QUANTITATIVE RESPIRATOR FIT-TESTING

Conducted At:

Illiopolis PVC Facility

Thermoplastics Division

Illiopolis, Illinois

February 1, 1982

BY:

Corporate Industrial Health Dept.
Columbus, OH 43229

A. INTRODUCTION

On January 19, 20, 1982, quantitative respirator fit-testing was performed on those paste department employees involved in the bagging operations who are required to wear dust respirators.

Quantitative fit-testing is the process by which exact respirator fit can be determined, and involves placing an employee in a bag-like enclosure while wearing a respirator (see figure 1). Within this enclosure, a fine mist-like aerosol of corn oil (particle size less than 3 microns) is generated. Two sampling probes are located in the enclosure, one inside the respirator, and one outside the respirator, which are connected to a photometer that measures the amount of corn oil from each probe. Any leakage getting into the respirator can thus be determined. Due to the high filtering efficiency of the respirator media, any corn oil measured in the respirator is largely a product of penetration around the face seal.

The overall ability of the respirator to remove the test aerosol can be listed as the respirator efficiency (usually a percentage) or the protection factor, which is the contaminant concentration outside the respirator divided by the contaminant concentration inside the respirator.

$$\text{Protection Factor} = \frac{\text{concentration outside respirator}}{\text{concentration inside respirator}}$$

Factors which adversely affect the fit of a negative pressure respirator include: beard or other facial hair, extremely narrow faces, broken or crooked nose, scars, etc. Exact fit is not a factor on positive pressure (air-line) respirator performance. During the fit testing, the employees are requested to perform several exercises which are designed to simulate work movements. This is done to assure that respirator fit is not impaired during normal work activities.

B. RESULTS AND DUSCUSSION

Listed below are the results of the quantitative fit testing that was conducted on the Paste Department Bagging employees on January 19, 20, 1982:

Name	Total Respirator Efficiency	Protection Factor	Comments
David Turner	70-97	3.3-33	very narrow fa
Gary Smith	80-96	5-25	full beard
Dough High	82-95	5.5-20	moustache & st
Ron Williams	96-100	25-100	
Leon Caffey	95-98	20-50	some stubble
Randy Negley	80-97	5-33	partial beard
Dan Lyons	96-99	25-100	
Bill Crouse	91-98	11-50	small beard
Eric Mendenhall	95-99	20-100	small goetee

During the above testing, the 3M 8710 (currently in use at the plant) and 3M 9910 dust masks were evaluated. The 9910 model is similar to the 8710 in appearance but has elastic-cloth straps (instead of rubber) and a thicker filter media. Our experience at other plants indicates that many workers prefer the 9910 because of the cloth straps, thus reducing the number of employees removing the bottom respirator strap because of discomfort. The removal of any respirator straps completely negates the effectiveness of the respirator.

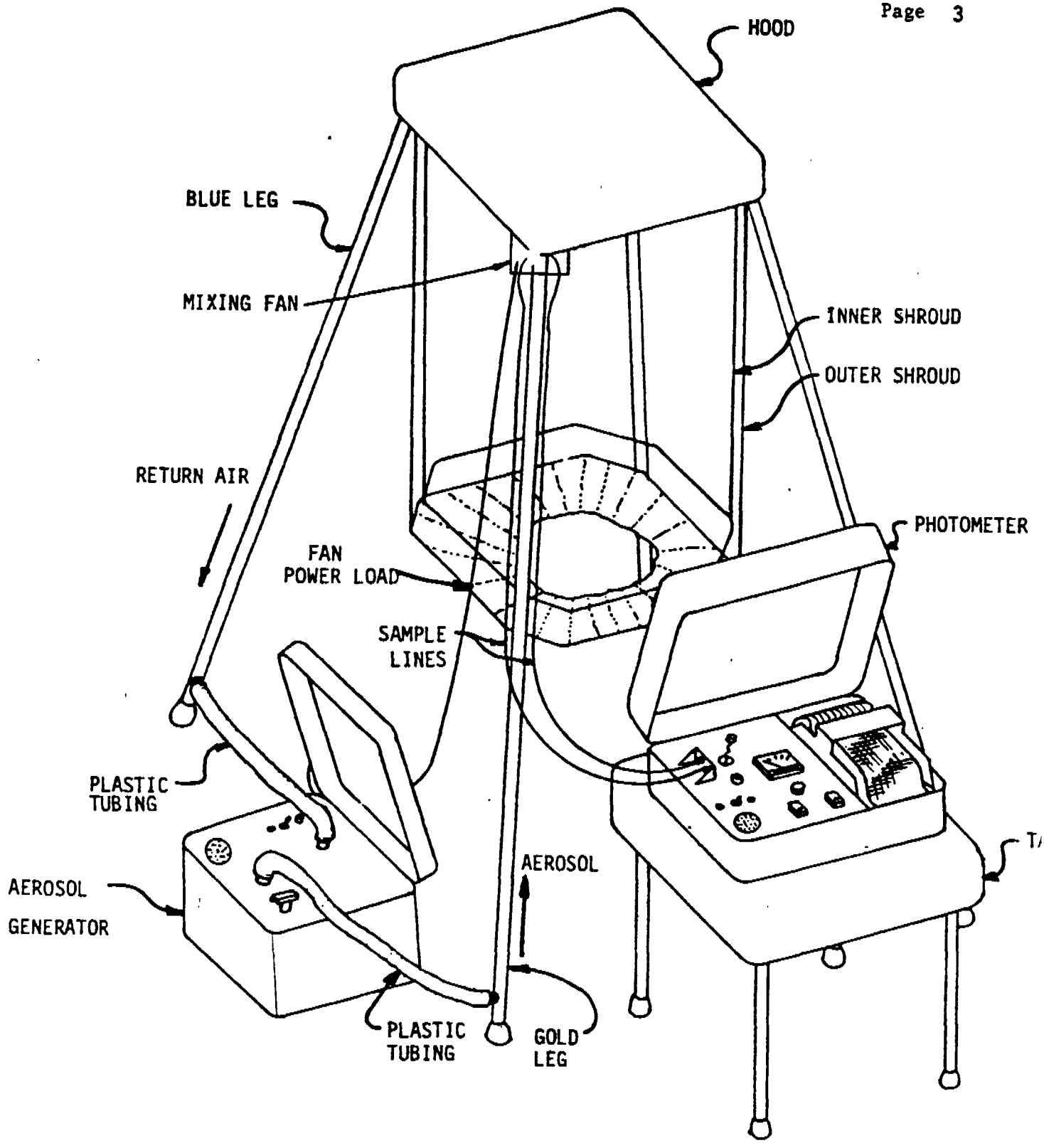
Employees using the negative pressure Scott Gas Masks for vinly chloride (VCM) were not given quantitative fit tests because the VCM cannisters would not adequately filter out the test aerosol (corn oil) in the chamber. It is our intention to appropriately modify such a cannister so that quantitative fit tests on these individuals can be performed some time in the future.

C. CONCLUSIONS

The results of the quantitative respirator fit testing performed on the Illiopolis Paste Department Bagger operators showed that all workers tested had respirator efficiencies between 70 and 100%. These efficiencies would likely provide adequate protection against the PVC dust exposure excursions realized during the normal work shift. These disposable respirators tested, however, would not be recommended for operations such as baghouse cleaning/changing which would overwhelm the filter media. The results of this fit testing also show the adverse effect of beards and other prominent facial hair on the effective fit of negative pressure respirators.

The quantitative fit testing of those employees wearing negative pressure vinyl chloride gas masks will be performed at a later date after appropriate modifications have been made in the filter media to allow suitable testing.

Figure 1
Quantitative Fit-Test
Unit



DETERMINATION OF NOISE

Conducted At:

Illiopolis PVC Facility

Thermoplastics Division

Illiopolis, Illinois

February 1, 1982

BY:

Corporate Industrial Health Dept
Columbus, OH 43229

SECTION II: NOISE EVALUATION

INTRODUCTION:

On January 19, 20, 1982, sound level readings were taken throughout the Illiopolis PVC facility to assess employee noise exposures, and to determine the impact of the new OSHA hearing conservation amendment.

The current OSHA limits for noise exposures (29 CFR 1910.95) are as follows:

Sound Level (dBA)	Allowable Duration
90	8 hours
92	6 hours
95	4 hours
97	3 hours
100	2 hours

Exposures above these limits require the mandatory use of hearing protection, engineering controls (if feasible) and annual audiometric testing. The new amendment to this noise standard requires that annual audiometric testing be provided and that hearing protection be made available (but not necessarily required) for employees exposed above the following criteria:

Sound Level (dBA)	Duration
85	8 hours
86	7 hours
87	6 hours
88	5.5 hours
89	4.5 hours

All noise measurements were taken with a Quest Sound Level Meter (model 215) calibrated on the days of the survey. Integrated noise measurements over time were taken with Metrosonics sound measuring equipment.

RESULTS: Listed below are the results of the noise evaluations performed at the Illiopolis location. A more detailed graphical representation of these measurements can be found in appendix A at the back of this section.

PVC I

Location	Sound Level (dBA)
South End, First floor	87-96
North End, First floor	88-95
South End, second floor reactor room	84-88
North end, second floor reactor room	84-88
Dryer #9 & #10 area	92-96
Vibrator on centrifuge chute (east end of of dryers #9 & #10)	99-101
Control panel - dryer #9 & #10	89-90
Paste bagging area (equip. on)	87-88
Paste dryer control panel	86-88
Paste grinder area	102-105
Outside fans for paste dryers(at 15')	97-98
Blow down area	92-94
Activator floor	85-86

Location	Soumd Level (dBA)
Pr duct bin level	85-86
Sifter level	89-92
Homogenizers	not running
Recovery building (upper floor)	87-90
(lower floor)	88-89
MVC pump house & tank farm area	76-78

PVC II

Reactor building, first floor	90-95
Reactor building, third floor	84-87
Chemical storage area, first floor	89-98
Chemical preparation area, second floor	83-84
Dryer building	84-91
Centrifuge room	88-90
Dryer feed tank area	82-83
Product bin level	86-88
Sifters	89-91
Utility Bldg. (lower level)	87-93
(upper level)	85-87
(break area)	75-77
Catalyst prep. bldg.	65-70
Polyco	84-86 (peaks to 89)
Resinite	80-87

Dosimetry Data

PVC #1 - Dryer Operator Station 88 dBA (equivalent dose)
PVC #2 - Dryer Operator Station 88 dBA (equivalent dose)

DISCUSSION:

As can be seen from the above data, with the exception of the Polyco, Resinite and Catalyst preparation operations, most production and related areas have noise levels in the 85-90 dBA range, and would be affected by the new OSHA hearing conservation amendment. This fact is further underscored by the recent personal dosimetry data collected by the plant showing the following job categories to be in the 85-90 equivalent dBA range: Maintenance operators, utility operators, polymerization operators, dryer operators, water blaster operators, production workers, group leaders, stripper operators, and plant supervisors. Additionally, several other areas have sound levels significantly above the current OSHA limit of 90 dBA:

a. Reactor building, first floor - PVC I, PVC II
b. Dryers - PVC I (from vibrator on centrifuge chute)
c. Paste grinder room
d. Blow-down area - PVC I
e. Chemical storage area, first floor - PVC II
f. Outside fans for paste dryers
g. Utility building

Hearing protection (approved muffs or plugs) must be worn in these areas, and signs need to be posted stating this fact.

With respect to engineering controls for the noise, compliance will be difficult in several areas. On the first fl ors of the Reactor Rooms, much of the noise is the result of pump and compressor operation. The vibrator on the centrifuge chute is the most significant noise source in the PVC I dryer area. The grinder in the paste department emits sound levels between 102 and 105 dBA.

CONCLUSIONS AND RECOMMENDATIONS:

Sound level measurements conducted throughout the Illiopolis PVC facility showed most production and related area, (except Polyco, Resinite and the Chemical preparation building) in the 85-90 dBA range and would be affected by the new OSHA hearing conservation amendment. This amendment requires annual audiometric testing and the optional use of hearing protection. Employee training in the contents of the amendment and in the proper use of hearing protection is also recommended.

In addition to the above, seven specific plant locations were found to be significantly above the current OSHA 8 hour limit of 90 dBA:

a. Reactor building, first floor - PVC I, PVC II
b. Dryers - PVC I (from vibrator on centrifuge chute)
c. Paste grinder room
d. Blow down area - PVC I
e. Chemical storage area, first floor - PVC II
f. Outside fans for paste dryers
g. Utility building

Employees working in these areas must be required to wear hearing protection, and signs indicating that hearing protection must be worn, need to be posted at the door.

As we discussed during the visit, several options for having the audiometric testing performed are currently being considered. It is hoped that one service will be able to provide the testing (through the use of mobile vans) in a cost effective manner for most of the Borden plants throughout the country.

We expect resolution of this issue in the next few weeks, and will keep you informed of our findings.

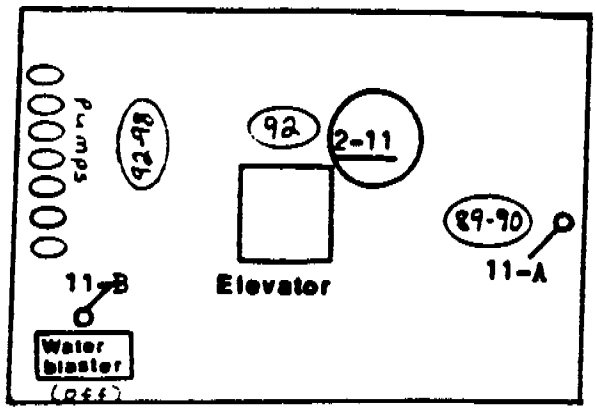
SECTION II

Appendix A

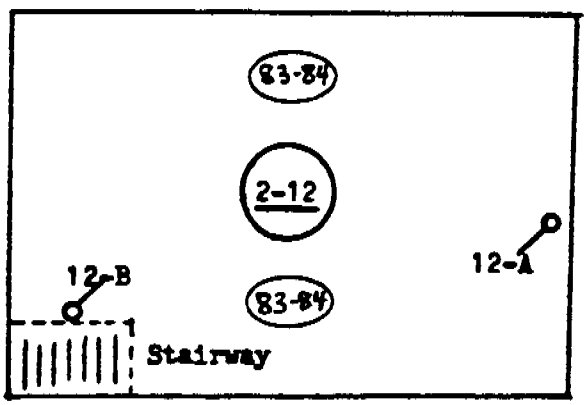
Sound Level Readings
By Area
Illiopolis PVC Facility
Illiopolis, IL

February , 1982

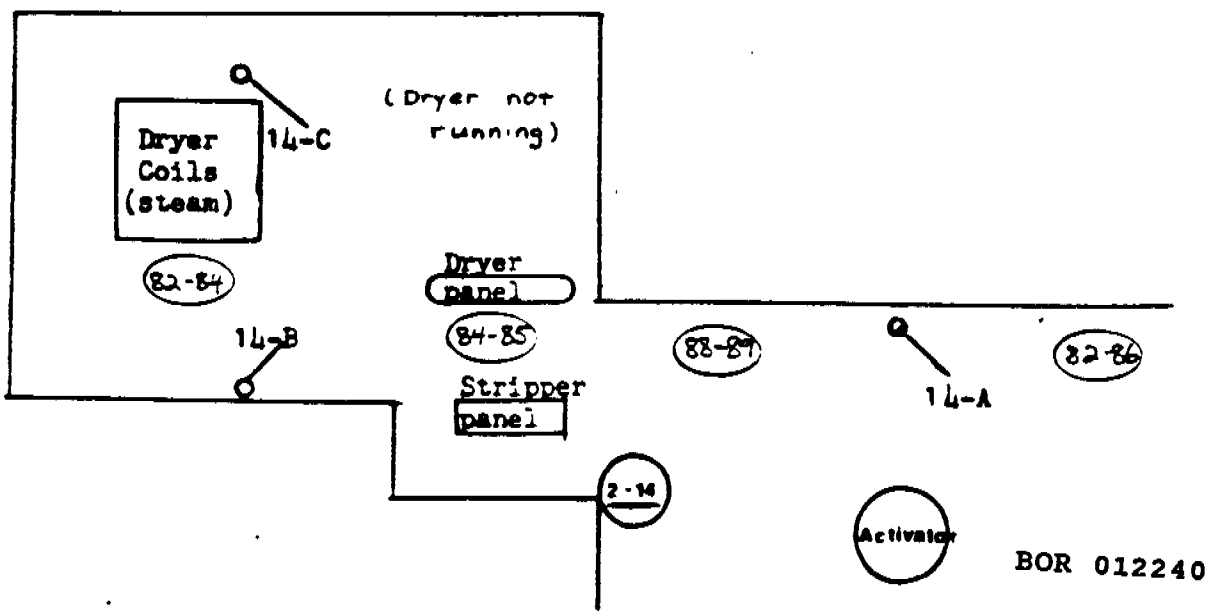
1st FLOOR, CHEMICAL STORAGE AREA



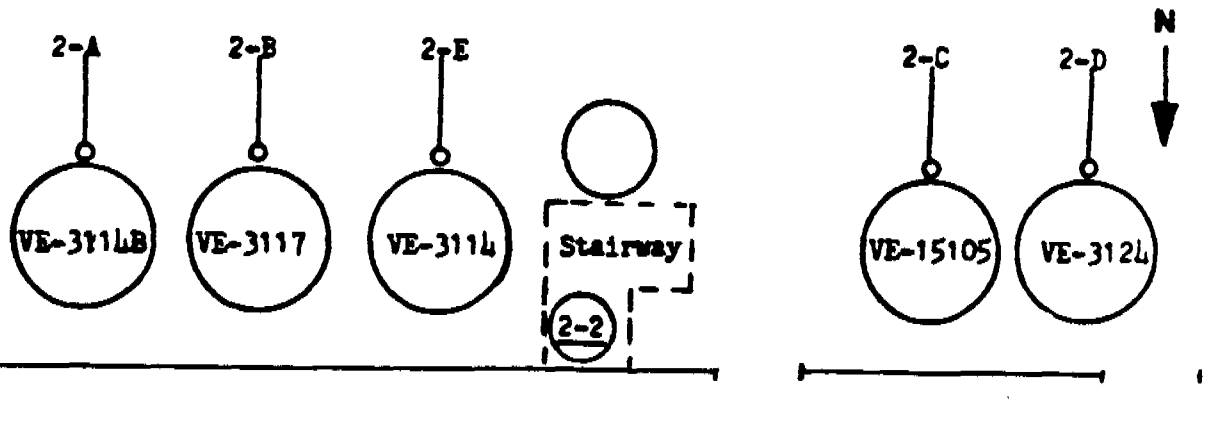
2nd FLOOR, CHEMICAL PREPARATION AREA



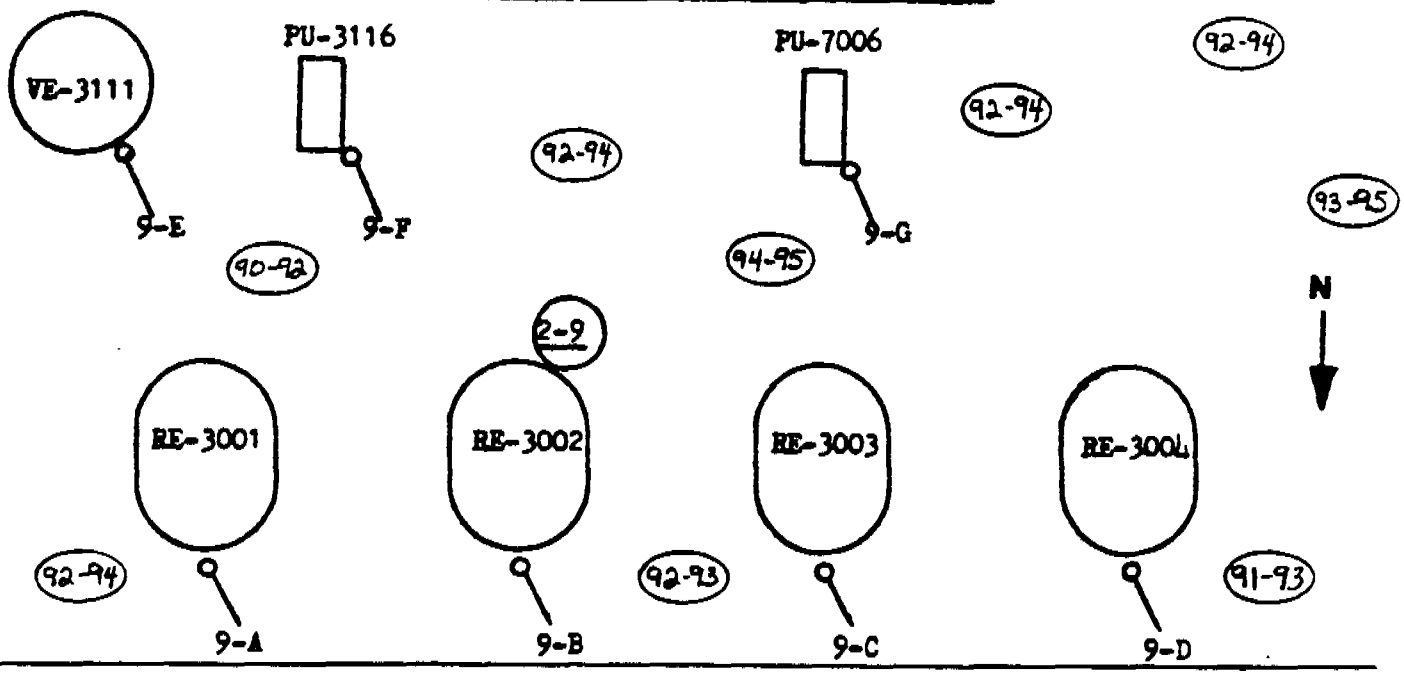
DRYER BUILDING & AREA



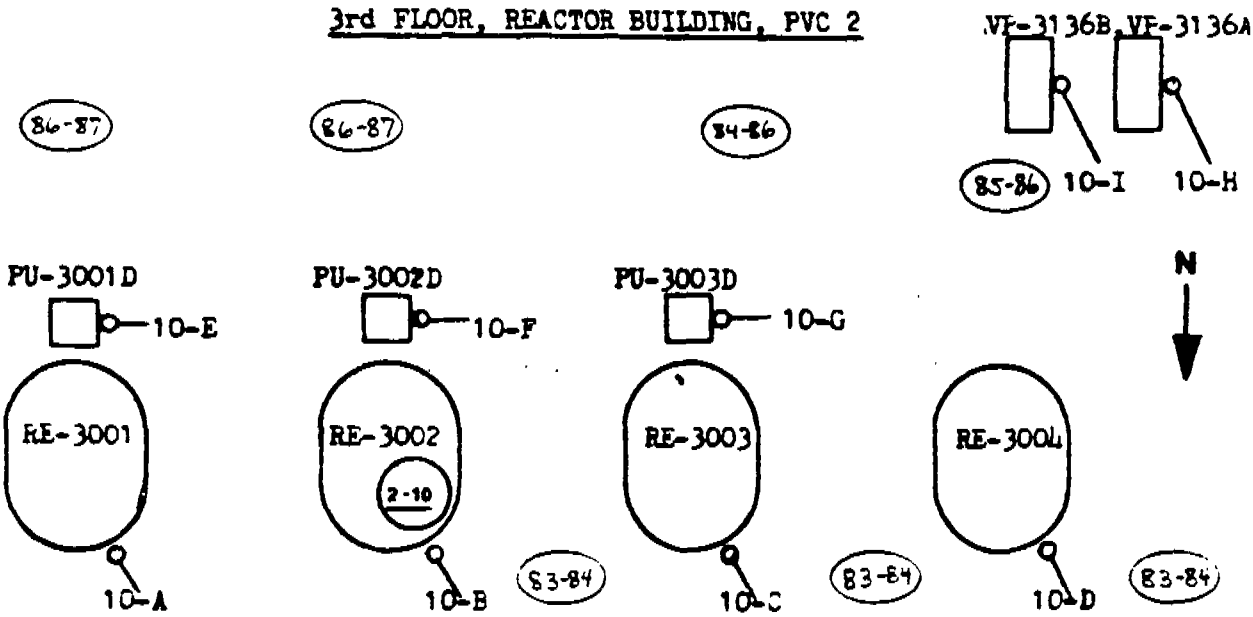
OUTSIDE, SOUTH, RVCM TANKS & AREA



1st FLOOR, REACTOR BUILDING, PVC 2

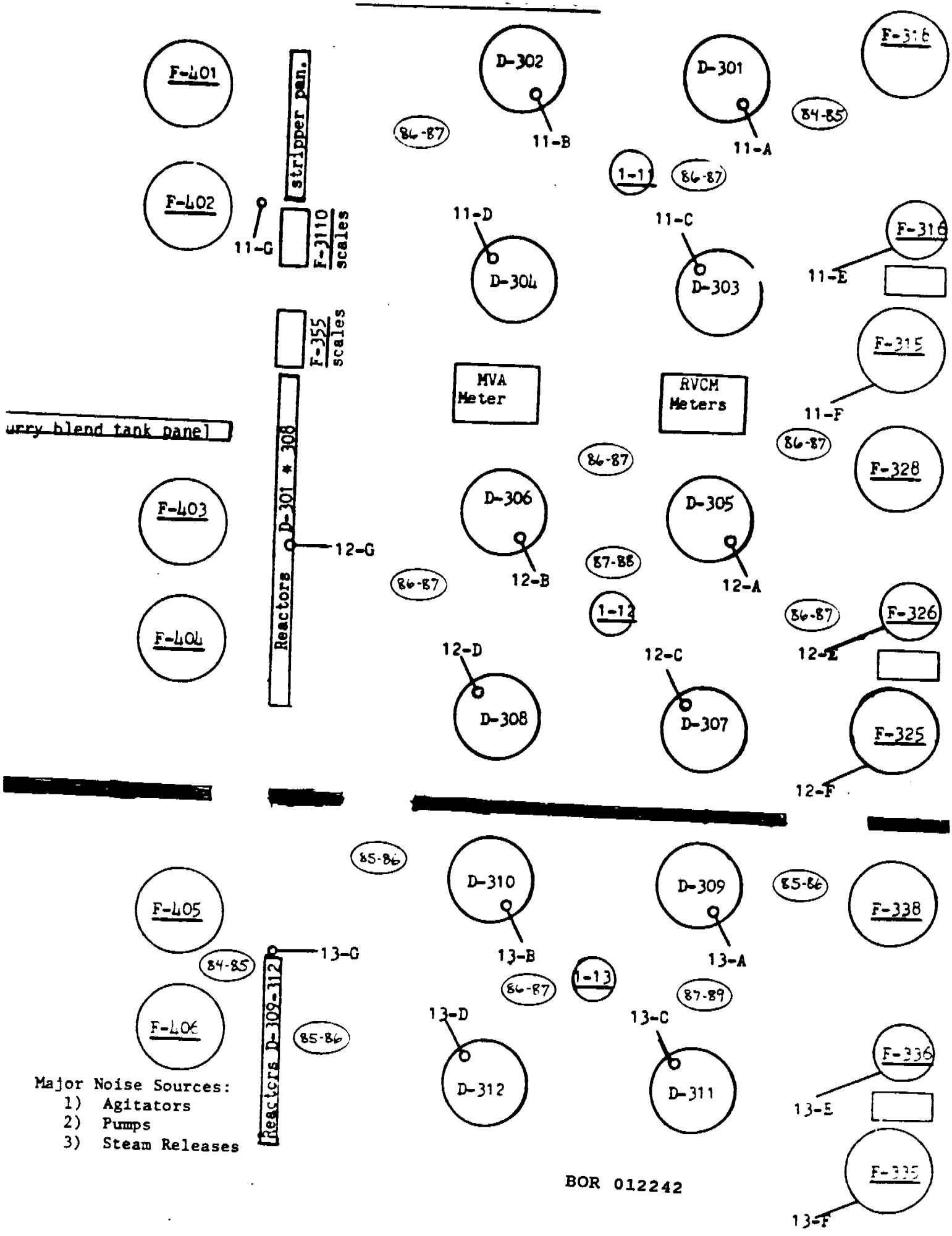


3rd FLOOR, REACTOR BUILDING, PVC 2



CONTROL PANEL

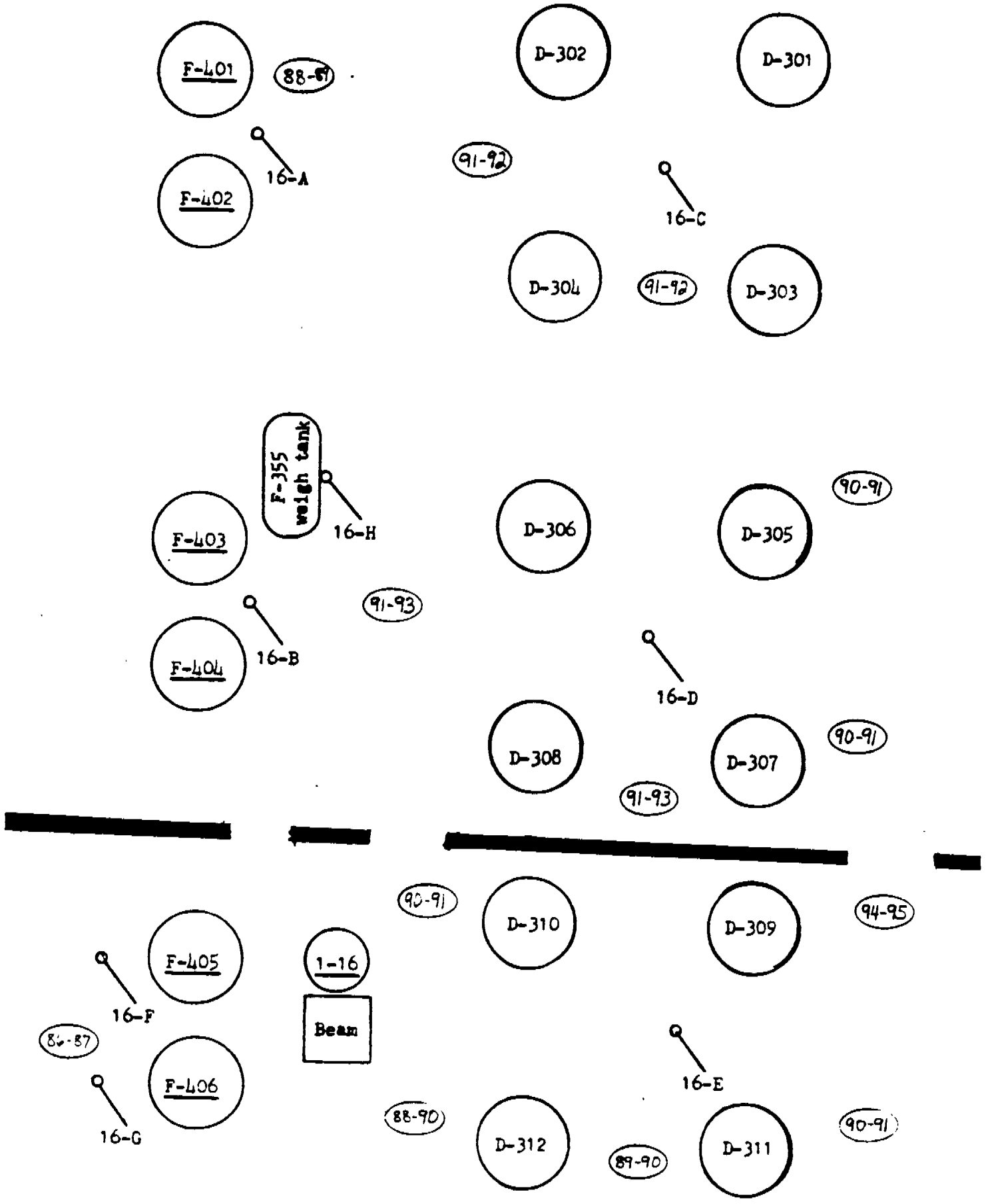
BOR 012241



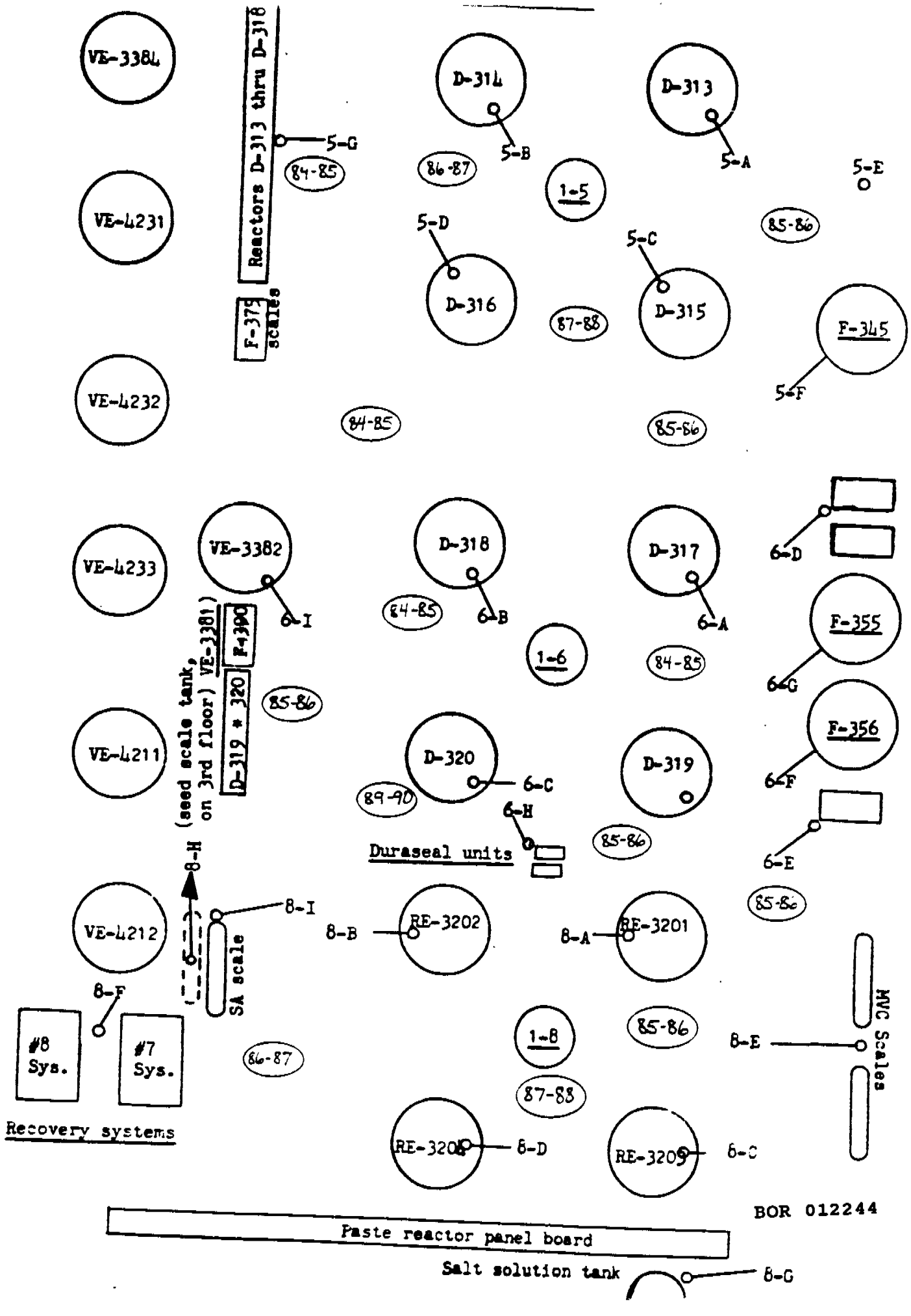
Major Noise Sources:
1) Agitators
2) Pumps
3) Steam Releases

BOR 012242

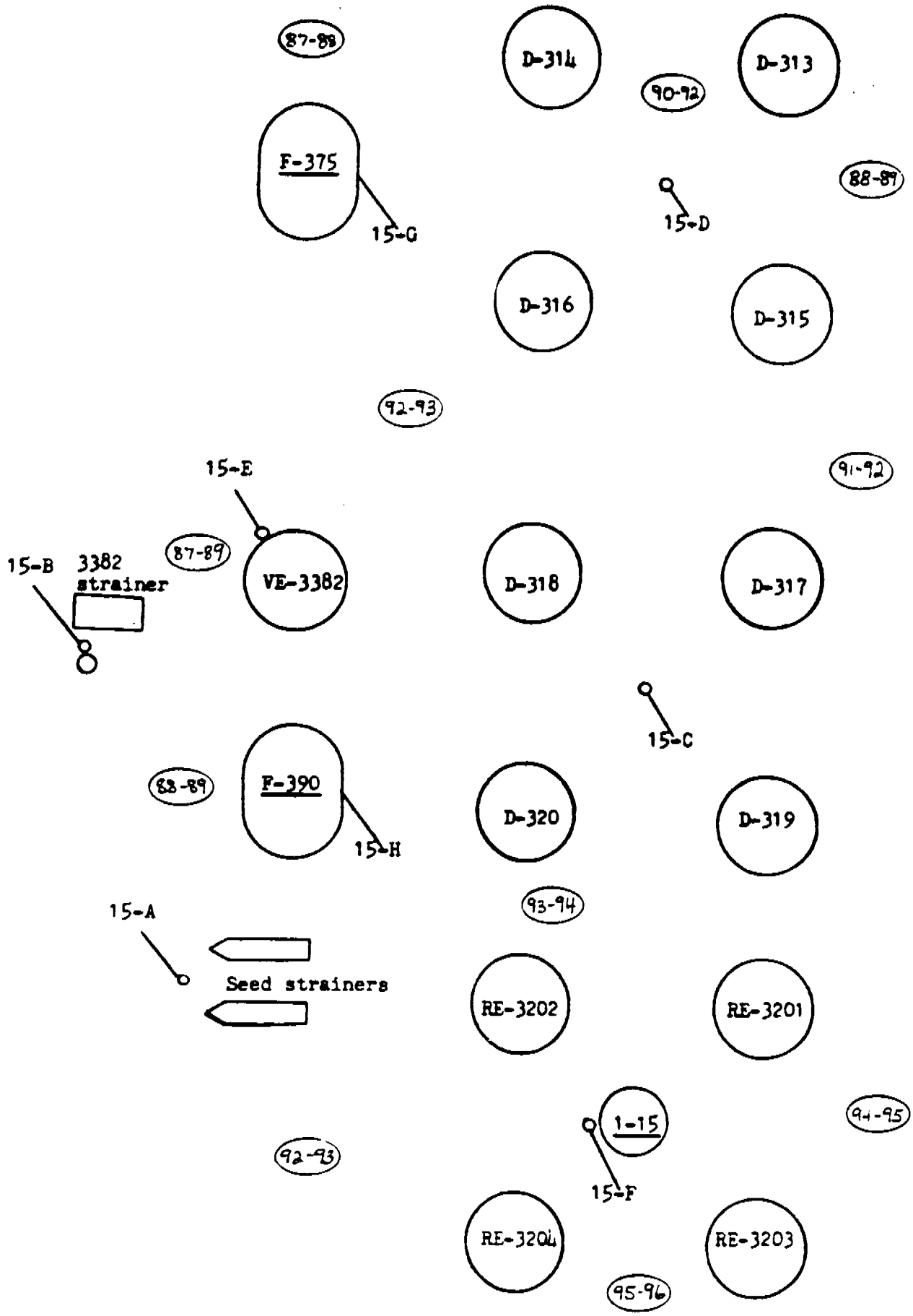
NORTH END-1st FLOOR-PVC-1



BOR 012243


VE-3384
VE-4231
VE-4232
VE-4233
VE-4211
VE-4212
Reactors D-313 thru D-318
5-G
84-85
F-379 scales
D-314
5-B
D-313
5-A
86-87
1-5
5-E
85-86
5-D
D-316
5-C
D-315
87-88
F-345
5-F
84-85
85-86
VE-3382
6-I
D-318
6-B
D-317
6-A
6-D
F-355
6-G
84-85
1-6
F-356
6-F
F-390
D-319 * 320
85-86
(seed scale tank, on 3rd floor) VE-3381
D-320
6-C
6-H
89-90
D-319
Duraseal units
6-E
85-86
8-H
8-I
8-B
RE-3202
8-A
RE-3201
85-86
SA scale
8-F
#8 Sys.
#7 Sys.
Recovery systems
86-87
1-8
85-86
8-E
MVC Scales
87-88
RE-3208
8-D
RE-3209
8-C
Paste reactor panel board
Salt solution tank
8-G

BOR 012244


87-88
D-314
D-313
90-92
F-375
15-G
15-D
88-89
D-316
D-315
92-93
15-E
91-92
15-B
3382
strainer
87-89
VE-3382
D-318
D-317
15-C
F-390
83-89
15-H
D-320
D-319
93-94
15-A
Seed strainers
RE-3202
RE-3201
1-15
94-95
92-93
15-F
RE-3204
RE-3203
95-96

VCM COMPLIANCE PROGRAM AUDIT

Conducted At:

Illiopolis PVC Facility

Thermoplastics Division

Illiopolis, Illinois

February 1, 1982

BY:

Corporate Industrial Health Dept.
Columbus, OH 43229

SECTION I: VCM COMPLIANCE PROGRAM AUDIT

A. INTRODUCTION

The Vinyl Chloride Monitoring and Control Program was established at the Illiopolis PVC manufacturing facility to meet the federal requirements of th vinyl chloride standard and, ultimately, to reduce the risk of any adverse health problems associated with this type of operation. The VCM Program at Illiopolis consists of a number of program elements associated with worker protection practices and controls. Proper worker protection is reflected in appropriate implementation of the above measures, and the following is a summary of our observations and comments concerning the effectiveness of such practices to date.

B. LEAK DETECTION AND PREVENTION

The success of the VCM Monitoring and Control Program is greatly dependent on rapid leak detection and proper response to minimize worker exposures. It allows the timely containment and/or repair of leaks before large emissions of vinyl chloride develop and it assists in reducing exposure by activating audible and visual alarms to dictate the necessary respiratory protection requirements.

The basis of the system is a fixed area monitoring network consisting of 39 strategically located air sampling heads linked to three Bendix gas chromatographs. This system is tied to a Hewlett Packard computer so that any level above 1 ppm will trigger the warning signals.

Once an alarm is activated, a safety technician will use a Century OVA portable detector to determine the exact location of the leak. Immediate containment is accomplished by local exhaust or other measures. A leak sheet is filled out and forwarded to the proper supervision for appropriate corrective action.

From our observations employee exposure potentials to occasional fugitive emissions of vinyl chloride monomer are being properly minimized by the complex detection and control system in operation at Illiopolis. The monitoring system is capably directed by a designated monitoring coordinator who oversees a number of trained safety technicians. The safety technicians are responsible for the day to day operation of the system.

Proper operation is achieved through pre-programmed calibrations that are currently performed after every 960 counts. Additionally, the system parameters, such as cylinder pressures, GC conditions, and sample and purge flowrates are recorded before the beginning of every shift. Regular checks of the alarm system are likewise performed. All necessary data is properly recorded and maintained for a reasonable length of time.

Both eight hour and twenty-four hour time-weighted averages (TWA) are computed and distributed for review by supervision. With this approach, production is kept aware of the current conditions and can respond accordingly.

Another important aspect is the performance of the safety technicians in contributing to the overall reduction of employee exposure potentials to VCM. During our brief discussions in the monitoring trailer, it was noted that the safety techs demonstrated a good understanding and awareness of the current conditions in the plant. Their timely response to the alarms and subsequent detection of the leaks is a significant step in minimizing the length of an excursion above 1 ppm. Th safety tech faithfully fills out a MVC Leak Sheet for each leak detailing the source and level of the emission. This information is brought to the immediate attention of the area foreman who acknowledges and initiates corrective action.

A review of the leak sheet master file, which was very thorough, showed that, for the most part, appropriate follow-up and corrective action is being accomplished in a timely manner.

Additionally, in order to detect leaks early when they are small and the exposure areas are not extensive, the safety techs conduct daily plant monitoring tours of the regulated areas with the portable OVA detectors. Potential emission points on reactors and other equipment are checked and levels are recorded on specific leak check sheets.

The extensive data that is collected daily is analyzed and summarized on a regular basis. The emission data is broken down into mechanical errors and operational errors so that both engineering and maintenance control improvements and work practice procedure modifications can be prioritized for subsequent corrective actions. From the summary data we reviewed, priorities that have been established should lead to further reductions in employee exposure potentials.

C. RESPIRATORY PROTECTION

Since the respiratory protection program is keyed to the monitoring and alarm systems, several alarm areas in the reactor rooms of PVC I were entered to evaluate compliance with this requirement. For the most part, full compliance was achieved. However, there appeared to be a slight disregard for the requirement by the more transient workers (maintenance) during these specific alarm periods. Additionally, it was noted that several employees had either improperly placed the respirator straps over hardhats or had failed to buckle the bottom strap of the mask. It is probable that the protection afforded by the masks is reduced by these practices. Although these situations are not uncommon in typical workplaces, continued employee education is necessary to minimize these occasional problems.

The respiratory issuance, cleaning and maintenance procedures were likewise reviewed for complaince. The set-up appears to be operating effectively. The location of the mask room near the central time clock simplifies the issuance and return of the respirators. An inventory of all respirators issued for a particular shift is faithfully maintained as noted by the 15 masks issued on January 20, 1982 for the first shift. The safety techs responsible for this part of the program displayed a good working knowledge of respirator cleaning and maintenance techniques. A random inspection of several respirator bags found facepieces to be properly stored in clean plastic bags and straps and hoses to be in good shape. Therefore, it was apparent that if the respirators are returned to the mask room at the end of a shift, they will be properly inspected and cleaned for the next day.

D. TRAINING

Annual training of all VCM workers assigned to regulated areas is required by the OSHA vinyl chloride standard. It was learned that this training requirement for 1982 was in the process of being conducted during the month of January.

In addition to this required training, the plant has initiated a comprehensive program designed to reduce the number of operational errors that result in emissions above 1 ppm. The training coordinator appears to have a good grasp of what needs to be done as exemplified in the recently completed training tape concerning correct filter change procedures in the vacuum system operation. This particular operation had been a source of emissions in the paste facility until operators were shown this tape. A drastic reduction in the number of excursions above 1 ppm have resulted. The approach of utilizing department supervision and

operators in the film has a positive effect on those who view it. Continued emphasis directed towards specialized training tapes should contribute to employee job awareness and,ultimately, to the success of the VCM Program.

E. PERSONNEL MONITORING

Since there are designated regulated areas at Illiopolis, all personnel routinely assigned to these regulated areas are monitored monthly. This personnel monitoring is being conducted consistently over all three shifts by the safety tests under the direction of the monitoring coordinator. The method followed utilizes the Bendix Model H/S 10 Flasher unit and Sipin vacuum pump which allows for accurate sample collection and direct analysis by gas chromotography for vinyl chloride in air. Although the sampling and analytical procedures were not evaluated in detail by means of parallel sampling during this audit, consistent results continue to be obtained as evidenced in the weekly personnel monitoring reports reviewed regularly by the Industrial Health Department. A more detailed evaluation of this program aspect will be conducted at a later date.

F. COMPLIANCE PROGRAM

A general review of the written compliance program indicates a thorough documentation of all aspects of the VCM Monitoring and Control Program. The written plan has been consistently revised and updated every six months. In order to demonstrate that the program is dynamic, all modifications and improvements (e.g. purchase of two timers for the fixed area monitoring system in PVC I) should perhaps be logged and briefly described in the written program. This could provide a mechanism for easier review of the program as it changes over time.

G. RECORDKEEPING

Although no in-depth analysis of the recordkeeping system was conducted during this audit, some area monitoring data and leak sheets were reviewed. A consistent and thorough logging of information was noted. Other required records, such as for personnel monitoring, medical surveillance and training, are likewise believed to be maintained in a consistent and orderly manner.

H. BREATHABLE AIR ANALYSIS

OSHA requires that breathing air shall meet at least the requirements of the specifications for Grade D breathing air as described in the Compressed Gas Association Commodity Specification G-7.1-1966. The constituents in the air for which concentrations must not exceed a specified maximum include percent oxygen, hydrocarbons, carbon monoxide, carbon dioxide and odor. Since breathing air is an important commodity for worker protection under the VCM Program, verification tests, as described in specification G-7.1, were performed. Breathing air is produced from two Joy compressors located in the utility building, and air samples for the verifications tests were collected from an air supply line in PVC I. The results, as shown below, indicate that the breathable air meets Grade D quality under the conditions tested.

Air Constituent	Comment
Oxygen	21%
Carbon Monoxide	None detected
Carbon Dioxide	None detected (lower level of detection of indicator tube - 200 ppm)
Odor	No detectable odor
Hydrocarbons (VCM)	None detected

Additionally, the plant has incorporated a sampling point in the breathing air system as part of the fixed area monitoring for VCM and have identified it as stream #1-10. Any level above 1/2 ppm triggers an alarm and appropriate action is initiated. Also, the safety techs regularly check the intakes to the breathable air compressors with gas bags and the OVA.

I. SPECIAL PROBLEM AREAS

The extensive monitoring that has been conducted has indicated the compressor area of the tank farm and the PVC II weigh tank area to be potentially high sources of VCM. The plant is currently conducting special monitoring to better define the extent of the problem areas before controls can be proposed. Appropriate respiratory protection is required for employees who must work in these areas which is understood to be very infrequent. Continued progress in further controlling the potential sources is anticipated.

INDUSTRIAL HYGIENE SURVEY:

1. VCM Program Audit
2. Noise Evaluation
3. Respirator Fit Testing

Conducted At:

Illiopolis PVC Facility

Thermoplastics Division

Illiopolis, IL

February 1, 1982

By:

M. Gruenwald
R. Hackman
Corporate Industrial Health
Borden Inc.
990 Kingsmill Parkway
Columbus, OH 43229

SUMMARY

On January 19, 20, 21, 1982, the Illi polis PVC facility was visit d for the following purposes:

a. To conduct an audit of the VCM Compliance Program

b. To evaluate employee noise exposures

c. To perform quantitative respirator fit testing on the PVC Paste Bagging Operators.

A summary of this survey is as follows:

I. VCM COMPLIANCE PROGRAM AUDIT:

An audit of the VCM Monitoring and Control Program at the Illiopolis PVC manufacturing facility was conducted by the Industrial Health Department to evaluate various program elements directed at worker protection practices and controls. The major program elements evaluated included leak detection and prevention procedures and controls, respiratory protection, employee training and personnel monitoring. The evaluation was conducted by discussing program objectives and accomplishments to date with plant personnel, by reviewing various procedures, monitoring data and records, and by observing the response of plant personnel to the program requirements.

The results of our audit indicate that the VCM Monitoring and Control Program is functioning in a properly organized and professional manner to reduce the employee exposure potential to the vinyl chloride monomer. It is apparent that the approach taken by the plant to implement the complex requirements of the program has been effective. Continued emphasis on employee job awareness and education should further contribute to the success of the VCM Program.

II. NOISE DETERMINATION

The results of the sound level survey conducted at the Illiopolis PVC facility can be found in Section II of this report (page 1&2) and indicate most production and related areas (except Polyco, Resinite, and the Chemical Preparation Building) in the 85-90 dBA range.

Plant locations/operations with noise levels in this category would be affected by the new OSHA hearing conservation amendment necessitating the following actions:

1. Hearing protection must be provided to all affected employees (the actual use of the hearing protection becomes mandatory with noise exposures above 90 dBA).

2. Annual audiometric testing must be provided to affected employees.

3. Noise exposed employees must be trained in the proper use of the hearing protection, and on the contents of the OSHA hearing conservation amendment.

In addition to those areas found to be between 85 and 90 dBA, seven specific plant locations were identified as having noise levels significantly above the current OSHA 8 hour limit of 90 dBA:

1. Reactor building, first floor - PVC I, II
2. Vibrator on centrifuge chute to PVC I dryers
3. Paste department grinders
4. Blow-down area - PVC I
5. Chemical storage area, first floor - PVC II
6. Outside fans for paste dryers
7. Utility building

Employees working in these locations must be required to wear hearing protection and signs must be posted at the doors to each area, indicating that hearing protection needs to be worn.

III. QUANTITATIVE RESPIRATOR FIT-TESTING

Quantitative respirator fit-testing was performed on Paste Department Bagger employees to determine the overall respirator effectiveness of the 3M dust masks worn by these individuals. The results of this testing can be found in Section III of this report and indicate that all workers tested had total respirator efficiencies of 70-100%. These efficiencies would likely provide adequate protection against the PVC dust exposure excursions realized during the normal work shift. The results of this testing also show the adverse effect of beards and other prominent facial hair on negative pressure respirator fit.

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