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FIBROUS GLASS DUST

AND

INDUSTRIAL HYGIENE SURVEY

GENERAL ELECTRIC APPLIANCE PARK
Louisville, Kentucky

SURVEY CONDUCTED BY:

Donald Marano
Kenneth Wallingford
Ralph Zumwalde

REPORT PREPARED BY:

Ralph Zumwalde

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Environmental Investigations Branch
Division of Field Studies and Clinical Investigations
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

PLACE VISITED	:	General Electric Appliance Park Louisville, Kentucky
DATE OF TRIP	:	November 8-9, 1972
PERSONS MAKING TRIP:		Donald Marano Kenneth Wallingford Ralph Zumwalde
PURPOSE OF TRIP	:	To perform an industrial hygiene survey and evaluate fibrous glass and other potential worker exposures.
PERSONS CONTACTED	:	Mr. K.G. Cassady, *I.U.E. Local 761, President* Mr. M.F. Clay, *Facilities Industrial Hygienist* Mr. T. Fowler, *Union Relations Specialist, Building #6* Mr. I.G. Barrickman, *Safety Engineer, Building #6* Mr. D. Alberstadt, *Union Relations Specialist, Building #2* Mr. J. Ruffra, *Safety Engineer, Building #2* Mr. M. Reid, *Union Relations Specialist, Building #3* Mr. Nolan, *Shop Steward, Building #3*

INTRODUCTION

During the two days of November 8 and 9, 1972, a fibrous glass and industrial hygiene survey was conducted by Donald Marano, Kenneth Wallingford and Ralph Zumwalde, at the General Electric Appliance Park, Louisville, Kentucky.

During the two days, nine personal samples were taken for evaluation of asbestos, fibrous glass and free silica exposures. Sound level and ventilation measurements were also taken in appropriate areas. The following paragraphs describe the operations which were sampled, along with sample results and recommendations for improvements.

DESCRIPTION OF THE PLANT AND MEDICAL PROGRAM

The Appliance Park is located a few miles southeast of Louisville, Kentucky. The total acreage of the plant site is approximately 1000 acres. There are six production facilities, a warehouse, power plant, research facility and a few small miscellaneous facilities. (Figure 1) Each of the six production facilities produces a separate product and each is set up as a complete entity. The first of the six production operations started in 1952 with the last operation starting in 1958.

The total labor force is approximately 20,000 people, 15,000 of which are blue collar workers. Most of the operations in the plant are on a 24 hour per day, three shift basis. The products made in the six production facilities are as follows:

Building #1	-	Washers and dryers
Building #2	-	Ranges
Building #3	-	Dish washers and disposals
Building #4	-	Refrigerator components
Building #5	-	Refrigerators
Building #6	-	Air conditioners (room models)

The company has in-plant medical facilities in each of the six production buildings. Three part-time doctors (on a rotating call basis) and two full-time doctors cover the six buildings. There is also a registered nurse in each building during all three shifts. Each medical facility is equipped to do minor surgery if necessary.

Medical examinations are given to each new employee and to every employee who has missed 10 working days because of illness. Pre-employment examinations consist of an x-ray (14" x 17"), urinalysis, pulmonary function, selective audiometry and a physical examination.

All industrial hygiene responsibilities are handled by Mr. M. F. Clay. In each production facility there is a Safety Engineer who consults with Mr. Clay on hygiene matters. When a potential occupational or environmental health hazard exists, an evaluation is performed by Mr. Clay and analyzed by the Appliance Park's Research and Design Laboratory. This laboratory also does the quality control and research development for the six production facilities.

PERSONAL PROTECTION AND SAFETY PROGRAM

The safety program at the Appliance Park is operated through a union-management safety committee. In each production facility there is at least one plant safety engineer and one shop stewart on the committee.

Personal protection includes the use of safety glasses, hearing protection and respirators in appropriate areas. Both the union and management seem to be very conscientious in enforcing these policies.

DESCRIPTION OF SAMPLED PROCESSES

A walk through survey was conducted in three of the production facilities in which fibrous glass was being used (Buildings #2, 3, and 6). In all three facilities the type of fibrous glass and its use differed. Because of time and limited sampling equipment, industrial hygiene evaluations were made in only two of the three facilities.

During this walk through survey several potential health hazard areas were noted as follows:

Building #2

* * 1. Fibrous glass exposure (skin and respiratory) during handling of fibrous glass insulation.
* * 2. Fibrous glass exposure (skin and respiratory) during cutting and stripping of fiberglass insulated wire.
* * 3. Asbestos exposure (respiratory) during cutting and stripping of asbestos insulated wire.
* * 4. Fibrous glass exposure (skin and respiratory) during terminal splicing operation.

Building #3

1. Fibrous glass exposure (skin and respiratory) during handling of fiberglass insulation.
2. Petroleum naphtha exposure (skin and respiratory) during application of the glue onto the insulation.

Building #6

* * 1. Fibrous glass exposure (skin and respiratory) in the deflashing room.
* 2. Styrene exposure (respiratory) around the molding areas.
* * 3. Silica exposure in the deflashing room and molding area.
* 4. Freon (TMC) exposure in the pump room (degreasing operation).
* * 5. High noise exposure near molding area and in the deflashing room.

* *Samples were taken in the specified areas; however, work practice recommendations are made for all areas.*

The following is a detailed description of the areas and operations that were sampled.

Building #2

In Building #2, where ranges were being assembled, three operations were evaluated with two of the three being sampled. One of the two operations was a wire cutter and stripper machine. In this operation, the wire is unwound from spools and cut into known lengths. From both ends of the precut wires, a portion of the insulation was stripped. The wire insulation consists of either a twisted fibrous glass or a combination of fibrous glass and asbestos. Every spool of wire containing asbestos was labeled informing the purchaser of the asbestos content. There was no local exhaust at the machine and all spools of wire were stored in an adjacent area on designated open shelves.

The other operation which was evaluated and sampled was a splicing process. At this operation, the employee takes the pre-cut wires and trims the ends and fastens them on a terminal clip. Small vacuum cleaner-like exhausts are available at each work site. The use of the vacuum cleaner is left to the discretion of the employee. There were approximately six of these splicing machines located in a 10' x 20' area. This area was adjacent and upstairs from the cutting and stripping operation previously described.

Another area of possible concern, which was observed but not sampled, was the installation of pre-cut fibrous glass used as insulation. At a prescribed station along the assembly line, a few employees take the pre-cut insulation and clip it on the sides of the ranges. All insulation that is used in this operation contains a binder agent (phenol-formaldehyde) and is received at the plant in the completely cured state (Attachment III).

Building #3

A walk through survey was conducted in building #3 where pre-cut sheets of fibrous glass insulation are glued to the sides of dish-washers. Unlike the insulation process in Building #2, where clips are used for securing the insulation in place, a petroleum naphtha glue is brushed on the sides of the dishwashers for retention. Previous to this time the glue was sprayed onto the insulation instead of brushing it on the sides of the dishwashers.

Building #6

In Building #6, a partially polymerized styrene monomer reinforced with fibrous glass is molded to use as the outer castings for room air conditioners. The composition of the material is 35% resin (40% of which is styrene), 15% glass, 1% organic peroxide (catalyst), 1% pigment and the remainder being filler (aluminum hydrate, zinc and polyutherene powder). The partially polymerized styrene monomer is received in sheets of approximately 12" x 15" and has a dough like consistancy. These sheets are trimmed until they reach a prescribed weight. The sheets are then placed between a two-faced mold where an initial pressure of 500 pounds per square inch is exerted at a temperature of 300°F. After the initial pressure, a constant 20 pounds per square inch pressure is maintained at a 300°F temperature for five minutes. The molded parts are then taken off and placed on an overhead conveyor. The molded parts, which are now a polystyrene plastic are eventually conveyed to a deflashing room. Before the castings enter this room they are taken off the conveyor and placed on a multiple drill. Once drilled, the castings are put back on the conveyor and carried into the deflashing room.

The deflashing room (Figure 2) is approximately 30 feet adjacent to the molding area and enclosed on four sides with two large openings at either end. The overhead conveyor enters at one end of the room, circles the room and carries the finished castings from the area.

Those castings which need a rough deflashing are either glass blasted or placed into a machine known as a "Wheelabrator". The glass blasting operation is handled in a completely enclosed chamber 5' x 4' x 3' with a viewing window and protective hand inserts. In this chamber the castings are bombarded with glass spheres of 175 microns in diameter until most of the large flashing material is knocked off. The "Wheelabrator" accomplishes the same end but on a larger scale. The castings are fed into this machine and the rough flashings are knocked off by bombardment with walnut shell fractions (approximarely 1/16" diameters). Once the castings have undergone a rough deflashing, they are inspected and a final deflashing is done with small hand grinders. The finished castings are then put back on the conveyor and carried out of the deflashing room.

Another area in Building #6 that was evaluated was an operation in which the internal mechanisms of the air conditioners were degreased and assembled. (Figure 3) The operation of concern is a degreasing chamber in which the parts pass through a spray of Freon (TMC). Because of the low tolerance work performed, the room was humidity and temperature controlled (72°F, 28% relative humidity).

SAMPLING, EVALUATION PROCEDURES AND RESULTS

Samples were collected in this plant for evaluating exposures to fibrous glass dust, silica dust, asbestos, and noise. Ventilation measurements also were conducted. The following paragraphs describe the sample collection and evaluation methods used.

Asbestos, Fibrous Glass and Silica

Airborne personal samples were collected at the wire cutting and stripping operation and the terminal splicing operation in Building #2 for the evaluation of asbestos and fibrous glass exposure, and for fibrous glass and free silica at the deflashing operations in Building #6.

For asbestos, the samples were collected on a 37mm diameter Millipore Type AA cellulose ester membrane filter at a calibrated collection rate of 2.0 liters per minute. The samples were analyzed by phase contrast microscopy at 430X magnification. For determining an asbestos exposure all fibers greater than 5 microns in length were counted using a calibrated "Porton" recticle. This method of evaluation is recommended by NIOSH for asbestos.[1] A further evaluation was performed to determine the percent of asbestos in the air samples. This evaluation was made using a "Leitz" polarized microscope with a rotating stage and a magnification of 400X.[2] Chrysotile asbestos can be identified by this method as chrysotile shows parallel extinction with crossed polars and glass fibers show no extinction.

No asbestos was found in the samples so evaluated.

For the fibrous glass, samples were evaluated for total fiber count and total weight. Samples were collected on a 37mm diameter AA Millipore filter at a calibrated flow rate of 2.0 liters per minute. All fibers $\leq$ 10 microns in diameter (respirable) were counted at 430X magnification by phase contrast microscopy. Method of evaluation was the same as that used for asbestos.

Personal samples for total dust weight were collected simultaneously with those samples used for fibrous glass counts. The samples were collected on MSA polyvinyl chloride membrane filters with a flow rate of 2.0 liters per minute. The samples were tared and re-weighed on the 20 milligram "A" scale of a Cahn Gram Electrobalance. Total dust concentrations are reported in milligrams per cubic meter of air.

The fibrous glass and total dust concentration results are presented in Table 1. All personal samples that were collected at the deflashing operation for total dust also were evaluated for free silica. Some of the filters were analyzed using the colormetric method of Talvitie[3] while the others were analyzed using x-ray diffraction[4]. Both the x-ray diffraction and the Talvitie methods were used to analyze settled dust samples collected in the molding and deflashing areas.

No free silica was detected in the samples. The limit of detection for both techniques with these samples is approximately 3% by weight.

Noise

In addition to air sampling, noise level measurements were made in the molding and deflashing areas. At each location three readings were taken to provide some indications of the frequency distribution of the noise. A General Radio Type 1565-A sound level meter calibrated with a Type 1562-A calibrator was used for all measurements. The meter response was set on the slow position and measurements made on the "A", "B", and "C" weighing networks[4]. The results of this monitoring are presented in Table 2.

Ventilation Measurements

Ventilation measurements were confined to the operational area of the deflashing room and the degreasing (pump) room. The location of these measurements are shown schematically in Figures 2 and 3. There were no detectable negative pressures inside any of the three surveyed buildings. The degreasing room of Building #6 is maintained at a positive pressure to initiate the air movement through the degreasing chamber.

Measurements taken in the deflashing room were limited to the four (4) work tables. Each work table is approximately 5' x 3' with a short back wall and a partial hood. At the back and the middle of each table there is a 2" diameter local exhaust intake located 4" from the surface of the table. These ventilation systems are vented to individual dust collectors known as a "Tornado". The "Tornado" is essentially a bag type collector with its discharged air vented back into the room. The recorded face velocities of the four work tables can be found in Table 3.

On both of the two "Wheelabrator" machines one wet scrubber is used as a collector. The scrubber is an American Air Filter, "Roto Clone" type "N". The sludge from the collector is deposited into a small hopper and discarded with the same waste collected in the "Tornado" and the waste which is swept up off the floor. There is no recycling of scrap material. General air movement in the room is provided by a propellor fan located in the roof.

Ventilation measurements also were taken in the degreasing (pump) room. Face velocity measurements were made at the opening of the degreasing chamber and at the exhaust of the chamber. Location of measurements are illustrated in Figure 3. Air movement through the chamber resulted from a constant positive pressure maintained in the degreasing room. Some measurements were attempted along the opening of the chamber but no reading could be obtained. The opening into the chamber was approximately 3' x 6'. A measurement also was made at the exhaust of the chamber which was being vented into the adjoining room. The opening of the exhaust was approximately 9" x 12". The air velocity at the exhaust had a face velocity of 180 to 220 fpm. Measurements at the exhaust were taken both with the degreasing room door open and closed. Under both conditions there was no visible change in the air flow measurement, indicating that a constant static pressure was maintained in the room. Knowing the air flow and the size of the opening at the exhaust the predicted intake velocity at the opening of the chamber was calculated and found to be approximately 8-10 fpm. This low velocity would account for the inability to obtain a measurement.

CONCLUSIONS AND RECOMMENDATIONS

Fibrous Glass Exposure

Deflashing Room, Cutting and Stripping and Splicing Operations:

Although no meaningful standard for fibrous glass exposure has yet been established, levels found in this plant would appear to be low based on both fiber counts and total dust concentrations. The low airborne fiber levels can best be explained when fiber sizes are considered. The typical fiber diameter in the deflashing room was between 9 and 11 microns. Since the criteria for a fiber is ≥3:1 aspect ratio the smallest fiber length would be 27 microns. Based on these large sizes, one would expect that most of these fibers would settle rapidly and therefore not be airborne for any appreciable length of time. It is not entirely known at this time what the size range is for a respirable fiber, but the main consensus is that the fiber diameter must be ≤10 microns. Since these large fibers do tend to be irritating to the skin and mucous membranes, protective apparel should be available to those exposed employees.

Like the exposure in the deflashing room the fibrous glass at both the cutting and terminal splicing operations were very low. The only difference being that the typical fiber diameter was approximately 7 microns. Even though the counts were very low the fact that the diameters were <10 microns makes them potentially respirable. Again, fibers with these diameters will possibly cause skin irritations. Steps should be taken to reduce the discomfort as much as possible.

Noise

Deflashing and Molding Areas:

From the results of the noise survey, two areas apparently exceeded the 90 dBA standard. These two areas, multiple drill and hand grinding, had peaks of 91 dBA. Even though these were peak values, the consistency of this sound level should warrant some type of hearing protection for those exposed. When comparing the "A" and "C" scale measurements in Table 2, it is noted that all "C" scale readings are higher, indicating a prevalence of low frequency noises probably below 600HZ[5].

In Attachment I a list of proposed improvements, for the installation of new equipment in the deflashing room, has been compiled by both the union and management. Since the greatest single source of noise in that room is caused by the "Tornado" bag collectors, the new addition of worktables with enclosed collectors should eliminate most of this noise. It would be advisable to recheck the sound levels after the improvements have been made.

Ventilation

Degreasing Room:

The results of the ventilation measurements on the degreasing chamber indicates an inefficient flow rate of 8-10 fpm at the hood opening. It is recommended that a minimum velocity of 50 fpm be maintained in order to keep the vapors from escaping. Since Freon 113 has a molecular weight 4 to 5 times greater than that of air it would be advisable to vent the vapors from a lower position in the chamber. In doing so a fan should be installed in the exhaust so as to maintain the necessary velocity at the hood opening.

As a matter of good practice, the vapors from the chamber should not be exhausted into nearby work areas. The present arrangement has the vapors being vented into the next room; this problem can be easily remedied by extending the duct work to the ceiling and into the overhead exhaust. These suggestions are illustrated in Figure 2.

Although the toxicity of Freon is not entirely known, recent experiments with 1,1,2-Trichloro, 1,2,2-Trifluoroethane (Freon 113) indicate no adverse effects, except mild throat irritations. These have been noted with prolonged human exposures (six hours, 5 days a week) at concentrations of 500 to 1,000 ppm. There has been found no decrements in performance of complex mental tasks and no abnormal findings revealed by physical examinations, laboratory tests or clinical observations. There is no indication of significant deterioration of psychomotor performance until concentrations exceed 2,500 ppm[6]. Present Appliance Park sampling indicates concentrations of 50 ppm; nevertheless, it would be adivsable to take more samples and check for leaks around the periphery of the chamber.

Deflashing Room:

The ventilation hoods at the present worktables are extremely inefficient. Even though the face velocities ranged from 1200 to 7000 fpm the actual capturing velocity at the work site was only a small fraction of this. It is noted that this is one of the items listed in Appliance Park's proposed changes (Attachment I). The installation of new downdraft worktables (illustrated in Attachment II) should eliminate most of the dust problems.

Styrene Exposure

Molding Area:

Periodic samples should be taken around the molding operation to check the styrene concentration. Since the styrene monomer is only partially polymerized upon arrival, styrene vapors will be given off during the high temperature molding operation. If concentrations should exceed 100 ppm (TLV standard) local ventilation should be employed immediately. Not only is the inhalation of styrene vapors potentially hazardous but the continuous handling of styrene may cause dry, scaley, and fissured dermatitis. It would be advisable that all employees who handle the styrene monomer wear protective gloves or other apparel to prevent skin contact.[7]

Because the styrene monomer is only partially polymerized when received, often inhibitors such as hydroquinone and parabutylcatechol are added to prevent polymerization during shipment. These two inhibitors are both potentially allergic sensitizers.[8]

Petroleum Naphtha Exposure

Building #3:

The application of petroleum naphtha as an adhesive for fiber glass insulation can possibly be very irritating to skin, conjunctiva, and mucous membranes of the upper respiratory tract.[7]

Certain petroleum naphthas do contain varying amounts of benzene which has been found to be a known carcinogen. Even though benzene has been eliminated from most of the petroleum naphtha products, it would be advisable that the chemical content of the adhesive be checked.

REFERENCES

1 Edwards, G.H. and J.R. Lynch."The Method Used by the Public Health Service for Enumeration of Asbestos Dust on Membrane Filters" Ann. Occup. Hyg., Vol. 11, pp.1-6, 1968

2 McCrone, Walter C., "The Particle Atlas" Ann Arbor Science Publishers Inc., 1967

3 Talvitie, N.A. "Determination of Free Silica: Gravemetric and Spectrophotometric Procedures Applicable to Airborne and Settled Dust." American Industrial Hygiene Association Journal 25:196, 1964

4 Talvitie, N.A. and L.W. Brewer. "X-ray Diffraction Analysis of Industrial Dust." American Industrial Hygiene Association Journal 23:214, 1962

5 Paterson, Arnold P. and Gross, Ervin E., <u>Handbook on Noise Measurement</u>, 6th Edition, General Radio Company, 1967.

6 American Conference of Governmental Industrial Hygienist. "Documentation of the Threshold Limit Values for Substances in Workroom Air" Third Edition, 1971

7 Gafafer, W.M.,"Occupational Diseases: A Guide to their Recognition" U.S. Department of Health, Education and Welfare, 1966

8 Adams, Robert M., M.D. "Occupational Contact Dermatitis" J.B. Lippencolt Company, 1969

A P P E N D I X

TABLES

1 Fibrous Glass and Total Dust Concentrations in All Production Areas

2 Sound Level Results in Deflashing Area

3 Ventilation Measurements in Deflashing Room and Degreasing Room

FIGURES

1 General Plant Layout for General Electric Appliance Park

2 Deflashing Room

3 Degreasing Chamber with Ventilation Measurements

TABLE 1

FIBROUS GLASS AND TOTAL DUST CONCENTRATIONS

IN

ALL PRODUCTION AREAS

Millipore Sample #	*PVC Sample #*	*Operation*	*Air Volume M^3*	*PVC Dust Wt. Mg*	*Fibers ≤10μ In Diameter Per Liter*	*Total Dust Conc. Mg/M^3*
		BUILDING #6				
		DEFLASHING AREA				
M-529	P-132	Glass Blasting	0.30	0.33	40.0	1.1
M-558	P-129	Hand Grinding	0.28	1.53	33.0	5.5
M-560	P-130	Drill Press	0.28	0.14	11.0	0.5
		BUILDING #2				
		WIRE CUTTING & SPLICING AREA				
M-534	P-131	Terminal Splicing	0.36	0.07	30.0	0.2
M-535	-----	Wire Cutting	0.24	----	25.0	---

NOTE: *Both samples M-534 and M-535 were evaluated for asbestos under polorized light and dispersion staining microscopy. No asbestos was found in either sample.*

TABLE 2

SOUND LEVEL RESULTS
(Refer to Figure #2)

TEST NO.	*LOCATION OF MEASUREMENT*	*dB READINGS* *As*	*Bs*	*Cs*
1	Next to glass blasting operation	88	89	91
2	Next to the "Wheelabrator" operation	88	94	96
3	Next to deflashing worktable	87	89	92
4	Next to worktable:			
	(when operator is grinding)	91	94	94
	(when operator is not grinding)	86	93	94
5	Next to the multiple drill			
	(when operator is drilling)	91	91	93
	(when operator is not drilling)	82	85	87
6	Next to deflashing worktable	87	89	94
7	Middle of deflashing room near conveyor	85	88	89
8	Next to the "Wheelabrator" operation	88	94	96
9	Outside of the deflashing room near the molding operation	86	87	87

TABLE 3

VENTILATION MEASUREMENTS

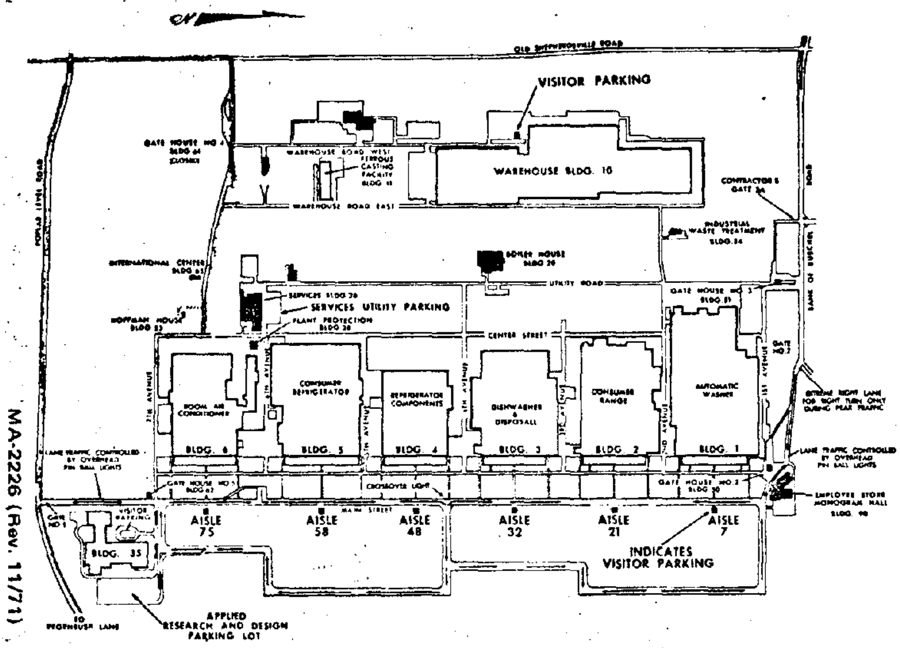
IN

DEFLASHING ROOM AND DEGREASING ROOM

LOCATION		*FACE VELOCITIES* *fpm*
DEFLASHING ROOM		
#4 Worktable		1400
#3 Worktable		1400
#3A Worktable		1200
#10 Worktable		7000
DEGREASING ROOM		
Opening to Freon Chamber	(A)	*8-10
Exhaust from Freon Chamber	(B)	180-220

* Predicted value from measurements made at exhaust

FIGURE 1



GENERAL PLANT LAYOUT

FOR

GENERAL ELECTRIC APPLIANCE PARK

FIGURE 2

DEFLASHING ROOM

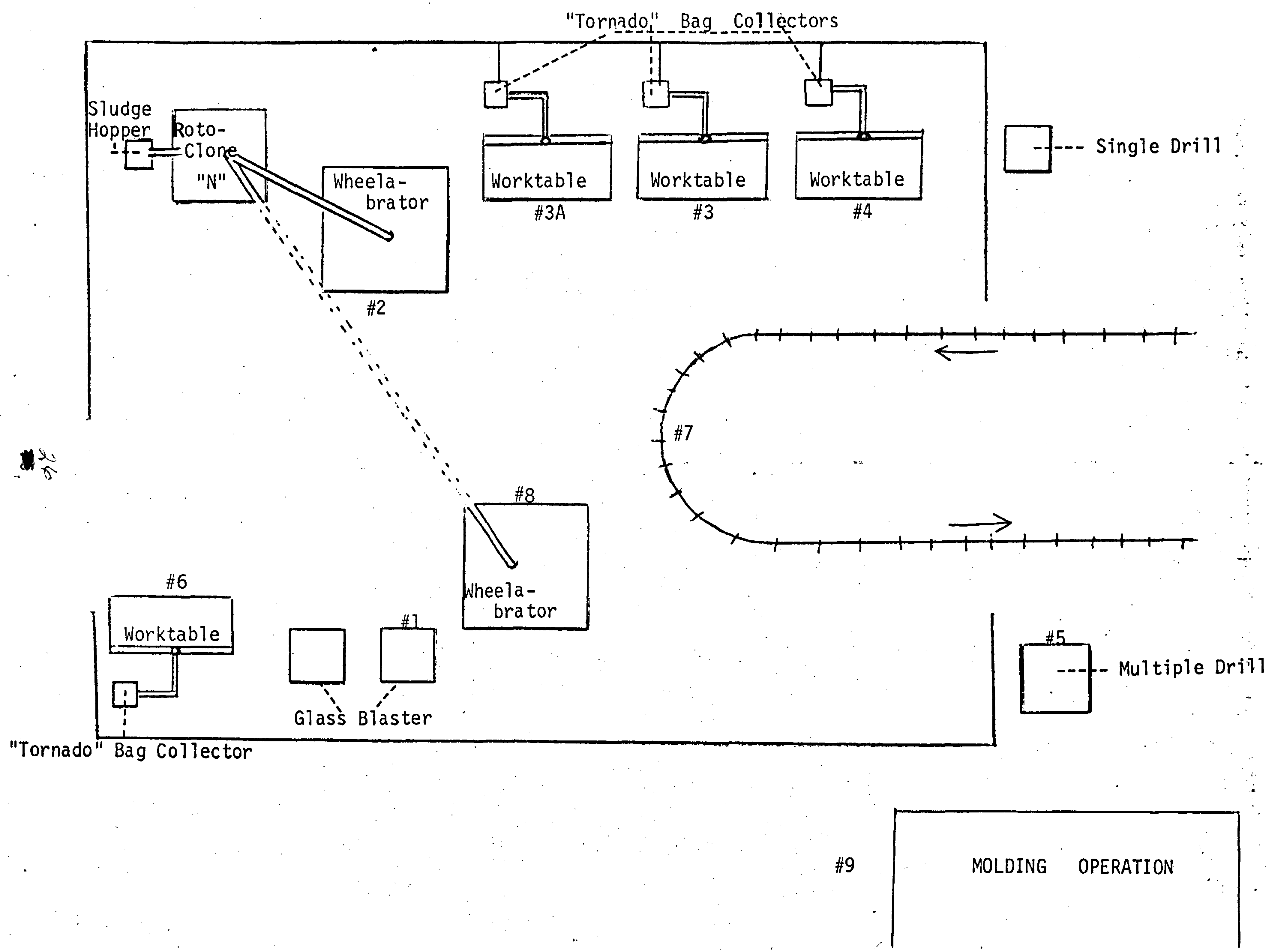


FIGURE 3

DEGREASING CHAMBER

WITH

VENTILATION MEASUREMENTS