

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE  
CENTER FOR DISEASE CONTROL  
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH  
CINCINNATI, OHIO 45226

HEALTH HAZARD EVALUATION DETERMINATION  
REPORT NO. 77-4-402

A & S TRIBAL INDUSTRIES  
POPLAR, MONTANA

JUNE 1977

I. TOXICITY DETERMINATION

A health hazard evaluation was conducted by the National Institute for Occupational Safety and Health (NIOSH) at the A & S Tribal Industries in Poplar, Montana, on January 10-12, 1977. Based on environmental and medical evaluations, no apparent health hazard was judged to exist. The NIOSH evaluation team, plant workers, and plant management agreed that the absence of respiratory illness and worker complaints was due to a new factory humidification system, maintaining the humidity at 37%. This system was not installed at the time of the previous health hazard evaluation (report #75-135-328). Environmental sampling did not demonstrate any detectable exposures to the anti-mildew agents containing lead, chromium, antimony, tin, xylene, cellosolve, vinyl acetate, and vinyl chloride (VC). Medical evaluation, including pulmonary function studies, medical histories, and physical examinations, indicated no apparent health hazards during this evaluation.

II. DISTRIBUTION AND AVAILABILITY

Copies of this determination report are currently available upon request from NIOSH, Division of Technical Services, Information and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days the report will be available through the National Technical Information Service (NTIS), Springfield, Virginia. Information regarding its availability through NTIS can be obtained from NIOSH, Publications Office at the Cincinnati address.

Copies of this report have been sent to:

A & S Tribal Industries  
U.S. Department of Labor - Region VIII  
NIOSH - Region VIII

For the purpose of informing 100 affected employees, copies of the report shall be posted in a prominent place accessible to the employees for a period of 30 calendar days.

### III. 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.

NIOSH received such a request from plant management of the A & S Tribal Industries, Poplar, Montana, to evaluate potential exposures to contaminants generated from the assembly of camouflage netting.

In September 1976 an identical health hazard evaluation determination report, #75-135-328, was completed for A & S Tribal Industries. A hazard was documented on the high number of workers reporting symptoms and showing physical signs of respiratory tract effects. Environmental levels in September 1976 were also below the most recent analytical detection limits. Therefore, in November 1976 plant management requested that NIOSH re-evaluate the facility.

### IV. HEALTH HAZARD EVALUATION

#### A. Plant Process

The product of the A & S Tribal Industries is camouflage netting which is used by the military. The process consists of opening packed bales of netting from the supplier, cutting the netting to specifications by use of a finger knife, sewing an edge on the netting, folding and packing the netting, and then shipping the netting to another plant for continuation of the manufacturing process. When the netting is received, it has already been pre-colored and pre-treated with anti-mildew agents. Workers at the A & S Tribal Industries include the following: Net splitters, net tier, edge corders, sewers, inspectors, squarers, receiving clerks, edgers, security guards, housekeepers, bookkeepers, supervisors, and packers. The anti-mildew agents applied to the netting include: Lead, chromium, antimony, and tin. Xylene, cellosolve, vinyl acetate, and polyvinyl chloride also are applied to the netting prior to receipt by A & S Tribal Industries. All of the above-mentioned workers were equally exposed to the netting.

#### B. Environmental and Medical Evaluation Design and Methods

Eight-hour breathing zone samples were taken on 25 workers throughout all areas of the plant. Lead, chromate, antimony, and tin samples were collected on AA filters using MSA Model G pumps at 1.5 liters per minute. Xylene, cellosolve, vinyl acetate, and VC samples were taken on organic vapor charcoal sampling tubes using Sipin pumps at approximately 50 cubic centimeters (cc) per minute. Humidity measurements were taken using a Bendix psychrometer.

Lead, chromate, antimony, and tin were analyzed by atomic absorption spectroscopy. Xylene, cellosolve, vinyl acetate, and VC were analyzed by gas chromatography.

Thirty-six workers were interviewed. Informed consent was obtained, and a directed medical questionnaire was administered by NIOSH personnel. These workers were randomly selected from a total work force of 100.

Pre- and post-shift physical examinations were performed on each worker by the NIOSH medical personnel, focusing mainly on the mucous membranes of the eyes, nose, and throat; chest auscultation and pulmonary function studies were also performed.

All personal breathing zone and general room samples collected for lead, chromate, antimony, and tin were collected on AA filters and analyzed by atomic absorption spectroscopy. All personal breathing zone and general room samples for xylene, cellosolve, vinyl acetate, and vinyl chloride were collected on organic vapor sampling tubes and analyzed by gas chromatography.

C. Criteria for Assessing Workroom Concentrations of Air Contaminants

The three sources of criteria used to assess workroom concentrations of air contaminants in this evaluation are: (1) Recommended and proposed threshold limit values (TLV's) and their supporting documentation as set forth by the American Conference of Governmental Industrial Hygienists (ACGIH) (1976); (2) Occupational Safety and Health Standards (29 CFR 1910.1000), U.S. Department of Labor, as of January 1, 1976; and (3) NIOSH recommended criteria for occupational exposures.

<u>Substance</u>	<u>Permissible Exposures 8-Hour Time-Weighted Exposure Basis (mg/M<sup>3</sup>)</u>		
	<u>1976 TLV's</u>	<u>NIOSH Criteria</u>	<u>OSHA Standard</u>
Lead . . . . .	0.15	<0.15	0.2*
Chromate (as CrO <sub>3</sub> ). . . . .	0.1	0.025	0.1
Antimony . . . . .	0.5	-	0.05
Tin . . . . .	2.0	-	2.0
Xylene . . . . .	435.0	435.0	435.0
Cellosolve (2-ethoxyethanol) . . .	370.0	-	540.0
Vinyl Acetate . . . . .	30.0	-	-
Vinyl Chloride . . . . .	**	**	1 ppm

mg/M<sup>3</sup> = approximate milligrams of substance per cubic meter of air.

C = ceiling value

\*=OSHA, DOL has proposed a reduction in the lead standard to 0.10 mg/M<sup>3</sup>.

\*\*= No safe exposure level has been described as required in Section 20 (a)(3) of the Occupational Safety and Health Act of 1970; therefore, any detectable level of vinyl chloride is unsafe. The Occupational Safety and Health Standard (29 CFR 1910.1000) as January 1, 1976, for vinyl chloride is one part per million averaged over any 8-hour period; at five parts per million averaged over any period not exceeding 15 minutes.

Occupational health standards are established at levels designed to protect individuals occupationally exposed to toxic substances on an 8-hour per day, 40-hour per week basis over a normal working lifetime.

#### D. Toxicology

##### Antimony

Exposure to this substance can result in irritation of skin, eczema, and other forms of dermatitis. Irritation of mucous membranes lining the mouth, nose, and throat can also occur. Acute exposure to antimony causes metallic taste, vomiting, colic, and diarrhea. Chronic exposure results in indigestion accompanied by loss of weight and of appetite. The symptomatology for exposure to antimony is similar to lead; however, sores in the mouth and sore throat help to distinguish antimony poisoning from that of lead.

##### Chromate

Chromic acid mist and chromate dusts are severe irritants of the nasopharynx, larynx, lungs and skin; they are known to cause ulcers of nasal septum. Chromium compounds, especially the hexavalent varieties, are associated with asthmatic bronchitis and an increased incidence of lung cancer in humans.

##### Tin

Exposure to dust or fumes of tin or tin oxide can cause the development of stannosis, a benign dust disease. Acute burns of skin and eyes can be caused by brief contact with butyl and dibutyl tin compounds. Itching is another main symptom of exposure to organic tin compounds.

##### Xylene

Xylene vapor is an irritant of the eyes, mucous membranes and skin. Gastrointestinal disturbances such as anorexia, nausea, vomiting, and abdominal pain, can also occur. Narcosis may occur at high concentrations.

### Cellosolve

Cellosolve is a solvent for industrial coatings and inks containing ethylene glycol monoethyl ether. It can be absorbed via the skin, lungs or gastrointestinal tract. Acute poisoning usually affects the central nervous system and the kidneys. Neurologic effects include headache, drowsiness, weakness, slurred speech, atoxic gait, tremor and blurred vision. Changes in personality are also noted in some cases. Chronic long-term exposure has been reported to cause an anemia, which resolves on cessation of exposure. Cellosolve is irritating to the skin and mucous membranes.

### Vinyl Acetate

This substance can cause eye and throat irritation. Continued contact with skin may result in severe irritation or blister formation of some persons. Studies of chronic exposure to vinyl acetate have not revealed any long-term effects.

### Vinyl Chloride

PVC is a white thermoplastic substance which has good mechanical and electrical properties and is highly resistant to chemicals. PVC is produced by the polymerization of VC gas in the presence of catalysts such as organic peroxide, persulphates and ozone. The properties of the PVC resin can be modified by the addition of plasticizers, stabilizers, filling agents and pigments. The PVC resin itself is not thought to be toxic; rather it is the unreacted vinyl chloride gas which is of concern. Vinyl chloride has been identified as a causative agent in the development of angiosarcoma, a rare and fatal form of liver cancer. The current OSHA standard for vinyl chloride has established the maximum permissible exposure to VC at 1 ppm time weighted average for any eight hour period. NIOSH recommends that no employee be exposed to measurable amounts of VC gas, since no safe level has been determined.

### Lead

Prolonged absorption of lead or its inorganic compounds from inhalation of vapor, fume or dust, as well as from oral ingestion can result in severe gastro-intestinal disturbances and anemia. With more serious intoxication, neuromuscular dysfunction may occur, and with severe exposure may result in encephalopathy. Presenting symptoms are often weakness, weight loss, lassitude insomnia, and hypertension. Usually associated with this, there is a disturbance of the gastro-intestinal tract, which includes constipation, anorexia, and abdominal pain described as colicky. The physical findings although occurring late usually consist of facial pallor, malnutrition, abdominal tenderness, and pallor of the eye grounds. The anemia associated with lead poisoning is of the hypochromic, microcytic type with basophilic stippling of the red cells being present. A lead line may appear on gingival tissues, and in severe cases of poisoning paralysis of the extensor muscles of the wrist, and less often of the ankles, can occur. Encephalopathy while common in children is unusual in adults.

Nephropathy can also result from prolonged exposure to lead or its inorganic compounds. These may be a progressive and irreversible loss of kidney function, with progressive azotemia, and occasionally hyperuricemia with or without gout. Lead is teratogenic in mammalian animals, so it is advised that exposure of women in the child bearing age to lead should be carefully monitored. Health information related to lead suggests that blood lead levels in individual workers should be kept at values less than 60 micrograms per 100 ml. It also should be noted that persons with anemia existing or sickle cell trait may be at increased risk from exposure to lead. At this present time NIOSH recommends the levels of 0 to 40 micrograms per 100 ml. to be in the normal range. The levels of 40 to 60 micrograms per 100 ml. in the increased absorption range and increasing levels above 60 micrograms per 100 ml. to be considered undesirable.

E. Environmental and Medical Evaluation Results

The environmental samples taken for lead, chromium, antimony, and tin were all below the laboratory detection limits of:

Lead . . . . .	2.0 micrograms per sample
Chromium. . . . .	1.0 micrograms per sample
Antimony . . . . .	4.0 micrograms per sample
Tin . . . . .	1.0 micrograms per sample

Xylene, cellosolve, vinyl acetate, and VC were all below the laboratory detection limits of 0.01 milligrams per sample. Tables were not prepared because all environmental samples were below these limits.

Humidity measurements were made using a Bendix psychrometer. The humidity was running approximately 37%. This is optimum humidity for comfort and is probably the reason why employees were not complaining as they had during the 1976 survey.

A total of 36 employees were studied during the medical portion of the survey. The age range of workers was 16 to 63 years, with a mean of 30 years and a median of 25 years. Seventy-five percent of the workers were female, and 25% were male; 72% were Indians; and 28% were non-Indian whites. Pre- and post-shift pulmonary function studies, physical examinations, and questionnaires were administered. Five workers who participated in the pre-shift testing did not present themselves for the post-shift testing, resulting in different group sizes. The workers were divided into smokers and non-smokers, and pre- and post-shift comparisons were made. There were no significant differences noted when comparing pre- and post-shift Forced Vital Capacity (FVC) and Forced Expiratory Volume in one second (FEV<sub>1</sub>) in any group (Tables I, II, III). Analysis of the Mean Maximum Expiratory Flow between 25% and 75% of FVC (MMF) showed a drop of 16.9% over the shift in one individual. The reason for this drop is uncertain. The worker's job and location did not differ from the remainder of the test group.

Results of the pre- and post-shift questionnaires can be seen in Table IV. There were no significant increases over the shift in symptomatology. In fact, most of the symptoms evaluated improved over the course of the shift. Most workers did not attribute their symptomatology to their work. Since the plant ventilation system changes had been instituted in April 1976, the workers interviewed stated that no further upper respiratory irritation problems have been experienced.

As seen in Table V, the only positive physical finding was nasal erythema. Statistical analysis revealed no significant difference ( $p < 0.05$ ) between pre- and post-shift physical examinations.

#### V. CONCLUSIONS

On the basis of environmental samples, pulmonary function studies, medical histories, and physical examinations performed at A & S Tribal Industries, no apparent health hazard was judged to exist during the time of this evaluation.

The interviewing process revealed general employee satisfaction with the ventilation and humidification changes that had been instituted in April 1976.

Each worker was notified of his or her pulmonary function study results. They were also advised to give a copy of these results to their personal physician and/or clinic to become part of their permanent records.

#### VI. RECOMMENDATIONS

1. Pre-employment and periodic health monitoring including pulmonary function studies, histories, and physical examinations, should be provided.
2. Personal hygiene of employees (showering, changing clothes) should be stressed as doing their part in making the work place a more healthy and comfortable environment.
3. Eating or smoking in the work area should not be permitted.
4. Respiratory and/or eye protection should be made available to these individuals that request it.

VII. REFERENCES

1. Kamburoff, and Weitowitz, Prediction of Spirometric Indices, British Journal of Diseases of the Chest, 1972.
2. Hamilton & Hardy, Industrial Toxicology, Publishing Science Group, Inc., 1974.

VIII. AUTHORSHIP & ACKNOWLEDGEMENT

Report Prepared By:

Bobby J. Gunter, PH.D.  
Regional Industrial Hygienist  
NIOSH - Region VIII - Denver

Bonnie Nelson  
Physician's Assistant  
Medical Section/HETAB  
NIOSH - Cincinnati, Ohio

Originating Office:

Jerome P. Flesch, Acting Chief  
Hazard Evaluation and Technical  
Assistance Branch  
Cincinnati, Ohio

Acknowledgements:

Robert Schutte, Medical Technician  
Medical Section/HETAB  
Cincinnati, Ohio

Eileen J. Philbin, R.N., M.P.H.  
Senior Nurse Officer  
Medical Section/HETAB  
Cincinnati, Ohio

TABLE I

A&S LOCAL INDUSTRIES  
January 10-12, 1977

## FORCED VITAL CAPACITY

SMOKERS					NON-SMOKERS				
PRE-SHIFT			POST-SHIFT		PRE-SHIFT			POST-SHIFT	
WORKER #	% PREDICTED	L	% PREDICTED	L	WORKER #	% PREDICTED	L	% PREDICTED	L
001	125	4.28			002	106	3.2		
003	120	4.8	117	4.7	009	108	4.12	92	3.5
004	117	4.15	112	4.0	013	91.8	3.4	85.1	3.15
005	123	5.05	117	4.8	014	85.7	3.0	97.4	3.41
006	108	4.55	109	4.6	015	112	4.8	110	4.75
007	125	4.9	120	4.7	020	80	4.9	79.5	4.85
008	124	4.7	121	4.6	022	111	4.5	104	4.25
010	122	4.72			023	135	5.2	135	5.2
011	117	4.05	122	4.2	024	102	4.4	106	4.6
012	122	3.95	111	3.6	025	115	3.35	115	3.35
016	106	5.56	106	5.56	029	108	4.05	94.0	3.5
017	108	5.45	107	5.4	032	103	2.95	107	3.05
018	120	4.95	122	5.05	033	103	2.75	99.2	2.63
019	101	3.6	97	3.46	035	104	3.9		
021	103	4.85	93.6	4.4	036	116	4.45		
026	116	3.75	114	3.7					
027	116	4.35	117	4.4					
028	110	6.6	115	6.85					
030	111	6.95	110	6.9					
031	114	6.5	107	3.05					
034	115	6.5	114	6.45					
Mean	115.3	4.96	112.1	4.75		105.3	3.93	102	3.85
Std. Dev.	7.3	.97	7.8	1.08		13.1	.78	14.6	.83

TABLE II

A&S - BAL INDUSTRIES  
January 10-12, 1977

## FORCED EXPIRATORY VOLUME IN ONE SECOND

SMOKERS					NON-SMOKERS				
PRE-SHIFT			POST-SHIFT		PRE-SHIFT			POST-SHIFT	
WORKER #	% PREDICTED	L	% PREDICTED	L	WORKER #	% PREDICTED	L	% PREDICTED	L
001	130	3.6			002	113	2.94		
003	123	4.2	120	4.1	009	115	3.75	101	3.3
004	120	3.6	111	3.95	013	94.5	2.95	91.3	2.85
005	133	4.68	127	4.45	014	86.5	2.5	98.6	2.85
006	125	4.5	123	4.45	015	117	4.3	117	4.3
007	137	4.55	122	4.05	020	80	4.05	80	4.05
008	123	4.0	118	3.85	022	120	4.2	114	4.0
010	133	4.3			023	135	4.35	135	4.35
011	119	3.4	128	3.65	024	114	3.65	117	3.75
012	129	3.4	118	3.1	025	121	2.8	119	2.75
016	105	4.65	108	4.8	029	110	3.45	105	3.3
017	120	4.5	122	4.6	032	111	2.45	118	2.6
018	114	4.05	117	4.15	033	102	2.1	94.6	1.94
019	99	3.05	103	3.2	035	113	3.62		
021	108	4.55	90.4	3.8	036	121	3.95		
026	118	3.2	119	3.22					
027	118	3.8	121	3.9					
028	100	5.15	109	5.6					
030	108	5.75	108	5.75					
031	119	5.9							
034	108	5.2	106	5.1					
MEAN	118.5	4.28	115.0	4.17		110.2	3.40	107.5	3.33
Std. Dev.	10.8	.789	9.6	.78		14.2	.73	15.2	.762

TABLE III

A&amp;S TRIBAL INDUSTRIES

January 10-12, 1977

## MAXIMAL MID-EXPIRATORY FLOW RATE

SMOKERS					NON-SMOKERS				
PRE-SHIFT			POST-SHIFT		PRE-SHIFT			POST-SHIFT	
WORKER #.	% PREDICTED	L	% PREDICTED	L	WORKER #	% PREDICTED	L	% PREDICTED	L
001	109	3.2			002	125	3.9		
003	118	4.2	110	3.9	009	117	4.1	117	4.1
004	118	3.9	97.5	3.2	013	89.5	3.0	92.5	3.1
005	164	6.0	151	5.5	014	78.6	2.4	88.5	2.7
006	151	5.6	140	5.2	015	114	4.25	126	4.7
007	105	3.6	108	3.7	020	66.6	3.8	68.4	3.9
008	102	3.6	92.3	3.25	022	106	4.0	110	4.15
010	150	5.3			023	118	4.0	121	4.1
011	119	3.7	129	4.0	024	103	3.3	100	3.2
012	136	3.85	148	4.2	025	94.9	2.45	91	2.35
016	98	4.9	94	4.7	029	98.5	3.4	95.6	3.3
017	85	4.1	97.9	4.7	032	110	2.55	119	2.75
018	86.4	3.2	93.2	3.45	033	63.6	1.49	51.7	2.95
019	101	3.5	107	3.7	035	114	4.2		
021	111	5.6	73.8	3.7	036	111	3.9		
026	114	3.45	119	3.6					
027	146	5.0	149	5.1					
028	68	3.9	75	4.3					
030	77.9	4.6	84.7	5.0					
031	114	6.5							
034	72.7	4.0	70.9	3.9					
Mean	111.7	4.36	107.7	4.17		100.6	3.38	98.39	3.44
Std. Dev.	26.5	.97	26.3	.70		18.7	.83	22.2	.73

TABLE IV

A&S TRIBAL INDUSTRIES  
January 10-12, 1977

## SYMPTOM COMPLAINTS

	PRE-SHIFT			POST-SHIFT		
	Positive	Negative	Percent "+"	Positive	Negative	Percent "+"
Sore Throat	9	27	25%	4	27	12%
Headaches	4	32	12%	1	30	3%
Eyes	2	34	6%	0	31	0%
Stuffy Nose	13	23	36%	12	19	38%
Nasal Irritation	4	32	12%	1	30	3%
Cough	5	31	14%	1	30	3%
Chest Tightness	0	36	0%	0	31	0%
Wheezing	1	35	3%	0	31	0%
Shortness of Breath	1	35	3%	1	30	3%

TABLE V

A&S TRIBAL INDUSTRIES  
January 10-12, 1977

PHYSICAL EXAMINATIONS

	PRE-SHIFT			POST-SHIFT		
	Positive	Negative	Percent"+"	Positive	Negative	Percent"+"
Nose	25	11	69%	24	7	77%
Throat	0	36	0%	0	31	0%
Lungs	0	36	0%	0	31	0%