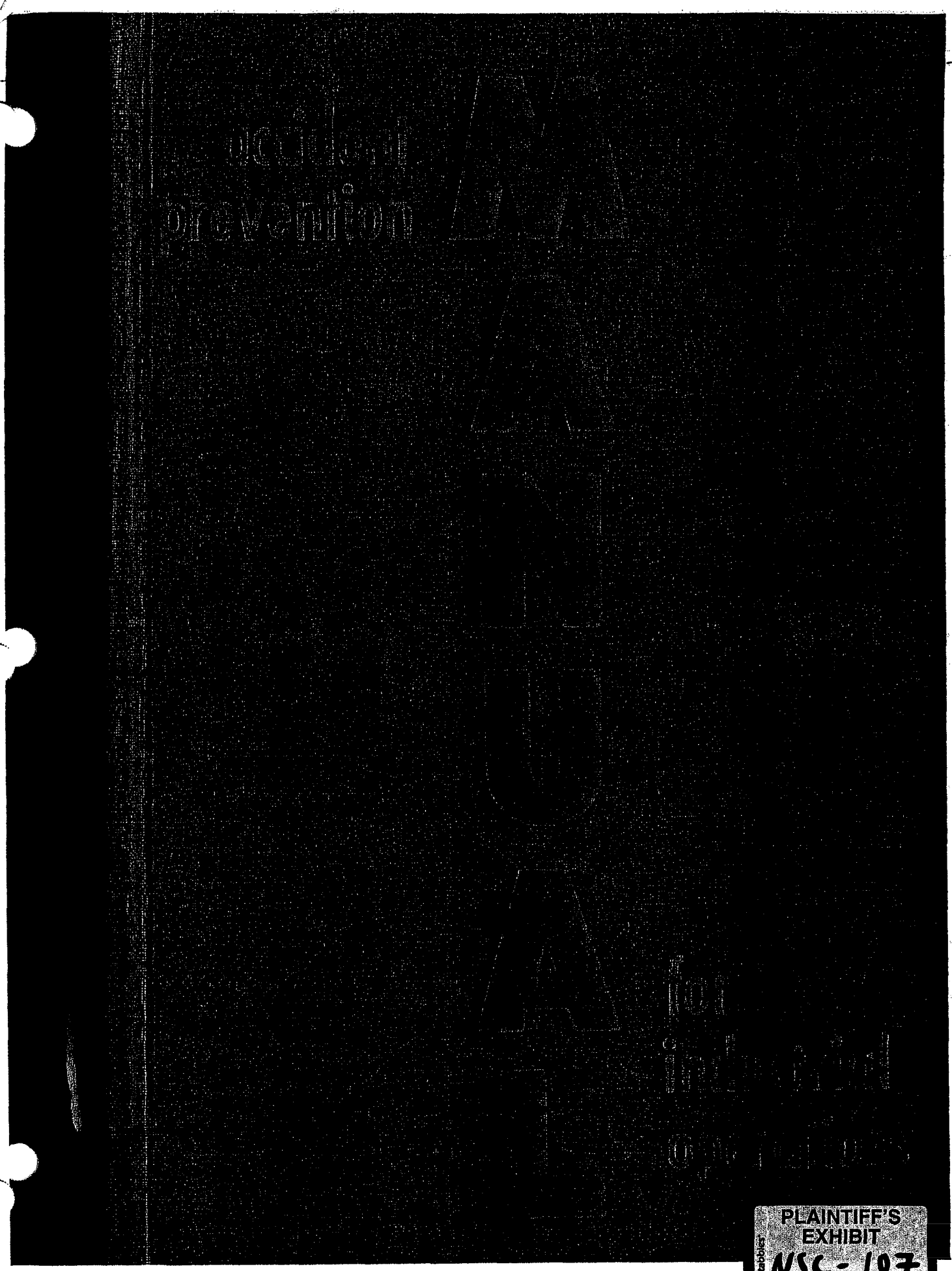
FILE NAME: National Safety Council (NSC)

DATE: 1951 Aug

DOC#: NSC119

DOCUMENT DESCRIPTION: NSC - Accident Prevention Manual for Industrial Operations



PLAINTIFF'S EXHIBIT
NSC-107

ACCIDENT • • PREVENTION

MANUAL *for* *INDUSTRIAL OPERATIONS* • •

This book was written by the staff of the National Safety Council, with the close collaboration of the Industrial Conference of the Council, particularly of its Manual Committee, under the chairmanship of William S. Smith, Director of Safety, Ford Motor Company. Appreciation is due the many consultants, especially the Executive Committees of the Council's Industrial Sections, who reviewed material pertinent to their own fields and whose advice contributed so much to the authority of the final result.

ENGINEERS of the Industrial Department of the Council prepared the major portion of the book. G. G. Grieve wrote Section 1, PERMANENT STRUCTURE AND PLANT LAYOUT; Robert L. Moore and George MacDonald Section 2, MAINTENANCE. Mr. MacDonald also wrote Section 15, ELECTRICAL HAZARDS.

William N. Davis prepared the three Sections, BOILERS, PRESSURE VESSELS AND REFRIGERATING EQUIPMENT; Arthur S. Kelly Sections 6 to 10, inclusive, on guarding machinery.

Lester W. Dutton wrote Sections 11 and 12 on materials handling; A. M. Baltzer, Section 13, HAND AND PORTABLE POWER TOOLS.

Floyd E. Frazier and Mr. Davis collaborated in the preparation of Section 14 on welding. Glenn F. Griffin and Mr. Frazier worked together on SAFETY ORGANIZATION AND TRAINING, Section 24.

Roy G. Benson is the author of the three sections on flammable liquids and fire, and of Section 26, THE SAFETY MAN'S RESOURCES.

E. P. Marconi prepared Section 19, PERSONAL PROTECTIVE EQUIPMENT; Floyd A. Van Atta Sections 21 through 23, INDUSTRIAL POISONS, MEDICAL SERVICES, and INDUSTRIAL HEALTH ENGINEERING.

H. Gene Miller, Director of the Statistical Division, is the author of the section on accident records; The Motor Transportation Bureau prepared Section 20, MOTOR TRANSPORTATION. Mrs. Mildred Grant of the National Safety Council Library did the alphabetical index.

Kent W. Francis, Editor, Industrial Department, supervised the organizing, editing and production of the book. He was assisted by Mrs. Russell Perry, Editor, and by Elizabeth Valovic, Administrative Assistant.

PRINTED IN THE UNITED STATES OF AMERICA
18M851

ACCIDENT . . . . PREVENTION

Manual

• SECOND EDITION

FOR
INDUSTRIAL
OPERATIONS

ACCIDENT • • PREVENTION

MANUAL, Second Edition, is another step in the National Safety Council's program for the development of technical material, a program which is continuous. Council staff and members have need, therefore, to keep abreast of new materials, new equipment, and new processes, and of hazards which may be involved in them.

In order that the eventual third edition may, at the time of its publication, represent the best in the field of safety engineering knowledge, comments and suggestions are requested of readers.

Substance	Flash point ° F.	Explosive limits % by volume		Auto-ignition temperature ° F.	Probable safe concentration for 8-hr. exposure	Usual mode of entrance to body	Signs and symptoms of poisoning
		Lower	Upper				
antimony (salts)	metal and sulfides flammable				0.1 mg/cu.m.[37]	inhalation of dust, ingestion	*Acute:* vomiting, colic, diarrhea, irritation of mouth and throat. *Chronic:* indigestion, loss of weight and appetite, sometimes severe dermatitis.
arsenic	...	...	...	...	0.15 mg/cu.m.[6]	inhalation of dust, ingestion and direct action on skin and mucous membrane	Irritation of skin, loss of hair and nails, perforation of nasal septum, hoarse voice, cough, neuralgic pains, diarrhea.
arsine	...	...	...	...	1 p.p.m.[5] 0.05 p.p.m.[37]	inhalation	Headache, nausea, vomiting, chills and shivering, jaundice, dark or bloody urine.
asbestos	nonflammable				5 million particles per cubic foot[7]	inhalation	*Chronic:* shortness of breath, asbestos corns.
barium (compounds)	peroxide, chlorate, and nitrate produce violent combustion in flammable materials				0.5 mg/cu.m.[37]	inhalation or ingestion of soluble salts, direct action on skin	Severe dermatitis from the caustic salts, vomiting, dyspnea, abdominal pain, cyanosis, paralysis.
benzene (benzol)	12	1.5	8	1000	100 p.p.m.[8] 50 p.p.m.[37]	inhalation	*Chronic:* weakness, fatigue, bleeding from the gums and nose, headache, dizziness. *Acute:* inebriation, convulsions, and loss of consciousness.
beryllium	...	...	...	...	2 micrograms/cu.m.[38]	inhalation	
bromine	...	...	...	...	1 p.p.m.[9]	inhalation direct attack on skin and mucous membranes	Irritation of eyes and respiratory tract, irritation and corrosion of skin, probable lung irritation in acute cases.

TABLE 21-F
CONVEYING VELOCITIES FOR INDUSTRIAL DUSTS

DUST				VELOCITIES—TEST			RECOMMENDED TRANSPORT VELOCITIES					
Description	Method of Production	Density	Median Size in.	Bounce	Roll	Clean	Alden[1]	Bull.[2] 217	Brandt[3] Table K	Brandt[3] Table 11	Witheridge[4]	Auth. Results
Aluminum chips	Grinding	2.72	.0132	3800	3000	2200	4000	4000	{3500 4500	5000	4500	4000
Asbestos	Saw	2.20	.0138	1800	1560	1500					3000	2000
Casein	Lathe & sanding	1.27	.0070	1370	1210	1270	3000					1600
Catalin	Lathe & sanding			1820	1250	1610	3000					2000
Foundry, nonferrous	Wheelabrator	3.02	.0046	2800	2340	1650	3500		4000	5000	3500	3100
Foundry, ferrous	Tumblers	2.52	.0092	1570	1430	1300	3500		4000	5000	{3500 4000	1800
Grain	Blast cabinet	1.41		2500	2400	1950	2000	2000		3000	2000	2800
Lead oxide	Mixer	8.26	.00058			3050						3400
Leather—shavings	Edge trimmer	1.34	.054	1880	1640	2380	3000			4000	3000	2700
Leather—sanding	Sanding	1.32	.021	1330	1270	1120	3000			4000	3000	1500
Limestone, coarse	Drilling	2.83	.0057	2410	1750	1530					3500	2700
Limestone, fine	Drilling	2.78	.0028	1420	1420	1720					3500	1600
Litho powder		1.94	.0048	610		1270						1400
Litho bronze		4.44	.0082	1570	1350	1620						1800
Metal (alum. & bronze)	Grinding	6.34	.0039	2730	2600	1560	3000	2200	{3500 4500	4000	3000	3100
Rosin	Hog		.020	3900	3900	1890						4000
Rubber	Grinding	1.14	.060	2000	1390	1800	2000	2000		3000	2000	2200
Starch		1.27	.0025	1300		2300						2600
Steel shot blasting	Blast cabinet	6.85	.0038	2500	2420	1900	3500		4500	4000		2800
Steel shot blasting	Blast cabinet	4.61	.0172	1500	1320	2180	3500		4500	4000		2400
Vinyl	Grinding	1.82	.0064	2020	1880	1390	3000					2300
Wood flour	Sanding		.012	1560	1390	1390	1500		3500		2000	1800
Wood hog dust	Hog		.023	3750	3300	1900	3500				3500	4000
Wood sawdust, heavy	Tumbling barrel		.055	2950	2220	1620	3000	2000	3500	4000	3000	3300
Wood sawdust, light	Table saw			2400	1730	2000	2000	2000	3500	3000	2000	2700
Wood shavings, hard wood	Planer			2150	2000	1770	3000	3000	3500	4000	3500	2400
Wood shavings, soft wood	Matcher			1590	1450	1550	3000	3000	3500	4000	3500	1800
Wood composition, chips	Hog	1.18	0.54	3900	3050	1560	3500					4000

[1] *Design of Industrial Exhaust Systems,* John L. Alden, Industrial Press, 1939.
[2] *The Determination and Control of Industrial Dust;* Public Health Bull. 217, J. J. Bloomfield & J. M. DallaValle, 1938.
[3] *Industrial Health Engineering,* Allen D. Brandt, John Wiley & Sons, Inc., 1947.
[4] *Air Sanitation and Industrial Ventilation,* W. N. Witheridge, 1945.

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much more common. Effects of antimony resemble those of arsenic primarily in the dermatitis, which may start as an inflammation of the hair follicles and progress through pus formation and sloughing to leave a contracted scar.

Arsenic, in the form of arsenic trioxide, is traditionally the most important of the poisonous materials used for criminal purposes. It is a profoundly irritating material which produces inflammation of the stomach and intestines, destroys the hemoglobin, and causes nervous collapse. However, cases of severe industrial poisoning are rare.

Men who handle the solid compounds of arsenic may suffer from a husky voice and cough, perforation of the nasal septum, ulceration of the skin, loss of hair and nails, warts and sometimes skin cancers which tend to follow a slow and not very malignant course. These troubles are all severe nuisances, but they are practically never fatal and seldom disabling.

Arsine. Severe and acute industrial poisonings with arsenic are likely to be the result of inhalation of *arsine,* produced accidentally when hydrogen has been generated in the presence of a material which contains arsenic. This gas has been reported in the acid cleaning of filter plates, in the handling of wet dross from a light metals plant, in the cleaning of tank cars which have held sulfuric and hydrochloric acids, in the cleaning of pipes with an acid contaminated with arsenic, in the precipitation of cadmium with metallic zinc, and in other circumstances as well.

Arsine rapidly destroys the red cells. After it has been inhaled, the first signs are those of lack of oxygen. After some time the body begins to excrete the damaged red cells which appear as a dark or bloody urine. The kidneys may then become too clogged to operate at all.

The possibility of arsine formation should always be considered when there is hydrogen formation around the active metals or around ores of the heavy metals, since arsenic is widely distributed in small amounts and only a trace of it is required to produce enough arsine to be troublesome.

Asbestos is a hydrated magnesium silicate found in the minerals chrysotile, amianthus, actinolite and tremolite. Practically all the commercial asbestos is either chrysotile or amianthus, and about 90 per cent of that used in this country is chrysotile. It is used almost exclusively for heat insulation or for textiles which must resist high temperature, such as heat resistant clothing and brake linings.

Inhalation of excessive quantities of asbestos fiber can produce a fibrosis in the lungs similar to that found in silicosis but somewhat milder and usually not so rapidly progressive. Like silicosis, the condition develops slowly and advances slowly and is equally resistant to treatment.

Prevention is essentially dust control. A maximum dust concentration of 5 million particles per cubic foot has been suggested, precisely as for pure free silica.

Barium. The soluble salts of barium are toxic when ingested, as well as highly caustic on the skin. There seems to be little toxic hazard in the inhalation of the dust of the less soluble salts.

Barium is a heavy metal, and the dust of the insoluble salts will collect in the lungs and give rise to the condition known as baritosis. Its nodular appearance on X-ray film may be mistaken for that of silicosis. Men showing the sign of baritosis are apparently not disabled or inconvenienced in any way.

Benzene is a colorless, flammable, volatile liquid with a rather pleasant aromatic odor. Its fire hazard is between that of ethyl alcohol and that of ether. *The greatest hazard is that of chronic poisoning by inhalation of comparatively small amounts over a long period of time. It is one of the two or three most dangerous organic solvents in commercial use.*

The action is primarily on the blood-forming organs, producing severe anemia, bleeding under the skin, and great reduction in the ability of the blood to clot.

The extent of chronic exposure to benzene may be determined qualitatively by measurement of the ratio of organic to inorganic sulfates in the blood. The most convenient measurement of damage is given by a blood count.

People who may be exposed to benzene vapor should have blood counts at regular intervals. Consistent change in the blood count should be closely investigated. Particularly significant changes are diminution in the total numbers of red cells, platelets or white cells.