characterized. One man per shift.
- 4) Feedermen. Wear full-face air-supplied respirators while feeding, as a result of OSHA citation. Sizable dust exposures. SO₂ exposures above present standard with peaks above 100 ppm. Arsenic exposures above proposed standard. Sizable contribution to all exposures from "blowing of the arch." 2 to 4 times per shift. Two to four men per shift.
- 5) Matte and Slag tapping. Exposures to SO₂ above recommended standard, but below present. Arsenic exposures above proposed standard. Tap points and launders are not hooded or ventilated. Three men per shift.
- 6) Waste heat boilers. Three men per shift with SO₂ exposures above proposed standard, but below present. Arsenic exposures above proposed standard. Heat exposure likely but not characterized.
- 7) Reverb--General
 - a) Others in reverb area (furnaceman, slag train motorman, furnace brick repairman) probably have exposures similar to tappers. Poorly characterized, Three to five men per shift.
 - b) Reverb "explosions" while feeding are commonplace source of contamination. Cause and prevention of such unknown.

C) Converter Aisle

- 1) Four converters with water-cooled hoods. Secondary converter hooding was outlined in fugitive emission control plans submitted to New Mexico authorities in or around early 1974, but plans were never implemented.
- 2) Skimmers and crane chasers with SO₂ exposures below proposed standards. Arsenic above proposed standard. Four to six men per shift. Skimmers sometimes exposed to excessive noise as a result of nearby punching.

- 3) Crane seals and ventilation allow excessive SO₂ levels (above 2 ppm) in crane cabs. Cranemen must often wear respirators. Three men per shift. Arsenic poorly characterized but likely because of location above converter aisle.
- 4) The hood(s) to cover ladles while filling are not routinely used.
- 5) Maintenance of cranes (regarding safety) has been a source of some labor-management conflict.
- 6) Converter punchers. Noise levels up to 6 times standard; also exceeding 115 dBA. Men wear ear plugs. Cited by OSHA in 1974 for lack of engineering controls. Modifications to one converter brought noise down from 115 dBA to 100 dBA. Other converters not yet modified. Arsenic exposures above proposed standard. Three men per shift.
- 7) Converter repair likely to involve serious dust exposures, as for jackhammerman and others in reverb rebuilding. Poorly characterized.
- 8) Silica flux handling tasks reported by union to be very dusty. Poorly characterized. One man per shift.

D) Refinery Area

- 1) Molten blister copper by ladle to holding furnace(s) or refinery furnace. Reduction by "poling" with natural gas. Metal covered with coke. "Black smoke" (unburned hydrocarbons) emitted. Canopy type hood above furnace. Effectiveness unknown. Hazardous exposures, if any, poorly characterized.
- 2) Refinery tapper and helper exposed to "irritating smoke." Not characterized. Two men per shift.
- 3) Potential heat hazard during long casting runs. Not characterized. Two to three men per shift.

E) Auxiliary Operations

- 1) Lime plant crusher. No local exhaust. Dust exposures. Free silica 12%. One man per day. Poorly characterized.
- 2) Lime kiln operator. Dust from lime transfer. One man per day. Poorly characterized
- 3) Lime slaker. Irritating calcium hydroxide mist exposure. No local exhaust ventilation. One man per day. Poorly characterized.
- 4) Flux crushing. Siliceous dust exposure in crushing (approx. 6 hours per day) and transfer (approx. 2 hours per day). One man per shift. Wetting but no ventilation. Poorly characterized.
- 5) Acid plant. Laborer's job description hints at potential dust and arsenic hazards during cleaning of gas-cleaning equipment.

- 6) ESP operator and helper. Precipitate drier operator. Poorly characterized. Job descriptions suggest intermittent high exposures to arsenic.

Comments:

COMPANY SAFETY AND HEALTH ACTIVITIES

A) History. Details unavailable

B) Staff--for entire complex

Director of Safety and Environmental Control

Safety Engineer (1)

Industrial Hygiene Technician (1)

Respirator Maintenance Person (1)

Supervisor of Environmental Control (1) } mainly air-pollution
Environmental Control Engineer (1) } issues

NOTE: Staff has grown by 3-4 since early 1970s.

C) Industrial Hygiene

- 1) Yearly sampling of some areas and work stations since 1973.
- 2) No reports or education given to workmen.
- 3) Results of monitoring are reportedly made available to the Inspector of Mines since 1976. That agency uses such to evaluate hazards.

D) Respirator Program. No details available

E) Safety

- 1) No accident investigations except those conducted through joint safety committee.
- 2) 1973 OSHA 102 data on hand. Other years not available.

F) Health Care

- 1) Bayard clinic (under contract) or Silver City hospital (more serious cases)

- 2) No nurse on premises. Some first-aid training
 - 3) Pre-employment physical. Hearing tests available yearly but not frequently taken by workers. No clearly defined hearing conservation program.
- G) Corporate activities are essentially educational and advisory to plant management. Local activities are fairly independent (except investment decisions).

Comments:

SAFETY COMMITTEE

A) Description

- 1) More than a decade old
- 2) Two management representatives, two from each of four unions
- 3) 1974 contract stipulates general characteristics, i.e., inspection tours, accident investigations, written records, etc.
- 4) No occupational health concerns addressed by committee.
- 5) Records indicate that inspection tours focus on visible safety hazards.

Comments:

REGULATORY HISTORY

A) Pre-1970

- 1) State Inspector of Mines

B) Post-1970

1) State Inspector of Mines

- a) Almost exclusively a safety focus until 1973, when limited health activities were implemented.
- b) Approximately two inspections per year. No union participation.
- c) Agency still active. Jurisdiction question vis a vis New Mexico State OSHA plan (see below) still unclear.

2) State OSHA plan

- a) Administered by New Mexico Environmental Improvement Agency.
- b) Approved 12/75. No smelter inspections yet conducted.

C) OSHA Activities

- 1) First two inspections: Safety.
- 2) Third inspection: Industrial Hygiene. Citations for noise and personal protective equipment.
- 3) Fourth inspection: Brief follow-up of (2) above.

D) MESA Activities

For the period October 1973 through April 1976 MESA conducted 6 safety inspections, 4 of which included among other areas the acid plant, lime kiln and the receiving area.

Comments:

NAME	AGE	POLLUTION CONTROLS
Rotary Dryer (for ppt.)	1965	Cyclone & baffle spray (scrubber)
5-Hearth Dryer? (old roaster?)	1962	
Flux crushing plant	N.A.	N.A.
Rotary Lime Kiln	1941	Cyclone
Reverb #1	1937	2 waste heat boilers; flue; ESP (40%
Reverb #2	1950	" " " " capacity); stack
Converter (Pierce Smith)	1938	Tight fittings; water-cooled hoods.
Converter "	1938	Gas to acid plant
Converter "	1940	
Converter "	1972	
Holding Furnace	1942	None
Holding Furnace	1943	"
Holding Furnace	1951	"
Refining Furnace	1940	Canopy-type hood while poling only
Acid Plant (double contact)	1974-1975	Gas conditioning. ppts; scrubbers; drop-out chambers; heat exchangers.

*Process flowsheet, Figures 2,3; Design and Operating Parameters for Emission Control Studies: Kennecott, Hurley, Copper Smelter.

	Number of Employees	Copper mg/M ³	Arsenic mg/M ³	Lead mg/M ³	Sulfur Dioxide (PPM)	NOTES
MATERIAL HANDLING	43					Most exposures poorly characterized. Some likely Arsenic hazards. Some estimates possible through job descriptions, interviews, other indirect sources.
REVERBERATORY FURNACE AREA	43	0.20-2.3	<.03-0.9	.002-.01	2.5-22	
CONVERTER AISLE	37	.01-.42	<.003-.09	.003-.006	0-18	Punchers exposed to up to six times the allowable noise
REFINERY, CASTING & LOADING	44					Most exposures poorly characterized. Some estimates possible through job descriptions, interviews, other indirect sources.
ACID PLANT	6					

*Independent of respirator usage.

Sources: OSHA Inspection records.

State Inspector of Mines records.

Inspections--Hurley

E	TYPE	FINDINGS	PENALTIES	FOLLOW-UP	COMMENTS
'72	general schedule safety	15 non-serious violations	\$330.--	NONE	
'74	general schedule health	3 non-serious violations	\$130.--	6/11/74	SO2: #2 reverber- atory furnaces Noise: #1 - 3 converters
'74	general schedule safety	16 non-serious violations	\$300.--	NONE	
'74	follow-up to 4/22/74	3 non-serious violations	\$80.--	NONE	Respirator program

tions: State of New Mexico, Inspector of Mines Dept.

	TYPE	FINDINGS	PENALTIES	FOLLOW-UP	COMMENTS *
- 72	safety	7 improvements abated during inspection 12 recommendations smelter, refinery, lime plant 3 recommendations general 12 recommendations mill-shops		4/20/72	Mill Shops Smelter Refinery Lime Plant Quarry
72	check-up			9 notices abated 3 notices unabated	Smelter Shop Refinery
72	spot & check-up	1 notice		3 notices abated	Smelter Shop Refinery
72- 72	safety	20 notices		17 notices abated 3/1/73	Smelter Shop Refinery
73	safety	16 notices		14 notices abated 10/9/73	Smelter Shop Refinery
73	safety & check-up	29 notices			Smelter Shop Refinery

INFORM was unable to obtain records of inspections
for the years 1974-1975.

	TYPE	FINDINGS	PENALTIES	FOLLOW-UP	COMMENTS
	safety & check-up	22 notices			Smelter Shop Refinery
- 6	safety & check-up	17 notices mill-shops 2 notices power plant 3 notices acid plant		19 notices abated 9/30/76	Mill-Shops Power Plant Acid Plant
- 6	dust	3 notices 14 free silica samples 5 SO ₂ samples 24 dust samples			Mill
- 6	safety & check-up	23 notices		22 notices abated 3/24/77	Mill-Shops Power Plant Acid Plant
6	electrical	37 notices: other 3 notices: acid plant 3 recommendations			Mill-Shops Power Plant Acid Plant
- 7	Noise	9 notices			Mines
- 7	safety & check-up	16 notices			Plant

*This column lists the areas covered by the inspection.

FACT SHEET

Facility: Nevada Mines Division, McGill Smelter

Company: Kennecott Copper Company

INFORM
25 Broad Street
New York, New York
10004
(212) 425-3550

GENERAL

Name: Nevada Mines Division, Kennecott Copper Corporation

Location: McGill, Nevada

Description:

- 1) Combination of McGill concentrator, green feed smelter and supportive facilities.
- 2) Mine begun in 1907; smelter, 1908.
- 3) 300 employees (170 concentrator, 130 smelter).
- 4) Ore from Ruth Pit. Arsenic content .12%. Other impurities unknown.
- 5) Largest employer in White Pine County.
- 6) Production (figures in tons)*

	1972	1973	1974	1975	1976
Copper	39,962	50,012	37,562	21,393	12,219

*Includes copper produced from precipitates obtained by leaching waste dumps.

Comments:

PROCESS AND HAZARDS

NOTE: The following comments evaluate TWA exposures independent of respirator use.

NOTE: Following an OSHA citation of 8/13/74, the company has supplied respirators to most areas of the plant. However, workers remain responsible for maintenance, clean-up and storage.

NOTE: Throughout the following remarks, the phrase "poorly characterized" is used to indicate that we have found no evidence that either the company or the regulatory agencies have sufficiently characterized the exposures to permit proper evaluation and corrective action.

A) Material Handling

- 1) Copper concentrates are received from the nearby McGill concentrator on open railroad cars, and unloaded into hoppers at the central dumping area. After storage the concentrates are transferred by open conveyor belts to charge bins above one of the two reverberatory furnaces. Arsenic and copper dust exposures throughout the area are poorly characterized.
- 2) Central dumper--documented violation for respirable silica exposures to laborer and tripperman, as well as documented housekeeping problems, indicate potential exposures to copper and arsenic dust. Seven workers.

- 3) Coal ball mill--OSHA reports potential noise hazard. Actual noise and other exposures are uncharacterized.
- 4) Conveyor belts--documented spillage from uncovered conveyors. Actual levels of arsenic, copper and silica dust are uncharacterized.

B) Reverberatory Furnaces

- 1) Concentrates and flux are fed into one of two reverberatory furnaces by way of tripper bin / shuttle conveyor system. Coal is fed to reverb #2 by a similar tripper bin system. Matte is tapped into hooded ladles and transferred to the converters by overhead crane. Slag is tapped into a 200-yard "slag tunnel" which transports it to the tailings pond where it is granulated and pumped to the slag dump.
- 2) Feederman--documented TWA sulfur dioxide exposures above the existing standard prior to installation of "fume collection equipment." Effectiveness in reducing hazard levels is unknown. Excursions of SO₂ as high as 20 times the existing standard during "puffs." Arsenic levels are uncharacterized. General dusty conditions reported in the area. Eight workers.
- 3) Skimmers--documented SO₂ excursion levels to eighty times the existing standard. Actual TWA SO₂ and arsenic exposures are uncharacterized. Five workers.
- 4) Tappers--documented sulfur dioxide levels well above existing standard. Actual TWA sulfur dioxide and arsenic exposures are uncharacterized. Five workers.
- 5) Tripper--cited by OSHA for sulfur dioxide TWA violations. Documented excursion levels of sulfur dioxide to twenty times existing standard during puffs, prior to company-reported enclosure of tripper floor. Effectiveness of enclosure in reducing hazard levels unknown. Potential arsenic exposures are uncharacterized. One worker.
- 6) Reverb helper--actual exposures to sulfur dioxide and arsenic are uncharacterized; however, job description places workers in areas of documented high sulfur dioxide levels. OSHA citation for high noise levels during jackhammering procedure. Thirteen workers.
- 7) Flue dust handler-- OSHA indicates similar operation and personnel as converter dust conveyor operator. Total dust TWA violations documented by OSHA for converter flue cleaning. Company reports the use of specially equipped respirators during operation. Other exposures, if any, are uncharacterized. One worker.
- 8) Other workers--documented dusty and gassy conditions in area. Actual exposures, if any, to additional workers are uncharacterized. Nine workers.
- 9) Slag tunnel--documented "safety problem" in slag tunnel in 1974. Problems included sulfur dioxide, erosion, lack of access, sub-standard guard rails and structural weaknesses. Union reports no major changes made since that time. Number of workers varies.

C) Converter Aisle

- 1) Matte is transferred by overhead crane to charge four Pine-Smith converters (two of which are normally in operation). The converters are primary hooded; however, mouth design problems have led to fugitive emissions at hood-mouth seal. Blister copper is then molded into cakes and transported for electrolytic refining. 23-27 workers.
- 2) Central platform--documented sulfur dioxide levels average at or slightly above existing standard for platforms on converters #2, 3 and 4. However, most severe exposures appear to be related to copper pouring and cooling schedules. Excursions up to nine times existing SO₂ standard during these operations. Arsenic levels are uncharacterized.
- 3) Skimmer--documented sulfur dioxide levels in "general room" between converters #2 and 3 varied from below proposed standard to three times existing standard. Excursions during other smelter activity are documented. Actual SO₂ and arsenic TWA exposures are uncharacterized. Nine workers.
- 4) Crane chaser--documented sulfur dioxide area levels above existing standard in converter aisle. Job description places worker in area "all the time." Actual sulfur dioxide and arsenic TWA exposures are uncharacterized. Four to five workers.
- 5) Dust conveyor operator--OSHA citation for total dust TWA violations during cleaning and belt operations. Company reports use of specially equipped respirators during operation. Other exposures, if any, are uncharacterized. One worker.
- 6) Converter helper--documented dusty conditions during "clean-up" procedures. Other exposures, if any, are uncharacterized. Three workers.
- 7) Converter punching--punching is accomplished with Kennecott type punchers. Workers report maintenance problems similar to those at Kennecott's Hayden smelter.
- 8) Crane operators are represented by the IBEW. The union reports that the company samples for potential hazards and repairs cabs if necessary upon request. Actual exposures, if any, are uncharacterized.

D) Auxiliary Operations

- 1) Silica-bentonite mixing area--documented violations for silica to the mixer and sacker prior to the design of mechanical system. Extent and effectiveness of system in reducing exposures is unknown.
- 2) Foundry--documented high noise levels to operator for short duration of time (79-108 dBA). Potential problem of "gas and fume" rising from furnace to crane cabs. Actual exposures, if any, are poorly characterized. 27 workers.
- 3) Areas of uncharacterized potential hazards include cake-casting (five workers), waste heat boiler clean-up and repair, and ESP clean-up and dust handling.

Comments:

COMPANY SAFETY AND HEALTH ACTIVITIES

A) History--Details unavailable

B) Staff

Safety and security director (1)

Senior industrial hygienist (2)

Safety inspectors (2)

C) Industrial Hygiene

- 1) There are full-time industrial hygienists at the division and company levels.
- 2) The company performs some evaluatory sampling. Exact frequency of sampling is unknown.

D) Respirator Program

- 1) Respirators are supplied on a need basis, based on evaluatory sampling.
- 2) Education for respirator use and maintenance is supplied by the company following a 1974 OSHA citation.
- 3) Workers are responsible for maintenance, cleaning and storage of respirators.

E) Safety

- 1) The company has established pre-employment safety orientation consisting of a safety booklet and instruction by immediate supervisors.
- 2) Refresher safety education is administered through monthly safety meetings.
- 3) Company issues free of charge most necessary safety equipment.

F) Health Care

- 1) Most medical care is administered through the public hospital in Ely, Nevada. There is an emergency transportation system from McGill to Ely.
- 2) The company has established an "emergency hospital" in McGill. Staffing consists of a registered nurse.
- 3) There are first-aid trained foremen and guards on all shifts.
- 4) The company performs pre-employment physicals and "occasional" hearing tests.

Comments:

SAFETY COMMITTEE

A) Description

- 1) Department Safety Committee
 - a) Monthly meetings attended by a company representative, plant safety engineer, one union representative per department, and the Steelworkers' general plant safety man.
 - b) The committee discusses safety suggestions and inspects each department.
- 2) General Plant Safety Committee
 - a) Quarterly meetings attended by the plant superintendent, the company safety director, and one union representative from each plant.
 - b) The committee acts on safety suggestions originating from the Department Safety Committee.
- 3) The committees assist in most accident investigations.

Comments:

REGULATORY HISTORY

A) Pre-1970

- 1) State Inspector of Mines

B) Post-1970

- 1) State OSHA Plan

- a) Nevada Industrial Commission
- b) pre-empted from the enforcement of health regulations.
- c) The Industrial Commission has not inspected the McGill facility.

C) MESA Activities

- 1) MESA has ^a~~retained~~ jurisdiction over the central dumper and has performed both safety and health inspections of the area.

note 1975

Comments:

Table 1

PROCESS EQUIPMENT--McGill

NAME	AGE	POLLUTION CONTROLS	COMMENTS
Reverberatory Furnace (2)	1903	Waste heat boiler → ESP → stack	There is presently no SO ₂ control at the McGill smelter.
Converters (4) (Pierce Smith)		4 multi-cyclone units → brick flue → stack	
Foundry		Gas rises to roof and passes through vents to atmosphere.	

SOURCES: Design and Operating Parameters for Emission Control Studies:
Kennecott, McGill Smelter

OSHA inspections

Table 2

tions--McGill

	TYPE	FINDINGS	PENALTIES	FOLLOW-UP	COMMENTS
4	accident/ fatality	1 serious violation	\$600	----	contestment was withdrawn
4	complaint/ health	6 non-serious violations	\$215	last progress report, August 4, 1976	sulfur dioxide, silica, & noise violations
4	complaint/ safety	41 non-serious violations	\$1,030	10/7/74	
74	follow-up/ safety	6 non-serious violations	\$240 amended to \$40	3/6/75	item #3 deleted; contestment withdrawn 1/75
	follow-up/ safety	1 non-serious violation	\$80	completed 5/14/75	
5- 75	follow-up/ health	no new violations	----	----	levels of SO ₂ similar to 8/13/74

Table 3

SUMMARY OF HEALTH HAZARDS--McGill

PLANT AREA	Number of Employees	TWA Exposures*			Sulfur Dioxide (PPM)	NOTES
		Copper mg/M ³	Arsenic mg/M ³	Lead mg/M ³		
Material Handling	34					Respirable silica dust violations in central dumper.
Reverberatory Furnace area	39 - 41				15 ppm TWA† excursions to 400 ppm	†Prior to installation of controls. Effectiveness reducing levels is unknown. Documented noise violations for reverb helper 125%.
Converter area	35				average level approximately 10 ppm; excursions to 45 ppm	Total dust violation to dust conveyor operator.
Others	45					Includes maintenance and foundry workers.

SOURCES: OSHA inspections
MESA inspections

*Independent of respirator usage

FACT SHEET

Facility: Magma Copper Company, San Manuel Smelter

Company: Newmont Mining Corporation

INFORM
25 Broad Street
New York, New York
10004

(212) 425-3550

I. GENERAL

Name: Magma Copper Company, San Manuel Smelter

Location: San Manuel, Arizona

Description:

- 1) Combination of concentrate receiving facilities, reverberatory furnaces (3), converters (6), refining furnaces (4), casting wheels (2), and supportive facilities.
- 2) Smelter began operation in 1956. Magma became a wholly owned subsidiary of Newmont Mining Corporation in 1969.
- 3) Employees: 398 smelter production.
- 4) Ore from the San Manuel mine (containing approximately 1 billion tons of ore - making it the largest underground copper mine in the world) and the underground Superior mine. Old smelter slag has also been processed to yield approximately the same recoverable copper content as the San Manuel ore, making a substantial contribution to total production.
- 5) Area's economic base largely derived from mining, milling, and reduction of copper ores.

6) Production*:	1973	1974	1975	1976
Copper (tons)	158,300	149,600	139,000	145,000
Sulfuric Acid (tons)	---	---	303,000	DNA

*Figures for other San Manuel products gold, silver, and molybdenum sulfide - were not available to INFORM.

Comments:

II. PROCESS AND HAZARDS

NOTE: Respirators are company supplied and worn on a need basis. The following comments evaluate TWA exposures independent of respirator use.

NOTE: Throughout the following remarks, the phrase "poorly characterized" is used to indicate that we have found no evidence that either the company or the regulatory agencies have sufficiently characterized the exposures to permit proper evaluation and corrective action.

NOTE: All documented arsenic exposures are expressed in terms of the new $10 \mu\text{g}/\text{m}^3$ standard. May worker exposures, while below the standard, are above the action level ($5 \mu\text{g}/\text{m}^3$). Therefore these workers will be re-subjected to the monitoring and medical surveillance requirements as set forth in the standard.

A) Material Handling (feed preparation area)

- 1) Ores from the San Manuel mine are concentrated in the San Manuel mill prior to transfer to 500-ton concentrate storage bins located adjacent to the smelting complex. Concentrates from other sources (i.e., the Superior concentrator) are received by railroad car and transferred to the bin storage area. Fluxes (silica and limestone) are crushed and prepared in the Lime Plant and also transferred to storage bins prior to transfer to the smelting circuit. The feed materials are transferred to the reverberatory building by a series of overhead covered conveyors. Poor housekeeping conditions documented at the walkways along the conveyors leading to the reverb building.
- 2) Charge Operator and Sub-charge Operator-- Supervises the loading and unloading of the storage bins. Also performs air lancing tasks when laborer's crew not available. Exposures to potential arsenic, copper, and silica dusts presently uncharacterized. (4 workers)
- 3) Laborers-- Principal job duties entail the unloading of the bins by using air lances to blow the materials down the sides of the bins and general clean-up duties such as shoveling up spills of materials around the bins. Potential exposures to arsenic, copper and silica dusts are presently uncharacterized. Potential noise exposures, especially during air lance use, are presently poorly characterized.
- 4) Standard safety equipment-- Safety lines and belts are provided to employees while working above these storage bins.

B) Reverberatory Furnace Area (81 workers)

- 1) Three suspended-arch furnaces. All three furnaces are usually operating at full capacity at all times. A five-year campaign conducted on the furnaces before rebuilding is required. The #2 reverb was recently rebuilt, and the #1 furnace is presently shut down for rebuild.
- 2) Reverb Charge Deck-- Feed materials enter the reverberatory furnace building proper where tripper belts distribute it to charge bins. Employees work over the reverberatory furnace on platforms elevated approximately 75 feet from the floor. Jobs in this area entail managing the distribution of concentrate and flux into the charge bins. Specific tasks include shoveling up spills of material around the bins and cleaning the bins with air lances.
 - a) Charge and Sub-charge Operators: Documented sulfur dioxide exposures above the present standard. Potential exposures to arsenic and copper dusts during air lance use and loading operations are poorly characterized. Potential noise expo-

tures during air lance use are also poorly characterized.
(4 workers)

- b) Departmental Laborers: These workers perform clean-up tasks throughout the reverberatory department. Their exposures vary, depending on the conditions in the area where the employee is working. They are presently uncharacterized.
- c) Since a 1975 citation by OSHA, the company has attempted to abate the excessive levels of sulfur dioxide in the upper reaches of the reverberatory building by the installation and the improvement of various engineering controls. These controls and improvements include:

--Water cooled charge hoppers were installed. However, the company has stated that the hoppers continue to be a source of sulfur dioxide leakage. The company informed OSHA that they are presently studying the feasibility of implementing a different method of feeding the reverbs "as yet untried in the industry."

--Roof fans: In order to enhance/improve the "chimney effect" and improve the flow of make-up air through the building, the company has increased the number of roof fans and altered the configuration of various walls throughout the smelter.

- d) Upon OSHA's return in late 1977 for a follow-up inspection, the Industrial Hygienist noted that the employees' exposures (sub-charge operators) had not changed, even after the implementation of various controls. The company's response in the latest progress report was that they are presently planning to install a control cab on the tripper.

- 3) Feed Deck-- The reverberatory charge is fed to one of the three reverbs by way of a belt tripper that moves along the furnace side-wall unloading the materials into water-cooled hoppers which feed the down chutes leading into the furnace.

- a) Feederman: Manages the distribution of the feed into the furnaces. OSHA documented sulfur dioxide levels of up to 35 ppm. The most recently available company figures show feederman exposures ranging between 2 and 13 ppm--all above the proposed OSHA standard. Documented arsenic exposures above the new arsenic standard. Noise levels were found to be below the standard. (15 workers)
- b) Helper: This job category includes the spoutman and the arch-blowers. The spoutmen work in the converter slag return area where they clean the slag from the spouts that load into the furnace. Potential exposures to sulfur dioxide, during the return of slag and from leakage through the spout, are poorly characterized. Other exposures, if any, are poorly characterized. The arch-blower's job is to blow the reverberatory roofs clear of dust by using compressed air lances. Documented exposures to arsenic at the standard, and documented exposures to sulfur dioxide above the present standard. OSHA documented noise levels at greater

than 115 dBA with the equivalent 8-hour TWA at 110 dBA. The company submitted plans to OSHA in regard to eliminating the blowing of the arch by replacing air lance use with a vacuum system. The company stated that they have repeatedly tried vacuuming; however, the roofs are still blown. (13 workers)

- c) Aside from dust, gas, and noise exposures, another hazard experienced in this area of the reverbs (feed deck) is blow backs from the furnace. In 1976, a worker was severely burned after such an event. A blow back occurs when the furnace experiences a build-up of gases that occasionally flair up and vent out the feed chutes or other openings in the reverberatory roof such as the slag spout. The State Mine Inspector cited the company for not providing adequate protective clothing. Reverb workers are now required to wear flame-proof jackets.
- d) The company installed a White-Cap System for use by all employees working above the reverbs. The company experienced "considerable difficulty" maintaining this respiratory protective equipment when first installed in 1976. In 1977, the company reported that the system is "now effective and probably more significant in SO₂ protection than it was at the time of installation." The Union reports that the system is no longer used (1978).

- 4) Matte and Slag Tapping Areas-- Once tapped, the matte flows through a matte drop hole to a ladle car. This ladle car is located in a tunnel that travels the length of the furnace to the converter aisle. Several ladles are filled before being brought out to the aisle by a cable system that pulls the cars back and forth. Two of the reverbs are equipped with operating exhaust enclosures--dog-houses--that cover the tap hole, the launder, and the drop point to the tunnels. The company is currently planning to redesign the dog-houses to allow for the use of new tapping equipment that they plan to install. This new design will be the company's fifth attempt at capturing sulfur dioxide at the tapping points and exhausting it away from areas where employees are working. The slag tapping is neither enclosed nor ventilated. The slag is tapped and loaded into cars loaded into cars located in the slag tunnel beneath the reverb.

- a) Tapper and Tapper Helper: Worker opens and closes tap hole and manages the flow of matte into the ladle cars. The company reports that the tapper is exposed to SO₂ levels ranging from 1 to 16.8 ppm. OSHA documented arsenic exposures above the standard. Other exposures, if any, are poorly characterized. (19 workers)
- b) Slag Motorman: Opens and closes the slag tap hole, manages the flow of slag into the slag train ladles, and drives the slag train to the slag dump. The company reports that sulfur dioxide exposures are below the standard. Other exposures, if any, are poorly characterized. (18 workers)

c) Some employees must work intermittently in the matte and slag tunnels. These include maintenance men, electricians, and equipment operators. Exposures, if any, while working in these tunnels are poorly characterized. Union filed complaint in regard to operating a D-8 loader in the tunnel without adequate "headache" protection. These loaders are occasionally brought into the tunnels for clean-up purposes. The State Mine Inspector issued an order prohibiting use of the loader in the tunnel until protection is provided for the operator.

5) Reverb Man-- This job category is a combination of two jobs: control room operator and furnace operator. The job includes checking the furnace for adequate feed, determines when the matte and the slag should be tapped, checks to ensure that adequate draft is maintained, and other duties relating to the overall operation of the furnace. The reverb man does not remain at one job station since his duties require him to be at different stations throughout the reverberatory furnace department. The company reports sulfur dioxide exposures above the proposed standard. Other exposures are poorly characterized and dependent on the area in which he is working. (12 workers)

C) Converter Area (45 workers)

- 1) Matte from the reverberatory furnaces is transferred in ladles to one of the six Pierce-Smith converters by an overhead crane. A siliceous flux is added to the converters. Gases from the converter process enter water cooled primary hoods over each converter and are then ducted to the acid plant. At the completion of the converter cycle, blister copper is transferred to the anode casting area.
- 2) Crane man-- There are four overhead "hot metal" cranes--three in operation. After an OSHA citation for sulfur dioxide exposures to crane men, the company began experimenting with new air purifying devices on one of the cabs. Company abatement data submitted to OSHA indicated that sulfur dioxide levels have been reduced to below the proposed standard. However, the company submitted exposure data during the 1977 SO₂ hearings that indicated craneman exposure levels were above proposed standard. The company later reported that it was having problems with the durability of the unit and was experiencing a shorter than expected lifetime of the filtering media. As a result, such units have not as yet been installed in the other crane cabs. Union reports that respirators are at times needed in the crane cabs. OSHA documented arsenic exposures above the standard. (9 workers)
- 3) Skimmer-- Operator of the converter. OSHA documented SO₂ levels above the present standard. Company industrial hygiene data from early 1977 indicated SO₂ exposures for skimmer platform as being below the proposed standard. Personal exposures are reported as variable with some exposures above the proposed standard. The union reports that the skimmer platforms at the #5 and #6 converters are

high SO₂ areas. Arsenic levels were found to be at or below the arsenic standard. Company was cited for excessive noise exposures in this area. Noise sources affecting the skimmers are the tuyere punching operation (see Punchers) and the reverberatory furnace burners. The company installed an acoustical wall at the burner end of the reverb; however, it was destroyed by swinging crane hoods before any evaluation of its noise level abatement capabilities could be made. Since the company is presently converting the reverberatory furnaces' fuel supply from natural gas to coal, a hold has been put on any additional construction of sound barriers in this area. The company's research has indicated that coal firing burners may be much quieter. A partial enclosure is, however, being designed and built to reduce skimmer exposure from the tuyere noise and other background noise sources, such as the reverb burners.

- 4) Puncher-- Punching performed mechanically by pneumatically operated tuyere punchers. The puncher operator sits on a moving cart and operates this mechanism. Company industrial hygiene data shows that sulfur dioxide levels in the punching area are above the present standard. Trace metal exposures are presently poorly characterized. Company was cited for excessive noise to the puncher--often exceeding 115 dBA. The company abatement program included the installation of Noranda Tuyere Silencers on all the converters. Leaks in the air lines to the tuyeres were also found to be problematic. To eliminate this noise source, the company has begun replacing the lines with "a new, longer, and more durable flex-line." The company reported to an OSHA hygienist that they were thinking of punching the converters remotely from an enclosed booth by using a laser as the aiming device. The company's latest quarterly report, however, does not discuss this concept. Instead, they are partially enclosing the punch car cab and presently evaluating its effectiveness.
- 5) Silica Belt Tender (sub-charge operator)-- These workers spend a few hours every other shift managing the distribution of silica fluxes into the converter flux storage bins. The flux belt gallery is not enclosed--subjecting these workers to high levels of sulfur dioxide. Other exposures--arsenic, silica dusts, etc.--are at present poorly characterized.
- 6) Converter Laborer-- Performs various tasks in the converter aisle and around the adjacent converters. Potential exposures to arsenic, sulfur dioxide and noise are poorly characterized. (3 workers)
- 7) Converter Aisle Equipment Operator-- Cabs are not enclosed. Exposures are poorly characterized. (3 workers)

D) Anode Area (81 workers)

- 1) Four anode furnaces and two casting wheels
- 2) Blister copper from the converters is transferred by overhead crane to an anode furnace where a final blow and subsequent deoxidation, using reformed gas, takes place. Anodes are poured in the casting wheel and after being cooled, are transported to the neighboring San Manuel Refinery for electrolytic refining.

3) After a worker complaint in 1976 (regarding high sulfur dioxide levels "in all of the smelter"), an OSHA hygienist found SO₂ concentrations on the Anode Floor at the present standard. During the inspection one interviewed worker stated that the gas (SO₂) comes when the wind "sets up" the valley and is only bad when several of the converters are out of the stack at the same time. TWA exposures in the anode area are poorly characterized.

4) Trace metal, noise, and heat exposures, if any are uncharacterized.

E) Acid Plant Area (19 workers)

1) The 2,400 TPD single contact was completed and placed on-stream in December of 1975. If the total amount of acid produced cannot be sold or it exceeds the available storage capacity, it is neutralized in an adjacent acid neutralization plant.

2) Exposures to workers (acid plant men, helpers, and departmental laborers), if any, are poorly characterized.

F) Electrostatic Precipitator Area

1) Dusts from the reverberatory precipitator are combined with lime and processed in a pug mill before being returned to the reverberatory furnace feed in the materials handling area. Dusts from the converter precipitator are taken by truck to the reverberatory furnaces or loaded into ladles and fed to the converters.

2) Potential exposures to copper and arsenic dusts are poorly characterized. Other exposures unknown.

G) Others (158 workers)

1) Due to the transient nature of a selected number of jobs, INFORM has created an "Others" category. While many of the workers on this list may be permanently associated with one sub-department of the smelter--i.e., some of the laborers work full-time in the material handling areas--we have been unable to differentiate these workers from their transient counterparts. Hence they are included in this category. These workers are listed as follows:

Laborers-- 102 workers

Utilitymen-- 28 workers

Brick Masons-- 14 workers

Equipment Operators-- 11 workers

Tool Tender-- 1 worker

Mechanical Sweeperman-- 1 worker

Janitor-- 1 worker

2) Most exposures for these employees are poorly characterized.

Comments :

COMPANY SAFETY AND HEALTH ACTIVITIES

A) History

- 1) Industrial Hygiene Program. In June of 1975, an Industrial Hygienist-in-training was added to Magma's staff. Other historical details were not available to INFORM.
- 2) Safety Program. History of Magma's safety program not available to INFORM.

B) Staff

- 1) Safety Director
- 2) Safety Engineers (2)
- 3) Director of Environmental Affairs
- 4) Industrial Hygienist (in training)
- 5) Safety Aide (respirator man)

C) Respirator Program

- 1) Administration of program is the responsibility of the Division safety department. Training, education, and supervision of respirator usage is the responsibility of plant managers, superintendents, and department heads.
- 2) All workers are assigned and fitted to a respirator according to the hazard present in their work areas. They are responsible for daily cleaning and maintenance of respirators.
- 3) A permanent employee (safety aide) was hired to service the respirators. Each week respirators are exchanged for ones that have been repaired and sanitized.

D) Safety Equipment

- 1) All required safety equipment is loaned to employees, except safety shoes with metatarsal guards which must be bought outright by the worker.

E) Industrial Hygiene Activities

- 1) Area and personal sampling for sulfur dioxide and noise performed by hygienist. No evidence that the company samples for other in-plant hazards.
- 2) INFORM was unable to determine the extent and frequency of the in-plant sampling program.
- 3) No formal reports or education are given to workers regarding the need, objective, and results of industrial hygiene sampling.

- 4) The company provided limited industrial hygiene related data during the course of the OSHA sulfur dioxide hearing, Magma did not participate in the arsenic hearings.

F) Safety Program

- 1) Smelter safety program as well as the safety programs throughout the San Manuel complex are under the direction of the Safety Director. Safety activities are carried out by two safety engineers.
- 2) Extent and frequency of safety inspections unknown to INFORM.
- 3) Accident investigations are conducted by company; however, workers are not allowed to participate. Written reports prepared at the conclusion of the accident investigations are not available to the union.
- 4) New employees are instructed on the general safety aspects of their jobs prior to employment in the smelter.
- 5) Formal safety refresher courses for all workers are not available.
- 6) Safety training for new equipment and process changes is provided on a limited basis.
- 7) OSHA 102 data is available for 1974, 1975, and 1976.

G) Health Care

- 1) Smelter complex has a first aid station staffed by a nurse. Aside from general first aid, nurse performs yearly pulmonary function exams.
- 2) Company owns and operates its own hospital in San Manuel, with physicians on call 24 hours a day. Union reports, however, that while "on call," physicians are not always available.
- 3) Emergency transportation is available at the plant. The ambulance is operated by a plant guard, who, the union reports, is not readily available.
- 4) All employees receive a physical examination prior to employment. Periodic health monitoring--excepting pulmonary function exams and audiograms--are not provided to workers. Salaried employees receive yearly physicals.
- 5) Hearing program
 - a) The company performed a plant-wide noise survey to determine areas where noise levels exceed 85 dBA. Areas found to be above this level were designated in writing and posted.
 - b) All workers in designed areas were given an audiogram. In 1976, the second year of this program, the company initiated an annual resereening audiogram program of the exposed work-

force. More frequent testing--in some cases quarterly--for those workers showing "a shift in hearing acuity and for those with an apparent, large, absolute loss."

- c) If a further loss of hearing is noted, the worker is moved out of the designated area or occupation. Workers do not retain wage rates if they are forced to change jobs as a result of an occupational injury or illness.
- d) It is the company's position that hearing protection can prevent "deterioration of hearing acuity if the employee will use it without fail." If worker audiogram results show a shift in hearing acuity, the company assumes that the worker failed to wear hearing protection properly and as a consequence he is removed from the exposure.
- e) INFORM has not found any evidence that the company performed, either through contract or through its medical department, any epidemiological or medical research studies.

Comments:

SAFETY AND HEALTH COMMITTEE

- A) There is no joint safety and health committee at the San Manuel complex.
- B) The union appoints a safety man from each division of the complex--mine, mill, smelter, refinery. Each representative is then allowed to accompany the company's safety engineer on an inspection of his respective division every six weeks during which time "he shall cooperate in making recommendations with respect to safety." The areas entered for the purpose of inspection are at the discretion of the company's engineers.
- C) At the conclusion of the inspection tour, a report is prepared and forwarded to the union.
- D) There is no contractual right to refuse unsafe or unhealthy work.
- E) The union does not have the right to review the results of the company's industrial hygiene monitoring.
- F) The International does not have the right to enter the plant for safety and health issues, nor is it allowed to review company-produced materials regarding safety and health.
- G) Workers do not retain wage rates if they are forced to change jobs as a result of an occupational injury or illness.

Comments:

REGULATORY HISTORY

A) Pre-1970

Office of State Mine Inspector

B) Post-1970

1) State OSHA Plan

- a) Developmental. Headed by Arizona Industrial Commission. Approved October, 1974.
- b) Jurisdiction over smelters still in hands of State Mine Inspector

2) Office of State Mine Inspector

- a) No contractual relationship exists with Arizona Industrial Commission.
- b) Two to three inspections per year, 1972-1976.
- c) Limited industrial hygiene efforts.

3) OSHA Activities

- a) OSHA has inspected smelter ten times. All were due to worker complaints.

Comments:

NAME	AGE	POLLUTION CONTROLS	COMMENTS
Reverberatory Furnaces (3) [Suspended arch]	1956	Waste Heat Boilers → ESP → 515' Stack	Green feed operation.
Converters (6)			
3 - 13'x35'	1956	Radiation/Conductive cooling ducts → ESP	Gases that by-pass Acid Plant
2 - 15'x35'	1956	Scrubber Cooler → Acid Plant → Stacks	are vented through 550' Stack
1 -	1975		
Anode Furnaces (4)	1956		
Casting Wheels (2)	1956		
Acid Plant	1975	Tail gases vented through (2) 200' stacks	2400 TPD with two parallel single contact sections.
Acid Neutralization Plant	1975		

SOURCES: Design and Operating Parameters for Emission Control Studies:
Magma, San Manuel, Copper Smelter

An Industrial Hygiene Study of the Magma Copper Company
Smelter [NIOSH Study]

PLANT AREA	Number of Employees	TWA Exposures*			Sulfur Dioxide (PPM)	NOTES
		Copper mg/M ³	Arsenic µg/m ³	Lead mg/M ³		
Material Handling	14					Worker exposures in material handling (bins to reverb) are uncharacterized.
Reverberatory Furnace	81	>2	<10-60		<1->35	SO ₂ excursions greater than 200 ppm. Arch blower exposed to noise levels > 115 dBA.
Converter	45		<10-40		1.8->30	Skimmer and puncher noise exposures > standard.
Anode	81				10	
Other (including acid plant)	177		<40			Most exposures poorly characterized.

*Independent of respirator usage

SOURCES: Sulfur dioxide OSHA hearings, 1975. Company data.
 OSHA inspections
 OSHA/company abatement correspondence
 Arizona State Mine Inspector inspections
 NIOSH data

Table 3

PECTIONS -- MAGMA, San Manuel Smelter
 ce of Arizona, State Mine Inspector

	TYPE	FINDINGS	PENALTIES	FOLLOW-UP	COMMENTS
8/71	Safety	4 violations	-0-	Company abatement letter	Machinery guards, fire extinguishers, gratings.
1/72	Dust Survey	No violations	---		SO ₂ levels in tripper belt area 14-18 ppm (not cited). Poor housekeeping tripper floor.
6/72	Safety	20 violations	-0-	All violations abated within 60 days.	Poor housekeeping - excessive dust build-up on steel beams.
7/70 ¹	Dust Survey	No violations	---		No counts above limit.
7/70 ¹	Safety	2 violations	-0-	All violations were subsequently abated.	SO ₂ above limit. Housekeeping exceptionally good.
7/71 ¹	Dust and Toxic Gas Survey	No violations	---		Two SO ₂ counts above limit.
7/73	Dust Survey	No violations	---		SiO ₂ measurement above standard not cited. SO ₂ "fairly high" in some areas.
73	Special Inspection	No violations	---		Special inspection investigating State Sen. Ulm's 24 complaints describing unsafe or unhealthy conditions in the smelter.
7/73	Safety	?	?		Inspection results not available to INFORM.
3/74	Safety	9 violations	-0-		Violations concerned guards covers, safety chains, etc.
1/74	Safety - Acid Plant	No violations	---		Good housekeeping and drainage in the Acid Plant.

pections--San Manuel [SMI], continued)

	TYPE	FINDINGS	PENALTIES	FOLLOW-UP	COMMENTS
'75	Complaint	1 violation	-0-	Variance granted	Complaint re use of Dozer in matte tunnel without "headache bar".
'75	Safety	6 (smelter) violations	-0-		Dust conditions must be improved in smelter.
'75	Abatement inspection	----	---		Violations of 2/15/75 abated.
'5	Safety	5 violations	-0-		Investigate the engineering solution to the precipitator dust handling system.
'6	Complaint	1 violation	-0-	Abated immediately	#4 converter crane not in compliance steel plate over "deadman" switch.
'76	Complaint	No violations encountered	---		Complaint re solitary employment, high temperatures, and no ventilation at sub-charge operator's station.
6	Accident investigation	1 violation	-0-		Employee severely burned during smelter "blow-back".
76	Toxic Gas Inspection	5 violations	-0-		All SO ₂ samples above TLV's Levels range from 22 ppm to 125 ppm.

Table 4

ACTIONS -- MAGMA, San Manuel Smelter

	TYPE	FINDINGS	PENALTIES	FOLLOW-UP	COMMENTS
'72	Complaint	In Compliance	---	---	Found complaint to be invalid. Management-Labor issue.
'73	Complaint	In Compliance	---	---	Employee discharges because refused unsafe work. CSHO found that "facts as stated in complaint were not entirely the same as observed at the actual scene. Employee reinstated.
'73	Complaint	In Compliance	---	---	Employee complaint re heat stress in tank house.
/74 75	Complaint	2 citations (5 non-serious items)	\$45.	abatement plan submitted	Cited for: 1. noise reverbs 2. noise - converters 3. SO ₂ - reverbs, cranes 4. no emergency eye & body flushing facilities 5. noise - rod plant
/74	Complaint	1 citation (7 non-serious items)	\$35.	recommended by CSHO	Complainant listed 24 hazards that he believed existed. Union rep was "somewhat disturbed over way which complainant had acted...they [Union] had a safety committee that took care of [such] problems....
- 75	Complaint	1 non-serious violation	\$35	recommended by CSHO	complaint re inadequate respirators. Company abated by initiating new respirator program. [SO ₂ -Sub-charge area]
5	Complaint	In Compliance	---	---	Complaint re lack of lunch room for smelter repair crew. Lunch room available in general vicinity.
75	Complaint	In Compliance	---	---	Reverb worker complained about elimination of White Cap protective equipment. OSHA only requires approved respirators which were issued.

CTIONS -- MAGMA, San Manuel Smelter
(continued)

	TYPE	FINDINGS	PENALTIES	FOLLOW-UP	COMMENTS
/75	Complaint [Health]	1 non-serious violation	\$0	none	Complaint re condition of holding vessels. Company now under a repair schedule to correct this condition. Other areas of complaint not cited since company under an abatement plan.
/75	Complaint [Safety]	no violations	---	---	Safety inspection for 12/10/71 complaint inspection. CSHO noted that "there appears to be a lack of communications between employees and super- vision to inform them (employees) of maintenance & repair schedules".
76	Complaint	In Compliance	---	---	Complaint re SO ₂ levels no violations found that were not already cited and under an abatement schedule.
76	Complaint	3 non-serious violations	\$0	company abatement letter	Complaint re unsanitary conditions in lunch room & in toilets. 3 minor safety violations found.

FACT SHEET

Facility: New Cornelia Branch, Ajo Smelter

Company: Phelps Dodge Corporation

INFORM
25 Broad Street
New York, New York
10004
(212) 425-3550

GENERAL

Name: New Cornelia Branch, Ajo Smelter

Location: Ajo, Arizona

Description:

- 1) Combination of open pit mine, concentrator, green feed smelter, anode casting, and supportive facilities.
- 2) Smelter built in 1950; mill in 1922.
- 3) Employees: 176--concentrator; 129--smelter; 1,400--mine.
- 4) Ore from New Cornelia open pit mine, as well as some custom work. Arsenic content of concentrate "less than .005%" as reported by James E. Foard, Phelps Dodge metallurgist.
- 5) Largest employer in Pima County
- 6) Production

a) Approximately 1/6 of Phelps Dodge's total

	1972	1973	1974	1975	1976
Copper (short tons)	57,876	53,799	43,501	33,025	
Acid					

Comments:

PROCESS AND HAZARDS--SMELTER

NOTE: Workers are issued company-supplied respirators; however, use is not mandatory. Workers are responsible for maintenance and storage. OSHA inspection of 2/24-26/76 indicated use but lack of clean-up program for USBM- and NIOSH-approved respirators. Level of recorded exposures precluded establishment of comprehensive program.

NOTE: The following comments evaluate TWA exposures independent of respirator use.

NOTE: Throughout the following remarks, the phrase "poorly characterized" is used to indicate that we have found no evidence that either the company or the regulatory agencies have sufficiently characterized the exposures to permit proper evaluation and corrective action.

A) Material Handling

- 1) Concentrates are transferred from the Cornelia Mine by uncovered conveyer belts. Exposures are uncharacterized but dusty conditions prevail.

- 2) Concentrate passes through filter and drying building; open conveyer to charge can filling area. New swivel conveyer hood of unknown effectiveness. Background exposures to arsenic and SO₂. Six men.

B) Reverberatory Furnace

- 1) One sprung arch type furnace situated parallel to converter aisle.
- 2) Arch last rebuilt June 1976. Workers complained of excessive heat and dust. OSHA found allegations to be unfounded, foreman apparently relieved of duties. Approximately 22 workers to rebuild. Exposures are uncharacterized.
- 3) Charge cans are transferred by overhead cranes to three charge points on each side (north and south) of reverberatory furnace. Crane cabs are enclosed but not pressurized. Exposure levels are a source of union/management friction. Three men.
- 4) Reverb is fed by high speed slinger system. Operator is exposed to levels of arsenic above the proposed standard. Sulfur dioxide exposures are poorly characterized.
- 5) Reverberatory arch cleaning is the responsibility of reverberatory laborer #2. Cleaning actually occurs no more than once a week. Vacuum system all but discontinued, arch is air lance blown. SO₂ exposure above the proposed standard. Arsenic exposures are poorly characterized.
- 6) Also present in the reverb area at various times is the refractory department. Hot patching is accomplished at least three times during each day. Reverberatory furnace area monitoring indicates arsenic levels above the proposed standard. Personal samples are poorly characterized, but likely to be high. Five men per shift.
- 7) Matte tap launders are uncovered but short. Launders transfer matte from reverberatory furnace into enclosed matte ladle area. Workers complain of inoperable exhaust and matte tap hole punching systems. Exposures above the proposed arsenic and SO₂ standards.
- 8) Slag drops to waiting cars below the reverb floor and is transferred to the slag dumping area. Exposures above the proposed arsenic standard have been reported. Slag launders are unhooded.
- 9) Reverb waste heat boilers reportedly leak and need replacing. There is a staff of nine, divided between the two reverb and three pressurized waste heat boiler areas. Arsenic levels of .062 mg/M³ are reported. Hand-lancing (soot-blowing) several times per day involves an unknown quantity of workers. Exposures during this mechanical operation are uncharacterized.
- 10) Crane repair bay (north end of reverberatory crane aisle) area exposures of SO₂ are as high as 6 times the proposed standard. Arsenic exposures are uncharacterized. Number of men and length of exposure are undetermined but likely to be varied.

C) Converter Aisle

- 1) Three Pierce-Smith converters with movable radiation cooled rib steel primary and secondary hoods. Due to production cutback, only one or two operate at a time.
- 2) Crane cabs are enclosed and air conditioned (1973, 1975 respectively). Exposures are poorly characterized. Cabs reportedly ride "roughly."
- 3) Converter punching stations cited for noise by OSHA. "Quietaire" and auto mufflers on pneumatic cylinder exhausts have reduced levels considerably. However, tuyere silencers have proved ineffective over time. Therefore, baffling of puncher platform reportedly was to be installed in January, 1977. As of July, 1977, no progress in installation. Cooling system reported to be ineffective, even when functioning. Supply air system never fully developed.
- 4) Silica is discharged into the converters by way of a Garr gun attached to portable silica hoppers above the skimming platform. Arsenic exposures above proposed standard. SO₂ exposures are poorly characterized. Three workers.
- 5) Converter operator (skimmer) is unsheltered from exposure. Exposures above proposed arsenic standard are reported. SO₂ and noise exposures are uncharacterized. Three workers.
- 6) Exposures during soot-blowing of waste heat boilers uncharacterized.
- 7) Converter repair bay SO₂ exposures average above proposed standard. Excursions as high as 22.28 ppm. Other exposures are poorly characterized. Number of men unknown.

D) Oxidizing Furnace

- 1) Formerly used for copper blowing. Due to production cutback, presently used as holding furnace.
- 2) Copper is transferred from the converters by overhead crane to an unhooded Great Falls Oxidizing Furnace. There are four 2-inch tuyeres. Exposures to arsenic, SO₂, and noise are uncharacterized. Possible high SO₂ and arsenic levels due to its proximity to the converter and reverb areas.

E) Anode Area

- 1) One anode furnace and one anode casting wheel. Area SO₂ exposures are generally low, while arsenic exposures above proposed standard are reported. Pedestal fans are reportedly situated throughout the area. Twelve workers.
- 2) Blowing of unhooded anode furnace is with reformed natural gas. Exposures during procedure are uncharacterized.
- 3) Two to four men per shift work on the anode casting wheel removing anodes, placing them in water and spraying silica solution in the anode molds. Exposures are poorly characterized.

F) Auxiliary Operations

1) Silica Crushing and Handling

- a) Silica circuit consists of junction house, smelter crushing building, uncovered conveyer belts, a ball mill, and portable hoppers. Exposures to silica likely. Number of men unknown.
- b) Crushed silica is transferred by converter overhead cranes. Crusher exposures to arsenic documented above the proposed standard. Other exposures are poorly characterized.

2) Acid Plant

- a) Acid Plant designed to handle the off-gases from one converter blow. Problems have included insufficient mist precipitator capacity and extensive corrosions. Exposures to the six men are poorly characterized.

3) DMA Plant

- a) 1972 plant designed to handle overflow converter gases, redirected to handle lower-sulfur-dioxide-concentration reverberatory furnace off-gases. Longest continuous run ten days. Exposures are uncharacterized. SO₂ exposures possible during malfunctions.

4) Electrostatic Precipitators

- a) Electrostatic precipitators are cleaned at undetermined intervals, by hand. Workers are equipped only with halfmask respirators.
- b) Revert is reportedly stored in open piles at various locations throughout the smelter building. Blowing dust is problem prior to recharging in converters. Possible exposures unknown.

Comments:

COMPANY SAFETY AND HEALTH ACTIVITIES

A) History--Details Unavailable.

B) Staff

Safety Director (1)

Environmental Engineer (1)

Safety technical personnel (part-time)

C) Industrial Hygiene

- 1) There is no full-time staff at local level. Company technicians from Tuscon on premises part-time.

D) Respirator Programs

- 1) Respirators are available in most areas of the smelter, but use is not mandatory.
- 2) Workers are responsible for training, maintenance and storage.
- 3) Levels of recorded exposure during 2/24-26/76 OSHA inspection precluded establishment of comprehensive program.
- 4) 1977 union contract demands included establishment of a respirator program.

E) Safety

- 1) There is no extensive pre-employment safety instruction.
- 2) Monthly departmental safety meetings are held infrequently if at all.
- 3) 1974, 1975 OSHA 102 Data on hand.

F) Health Care

- 1) New Cornelia hospital built and staffed by the Phelps Dodge Corporation.
- 2) Staff includes six doctors, twelve registered nurses, on full-time staff. Undetermined number of part-time technical personnel.
- 3) Adequate 24-hour emergency facilities, as well as pre-arranged referral capabilities to Phoenix and Tuscon medical centers.
- 4) Pre-employment physical includes x-ray, audiometric, and pulmonary function tests.
- 5) Conflicting information as to existence and/or extent of company-sponsored annual medical testing offered.

Comments:

. SAFETY COMMITTEE

A) Description

- 1) Established following the 1974 contract negotiations.
- 2) Management and labor (1/union) represented
- 3) Committee acts on suggestions received from departmental meetings.
The committee has no investigatory or inspection powers.

Comments:

. REGULATORY HISTORY

A) Pre-1970

- 1) Office of State Mine Inspector

B) Post-1970

1) State OSHA Plan

- a) Developmental. Headed by Arizona Industrial Commission.
Approved October, 1974.
- b) Jurisdiction over smelters still in hands of State Mine Inspector.

2) Office of State Mine Inspector

- a) No contractual relationship exists with Arizona Industrial Commission.
- b) Two to three inspections per year, 1972 - 1976.
- c) Limited industrial hygiene efforts.

3) OSHA Activities

- 1) Initial inspection: fatality investigation
- 2) 2nd inspection: general schedule safety
- 3) 3rd inspection: general schedule health. Citation for noise while punching converters.
- 4) 4th inspection: complaint, reverberatory arch building. In compliance.

Comments:

Table I

PROCESS EQUIPMENT*--Ajo

NAME	AGE	POLLUTION CONTROLS	COMMENTS
Reverb (1)	1950	ESP DMA plant or stack	high speed slinger feed
Converter (Pierce Smith)	1950	Primary and secondary hoods, ESP, acid plant	
Converter "	1950		
Converter "	1971		
Oxidizing Furnace (Great Falls)		None	Used primarily as holding furnace
Anode Furnace	1950	None	
Casting Wheel	1950	None	
Acid Plant (Single Contact)	1972		600 TPD
			50 TPD--handles reverb off-gases
DMA Plant	1972		Longest continuous run--10 days
Waste Heat Boilers (5)		3--Converter (pressurized) 2--Reverb	

*Figures 2,3,4,5; Design and Operating Parameters for Emission Control Studies:
Phelps Dodge, Ajo, Copper Smelter

Table 2

actions--Ajo

	TYPE	FINDINGS	PENALTIES	FOLLOW-UP	COMMENTS
'72	fatality	hazard not covered by standard	None	None	
./75	general schedule safety	17 non-serious violations	\$185	company letters	
'76	general schedule health	1 non-serious violation	None	company letters & memos through 1/3/77	converter #2,3--noise
'6	complaint	in compliance	----	----	reverb arch rebuilding

actions--Ajo

of Arizona, State Mine Inspector

	TYPE	FINDINGS	PENALTIES	FOLLOW-UP	COMMENTS
72	fatality	4 recommendations	----	10/5/72	#3 converter rollback spill
72	dust	5 SO ₂ samples 13 dust counts			grab area samples
72	safety	6 violations			
73	dust	9-dust counts			grab area samples
/73	safety	11 violations 3 recommendations			smelter acid plant
4	spot	1 violation 2 recommendations			acid plant
/74	safety	6 violations			
75	safety	11 violations		11 violations abated 10/20/75	
/75	dust	6 SO ₂ samples 13 dust counts			grab area samples
76	safety	10 violations		10 violations abated 5/18/76	smelter
76	safety	8 violations			acid plant
5	safety	3 violations			rebuilding reverb arch

Table 3

SUMMARY OF HEALTH HAZARDS--Ajo

PLANT AREA	Number of Employees	TWA Exposures*			Sulfur Dioxide (PPM)	NOTES
		Copper mg/M ³	Arsenic mg/M ³	Lead mg/M ³		
Material Handling	43					
Reverberatory Furnace	25		000-.317		0-48	
Converter	13		000-.026		0-22	Noise levels 1.59 times the standard for converter puncher.
Anode	12		000-.012			
Other	66					

*Independent of respirator usage

SOURCES: Arsenic OSHA hearings, 1975. Company data.
 OSHA inspections
 Arizona State Mine Inspector inspections

FACT SHEET

Facility: Douglas Reduction Works

Company: Phelps Dodge Corporation

INFORM
25 Broad Street
New York, N.Y.
10004
(212) 425-3550

GENERAL

Name: Douglas Reduction Works, Phelps Dodge Corporation

Location: Douglas, Arizona

Description:

- 1) Combination of custom smelter and supportive facilities.
- 2) Smelter built in 1903.
- 3) Employees: 565
- 4) Ore is received as toll from nearby open pit mines. Arsenic content of concentrate reported by the company to be between .1 and .3 percent.
- 5) The Douglas smelter employs 42% of Cochise County's manufacturing workforce, and is responsible for 50% of the County's manufacturing payroll, with an annual payroll of \$8,000,000.
- 6) Production:
Prior to the closing of the Bisbee Mine in 1974-1975, the Douglas smelter received the majority of its concentrate from there, with a small percentage from the developing Tyrone mines. Currently, the smelter processes Tyrone and toll concentrates and scrap purchased by the company, and revert dust from the company's Morenci smelter.

Comments:

PROCESS AND HAZARDS--SMELTER

NOTE: Respirators are available in most areas of the plant; however, use is not mandatory. Workers are responsible for training, maintenance, clean-up and storage of respirators.

NOTE: The following comments evaluate TWA exposures independent of respirator use.

NOTE: Throughout the following remarks, the phrase "poorly characterized" is used to indicate that we have found no evidence that either the company or the regulatory agencies have sufficiently characterized the exposures to permit proper evaluation and corrective action.

A) Material Handling

- 1) Concentrates are received at the preparation plant in open railroad cars which are dumped into bins. Dust generated by air lance use is reported. Documented respirable nuisance and silica dust violations as well as noise violations at concentrate unloading dock and bins. Five workers.
- 2) Concentrates are crushed, screened, and mixed, prior to open conveyor transportation to 100-ton feed bins above the multi-hearth roasters. Documented silica violations to feeder car man, screen operator and bedding plant operator, with near violations to several other workers. Documented noise violation to feeder car man, slag screen operator and rolls operator, with potential exposures to several other workers. Use of hearing protection is intermittent throughout preparation plant. Forty workers.
- 3) Potential exposure to arsenic dust is uncharacterized throughout the preparation plant.

B) Multi-Hearth Roasters

- 1) There are 24 Herreschoff multi-hearth roasters, with 16 to 20 normally in operation. Off-gases from the two parallel rows of 12 roasters pass into an electrostatic precipitator, are combined with reverb off-gases, and sent out through the stack. Concentrates are fed by vaned drum feeders into roasters. Company reports average area sulfur dioxide levels to be two times the existing standard.
- 2) Operating Decks
 - a) Tripper floor sulfur dioxide exposures vary from below proposed standard to four times existing standard. Arsenic exposures are poorly characterized.
 - b) Company reports charge floor average sulfur dioxide level at proposed standard. Excursions during malfunctions documented to 220 ppm. Company also reports feeder station TWA arsenic levels slightly above proposed standard, with operator exposure averaging well above proposed standard. Twelve workers.
- 3) Unloading Areas
 - a) Calcines are discharged into larry cars below roasters. Larry car trains of two cars each make approximately fifteen trips to reverb per shift.
 - b) Larry cars are filled from hoppers through pneumatically activated gates by remote control. Discharge points are draft hooded. Operator station is approximately 30 feet from hoppers; however, company reports sulfur dioxide exposures as high as 11.30 ppm, due to gap between larry car

and hoppers, and unhooded areas between hoppers. Company states gap is "necessary for clearance and is a source of gas spillage." Operator arsenic exposures are poorly characterized.

- c) Larry cars during transit are presently uncovered. Exposures to motor man reported by company to be as high as 19.53 ppm. Company reports that it has been unable to "put together a workable system" of closed containers or cars. Arsenic exposures are poorly characterized; however, limited company data indicates a level of four times proposed standard for 2-hour period.
- 4) Company reports that structure and design of building allow for "SO₂ and dust from this source (calcine cars) drift upward and permeate other working areas in the roaster building."
- 5) Other areas of potential exposure to hazards include the center aisle, where the company reports sulfur dioxide levels averaging approximately six times the existing standard, and the roaster flue test station, where limited company data indicates arsenic levels slightly above the proposed standard. Actual exposure and exact number of workers affected are unknown.

C) Reverberatory Furnace

- 1) Three reverberatory furnaces: two silica sprung arch, one suspended basic roof. Company reports area average sulfur dioxide level to be slightly above proposed standard.
- 2) After traveling approximately 200 yards, the larry cars are emptied through "close fitting linkages" on underside of car. There is no attempt to capture dust and gases at this area. Company reports calcine motor man exposed to levels of sulfur dioxide averaging two and one-half times the existing standard in reverberatory furnace area. Potential arsenic exposures in this area are uncharacterized.
- 3) Charge floor: Sprung arch furnaces #9 and #10 are fed through gravity (Wagstaff feeders), while #8 is fed by drag chain conveyor. Company reports leakage at both types and average sulfur dioxide exposure to area workmen slightly above proposed standard, with excursions higher than existing standard.
 - a) Reverb #8-- Company reports charge floor area arsenic levels average three times proposed standard. Company reports charge helper personal exposure to be nine times proposed standard for 2-hour period. Actual TWA exposures are uncharacterized. Documented sulfur dioxide levels of six times existing standard during charging.
 - b) Reverbs #9 and #10-- Company reports spoutman personal exposures to arsenic ranging from the proposed action level to thirteen times the proposed standard. Documented sulfur di

oxide levels as high as four times the existing standard during car unloading.

- 4) Matte tap areas: Company reports vented launder covers have become "distorted and ill-fitting," and ladle hoods are damaged, rendering them "ineffectual." Company sulfur dioxide data indicates an average area level below proposed standard, while working station concentration near vented launders is above proposed standard and two times existing standard at unvented launders.

- a) Reverb #10-- Company reports average arsenic level at the west side of matte launder to be greater than two times the proposed standard.
- b) Reverb #9-- Company reports personal arsenic exposures to tapper to range between two and twenty times the proposed standard.

- 5) Slag skimming areas: Slag holes are locally exhausted and vented. Company reports that sulfur dioxide exposure rarely exceed existing standard. Arsenic exposures are uncharacterized.
- 6) Reverberatory furnace man: Company reports that arsenic exposures range from three to thirty times the proposed standard for short periods of time. Actual time-weighted-average exposures are poorly characterized. Sulfur dioxide levels are uncharacterized.

D) Converter Aisle

- 1) Five Pierce-Smith converters with three running during normal operation. The converters are primary-hooded. Secondary hoods are considered "infeasible" by company. Company reports average area SO₂ level to be below the proposed standard; however, company also reports "SO₂ in work areas adjacent to the Douglas converter has been measured at 4.26 ppm." Arsenic exposure in entire converter area is poorly characterized.
- 2) Matte is transported across the converter aisle by overhead cranes. Cranes are enclosed and ventilated. Sulfur dioxide levels inside cabs are reported near or above the proposed standard. Arsenic exposures, if any, are uncharacterized.
- 3) Skimmer: Controls blowing schedule as well as silica flux input. Sulfur dioxide levels reported at present standard. Arsenic levels are poorly characterized.
- 4) Potential converter punching hazards--arsenic, sulfur dioxide, and noise--are poorly characterized.
- 5) Company reports extensive sulfur dioxide problem in upper galleys of converter area. Sulfur dioxide levels range from 60 to 170 ppm. Company is considering enclosing the most heavily exposed walkways (galleys). Arsenic exposures are poorly characterized.

E) Anode Area

- 1) Two furnaces and one casting wheel
- 2) Company data indicates sulfur dioxide levels below proposed standard. Arsenic exposures, if any, are uncharacterized.

F) Auxiliary Operations

- 1) Company reports potential arsenic problem in roaster gas cleaning bag house. Company data places arsenic exposure to inspector at greater than three times the proposed standard during inspection. Potential additional problem for repair and clean-up workers. Other exposures, if any, are uncharacterized.
- 2) Waste heat boilers: Company data indicates average sulfur dioxide level to be above proposed standard. Company also reports arsenic levels at #10 waste heat boiler to average above the proposed standard and personal exposure to #10 boiler fireman to average twice the proposed standard.
- 3) Electrostatic precipitators: Company reports arsenic levels above the proposed standard at converter precipitate dust bin. Other exposures, if any, are uncharacterized.
- 4) Documented exposure to dust in sample mill and bucking room. Actual current exposures are uncharacterized.

Comments:

COMPANY SAFETY AND HEALTH ACTIVITIES

A) History--Details unavailable.

B) Staff

1) Labor Department Head / Safety Director (1)

2) The Labor Department Head is assisted by the department heads, the master mechanic and one safety inspector.

C) Industrial Hygiene

There is no full-time staff at the local level. Company technicians from Tuscon on premises part time.

D) Respirator Program

1) The company provides respirators in most areas of the plant, but use is not mandatory.

2) Workers are responsible for training, maintenance, clean-up and storage of respirators.

E) Safety

1) Pre-employment safety orientation was developed in 1972.

2) New or transferred employees receive seven days of supervision at new job.

3) The company provides protective equipment in most areas of the plant.

F) Health Care

1) All employees are required to learn basic first aid. The Company annually reviews each employee's competence in the skill.

2) There are first aid stations located throughout the plant.

3) The extent of annual medical examinations is unknown at this time.

4) All extensive care is administered through the Cochise County Hospital in Douglas.

Comments:

SAFETY COMMITTEE

A) Description

- 1) Established in 1971.
- 2) The quarterly meetings of the Committee are attended by three company representatives and one representative from each union in the smelter.
- 3) The Committee is advisory in nature and has no inspection or investigatory powers.

Comments:

REGULATORY HISTORY

A) Pre-1970

Office of State Mine Inspector

B) Post-1970

1) State OSHA Plan

- a) Developmental. Headed by Arizona Industrial Commission. Approved October, 1974.
- b) Jurisdiction over smelters still in hands of State Mine Inspector.

2) Office of State Mine Inspector

- a) No contractual relationship exists with Arizona Industrial Commission.
- b) Two to three inspections per year, 1972-1976.
- c) Limited industrial hygiene efforts.

3) OSHA Activities

- a) There has only been one OSHA inspection. A fatal accident on December 27, 1973, brought two non-serious violations.

4) MESA Activities

- a) MESA has jurisdiction over the Douglas Preparation Plant.
- b) There have been ten inspections of the Preparation Plant since October of 1974.
- c) Citations have included safety violations, housekeeping, silica dust violations and noise violations.

Comments:

Table 1

PROCESS EQUIPMENT--Douglas

NAME	AGE	POLLUTION CONTROLS	COMMENTS
Roasters (24) multi-hearth	1903	flue → 4 parallel ESPs → stack	
Reverberatory Furnaces #8--suspended arch #9 and #10--silica spray arch	1903 1903	flue → 3 parallel ESPs → stack	Side-charge-fed furnace.
Converters (5)		Balloon flue → 4 parallel ESPs → stack	There is no SO ₂ control at Douglas. Acid plant was destroyed in 1945.
Anode Furnace (2)			

SOURCES: Design and Operating Parameters for Emission Control Studies:
Phelps Dodge, Douglas , Copper Smelter

OSHA inspections

Table 2

tions--Douglas
of Arizona, State Mine Inspector

	TYPE	FINDINGS	PENALTIES	FOLLOW-UP	COMMENTS
'2	dust	6 SO ₂ samples 18 dust counts	----		3 dust samples above allowable limit. 4 SO ₂ samples 20 ppm or above.
'2	safety	23 violations	----	company letter: 2/19/73	
'3	dust	60 SO ₂ samples 14 dust counts	----		1 dust count above allowable limit. SO ₂ as high as 220 ppm.
'73	safety	31 violations	----	company letters: 1/24/74. 5/21/74	
74	safety	18 violations	----	company letter: 11/26/74	
74	complaint --dust	20 dust counts		company letter 11/26/74; 3/28/75 inspection	"potential dust problem" at concentrate loading bin.
5	follow-up	15 violations abated	----	----	
5	safety	26 violations	----	2/5/76 inspection	
	safety	25 abatements 1 extension	----	----	
6	safety	7 violations	----	8/31/76	preparation plant
6	complaint	1 violation	----	4/13/76	dust, heat & gas at anode area

e 2--continued)

	TYPE	FINDINGS	PENALTIES	FOLLOW-UP	COMMENTS
76	accident	4 violations	----	4/13/76	reverb #9: roof
76	safety follow-up	9 violations	----	8/31/76	
76	accident	----	----	----	slag train
76	dust	5 SO ₂ samples 12 dust counts	----	----	1 SO ₂ sample at 25 ppm.
76	general inspection	4 safety violations; 15 dust counts	----	----	Preparation department-- no dust counts above allowable limit.
'6 '76	complaint/ accident: safety	4 violations	----	----	reverb repair

tions--Douglas

	TYPE	FINDINGS	PENALTIES	FOLLOW-UP	COMMENTS
73	accident/ fatality	2 violations	\$75	none	dock area

Table 3

SUMMARY OF HEALTH HAZARDS--Douglas

PLANT AREA	Number of Employees	TWA Exposures*			Sulfur Dioxide (PPM)	NOTES
		Copper mg/M ³	Arsenic mg/M ³	Lead mg/M ³		
Preparation Department	40					
Roasters			.004 average		10.59 ppm average	TWA as high as .007 reported. Company data--Excursions reported to 100 ppm. SMI indicates excursions to 200 ppm.
Reverberatory Furnace			charge floor average .0135† tapping average .011†		area general average 2.38 †† calcine motorman: 10.59††	†Company data indicates levels of .054, .121 for 2-hour time periods. ††Company data. SMI indicates reverb floor levels of 24 ppm.
Converter			see note		7.47 ppm	Company data for dust handling only. Data indicates TWA at .006, with excursions to .069. Company data. SMI indicates skimmer platform levels at 5 ppm. Company indicates galley levels to be as high as 170 ppm.
Anode					0-.46 ppm	
Other						

FACT SHEET

Facility: Morenci Smelter

Company: Phelps Dodge Corporation

INFORM
25 Broad Street
New York, New York
10004
(212) 425-3550

GENERAL

Name: Phelps Dodge Corporation, Morenci Branch

Location: Morenci, Arizona

Description:

- 1) Combination of crushing plant, concentrator, smelter, and supportive facilities in operation since 1942.
- 2) Smelter division had 374 employees in 1977. Entire operation (including mines) had 2800 employees.
- 3) Ore from Morenci open pit mine (70%) and the Metcalf open pit mine (30%). Arsenic content in the concentrate reported between .001% and .02%.
- 4) Largest employer in the county, with a payroll of approximately \$50 million.
- 5) Production

a) Approximately 45% of Phelps Dodge's total copper

b)	1972	1973	1974	1975	1976
Copper					
(short tons)	119,700	119,500	101,400	118,100	157,200
Sulfuric Acid (tons)					327,026

Comments:

PROCESS AND HAZARDS

NOTE: In many areas of the plant, workmen wear company supplied respirators on a need basis. The following comments evaluate TWA exposures independent of respirator usage.

NOTE: A number of the areas discussed below have been cited by OSHA. The details are all available to INFORM but not generally included in the interest of brevity.

NOTE: A significant amount of information concerning the issue of engineering controls is available in the record of the OSHA arsenic and sulfur dioxide hearings. Such information is not, on the whole, included below.

NOTE: Throughout the following remarks, the phrase "poorly characterized" is used to indicate that we have found no evidence that either the company or the regulatory agencies have sufficiently characterized the exposures to permit proper evaluation and corrective action.

A) Fluid bed roaster

- 1) Feeds 2 reverbs. About 35% of total feed.
- 2) Feed is very fine. Calcine is moved by screw conveyor.
- 3) Union has filed grievances for "dusty and gassy conditions."
- 4) Area samples in the control room indicate exposures 2 times the proposed arsenic standard.
- 5) Sulfur dioxide exposures in control room reported with a TWA of 10 ppm. Reportedly exposures occur as a result of emissions from nearby acid plant.
- 6) Personal exposures are poorly characterized.

B) Reverbs

- 1) Two furnaces with sprung silica arch. Three with suspended arches. Usually four in operation at once.
- 2) Four of the furnaces have "doghouse" ventilation on tap holes and covered launders. Newest furnace (#5) has the matte tap hole in an enclosed room with an automatic punching machine. Ladle car is withdrawn from room after filling.
- 3) Arsenic exposures range from undetectable to 40 times the proposed standard. Personal exposures are poorly characterized.
- 4) Sulfur dioxide exposures range from 3 to 78 ppm. TWA personal exposures are poorly characterized.
- 5) Furnacemen and chargers were exposed to excessive noise. Enclosure and maintenance lubrication of drag chain conveyors corrected the problem after it was cited by OSHA in 1974.
- 6) Copper exposures among feeders range from 1 to 9 times the dust standard. Use of vibrators, air lances and blow pipes to dislodge jammed concentrate from bins is source of dust in area above reverbs.
- 7) Waste heat boilers and uptakes reportedly leaky.
- 8) Flue cleaners lance waste heat boilers during day shift. Exposures uncharacterized. Reported "gassy and hot" by union.
- 9) Several burn and flashback incidents around the furnaces in 1974 exemplify a serious safety concern in the area.
- 10) Two acute exposures to sulfur dioxide have occurred in conveyor areas above the reverbs. Both cases have required hospitalization and the union has filed grievances.
- 11) Tops of furnaces are "blown" with compressed air causing general area contamination. No vacuuming has been tried, even on the 2 suspended arch furnaces.

C) Converter Aisle

- 1) Nine Pierce-Smith converters. About 7 operating at once. All are equipped with primary and secondary hoods.
- 2) 4 cranes are sealed and air-conditioned, but maintenance and/or design are poor and leaks cause exposure to sulfur dioxide above the present standard. Arsenic exposures are poorly characterized but likely high. 17 men.
- 3) Arsenic exposure range from 0.0 to 0.209 in the area. Personal exposures are poorly characterized.
- 4) Sulfur dioxide exposures in the lower levels of the aisle (skimmer platforms, aisle floor) are reported in excess of the proposed standard but are generally poorly characterized.
- 5) Punchers' noise exposure has been eliminated by enclosing the punchers' cabs after an OSHA citation. No safety concerns have been voiced by employees regarding the enclosures.
- 6) Conveyor galleries above the aisle result in excessive exposures to sulfur dioxide and metal fumes for workmen who must enter the area. Exposures are poorly characterized.

D) Refinery and Casting

- 1) Four anode furnaces and two casting wheels. Mouths of furnaces are not exhausted.
- 2) Some reports indicate occasional exposures to sulfur dioxide in excess of the proposed standard due to proximity to converters.
- 3) Some excessive exposures to noise (1-3 times the standard) occur near the refining furnaces. Personal exposures are poorly characterized.

E) Other

- 1) Exposures to air contaminants in the acid plants, if any, are poorly characterized.
- 2) Exposures arising from handling of dust from flues, precipitators, pug mills, etc., are poorly characterized.
- 3) A significant number of repairmen work in the different areas of the plant. Potentially high exposures may exist in areas such as the crane bay repair section. Repairmen are affiliated with the Machinists Union. Exposures are poorly characterized.
- 4) Men in refractory department are likely exposed to levels existing in reverb areas. 13 men. Poorly characterized.
- 5) Crushing plant. Silica dust exposures three times the limit, documented by MESA samples. Wetting system inoperative or nearly so. No local exhaust ventilation. 4 men.
- 6) Lime plant. Excessive silica exposures in crushing were documented by MESA in early 1976. Union reports that local exhaust was installed, with notable improvement. Lime slaking has no local exhaust ventilation, resulting in exposures to irritating calcium hydroxide mist.

- 7) Bedding areas. Documented high copper exposures for laborers suggest arsenic exposures as well most likely resulting from their duties in conveyor lines above the reverb. Poorly characterized. Transfer of silica flux in and around bins is reported dusty. Potential silica exposures are poorly characterized. (Four dust collectors were being installed in this area as of mid-1976.)

Comments:

COMPANY SAFETY AND HEALTH ACTIVITIES

A) History--Details Unavailable.

B) Staff

Safety Director (1)

Safety Engineer (1)

Smelter Safety Superintendent or Inspector (1)

Dust Engineer (1)

Other _____

C) Industrial Hygiene

- 1) Testimony during arsenic and sulfur dioxide hearings strongly suggests that little evaluation of air contaminants took place before 1974-1975. Since that time, the company has conducted some area sampling, but little or no personal sampling.
- 2) Dust Engineer, who performs air sampling, does not work under the supervision of a corporate industrial hygiene or similarly competent person.
- 3) Company statements strongly suggest that there is little industrial hygiene or occupational health expertise at the corporate level.

D) Respirator Program

- 1) Cited by OSHA in mid-1976. No corrections yet implemented.

E) Safety

- 1) Company conducts accident investigations utilizing a written format and report form.
- 2) Monthly safety inspections. Labor does not participate.
- 3) Monthly safety meetings and discussion for each work crew.
- 4) Company computes injury frequency and severity rates routinely, using ANSI method.
- 5) Frequency rates in 1974, 1975, and 1976 for total cases, lost workday cases and lost workdays are above the industry average for SIC 3333.

F) Health Care

- 1) 100-bed hospital in Morenci with 6 doctors and other staff. 24-hour emergency room.
- 2) Pre-placement exam.
- 3) No periodic health exams or medical monitoring, with the following exceptions:
 - a) Yearly audiometric exams.
 - b) Yearly medical exams for cranemen.
- 4) First aid equipment and trained personnel at the plant. Ambulance service is available.
- 5) Referral system pre-arranged with medical institutions in Tucson and Phoenix.
- 6) No company rehabilitation program. Workers rely on state efforts.

Comments:

SAFETY COMMITTEE

A) Description

- 1) Begun in 1971 contract.
- 2) Two company, two union representatives.
- 3) Few specific functions except to review suggestions. No regularly scheduled joint inspection tours. No written record provided to union participants. No monthly meetings.
- 4) Union judges it to be of little effectiveness.

Comments:

REGULATORY HISTORY

A) Pre-1970

- 1) Office of State Mine Inspector

B) Post-1970

- 1) State OSHA Plan
 - a) Approved 10/74.
 - b) Developmental.
 - c) Headed by Arizona Industrial Commission.
- 2) State Mine Inspector
 - a) Still retains jurisdiction over smelters.
 - b) No contractual relationship exists with the Industrial Commission.
 - c) Approximately 2-3 inspections per year between 1972 and 1976.
 - d) Limited industrial hygiene efforts. Essentially spot sampling.
- 3) OSHA Activities
 - a) Four inspections, all as a result of complaints. Two were safety only, one health only, and one combined. Last inspection was completely contested.
- 4) MESA Activities

MESA has traditionally inspected the lime plant, the silica plant and even sections of the bedding area. The jurisdiction which is exercised over the acid plants (i.e., MESA or OSHA) is unclear to INFORM.

Table I

PROCESS EQUIPMENT*--Morenci

NAME	AGE	POLLUTION CONTROLS	COMMENTS
Bedding Plant			
Crushing Plant		wet scrubber	
Lime Kiln		baghouse	
Roaster			A.P. produces 100% H ₂ SO ₄
Fluid Bed		series of cyclones → scrubber → acid plant	150 TPD used in plant, remainder sold operates 21 hrs. a day
Reverbs			
#1--	1942-43	gases pass through waste heat boiler →	
#2--}sprung silica arch		ESP → some dilution → 605' stack (reverb)	
#3--		*A new ESP installed to control #5 particulates	
#4--}suspended arch			
#5--1 new reverb; suspended roof with tripper belt sidewall feed			
Converters		close fitting hoods on all converters →	
9 Pierce Smith (7 usually active) (\bar{x} ≈3.37 blowing when 7 converters active)		gas coolers → 4 ESP → gas cleaning (i.e. scrubber) → single contact acid plant → tail gases out 605' stack (con- verter) secondary hoods on all now operating	1500 TPD H ₂ SO ₄ produced
Anode Furnace			Reducing gas through
4		None	tuyeres (at one time practiced poling)
Casting Wheels (2)		None	
Acid Plants (2) (single contact)		750 tons per day 2500 tons per day	

*Figures 2,3; Design and Operating Parameters for Emission Control Studies:
Phelps Dodge, Morenci, Copper Smelter

Table 2

actions--Morenci

	TYPE	FINDINGS	PENALTIES	FOLLOW-UP	COMMENTS
/73	complaint safety	1 non-serious	\$40	None	crane issues
74	complaint health	10 non-serious	\$120	None	7 noise 2 SO ₂ 1 respirator program
74	complaint safety	41 non-serious	\$995	None	
- 17/76	complaint safety & health	29 items 8 lumped as serious	\$700	None	in contest

actions--Morenci

of Arizona, State Mine Inspector

	TYPE	FINDINGS	PENALTIES	FOLLOW-UP	COMMENTS
14/72	health	noise & SO ₂ some high spot samples	None		
2	health	4 of 18 grab dust samples exceeded standards	None	compliance letter from co.	
/72	safety	22 violations	None	None	
3	health	1 of 9 grab dust samples exceeded standards	None	None	
73	safety	16 violations	None	compliance letter from co.	
74	safety	9 violations	None	compliance letter from co.	
/74	safety	25 violations	None	compliance letter from co.	
74	safety	32 violations	None	compliance letter from co.	jointly with MESA

Table 2 (cont.)

actions--Morenci
 e of Arizona, State Mine Inspector

	TYPE	FINDINGS	PENALTIES	FOLLOW-UP	COMMENTS
1/75	safety	15 violations	None	compliance letter from co.	
1/75	safety	28 violations	None	compliance letter from co.	
1-15/76	health complaints	high SO ₂ exposure in crane	None	None	recommended respirators and I.H. testing
1,13, '76	safety and health	"No dust problems"	None	None	

Table 3

SUMMARY OF HEALTH HAZARDS--Phelps Dodge, Morenci, Arizona

PLANT AREA	Number of Employees	TWA Exposures*		Sulfur Dioxide (ppm)	NOTES
		Copper mg/M ³	Arsenic mg/M ³		
Preparation Dept.	23	1.03-9.07 (among laborers; other exposures unknown)	.001-.030 (around Junction House and some conveyors)		Some hazardous exposure to siliceous dust in lime and silica plants.
Fluid Bed Roaster and Acid Plant + Converter Acid Plant	27		.002-.007	0.85-10.86	Area samples.
Reverberatory Dept.	83	22 (Feeders only, not entire dept.)	<.001-.169	0 - 131	Highest exposures to arsenic and sulfur dioxide occur in Feed floor.
Converter Aisle	87		0 - .209	0 - 23	Worst sulfur dioxide exposures are in upper reaches of converter aisle.
Refining and Casting	34				No hard data available to INFORM. Some excessive noise exposures reported near the refining furnaces.

*Independent of respirator usage.

SOURCES: OSHA Inspections

Table 3 (cont.)

SUMMARY OF HEALTH HAZARDS--Phelps Dodge, Morenci, Arizona

PLANT AREA	Number of Employees	TWA Exposures*		Sulfur Dioxide (ppm)	NOTES
		Copper mg/M	Arsenic mg/M		
Refractory Dept.	13				No details available to INFORM. Exposures likely similar to those in reverb areas.
Other	141				Some of the job categories strongly suggest hazardous exposures (eg., flue cleaners, sweepers, clean-up laborers, etc.). No details available to INFORM.

*Independent of respirator usage.

SOURCES: OSHA Inspections
 State Mine Inspector Inspections
 Company testimony in arsenic and sulfur dioxide hearings.

FACT SHEET

FACILITY: Hidalgo Smelter

COMPANY: Phelps Dodge Corporation

INFORM
25 Broad Street
New York, New York
10004
(212) 425-3550

GENERAL

Name: Hidalgo Smelter, Phelps Dodge Corporation

Location: Playas, New Mexico

Description:

1. Copper smelter and supportive facilities. Production equipment includes flash furnace, electric furnace, three converters, two anode furnaces, casting wheel, elemental sulfur plant and two acid plants.
2. 460 employees.
3. Concentrates are received from the Tyrone mine and concentrator. Arsenic content of concentrate is .002%. Other impurity data on hand. In the future the smelter will also handle concentrates from the company's Arizona Bagdad mine.
4. Annual payroll at the smelter is \$6 million.
5. Production:

	1977	1976	
Copper (tons)	82,500	37,900	

Comments:

PROCESS AND HAZARDS

NOTE: Respirators and replacement parts are issued to all smelter employees. Employees are responsible for care, maintenance, and storage. Following a 1976 OSHA citation, the company installed respirator storage and cleaning stations.

NOTE: Throughout the following remarks, the phrase "poorly characterized" is used to indicate that we have found no evidence to indicate that either the company or the regulatory agencies have sufficiently characterized the exposures to permit proper evaluation and corrective action.

NOTE: The Outokumpu type flash furnace at Hidalgo is the first application of this technology in the United States.

A. Material Handling

Concentrates are received at the smelter by rail and are transported by conveyor to the 24,000-ton covered storage area. From there conveyors transfer the concentrates to storage bins near the rotary drier. Concentrates and flux are transported, as needed, through the rotary drier on a single conveyor belt.

1. Exposures in the smelter's material handling areas are poorly characterized. The company has spent three years developing a dust-suppression wetting system to increase the moisture content of the concentrates received.

B. Flash Furnace

Concentrates and silica flux are pneumatically conveyed to bins above the flash furnace. The mixture is fed by a drag-chain conveyor into the furnace's reactor chamber where four concentrate burners preheat it. The feed rate (the speed of the feed belt) is established after a chemical analysis of the copper content of the furnace slag. A chemical analysis of the matte grade and temperature determines the air inflow and the concentrate burner combustion rates. Matte is tapped through hooded and exhausted tap holes and transported by overhead cranes to the converters. Slag is tapped through hooded and exhausted tap holes and transported by covered launder to the electric furnace. Both the tap holes and the slag launders are water cooled.

1. Arsenic exposures throughout the flash furnace area are poorly characterized. Potentially hazardous exposures, the result of leaks in the furnace and cumulative fugitive emissions from other vessels, have been documented at other smelters with similar arsenic content in their concentrate. In 1977, the company reported average sulfur dioxide exposures to be 4.35 parts per million, and average area levels to be 6.39 ppm.
2. In 1977, the company reported average sulfur dioxide levels near feed conveyor to range from 0-64 ppm; average 15.8 ppm. In 1976, OSHA documented levels at the top of the reactor shaft to be 4 to 10 ppm and levels higher up above the furnace to be 40 ppm.
3. OSHA has documented sulfur dioxide levels in the matte tapping area at 7 ppm. Actual exposures are uncharacterized.

C. Electric Furnace

The electric furnace at the Hidalgo smelter processes both flash furnace and converter slag. Slag arrives from the flash furnace by launder and from the converters by overhead crane. It is smelted again in the electric furnace on a batch basis. Matte is tapped through hooded launders and tap points and is carried by overhead crane to one of three Peirce-Smith converters. The slag is tapped into slag pots which diesel cars transport to the slag dump.

1. Arsenic exposures throughout the electric furnace area are poorly characterized. Potentially hazardous exposures, the result of leaks in the furnace and cumulative fugitive emissions from other vessels,

have been documented at other smelters with similar arsenic content in their concentrate. The company has reported average sulfur dioxide exposures to be 8.17 ppm and average area levels to be 4.67 ppm.

2. OSHA has documented sulfur dioxide levels as high as 25 ppm near the charge floor conveyors. OSHA has documented exposures for the operator helper to be 9 ppm.
3. The company has reported average sulfur dioxide levels on the west side of the slag skimming area to range between 0 and 138.5 ppm and average 28 ppm.

D. Converter Aisle

The Hidalgo smelter has three Peirce-Smith converters. Matte from the flash and electric furnaces is transported to the converters by overhead cranes whose cabs are enclosed. Slag from the converters is returned to the electric furnace. Blister copper from the converters is carried by crane to the anode area.

1. Arsenic exposures are poorly characterized. Potentially hazardous exposures due to fugitive emissions during converter roll-out and matte transportation have been documented in smelters with similar arsenic content in the concentrate. In 1977, the company reported average exposures to sulfur dioxide at 2.45 ppm and average area levels to be 5.58 ppm. OSHA has documented sulfur dioxide levels on the converter operating floors to range between 2 and 11 ppm. However, exposures are uncharacterized.
2. The company is currently operating under an extended variance for high noise levels during converter punching (110 dBA). OSHA documented high to very high exposures to the converter puncher and utility man (2 to 2.5 times the allowable exposure limit). The company is currently testing Noranda tuyere silencers to control noise levels. In requesting the extended variance the company stated, "Our preliminary investigations to date [June, 1977] suggest that the success of the tuyere silencers in regard to satisfying the OSHA regulation is marginal." Exposures are uncharacterized.

E. Anode Area

The Hidalgo smelter has two anode furnaces and one casting wheel. The blister copper in the anode furnaces is "poled" with a reformed propane/air mixture to drive off the oxygen in it, and then cast into anodes on the casting wheel. The casting wheel is equipped with an automatic "take off" device which removes the anodes.

1. Following an August, 1977 inspection, OSHA issued serious citations for high noise levels in the anode area (utility man's exposures ranged from 2 to more than 3 times the allowable exposure limit). In March, 1978, the company reported to OSHA that conversion from high-pressure air propane burners to low-pressure kerosene burners was reducing exposures and area levels which had ranged from 86 to 93 dBA. However, Phelps Dodge added, "We are not in compliance with the regulation at all times due to the proximity of the anode area to the converter tuyere punchers." Current exposures are unknown.

2. Arsenic exposures, if any, are poorly characterized. Although by this time most arsenic has been driven off from the blister copper, and the arsenic content of the concentrates at the Hidalgo smelter is low, this area has sometimes been the scene of potentially hazardous arsenic exposures at other smelters.

F. Other Areas

1. The company has reported an average sulfur dioxide level on the fourth floor of the Alhstrom Boiler to be 6.96 ppm. Exposures and number of workers affected are uncharacterized.
2. The company has reported that the average personal exposure to sulfur dioxide at the drier is 3 ppm. Individual exposures are uncharacterized.

Comments:

COMPANY SAFETY AND HEALTH ACTIVITIES

A. Staff

Industrial hygiene technician - 1

Safety Supervisors - 1

Safety Engineers - 2

Labor Department Director - 1

B. Industrial Hygiene

1. There is no industrial hygienist on staff at the smelter.
2. All industrial hygiene activities are co-ordinated by the Safety Supervisor and the industrial hygiene technician.
3. The company performs some industrial hygiene sampling for noise, sulfur dioxide, and hydrogen sulfide. Extent and exact frequency of sampling for these and other hazards is unknown.

C. Respirator Program

Respirators are issued to all employees. Employees are responsible for maintenance and storage. Following a 1976 OSHA citation, the company installed respirator cleaning stations.

D. Safety

1. Pre-employment safety orientation is conducted by the Safety Supervisor.
2. Refresher safety education is administered through department-level meetings every six weeks.
3. The company issues free of charge most necessary safety equipment.

F. Health Care

1. Most medical care is administered through the company clinic in Playas, New Mexico, ten miles from the smelter.
2. Clinic staff includes registered nurses, and paraprofessional personnel. Closed circuit TV monitor connects clinic with hospital in Silver City during emergencies. An M.D. visits the clinic twice a week.
3. Facilities for emergency and out-patient care only. All other treatment is handled in the Silver City Hospital, sixty miles to the north.
4. There are supervisors and workers trained in first aid on all shifts.
5. The company performs pre-employment physicals.

Comments:

SAFETY COMMITTEE

There is no Joint Safety and Health Committee at the Hidalgo smelter.

7 . REGULATORY HISTORY

A. Pre-1970

1. State Inspector of Mines

B. Post-1970

1. State Inspector of Mines

- a. Almost exclusively a safety focus until 1973, when limited health activities were implemented.
- b. Approximately two inspections per year. No union participation.
- c. Agency still active. Jurisdiction question vis a vis New Mexico State OSHA plant (see below) still unclear.

2. State OSHA plan

- a. Administered by New Mexico Environmental Improvement Agency
- b. Approved 12/75. No smelter inspections yet conducted.

C. OSHA Activities

Seven inspections: 3 health, 3 safety and one fatality.

TABLE 1

PROCESS EQUIPMENT--Hidalgo

NAME	AGE	POLLUTION CONTROLS	COMMENTS
Flash Furnace (1)	1977	Waste Heat Boiler → Electrostatic Precipitator → Acid Plants	
Electric Furnace (1)	1977	Scrubber → Stack	
Peirce-Smith Converters (3)	1977	WHB → ESP → Acid Plants	
Anode Furnace (2)	1977	none	
Anode Casting Wheel (1)	1977	none	
Acid Plant (2)	1977		
Elemental Sulfur Plant	1977		

TABLE 2

SUMMARY OF HEALTH HAZARDS--Hidalgo

PLANT AREA	Number of Employees	TWA Exposures Δ			Sulfur Dioxide (PPM)	NOTES
		Copper mg/m ³	Arsenic mg/m ³	Lead mg/m ³		
Material Handling					3.00 personal*†	†Dryer
Smelting Furnaces						
Flash Furnace					4.35 personal* 6.39 area*	excursions to 64 ppm of sulfur dioxide
Electric Furnace					8.17 personal* 4.67 area	excursions to 138 ppm of SO ₂ .
Converters					2.45 personal* 5.58 area*	Noise exposures to 248 percent of standard
Anode Area					.16 personal*	•Silica exposure to cast sprayer approximately one-half permissible level. •Noise exposures to 316% of standard
Acid Plants					1.05 personal*	
Ahlstrom Boiler					6.96 area*	

 Δ Independent of respirator usage

*Company reported average figures

Sources: OSHA inspections

Company data--OSHA Sulfur Dioxide inspections

TABLE 3

SHA Inspections
Idalgo, Phelps Dodge

DATE	TYPE	FINDINGS	PENALTIES	FOLLOW-UP	COMMENTS
19/76	general schedule health	2 nonserious violations	0	3/26/76 completed	respirator program
20/76	general schedule safety	28 nonserious violations	\$305		
9/76	complaint health	7 nonserious violations	\$95	Noise vio- lations. Under variance until 12/78	Converter punching noise, respirator program.
4/77	complaint safety	2 serious, 7 nonserious violations	\$240	9/29/77 inspection	
4/77	complaint health	1 serious violation	\$490	closed without follow-up inspection	anode burner noise
10/78	accident fatality	no citations	0		maintenance worker
1/78	complaint safety	1 nonserious violation	0		converter skimmer controls