

FILE NAME: Packings and Gaskets (PAG)

DATE: 1978

DOC#: PAG004

DOCUMENT DESCRIPTION: Report - Asbestos Exposure from Gasket Operations
- Naval Regional Medical Center

C/106-14
M. CRAWFORD

ASBESTOS EXPOSURE FROM GASKET OPERATIONS

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GASKET OPERATIONS

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TABLE OF CONTENTS CONT'D

PAGE NO.

C. Appendix

1.	Sampling data and material description	55
a.	Section I Storage	56
b.	Section II Hand Punching	57
c.	Section III Hand Operated Mechanical Punching	58
d.	Section IV Machine Punching	59
e.	Section V Hand Shaping	60
f.	Section VI Machine Shearing	61
g.	Section VII Machine Nibbling	62
h.	Section VIII Installation	63
i.	Section IX Removal and Concurrent Installation	64
j.	Section X Clean-Up Following Removal	65
k.	Section XI Removal with Simultaneous Clean-Up	66
l.	Section XII Miscellaneous and Multiple Operations	67

LIST OF TABLES

TABLE	PAGE NO.
I. Airborne asbestos levels during storage	7
II. Airborne asbestos levels during hand punching	15
III. Airborne asbestos levels during hand operated mechanical punching	18
IV. Airborne asbestos levels during machine gasket punching	21
V. Airborne asbestos levels during hand shaping	25
VI. Airborne asbestos levels during machine shearing	27
VII. Airborne asbestos levels during machine nibbling	30
VIII. Airborne asbestos levels during installation	33
IX. Airborne asbestos levels during concurrent gasket removal and installation	36
X. Airborne asbestos levels during removal of residual material after gasket removal	38
XI. Airborne asbestos levels during gasket removal and simultaneous clean-up	41
XII. Comparison of airborne asbestos fiber concentration in all evaluated phases of gasket operations	46

LIST OF FIGURES

FIGURE		PAGE NO.
1.	Asbestos containing gasket material stored for issue in individual rolled sheets	8
2.	Asbestos gaskets and packing stored in open bins	9
3.	Asbestos containing gaskets stored in open bins in sealed impermeable bags	10
4.	Asbestos containing gaskets stored in open bins in sealed impermeable bags and on open overhead storage racks	11
5.	Storage of asbestos gasket sheets on open rack	12
6.	Storage of gaskets in open bins	13
7.	Manufacture of gaskets by hand punching	16
8.	Hand operated mechanical punch used for gasket manufacture	19
9.	Unventilated machine for punching gaskets	22
10.	Ventilated and unventilated machines for gasket punching	23
11.	Machine shearing gasket material	28
12.	Machine nibbling gasket material	31
13.	An installed gasket	34
14.	Flange after gasket removal and before removal of residual gasket material	39

PROJECT DEFINITION

Asbestos, a fibrous mineral silicate which is a component in many gasket materials, is a documented health hazard causing cancer and a chronic lung disease known as asbestosis (reference (a)). Due to the unknown personnel exposures to asbestos during gasket use, the Naval Ships Engineering Center tasked the Naval Regional Medical Center (NRMC) Bremerton, WA via the Bureau of Medicine and Surgery (references (b) and (c)) to obtain additional data during all aspects of the life cycle of asbestos containing gaskets. Statistically significant data was requested so that reference (d) can be modified to include specific procedures for gasket handling, storing, marking, processing, installing, removal and disposal.

NRMC Bremerton was assigned the lead in the project with NRMC Oakland tasked to assist in data collection. The majority of the samples were collected by NRMC Bremerton at Puget Sound Naval Shipyard in various shops and aboard ship. The photographs in the report were provided by Puget Sound Naval Shipyard.

METHODS AND MATERIALS

AREAS SAMPLED:

All phases of asbestos gasket handling were evaluated by obtaining air samples in the breathing zone of workers. Samples were collected from the following operations: storage, hand gasket punching, hand operated mechanical punching, machine punching, hand shaping, machine searing, machine nibbling, installation, removal with concurrent installation, removal and hand scraping, removal and wire brushing, and clean-up following removal.

SAMPLING PROCEDURE:

Samples were collected using Bendix personal sampling pumps at an air flow rate of 2.0 liters per minute. A 37 mm, four piece (2 rings) filter cassette with 0.8 micrometer pore size mixed cellulose ester filter was used to collect the airborne asbestos fibers. Samples were collected with the face cap of the cassette removed and the filter facing downward. Sampling time ranged from a minimum of six minutes to a maximum of 132 minutes (Enclosure 1 is a copy of the complete sampling procedure). Environmental data collected in the field were recorded on a collection sheet (Enclosure 2). A total of 166 samples were collected covering each phase of gasket operations. The number of samples collected in each phase of operation was sufficient to meet the required number of samples for statistically valid air sampling data as requested by reference (b). The required number of samples needed for statistical analysis and comparison was determined by guidelines set forth in reference (e).

COUNTING PROCEDURE:

All personnel asbestos samples were counted using the phase contrast microscopy method (enclosure 3). Samples were counted by workers at NRMCM Bremerton, the Navy Environmental Health Center (NAVENVIRHLTHCEN), and the Environmental Health Science Laboratory, Richland, WA, who actively participate in the National Institute of Occupational Safety and Health (NIOSH) Proficiency Analytical Testing Program.

CALCULATIONS:

Airborne asbestos fiber concentrations are computed using the following formula:

$$\text{Concentration} = \frac{(\text{average fiber count}) (\text{filter area})}{(\text{field area}) (\text{sample volume}) (1000 \text{ cc/l})}$$

For example, assume an average fiber count of 1.2 fibers/field, 30 minute sampling time at 2 liters per minute (lpm), and field area of 0.00469 mm².

$$\begin{aligned} \text{Concentration} &= \frac{(1.2 \text{ fibers/field}) (855 \text{ mm}^2)}{(0.00469 \text{ mm}^2/\text{field}) (60 \text{ l}) (1000 \text{ cc/l})} \\ &= 3.65 \text{ fibers/cc} \end{aligned}$$

Results are reported to the nearest 0.01 fibers/cc. Negative results are not reported as zero, but as less than the lower detectable limit of one fiber in 100 fields. Thus, a 30 liter (l) sample has a different lower detectable limit than a 10 liter sample. For example:

In a 10 l sample:

$$\begin{aligned} \text{Concentration} &= \frac{(< 0.01 \text{ fiber/field}) (855 \text{ mm}^2)}{(0.00469 \text{ mm}^2/\text{field}) (10 \text{ l}) (1000 \text{ cc/l})} \\ &= < 0.18 \text{ fibers/cc} \end{aligned}$$

In a 30 l sample:

$$\begin{aligned} \text{Concentration} &= \frac{(< 0.01 \text{ fiber/field}) (855 \text{ mm}^2)}{(0.00469 \text{ mm}^2/\text{field}) (30 \text{ l}) (1000 \text{ cc/l})} \\ &= < 0.06 \text{ fibers/cc} \end{aligned}$$

The lower detectable limit is due only to sample size and therefore to length of the operation being evaluated.

CONTROL DEFINITIONS:

Various types of asbestos gasket materials were used during the survey. Types of material used for each operation can be found in Appendix I. Controls for the various operations were defined and characterized under the following definitions:

None - no specific controls were used, i.e., no wetting, enclosing, or ventilation.

Housekeeping - high efficiency vacuum cleaners (Portvacs) used to clean areas (reference (f)); waste material placed in sealed containers; area kept clean and free of debris accumulation; stored material sealed in impermeable polyethylene bags.

Ventilation - Filtered local exhaust ventilation provided to operation.

ASBESTOS FIBER EXPOSURE STANDARDS

The current maximum allowable exposure to asbestos as stated by references (d), (g), (h) is 2.0 fibers greater than five micrometers (μ) per cubic centimeter of air (2.0 fibers/cc) for an eight hour day with a ceiling limit of 10.0 fibers/cc for any 15 minute period. The 2.0 fiber/cc level is a time weighted average (TWA) allowable exposure and is the current exposure limit. The Department of Labor Occupational Safety and Health Administration (OSHA) has proposed a standard of 0.5 fibers/cc with a ceiling limit of 5.0 fibers/cc (reference (i)). The National Institute of Occupational Safety and Health (NIOSH) has recommended a limit of 0.1 fibers/cc with a ceiling limit of 0.5 fibers/cc (reference (a)). The Navy Environmental Health Center (NAVENVIRHLTHCEN) has been designated as the central management point for the Navy-wide Asbestos Medical Surveillance Program. NAVENVIRHLTHCEN states they will begin medical surveillance of all personnel potentially exposed to a level of 0.1 fibers/cc (reference (j)). Reference (g) does not specify the level at which medical monitoring should begin.

Results of the current study are based on actual exposure time during sampling, rather than a time weighted average. Jobs involving asbestos gaskets are usually of short duration and are done on an intermittent basis. Therefore, conversion of actual exposure time values to TWA values is not applicable.

SECTION I

STORAGE

STORAGE

Storage of asbestos gasket materials is generally handled as a supply function. Material is typically received in two forms, sheets and precut gaskets. Asbestos sheet material is stored in either flat sheet form or rolled into bundles (Figure 1). Sheet material is typically stored in open air areas and is either wrapped in polyethylene film (may be color coded for asbestos handling) or unwrapped. Precut gaskets and gasket packing materials are stored in exposed open fronted storage bins and are either wrapped or unwrapped (Figures 2 and 3). Some precut gaskets are stored on exposed hanging pegs (Figure 4); these gaskets are not covered. Inspection of Table I shows an average fiber concentration of 0.02 fibers > 5 μ /cc of air was found in supply storage areas.

Asbestos material stored for use outside of main supply storage areas is in open fronted bins or shelves (Figures 5 and 6). An average fiber concentration of 0.04 fibers > 5 μ /cc air was obtained (Table I).

These data indicate that the manner of storage for asbestos gasket material is irrelevant when airborne fiber concentrations are considered. The various methods of storage examined showed fiber concentrations well below the currently used standard of 2.0 fibers/cc air, the Department of Labor proposed level of 0.5 fibers/cc air, and the point of initiation of medical monitoring of 0.1 fibers/cc air.

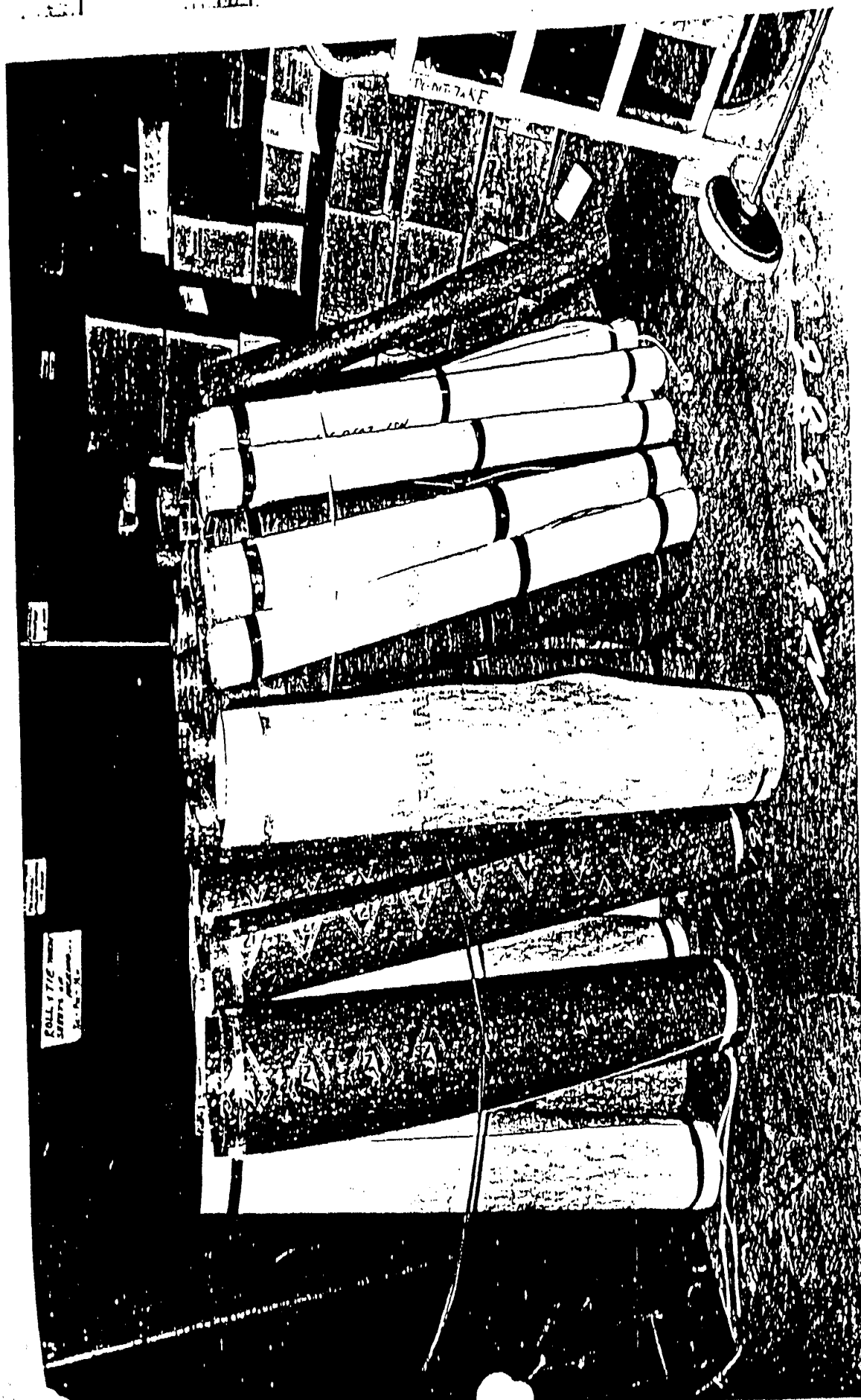
(Individual sampling data listed in Appendix 1).

TABLE I Airborne Asbestos Levels During Storage

<u>Operation</u>	<u>Controls</u>	<u>Breathing Zone Dust Conc.</u> <u>(fibers > 5 μ/cc air)</u>		<u>No of</u> <u>Samples</u>
		<u>Range</u>	<u>Ave.</u>	
Storage for receipt and issue	housekeeping	< 0.01-0.05	0.02	14
Storage for use	none	< 0.01-0.12	0.04	7

FIGURE 1

ASBESTOS CONTAINING GASKET MATERIAL STORED FOR ISSUE
IN INDIVIDUAL ROLLED SHEETS



COLLAPSED
SHEETS OF
PAPER

FIGURE 2

ASBESTOS GASKETS AND PACKING STORED IN OPEN BINS



FIGURE 3

ASBESTOS CONTAINING GASKETS STORED IN OPEN BINS
IN SEALED IMPERMEABLE BAGS

9C-4730-S02-7706
1 1/2" S-2-14 BRANCH-Fire

14730-S02-7707
1 1/2" S-2-14 BRANCH-Fire

34

35

5330-S04-0064
1" LPN GASK. 1/8" ASB.

5330-S04-0065
1 1/4" LPN-GASK. 1/8" ASB.

5330-S04-0066
1 1/2" LPN-GASK. 1/8" ASB.

5330-S04-0067
2" LPN. GASK. 1/8" ASB.

5330-S04-0244
4" GASK. LPN.-ASB.
1/2" THK.

5330-S04-0245
5" GASK. LPN.-ASB.
1/2" THK.

58

59

FIGURE 4

ASBESTOS CONTAINING GASKETS STORED IN OPEN BINS IN
SEALED IMPERMEABLE BAGS AND ON OPEN OVERHEAD STORAGE RACKS

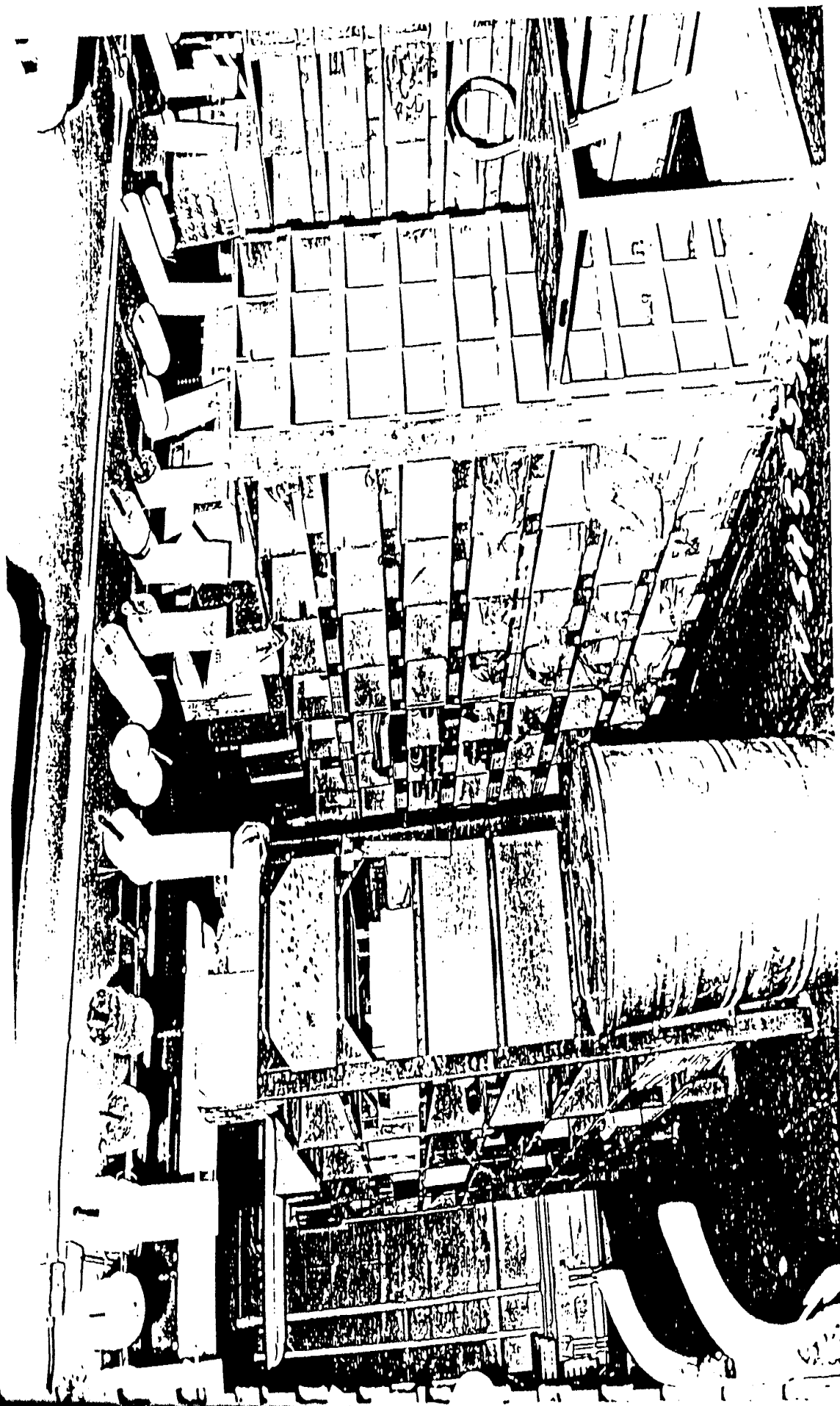


FIGURE 5

STORAGE OF ASBESTOS GASKET SHEETS ON OPEN RACK

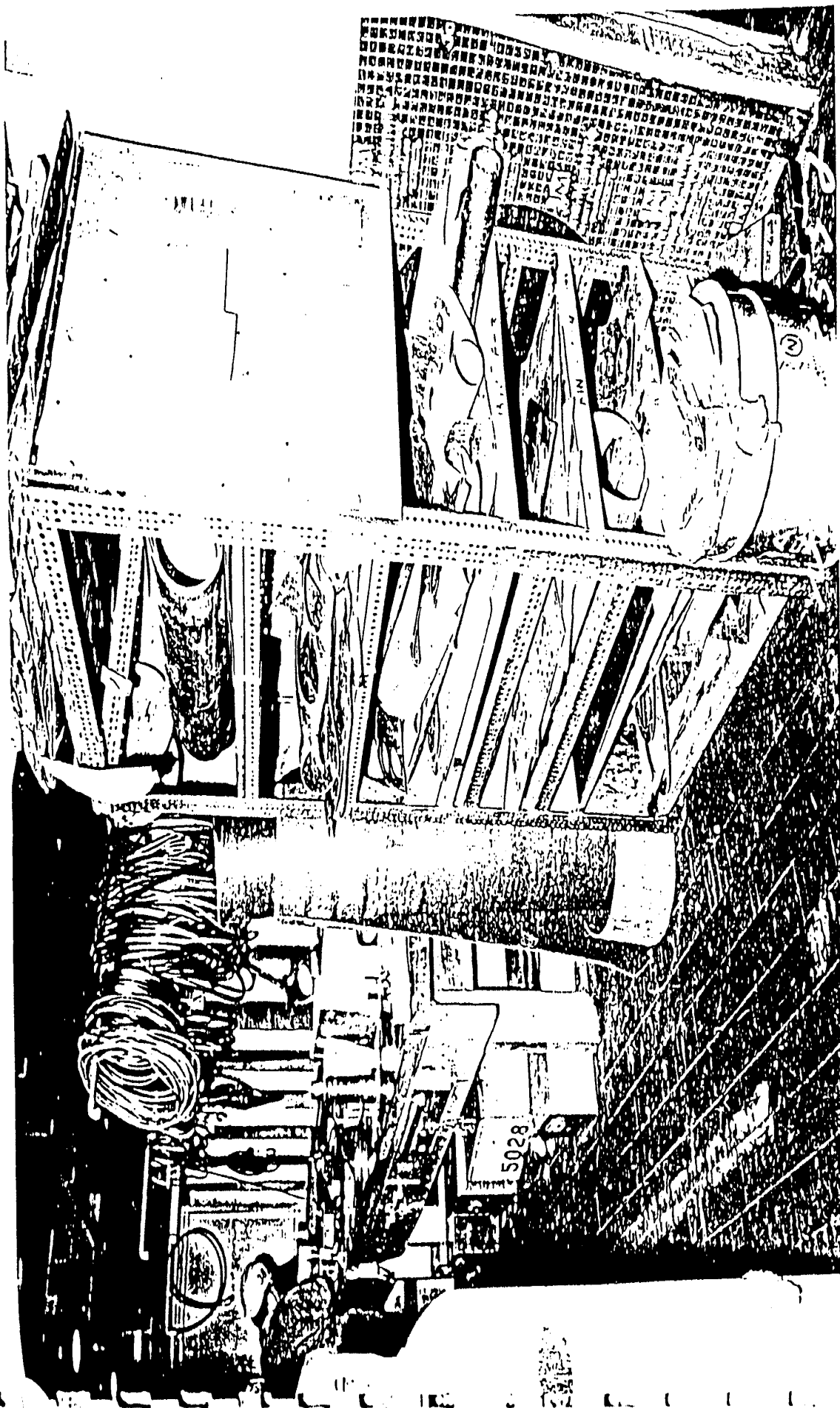


FIGURE 6
STORAGE OF GASKETS IN OPEN BINS

