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HEALTH HAZARD EVALUATION REPORT 71-20-49

HAZARD EVALUATION SERVICES BRANCH

DIVISION OF TECHNICAL SERVICES

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Organics Division  
Newport, Tennessee

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U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE  
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH  
CINCINNATI, OHIO 45202

TABLE OF CONTENTS

	<u>Page</u>
I. Summary Determination	1
II. Introduction	3
III. Background Hazard Information	3
A. Standards	3
B. Toxic Effects	4
IV. Health Hazard Evaluation	5
A. Observational Survey	5
B. Environmental Evaluation	6
C. Medical Evaluation	8
D. Conclusions	10
V. Recommendations	11
VI. References	12
VII. Figures, Tables, and Photographs	13

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HEALTH HAZARD EVALUATION REPORT 71-20  
CHEMETRON CHEMICAL  
ORGANICS DIVISION  
NEWPORT, TENNESSEE

JUNE 1973

I. SUMMARY DETERMINATION

A. Introduction

Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669 (a)(6), authorizes the Secretary of Health, Education, and Welfare, following a written request by any employer or authorized representative of employees to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

The National Institute for Occupational Safety and Health (NIOSH) received such a request from an authorized representative of employees regarding exposure to the underlisted substances in the production of acetyl sulfanilyl chloride at the Chemetron Chemical Organics Division in Newport, Tennessee.

B. Federal Standards

The substances used or found in the workplace with potentially toxic properties are listed below with their respective exposure standards as promulgated by the U.S. Department of Labor (Federal Register, Volume 37, §1910.93, October 18, 1972).

Material	8-hour time weighted average	Acceptable ceiling concentration	Acceptable maximum peak above the acceptable ceiling concen- tration for an 8-hour shift	
			Concentration	Maximum duration

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Methylene Chloride-----500 p.p.m.\*-----1000 p.p.m.\*-----2000 p.p.m.\*-----5 minutes in  
(MDC) (Z37.3-1969) any 2 hours

N-Acetyl Sulfanilyl  
Chloride (ASC)

\*ppm - parts of vapor or gas per million parts of air.

\*\*No Standard Established

### C. Environmental Evaluation Results

Results of the most recent environmental survey conducted on February 9-11, 1973 indicate that MDC eight-hour time weighted average concentration for the centrifuge dryer operator was 875 ppm. The average full-shift personal exposure for dryer operators to ASC was 5.1 mg/m M<sup>3</sup>; the general room average exposure was 2.1 mg/M<sup>3</sup>.

### D. Medical Evaluation Results

Medical evaluations indicated toxicity reactions to ASC including irritation to eyes, skin and upper respiratory tract. It also appears that certain individuals, after an interval of experiencing irritations at the levels encountered, become sensitive to small amounts of ASC and develop symptoms characteristic of immediate allergy.

### E. Toxicity Determination

From the results of medical and environmental studies conducted from March 1972 through February 1973 by officers of the National Institute for Occupational Safety and Health it has been concluded that there is a significant hazard to the health and well being of workers involved in the production of acetyl sulfanilyl chloride at Chemetron Corporation, Newport, Tennessee.

The substances n-acetyl sulfanilyl chloride (ASC) and methylene chloride (MDC) were determined to have toxic effects at the concentrations found. This conclusion is based upon (1) evidence of irritant and immediate allergic reactions following exposure to ASC and (2) airborne concentrations of MDC exceeding Federal Standards which are regarded as the current-best-estimate of safe exposure limits.

It is recommended that steps be taken to bring employee exposures (1) within Federal standards for MDC, and (2) to levels of ASC low enough to preclude adverse physiological reactions.

### F. Distribution

Copies of this Summary Determination of the evaluation are available upon request from the Hazard Evaluation Services Branch, NIOSH, U. S. Post Office Building, Room 508, 5th and Walnut Streets, Cincinnati, Ohio 45202. Copies have been sent to:

- a) Chemetron Chemical Organics Division
- b) Authorized Representative of Employees
- c) U. S. Department of Labor - Region IV

For purposes of informing the approximately 16 "affected employees," the employer will promptly "post" the Summary Determination in a prominent place(s), near where affected employees work, for a period of 30 calendar days.

II. INTRODUCTION

Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6), authorizes the Secretary of Health, Education, and Welfare, following a written request by any employer or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

The National Institute for Occupational Safety and Health (NIOSH) received such a request from an authorized representative of employees regarding exposures to acetyl sulfanilyl chloride (ASC) and methylene chloride (MDC) at the ASC Production Facilities, Chemetron Chemical Corp., Newport, Tennessee.

III. BACKGROUND HAZARD INFORMATION

A. Standards

Two chemical substances to which workers are exposed during the production of acetyl sulfanilyl chloride are acetyl sulfanilyl chloride and methylene chloride.

The occupational health standards as promulgated by the U.S. Department of Labor (Federal Register, Part II, §1910.93, Table G-2) applicable to substances of this evaluation are as follows:

Material	8-hour time weighted average	Acceptable ceiling concentration	Acceptable maximum peak above the acceptable ceiling concentration for an 8-hour shift.	
			Concentration	Maximum duration

Methylene Chloride (MDC) (Z37.3-1969)	500 p.p.m.*	1000 p.p.m.*	2000 p.p.m.*	5 minutes in any 2 hours
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N-Acetyl Sulfanilyl\*\* Chloride (ASC)

\*ppm - parts of vapor or gas per million parts of air at 20°C and 760mm pressure.  
 \*\*No Standard Established.

B. Toxic Effects

Methylene Chloride (MDC)

The Documentation of Threshold Limit Values, ACGIH, 1966, states the following concerning MDC:

Heppel and coworkers found that repeated inhalation of 100,000 ppm caused some narcosis in animals and some deaths from lung damage and liver injury. Concentrations of 5,000 ppm breathed for six months reduced the activity of rats but had no visible effect on three other species. Fairhall records a human fatality after accidental anesthesia.

The most serious effect from inhaled methylene chloride in chronic poisoning is liver damage. It is mildly irritating to the skin. In the eye the liquid will be painful and irritating but is not apt to result in serious injury. Its major effect is its anesthetic action leading to "drunkenness", incoordination, headache, stupor, irritability, numbness and tingling in the limbs.

The 500 ppm value is considered to be low enough to prevent anesthetic effects and hazard to health.<sup>1</sup>

Patty reports that "methylene chloride is by far the least toxic of the four chlorinated methanes. The principal problem will be 'drunkenness' and incoordination, which may lead to unsafe operation."<sup>2</sup>

Acetyl Sulfanilyl Chloride

This compound, termed ASC, is an intermediate in the manufacture of sulfa drugs. There is no established standard for ASC. Little is reported in the literature regarding industrial exposures.

The only pertinent industrial report in the literature involved workers with eczema, handling ASC in the preparation of sulfathiazole. Six out of thirteen workers developed positive allergic skin reactions on patch testing with ASC. Irritant symptomatology was not discussed in the report. These workers were exposed to other sulfa intermediates and gave positive patch testing responses to them as well, but not to the finished product, sulfathiazole. The ASC reaction could represent cross sensitivity to the other allergens.<sup>3</sup>

IV.a HEALTH HAZARD EVALUATIONa

A.a Initial Observational Surveya

On March 15, 1972, Edward Shmunes, M.D., James Taylor, M.D., and David J. Burton, Industrial Hygienist, of the National Institute for Occupational Safety and Health, met with XXXX, Branch Manager, XXXX, Personnel Manager, XXXX, Safety Manager, and XXXX, Development Manager, of the Chemetron Chemical Corporation.

1.a Background Information:a

The Newport Facility of Chemetron Chemical Corporation has been in operation since 1957. The plant operates 24 hours a day, 7 days a week and uses 4 shifts which overlap. There are approximately 130 hourly employees. Hourly employees are represented by the Oil Chemical and Atomic Energy Workers Local 3724. The president of the local union is XXXX, who participated in a walk-through survey of the plant.

Employees are provided a central locker room with showers and a lunch room located in the Administration Building. There are three or four physicians on call out of a clinic in Newport. Employees are given a pre-employment physical. There are no periodic examinations, periodic tests or health programs. Employees absent for more than 3 days require a release from a physician for readmission to the job. Personal protective devices required by all employees are hard hats, safety glasses, and safety shoes. There is no system of regular monitoring of environmental conditions. There is a first-aid room on the premises but no full time staff to staff it. Each shift has one person working who has completed a first-aid course.

2.a Plant Process:a

The ASC production area is located in Building No. 2 of the Newport Operations. This operation has been functioning since 1957. It was indicated by company management that 16 people per day work in the ASC operation.

ASC manufacture starts with the combining of acetic acid and analine to make acetanilide, a flakey material, which is then manually dumped into a reactor in which it combines with chlorosulfonic acid to become acetyl sulfanilyl chloride. (A closed system to transfer the acetanilide to the reactor was in the process of being installed as of February, 1973.) The ASC is then transferred under a closed system to another reactor where it is quenched in methylene chloride. Then the solvent is extracted, the material is cooled and centrifuged.

3. Environmental Observations:

The centrifuge appeared to be a major contributor to MDC exposures. The dryer and milling operations appeared to be the major contributor to ASC exposures.

4. Medical Observations:

The employees on shift during our walk-through were interviewed by Drs. Shmunes and Taylor. Typical health complaints included: bleeding noses, sore throat, eye irritation, dizziness, stuffiness, and skin inflammation.

The company supplied a list of past ASC medical reactions as follows:

1969 - 12 cases  
1970 - 21 cases  
1971 - 11 cases

These reactions consisted mainly of contact dermatitis or conjunctivitis which were referred to a physician. Of this group of reactors, three employees have quit, four have been released because of other problems, and an unknown number have been transferred to other areas of the plant.

B. Environmental Evaluation

During the periods June 27-29, 1972, and February 9-11, 1973, follow-up environmental surveys were made of the ASC operations at the Newport Facility. The purpose of this survey was to obtain measurements of employee exposure to ASC and MDC.

Employee exposures to ASC and MDC were obtained using personal air sampling equipment, which sampled air in close proximity to the employee's actual breathing zone. MSA Model G battery powered vacuum pumps were used to draw air through silver membrane filters to collect the ASC. Activated charcoal tubes were used to collect MDC samples.

Area samples in the Building #2 area were taken using Research Appliance Company Sequential Samplers. Area samples for ASC were taken to determine the general room air concentrations over a 48-hour period of time, in four-hour sampling increments.

In the time between the first sampling period in June, 1972, and the second sampling period in February, 1973, the equipment configuration of the ASC operation was changed. The major change was the moving of the centrifuge into the same room as the dryer. The centrifuge, dryer, and mill were essentially unchanged between sampling periods. A number of holes in the exterior wall of the building had been filled in, thus limiting natural ventilation. A storage tank for acetanilide had been installed in the north west end of the building, but was not functioning at the time of the second sampling. If anything, work conditions since the modification appear to have worsened, due to the closer proximity of equipment.

A second sampling period was required because lab results for ASC from the first sampling period did not show adequate sensitivity to low exposures. The present floor plan of the centrifuge and dryer area of the ASC operations is shown in Figure 1.

The employee who works in this area is termed the "centrifuge-dryer operator". His duties are outlined as follows:

A slurry of MDC plus ASC are piped into the centrifuge. The slurry is then centrifuged to drive off most of the MDC which is recovered in another part of the building. The dryer operator then manually empties the centrifuge through the bottom of the centrifuge into barrels which are then rolled over to the vicinity of the dryer. The barrel is then raised on a hoist to the top of the dryer where the dryer operator empties the barrel of ASC into the dryer. This operation occurs two to three times per shift and requires 1-1/2 to 2 hours of time. The dryer is then activated and the remaining MDC is removed from the ASC. The dryer is then manually emptied into a screen shaker which shakes the dried ASC into two different drums. One drum is for the fines, the other drum for lumps or flakes of ASC which are not properly dried. The lumpy material is then milled to bring it to a fine powdered consistency. Each drum weighs approximately 165 pounds and is weighed on an adjacent scale by the operator. The operator is required to lift the drum approximately 6 inches to the scale. It is then capped and taken away to a storage facility outside this immediate area. The dryer is pulled approximately twice per shift.

Pertinent observations regarding this operation are as follows:

1. MDC exposures were particularly heavy during centrifuging and while pulling of the centrifuge.
2. Most of the time the dryer operator was not wearing his respirator.
3. Even though the dryer operator wore gloves, they were not high enough to protect his upper arms.
4. Considerable amount of dust was generated during the pulling of dryer, particularly during the screening operation and the milling operation. Both operations were equipped with rudimentary forms of local exhaust ventilation. During one sampling period the

equipment was not functioning. During another it was obvious that exhaust velocity was not sufficient for capture. The ventilation system on the flaker was later found to be clogged with dust and thus rendered useless.

5. Housekeeping had improved during the second sampling period over the first sampling period, but much was still left to be desired. Spills were left untouched, and there seemed to be little housekeeping conscienceness on the part of employees. It was noted that one operator spilled a pound or two of ASC on the ground trying to lift a drum to the scale. This was left underfoot for the remainder of the shift.

Methylene chloride exposure levels are shown in Tables 1A and 1B. The 8-hour time-weighted-average exposure during the second sampling period was calculated to be 875 p.p.m. which exceeds the Federal Standard of 500 p.p.m. The acceptable-ceiling and the maximum-peak concentrations were also exceeded. MDC determinations were made by gas chromatography.

Results of ASC (Tables 2A,2B) averaged 2.1 mg/M<sup>3</sup> for the general room air, and 5.1 mg/M<sup>3</sup> for the time-weighted, full-shift, breathing-zone samples of the centrifuge-dryer operators. No standard has been established for ASC. ASC analysis was determined by using silver filter weight differences. This method was shown to be adequate by a CHN ratio of analysis of filter #2.

### C. Medical Evaluation

This hazard request was directed at the possible health hazards associated with production of acetylsulfanyl chloride (ASC). The complaints raised in the hazard evaluation request were that (1) the compound ASC produced rashes and other allergic symptomatology as well as ulcerations and bleeding of the nose, and (2) MDC exposures were causing various CNS reactions.

The medical evaluation of MDC exposure was limited to employee interviews.

The medical evaluation of ASC exposure consisted of three parts: (1) primary irritation index patch testing in rabbits, (2) 48-hour occlusive patch testing of employees, and (3) a medical interview and dermatologic examination. Medical studies were conducted on July 9 through July 13, 1972.

#### 1. Primary Irritation Index to Rabbits (Patch Testing)

In order to decide on an appropriate concentration of ASC for human patch testing, the primary irritation index to rabbit skin was first determined. ASC dissolved in absolute methyl alcohol was placed on the shaved back of two rabbits in concentrations of 100%, 50%, 25%, 10%, and 0.1% in dosages of 0.1 ml. per 20 mm<sup>2</sup> area of

skin. The test sites were occluded for 24 hours and readings were made at 24 and 48 hours. The Primary Irritation Index was considered to be the highest concentration which did not produce erythema.

The results of the patch tests placed on two rabbits are listed in Table 3.

On the basis of this study, the Primary Irritation Index to rabbits is 10% (the highest concentration not causing erythema) and a 10% solution was prepared for human patch testing.

## 2. Forty-eight Hour Occlusive Human Patch Tests

Twenty-nine male employees, aged 18 to 41, volunteered for the study. Thirteen of these individuals were current employees in the ASC area; thirteen had been compensation cases because of an adverse reaction from ASC, and had been referred to the plant physician. Sixteen had been reassigned to a different area of the plant after having developed problems. Each participant was questioned about health problems during his employment in the ASC area, examined by a dermatologist, and given 48-hour occlusive patch tests to solutions of ASC prepared from crystalline ASC diluted 1:10 in methanol, methanol alone, and sulfacetamide prepared from crystalline sulfacetamide diluted to 3% in methanol. Forty-eight and 72-hour readings at patch test sites were performed.

Forty-eight and 72-hour occlusive patch testing did not show any allergic responses at the patch testing concentrations to the ASC, the methanol, nor the sulfacetamide. One-third of those tested did show some primary irritant responses at the test sites with well demarcated erythema and tenderness usually at the border of the cloth square. This erythema began to fade within 24 hours of the removal of the patches. Five control subjects did not exhibit any reactions of patch testing.

## 3. Medical Interview and Dermatological Examination

All workers in this study had been symptomatic while working in the ASC area, including current workers. The various symptoms represented system involvement of eyes, nose, skin, throat, and chest and are shown in Table 4.

The degree of symptomatology seemed to fall into two groups: Those who became symptomatic when working the drier station (the dustiest operation) and those who eventually became symptomatic to small amounts of ASC dust. There were twenty employees who were symptomatic only when pulling the drier and nine employees who now develop symptoms when they are anywhere in Building #2. One employee

having been removed from the area has continued to react even if he handles small quantities of dust on the outside of containers of ASC in a separate warehouse. The interval between employment and development of symptoms was as follows: 8 after one day, 8 after one week, 8 after 2-4 weeks, 3 after several months, and 2 employees developed symptoms approximately one year after working with ASC. Dermatitis reported was largely confined to the face and neck, but involved a few other sites as well. The men reported that shaving before work increased the likelihood of developing dermatitis on their face during the work shift. The distribution of the reported dermatitis is shown in Table 5.

The medical evaluation of MDC exposure consisted of employee interviews. Workers consistently claimed to have experienced symptoms classical to MDC intoxication namely: dizziness, a feeling of being "high," or "drunk," dullness, lethargy, and a sense of numbness. Occasionally a worker has passed out.

#### D. Conclusions

On the basis of the environmental and medical studies reported above it is our determination that ASC produces toxic effects as used and found in the ASC production area. Toxicity reactions included irritation to eyes, skin, and the upper respiratory tract. It also appears that certain individuals, after an interval of experiencing irritation at the levels encountered in this area in the plant, become sensitive to small amounts of ASC and develop symptoms characteristic of immediate allergy (hives, sneezing, wheezing, facial swelling). Irritation not allergy, however, was responsible for the skin problems.

It is also judged that MDC is hazardous to dryer operators at the concentrations used and found. This judgement is based upon (1) worker complaints, and (2) airborne levels of MDC exceeding Federal Standards which are accepted by the Department of Labor as the current best-estimate of safe exposure limits.

V. RECOMMENDATIONS

It is recommended that the company take immediate steps to protect the health and well being of workers in the ASC operation as is found necessary. This performance could be achieved through the following recognized procedures:

1. Provide adequate local exhaust ventilation. This ventilation should be able to control MDC airborne concentrations to 500 ppm or below. It is also recommended that ventilation be adequate to control ASC airborne exposures to levels devoid of adverse symptomology. See Comments.
2. Avoid unnecessary ASC contamination of equipment or personnel. This can be accomplished through the use of training sessions for employees, the institution of more stringent work standards, and the enforcement of housekeeping procedures.
3. Provide personal protective devices for employees. This includes the use of protective gloves, aprons, goggles, and respiratory devices. A respiratory program should be instituted in the event that respiratory devices are needed. This would include the fitting, cleaning, and maintenance of respiratory devices.
4. Improve employee medical services. This could include periodic medical examinations, and the possibility of on-site medical evaluations by a doctor or nurse. Employees showing excessive sensitivity to ASC should be transferred to another area.
5. Provide environmental monitoring. This would include periodic evaluation of airborne concentrations of MDC and ASC, and periodic evaluation of control systems to include local exhaust ventilation and personal protective devices.
6. Alter the presently open system to a closed system, thereby eliminating the possibility of airborne concentrations of ASC and/or MDC.
7. Periodically review control programs and procedures.

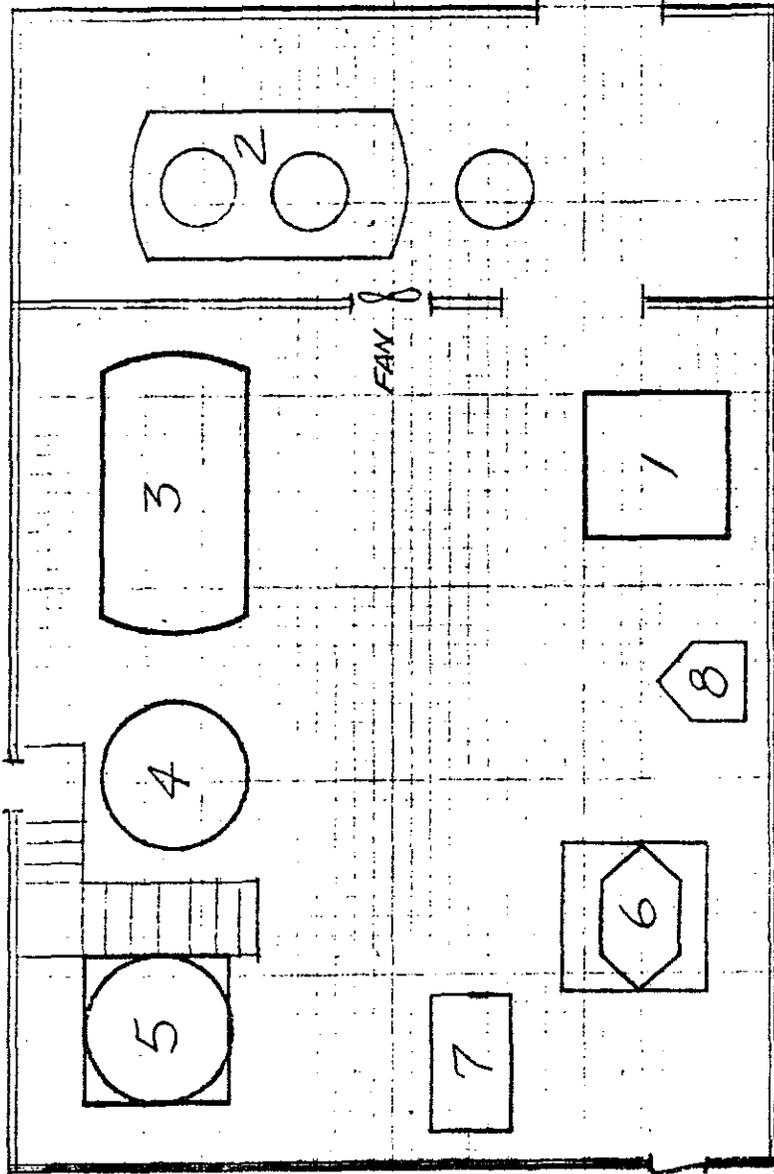
COMMENTS

We have endeavored through this evaluation to (1) determine exposure levels and the toxic effects of the substances ASC and ~~MDC~~ as used and found, and (2) to make recommendations which will eliminate toxic or hazardous conditions.

It was not in the scope of this hazard determination to produce a standard for ASC. The statistical, environmental, and medical data will, however, be reviewed by NIOSH and forwarded to the Department of Labor for further action.

VI. REFERENCES

1. Documentation of Threshold Limit Values, ACGIH, 1014 Broadway, Cincinnati, Ohio, 1966.
2. Industrial Hygiene and Toxicology, Patty, et al, John Wiley & Sons, New York City, New York, 1963.
3. Seeberg, George: "Occupational Skin Diseases in Workers Preparing Sulfathiazole," ACTA Dermato Venerol, Vol. 24, pp. 317-33, 1943.



1. ACETANALIDE FLAKER (ON UPPER DECK)
2. SULFANALIDE STORAGE TANK
3. ACETANALIDE CONCENTRATOR
4. DRYER
5. MILL
6. SCALE
7. FLAKER
8. FAN

FIGURE 1. LAYOUT, DRYER AREA, BLDG. 2

TABLE 1A - MDC Concentrations, Building #2 (ASC),  
Charcoal Tube Personal Samples, June, 1972

Date	Sample No.	Employee No.	Job Title Code	Methylene Chloride Concentration ppm*	Activity During Sampling Period
6/28	4	1	A	9	Working in West End of Building
6/28	24	2	B	3	Before Centrifuging, start of shift
6/28	25	1	A	2	Working in West End of Building
6/28	30	2	B	268	Centrifuging
6/28	47	2	B	556	Centrifuging
6/28	9	3	B	None Detected	Pulling Dryer
6/29	44	3	B	96	Charging Centrifuge

JOB TITLE CODE: A - Acetanalid Operator (works away from centrifuge area)

B - Centrifuge - Dryer Operator

\*ppm - Parts MDC per million parts air by volume.

TABLE 1B - MDC Concentrations, Building #2 (ASC),  
Charcoal Tube Personal Samples, February, 1973

Date	Sample Number	Employee Number	Job Title Code	MDC Conc. ppm*	Location or Activity During Sampling Period
2/9	T1	4	B	2440	Pulling Centrifuge
2/9	T3	4	B	1450	Loading Centrifuge
2/9	T5	4	B	1030	Pulling Centrifuge
2/9	T2	4	B	310	Pulling Dryer, Milling
2/9	T6	4	B	315	General Activity
2/9	T4	4	B	1420	Loading Centrifuge
2/11	T10	5	B	5520	Pulling Centrifuge

JOB TITLE CODE: B - Centrifuge - Dryer Operator

Calculation of 8-Hour Time-Weighted-Average Exposure

Activity	Hours/Day Exposed	Average Exposure Concentration, ppm*	ppm-Hours
Loading Centrifuge	1	1435	1435
Pulling Centrifuge	1-1/2	2995	4492
Other Activity In Area	3-1/2	310	1085
Out of Area	2	0	0
TOTALS	8		7012

$$TWA = \frac{7012}{8} = 875 \text{ ppm}$$

\*ppm - parts MDC per million parts air by volume

TABLE 2A - ASC Concentrations, Building #2, 4-Hour  
 General Room Air Samples, February, 1973

Date	Sample Number	ASC Conc. mg/M <sup>3</sup> *	
2/9	6	6.4	General Room Air Sample Average, 48-Hours = 2.1 mg/M <sup>3</sup>
2/9	24	2.1	
2/9	7	1.6	
2/9	13	1.3	
2/10	23	0.7	
2/10	18	1.4	
2/10	15	2.1	
2/10	16	2.5	
2/10	21	1.9	
2/10	8	1.8	
2/11	14	1.2	
2/11	17	1.5	

\*Milligrams ASC per cubic meter of air

TABLE 2B - ASC Concentrations, Building #2,  
Full-Shift Personal Samples, February, 1973.

Date	Shift	Employee Number	Job Title Code	ASC Conc. mg/M <sup>3</sup> *	Activity During Shift	Sample Number
2/9	1	4	B	6.1	Pulled Dryer Once	19
2/9	2	6	B	3.2	Pulled Dryer Once	12
2/10	1	7	B	8.9	Pulled Dryer Twice	2
2/10	2	8	B	2.2	Pulled Dryer Once	20
2/9	1	9	C	1.4	General Activities	11
2/9	2	10	C	1.1	away from immediate	10
2/10	1	9	C	0.8	Dryer Area	5
2/10	2	11	C	0.7		25

JOB TITLE CODE: B - Centrifuge - Dryer Operator  
C - Sulfanator Operator

\*mg/M<sup>3</sup> - Milligrams ASC per cubic meter of air, represents T.W.A. exposure for a full 8-hour shift

Average Full-Shift Exposure to centrifuge-dryer operators: 5.1 mg/M<sup>3</sup>

TABLE 3 - Results Of Patch Tests On Rabbits

	<u>100%</u>	<u>50%</u>	<u>25%</u>	<u>10%</u>	<u>1%</u>	<u>0.1%</u>
Erythema	++	+	+	0	0	0
Vesicles	0	0	0	0	0	0

TABLE 4 - Reported Symptoms Of ASC Workers Following Exposure

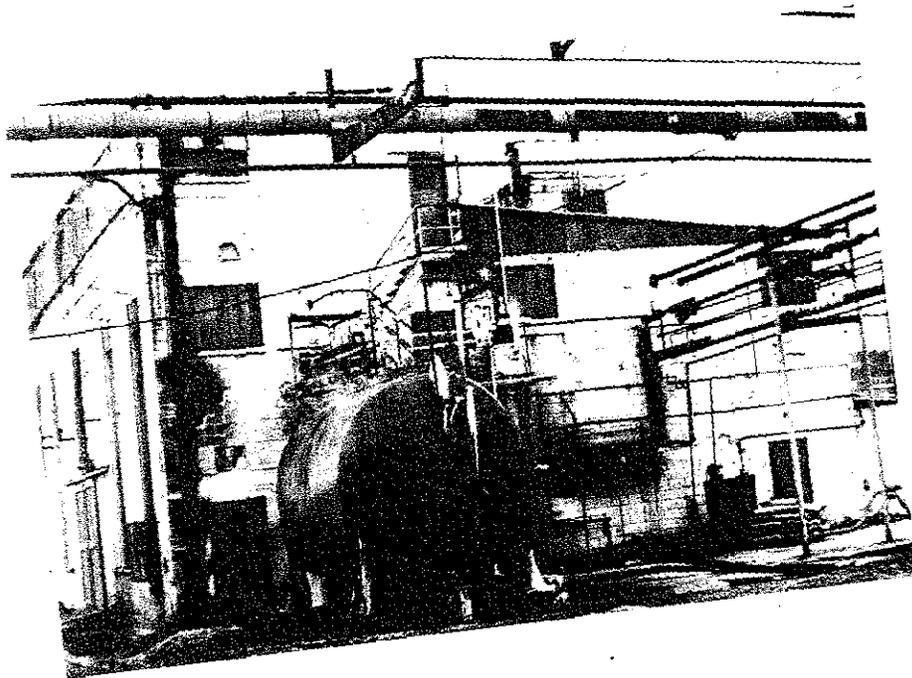
<u>Symptom</u>	<u>Number Symptomatic</u>	<u>Percentage *</u>
Sneezing	24	83%
Rhinorrhea	23	79%
Burning of eyes	22	76%
Tearing	18	62%
Dermatitis	14	48%
Nose bleeds	12	41%
Pruritus	8	28%
Sore throat	8	28%
Hives	6	21%
Nasal congestion	4	14%
Staining of the hands	3	10%
Wheezing & tightness of chest	3	10%
Photosensitivity	1	3.4%

\* Total number of workers exposed to ASC was twenty-nine, 29.

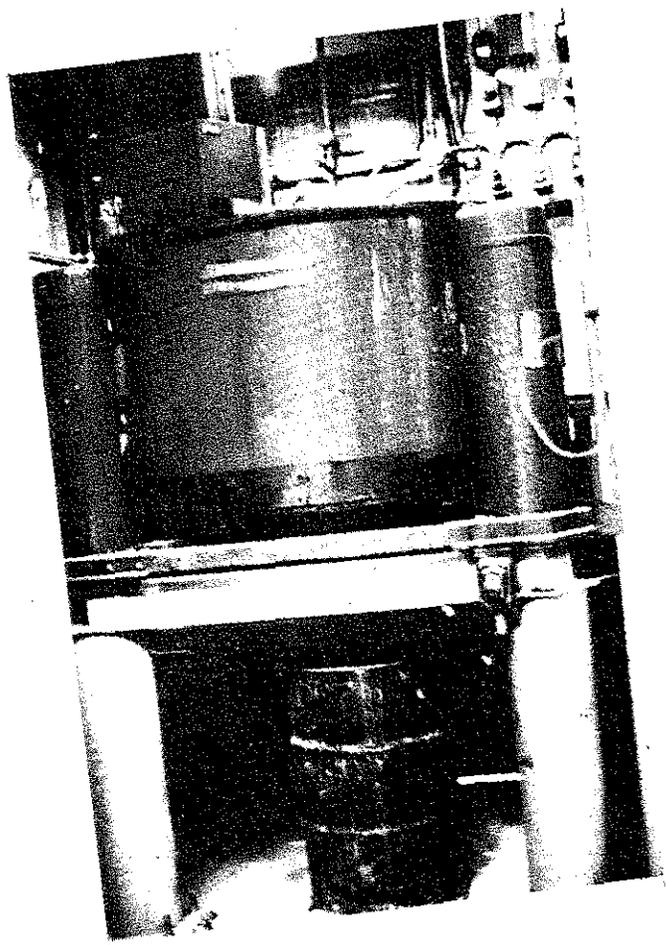
TABLE 5 - Distribution of Dermatitis for Men Working With ASC

<u>Site of Rash</u>	<u>Number*</u>
Face	8
Neck	7
Forearm	3
Groin	1
Wrist	1
Legs	1
Trunk	1

\* Total number of workers exposed to ASC was twenty-nine, 29.

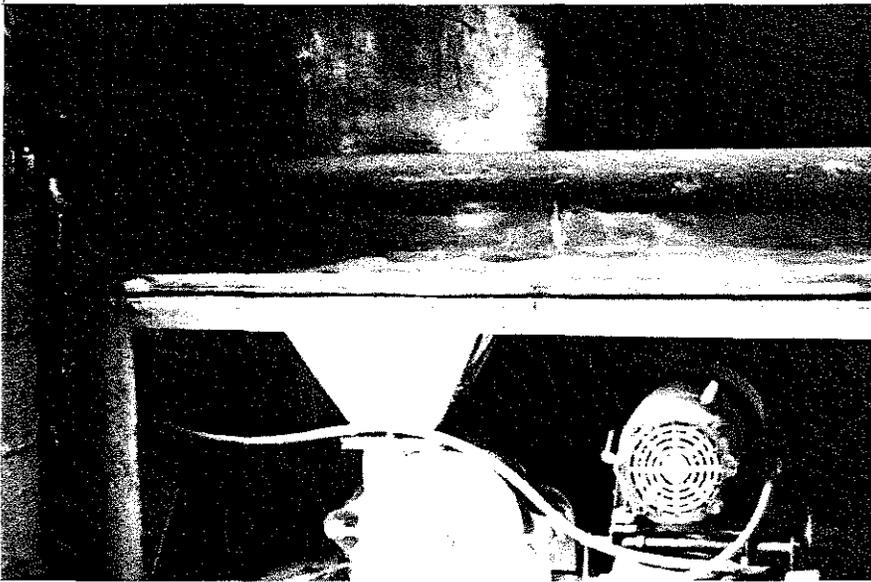
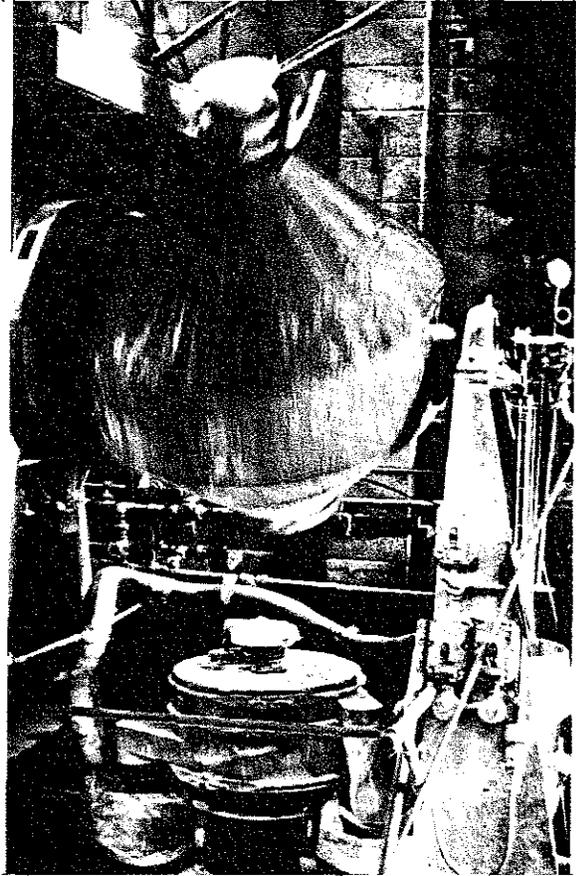


Photograph No. 1: Building #2, ASC  
Production Facilities

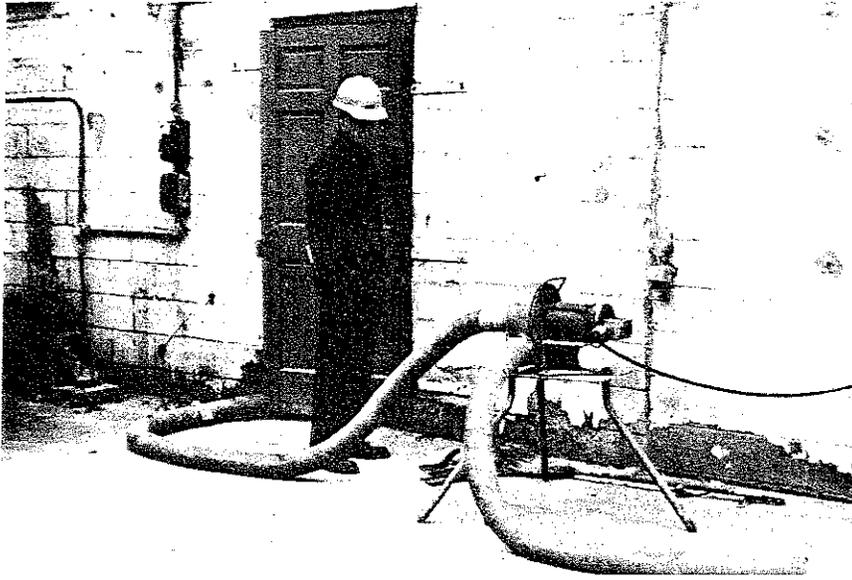


Photograph No. 2: Centrifuge

Photograph No. 3: Dryer (Rotating),  
Shaker (Bottom)



Photograph No. 4: Mill



Photograph No. 5: Temporary Exhaust System used with Mill.



Photograph No. 6: Scale.