FILE COPY

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

FILE COPY

HEALTH HAZARD EVALUATION DETERMINATION
REPORT NO. 74-111-283

COOK PAINT AND VARNISH COMPANY
NORTH KANSAS CITY, MISSOURI 64116

APRIL 1976

I. TOXICITY DETERMINATION

It has been determined that employees of the Powder Coatings Department are potentially exposed to toxic concentrations of total airborne particulate matter and trimellitic anhydride (TMA) during the manufacture of "Pipe Clad" epoxy paint. This determination is based on data collected on September 5 and 15, 1975, during the processing and decontamination procedures. This data collection consisted of: (a) Medical interviews and limited physical examinations; (b) Environmental in-plant measurements for total airborne particulate matter and TMA; and (c) A review of available literature for these substances. Environmental results on these two survey dates indicate that potential exposure of employees exceeds the current American Conference of Governmental Industrial Hygienists (ACGIH) recommended Threshold Limit Value (TLV) for total nuisance dusts of 10 mg/M^3 (milligrams of contaminant per cubic meter of air sampled). Although there is not a current recommended standard for TMA, current information suggests that the airborne levels found (e.g., 0.1 mg/M^3 or greater) have caused irritation of the respiratory system and eyes of employees. Medical data results of this evaluation show that employees have experienced symptoms of irritation of the respiratory system and eyes. The associated environmental levels of TMA found during the survey ranged from 0.1 mg/M^3 to 7.5 mg/M^3. It is noted that this determination recognizes the "potential" toxicity of the above exposures since Department employees are currently afforded a substantial degree of protection through a respirator program which is now in effect. Respirators, however, are not considered an acceptable long-term solution for reducing employee exposure.

It has further been determined that employees are not exposed to toxic concentrations of chromic oxide (Cr_2O_3), stannous octoate, and organic vapors (e.g., methyl ethyl ketone, methyl isobutyl ketone, toluene, and xylene) since environmental concentrations either by themselves or if considered additive were all less than 25 percent of the appropriate TLV or occupational health standard on the dates surveyed.

The above determinations are based on the environmental and medical data collected at the time of the survey. Detailed information concerning the results of these findings are contained in the body of this report. Recommendations are included in this Determination Report which are designed to reduce employee exposure to these agents to a minimum.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are available upon request from NIOSH; Robert A. Taft Laboratories; 4676 Columbia Parkway; Cincinnati, Ohio 45226. Copies have been sent to:

a. Cook Paint and Varnish Company; North Kansas City, Missouri

b. Authorized Representative of Employees

c. U.S. Department of Labor - Region VII

d. NIOSH - Region VII

For the purpose of informing the approximately 5 "affected employees", the employer shall promptly "post" the Determination Report for a period of 30 calendar days in a prominent place(s) near where exposed employees work.

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 an 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.

The National Institute for Occupational Safety and Health (NIOSH) received such a request from an authorized representative of The Brotherhood of Painters and Allied Trades, AFL-CIO, to evaluate employee exposure to various airborne contaminants, particularly trimellitic anhydride (TMA), used in the manufacture of epoxy paints. The request was precipitated by employee concern regarding possible harmful effects from exposures to emissions during processing and decontamination operations involving epoxy "Pipe Clad" paints.

IV. HEALTH HAZARD EVALUATION

A. Description of Process - Conditions of Use

The basic materials used in the formulations of "Pipe Clad" paints are for the most part purchased from external sources. The process starts with the manual weighing of various dry granular components and placing them in a hopper or feeder. The dry feeder ingredients are transferred gravimetrically into a grinder-mixer where a viscous liquid is added and the materials are thoroughly mixed. The mixed material is then heated and extruded onto a water-cooled conveyor belt for hardening, and subsequent rough chipping via the chipping machines. The chips are then transferred pneumatically and processed through various pulverizers and micro-pulverizers prior to packaging.

B. Study Progress and Design

The procedures used to evaluate the areas of concern included on-site interviews with representatives of union and management, preliminary medical and environmental studies, contacts made with manufacturers of products used in the process to identify toxic substances, administration of medical questionnaires and examination of exposed workers, development of analytical techniques with sufficient sensitivity to detect trimellitic anhydride, and extensive air sampling to detect potential exposure to airborne contaminants.

Based on information obtained from contacts with management and suppliers of products used in the process, walk-through and initial environmental sampling surveys were conducted on October 23, 1974, and May 5, 1975, respectively. The final study involved the evaluation of employees' exposure to the following chemicals:

1. Total dust - nuisance
2. Trimellitic anhydride
3. Chromic Oxide (Cr_2O_3)
4. Stannous Octoate
5. Organic Solvents (e.g., MEK, MIBK, xylene and toluene)

The final environmental-medical evaluation occurred on September 5 and 15, 1975, during processing and preliminary decontamination operations involving epoxy paints containing trimellitic anhydride. Sample results for an evaluation of workers' exposure to organic solvents (e.g., methyl ethyl ketone, methyl isobutyl ketone, xylene and toluene) did not indicate significant exposure (less than 25 percent of the ACGIH recommended TLV) of workers at the time of the survey. Hence, the exposure of workers to organic solvents during processing and decontamination procedures are not discussed further in this report. However, it should be pointed out that the survey was not conducted during a period when final cleaning or decontamination was taking place. This very thorough cleaning is only carried out before a change in product color is made. It is probable that higher levels of solvent exposure and, in particular MEK exposure, occur sporadically during such change-over decontamination.

C. Evaluation Methods

1. Environmental Methods

Personal air samples were used to evaluate employee exposure. The personal samplers were connected on or near the collar of the employees to collect a representative sample of air in the breathing zone of the workers. General area samples were collected in the vicinity of the weighing and filling stations.

Total and respirable particulate samples were collected on polyvinylchloride (PVC) filters, 3-piece cassettes, and 2-piece cassettes with a 10 mm cyclone using a MSA Model G pump operating at a flow rate of 1.7 liters of air per minute (lpm). These samples were analyzed using standard analytical methods[1] by NIOSH Laboratories in Salt Lake City, Utah, for total dust, respirable dust, stannous octoate and chromic oxide. Samples for trimellitic anhydride (TMA) were obtained on glass fiber filters and analyzed by NIOSH Laboratories in Cincinnati, Ohio, using a procedure based upon "Rapid Esterification for Gas Chromatographs" by Richard Harry Greely, Journal of Chromatography, 88, (1974), pages 229-233.

2. Medical Methods

Thirteen present or past Powder Coating Department employees were privately interviewed by a NIOSH physician. Interviewing was begun in a non-directed manner to spontaneously elicit health-related complaints thought to be work-related. A review of past occupational history and prior illness was obtained and followed by a review of systems. A brief physical examination was carried out on the majority of employees interviewed. This emphasized examination of the eyes, nose, throat, chest, and vital signs.

D. Evaluation Criteria

1. Environmental Standards or Criteria

The three primary sources of environmental evaluation criteria considered in this report are: (a) NIOSH Criteria Documents recommending occupational standards; (b) American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLV's) with supporting documentation; and (c) Federal Occupational Health Standards as promulgated by the U.S. Department of Labor.

For brevity, the recommended health guides of the ACGIH are used as reference points in the following presentation of evaluation criteria. Use of the two other sources of criteria would not change any conclusions contained in this report.

The occupational health guide promulgated by the ACGIH (1975) applicable to the principal individual substances of this evaluation are as follows:

Substance	TLV 8-Hour Time-Weighted Average (TWA) Exposure Standard or Guide
Total Inert Dusts (Particulate)	10 mg/M^3
Respirable Inert Dusts	5 mg/M^3
Chromic Oxide (as Cr)	1.0 mg/M^3
Stannous Octoate (as Sn)	2.0 mg/M^3

mg/M^3 - milligrams of contaminant per cubic meter of air.

Occupational health exposure limits for individual substances are generally established at levels designed to protect workers occupationally exposed on an 8-hour per day, 40-hour per week basis over a normal working lifetime.

There are no current recommended guidelines or Federal occupational health standards and little background information concerning trimellitic anhydride (TMA), although TMA is generally considered by the investigators as more hazardous than phthalic anhydride which is similar chemically. Based upon a review of the literature and informal contacts with public and private organizations, the authors feel that a level exceeding 0.1 mg/M^3 of TMA may be considered as significant for purposes of this report only. (See Section 2.b. of this part).

2. Medical Standards or Criteria

a. Total and Respirable Dust - "Inert" or Nuisance Particulate

"Inert" or nuisance dusts produce little adverse effect upon the lungs and do not result in significant organic disease or toxic effects if kept under reasonable control. When inhaled, such dusts may provoke some cellular response, but the reaction is potentially reversible and progressive lung disease does not ensue. When present in excessive concentration, they may reduce visibility or cause unpleasant deposits in eyes, ears, or nasal passages. A threshold limit of 10 mg/M^3 is recommended for substances which have no specific assigned threshold limits or documentation of health effects to suggest a TLV.

b. Trimellitic Anhydride (TMA)

Human experience with trimellitic anhydride is limited, and no published studies on human effects exist. It is probable that the toxic effects of this substance resemble those of other acid anhydrides[2], (i.e., malic, phthalic, etc.), used in plastic resin systems. These are potent eye, skin, and respiratory tract irritants. Phthalic anhydride has been reported to cause bloody nasal discharge, hoarseness, cough, occasional bloody sputum, bronchitis, and emphysema. Bronchial asthma has been reported, as well as skin sensitization and urticaria (hives). These latter conditions are all forms of allergy and are seen with many substances capable of reacting with protein amino groups, which includes the acid anhydrides.

Animal data supplied by the manufacturer indicates that trimellitic anhydride is severely irritating to the respiratory tract and that human experience in their facility confirms this finding. In addition, skin and eye irritation has also been noted. They recommend that air concentrations be kept below those which are even minimally irritating to the nose or throat and suggest a level of 0.1 mg/M^3.

c. Stannous Octoate - tin (Inorganic compounds except SnH_4 and SnO_2) - as Sn

Stannous octoate from a toxicity standpoint is grouped with the inorganic tin compounds. Long-term exposure to excessive dusts containing tin is recognized to result in stannosis, which is a benign, non-progressive, deposition of dust in the lung. No case of progressive fibrosis from overexposure has been reported. A review of the industrial hygiene and toxicology of tin may be found in Patty.[2]

d. Chromic Oxide - Chromium (as Cr) - Metallic Chromium and Insoluble Compounds

Chromic oxide (Cr_2O_3) and similar insoluble compounds are ascribed a low order of toxicity and have caused no significant industrial illnesses according to Akalsuka and Fairhall.[3] Although this report and others indicate that Cr_2O_3 is considerably less toxic than other chromium compounds (e.g., chromic acid, etc.), it cannot be considered as harmless. Hence, the TLV of 1 mg/M^3 for Cr_2O_3 is recommended to prevent pulmonary disease and other toxic effects.

E. Evaluation Results and Discussion

1. Environmental Results and Discussion

Tables I-A and I-B present a summary of all sample results obtained during processing operations for total and respirable dusts, trimellitic anhydride, chromic oxide (Cr_2O_3) and stannous octoate. Tables II-A and II-B present a summary of all sample results obtained during decontamination operations for the same substances. In reviewing Table II, it is noted that the first few hours of the shift were spent in decontaminating the weigh station and mixer while the rest of the line was in normal operation until about 10:30 a.m. After 10:30 the rest of the equipment was decontaminated using compressed air and other methods. Chromic oxide was not used in the formula during normal operations but was present in the epoxy powder during decontamination procedures. Although no eight-hour time-weighted average (TWA) was estimated for various operations, it is felt that the personal sampling times were of such a long duration that they are representative of an estimated TWA.

a. Results for Total Dust or Particulate

Environmental results of five (5) long-term personal samples taken for total particulate during processing operations varied from approximately 3 mg/M^3 to 19 mg/M^3 (average - 10 mg/M^3) with two samples exceeding the ACGIH recommended TLV of 10 mg/M^3. Environmental results of eight (8) long-term personal samples taken for total particulate during decontamination operations varied from approximately 1.5 mg/M^3 to 77 mg/M^3 (average - 32.5 mg/M^3) with five samples exceeding the ACGIH recommended TLV of 10 mg/M^3.

b. Results for Trimellitic Anhydride (TMA)

Environmental results of six (6) long-term personal samples for TMA varied from none detected to 4.0 mg/M^3 (average - 1.5 mg/M^3) during processing operations with five samples exceeding the level of 0.1 mg/M^3. Environmental results of seven (7) long-term personal samples for TMA during decontamination operations varied from none detected to 7.5 mg/M^3 (average - 2.8 mg/M^3) with six samples exceeding the level of 0.1 mg/M^3.

c. Results for Chromic Oxide and Stannous Octoate

Environmental results for thirteen (13) long-term samples for chromic oxide (as Cr) and stannous octoate (as Sn) obtained during processing and decontamination operations were all less than forty percent of the ACGIH recommended TLV's of 1.0 mg/M^3 and 2.0 mg/M^3, respectively.

d. General Discussion

In reviewing Tables I and II and from personal observations made by the NIOSH investigators at the time of the survey, it appears that the main exposure during processing and decontamination operations occurs in filling and weighing station operations. The area samples were taken three to seven feet from the point of operation at the filling and weighing stations and confirm the personal sample results. The area samples also indicate that a significant portion of the dust is of respirable size. Although the ACGIH recommended TLV for total dust or particulate is 10 mg/M^3 for nuisance or inert dust, much of the dust involved in these operations should not be considered as inert due to the known composition of the formulation. The principal toxic ingredient in the dust appears to be TMA.

2. Medical Results and Discussion

A total of thirteen present (5) and former (8) Powder Coatings Department personnel were interviewed and the majority also briefly examined. Because of the small number of present Department employees, it was felt that no meaningful health data could be obtained without including former employees. Since these employees had been out of the area from three months to three years (average 1 year and eight months), it was felt that their recall of symptoms would be somewhat less accurate than that of current employees. Nonetheless, this type of error should reduce the number of positive responses and minimize the actual incidence of symptoms.

All employees were male and averaged 34 years of age (range 24-57). They averaged over seven years in total company employment, but had on the average worked only a year and three months in the Powder Coatings Department. Three former Department workers stated that they left the area basically for health reasons. Most symptoms and complaints were clearly related to TMA exposure with complaints subsiding when non-TMA containing products were being formulated. Symptoms related to TMA exposure are tabulated below:

Symptom	Number of Workers Reporting
Eye irritation (burning, tearing, redness)	8 (62%)
Nasal irritation (bloody discharge, burning)	8 (62%)
Chest symptoms	8 (62%)
Shortness of breath	5 (38%)
Wheezing	3 (23%)
Cough	3 (23%)
Gastric Distress (heartburn, nausea, pain)	3 (23%)
Headache	3 (23%)
Photophobia	2 (15%)
Skin Irritation	2 (15%)
Throat Irritation	1 (8%)

The irritant effects of TMA are amply evidenced by the high incidence of eye and nose symptoms. It is of considerable interest that at least three men had experienced asthma-like symptoms. Since chest tightness and wheezing were noted primarily following especially heavy TMA exposures and not experienced consistently when TMA was in use, these asthma-like symptoms probably resulted from direct bronchial irritation rather than sensitization. The photophobia is also probably related to temporary corneal irritation (edema). The only pertinent finding on physical examination was slight conjunctival congestion in three present employees. This data confirms the severe irritant properties of TMA and shared by other acid anhydrides.

The only other symptoms related to work exposure were occasional early narcotic or anesthetic complaints (sensation of dizziness, drunkenness, lightheadedness) experienced by three employees when using T-10 (methyl ethyl ketone) in final decontamination. Three other men related excessive skin dryness in association with T-10 usage. These are well known effects of this solvent.

F. Recommendations

In view of the above and as previously discussed with the staff at Cook Paint and Varnish Company, the following recommendations are made to reduce or ameliorate the existing hazards and to provide a better working environment:

1. Immediate action should be taken to lower the air concentrations of particulate matter and TMA during normal processing operations and decontamination operations. The ventilation system, particularly the local exhaust for weighing and filling operations, should be improved. A vacuum cleaner for decontamination operations would significantly reduce airborne dust concentrations. The use of compressed air for cleaning operations should be reduced to an absolute minimum.

2. The current respiratory program does not appear entirely adequate and should be improved (e.g., training, face fit, field checks, cleaning, change cartridges, etc.) to meet the requirements of Part 1910.132 - Subpart I - "Personal Protective Equipment" of Title 29 of the Code of Federal Regulations - Chapter XVII. Additionally, the use of a full face mask or chemical goggles should preclude any potential problem of eye irritation. Please note that personal protective equipment should not be utilized in lieu of improved engineering controls.

3. Employees should be informed of the hazards of working with the various chemicals used in the Powder Coatings Department and the need for good personal hygiene practices. This should also include improved handling techniques of solvents to preclude undue exposure of employees which may result in dizziness, dryness of skin and similar symptoms. If such symptoms are noted, the casual exposure should be promptly terminated and measures taken to ensure that the condition does not recur.

4. Employees in the Powder Coatings Department should have an annual physical examination, pulmonary function evaluation, and chest X-ray.

5. The company should periodically monitor the concentrations of airborne dust and TMA during normal and decontamination operations. This would permit the evaluation of comtemplated engineering changes and provide data on which to base future process changes.

V. REFERENCES

1. NIOSH Manual of Analytical Methods. P & CAM #178, HEW Publication No. (NIOSH) 75-121.

2. Industrial Hygiene and Toxicology. Patty, F.A.; Volume II, 2nd Edition; pages 1148-1153; Interscience, New York (1963).

3. Journal of Industrial Hygiene. K. Akalsuka and L.T. Fairhall; 16, 1, 1934.

VI. ACKNOWLEDGEMENTS AND AUTHORSHIP

Originating Office : Jerome P. Flesch, Chief
Hazard Evaluation Services Branch
Cincinnati, Ohio

Report Prepared & Field Investigation By: Raymond L. Hervin
Regional Industrial Hygienist
Kansas City, Missouri

Report Prepared & Field Investigation By (continued) : James B. Lucas, M.D.
Special Assistant to the
Associate Director for
Medical Affairs
Cincinnati, Ohio

Laboratory Analysis : Russell Hendricks, Ph.D.,
Chemist, DLCD
Richard Kupel, Chemist, DLCD
Robert Larkin, Chemist, DLCD
Wayne Smallwood, Chemist, DLCD

TABLE I-A

SUMMARY OF ENVIRONMENTAL RESULTS FOR TOTAL DUST OR PARTICULATE (SAMPLE NO.-T) OR RESPIRABLE DUST OR PARTICULATE (SAMPLE NO.-R), CHROMIC OXIDE (Cr_2O_3) AND STANNOUS OCTOATE DURING NORMAL OPERATIONS IN THE POWDER COATINGS DEPARTMENT AT COOK PAINT AND VARNISH COMPANY ON SEPTEMBER 9, 1975. (All sample results expressed as milligrams of compound per cubic meter of air sampled - mg/M^3)

JOB DESCRIPTION OR LOCATION	SAMPLE NUMBER	TIME	AIR VOLUME LITERS	DUST OR PARTICULATE*	Cr_2O_3* (as Cr)	STANNOUS OCTOATE* (as Sn)
Working Foreman	V-1-T	7:31--3:22 PM	800	15.0	ND	.02
Weight Station Operator	V-3-T	7:34--3:28 PM	805	7.8	ND	.02
Fill Station-Support Operator	V-10-T	11:25--3:15 PM	391	5.3	ND	.02
Support Operator	V-2-T	7:38-11:30 AM	394	3.0	ND	.01
Fill Station-Support Operator	M-11	11:30--3:17 PM	385	19.6	ND	ND
Weight Station Area	V-5-T	8:05--3:20 PM	739	2.4	ND	.01
Weight Station Area	V-6-R	8:05--3:20 PM	739	1.4	ND	.01
Fill Station Area	V-7-T	8:32--2:45 PM	623	17.1	ND	.06
Fill Station Area	V-8-R	8:32--2:45 PM	634	3.9	ND	.02

TABLE I-B

SUMMARY OF ENVIRONMENTAL RESULTS FOR TRIMELLITIC ANHYDRIDE (TMA) DURING NORMAL OPERATIONS IN THE POWDER COATINGS DEPARTMENT AT COOK PAINT AND VARNISH COMPANY ON SEPTEMBER 9, 1975. (All sample results expressed as milligrams of compound per cubic meter of air sampled - mg/M^3)

JOB DESCRIPTION OR LOCATION	SAMPLE NUMBER	TIME	AIR VOLUME LITERS	TMA*
Working Foreman	G-1-T	7:31--3:22 PM	800	3.5
Weight Station Operator	G-3-T	7:34--3:28 PM	805	4.0
Support Operator	G-2-T	7:38-11:30 AM	394	ND
Fill Station-Support Operator	G-11-T	11:30--3:17 PM	385	0.31
Fill Station-Support Operator	G-4-T	7:41-11:24 AM	379	0.53
Fill Station-Support Operator	G-10-T	11:25--2:56 PM	358	0.88
Weight Station Area	G-6-T	8:05--3:20 PM	739	1.5
Weight Station Area	G-5-R	8:05--3:20 PM	739	0.15
Fill Station Area	G-7-T	8:32--2:45 PM	634	0.95
Fill Station Area	G-8-R	8:32--2:45 PM	634	ND

*ACGIH Standards for Eight-Hour Time-Weighted Average - Threshold Limit Value for above compounds are as follows:

Total Dust or Particulate - 10 mg/M^3 — Chromic Oxide (Cr_2O_3-- as Cr) - 1.0 mg/M^3

Respirable Dust or Particulate - 5 mg/M^3 — Stannous Octoate (as Sn) - 2.0 mg/M^3

There are no current suggested limits, TLV's or other health standards for Trimellitic Anhydride (TMA); although it is considered a potent skin, eye and upper respiratory irritant. (ND = None Detectable)

TABLE II-A

SUMMARY OF ENVIRONMENTAL RESULTS FOR TOTAL DUST OR PARTICULATE (SAMPLE NO.-T) OR RESPIRABLE DUST OR PARTICULATE (SAMPLE NO.-R), CHROMIC OXIDE (Cr_2O_3) AND STANNOUS OCTOATE DURING DECONTAMINATION OPERATIONS IN THE POWDER COATINGS DEPARTMENT AT COOK PAINT AND VARNISH COMPANY ON SEPTEMBER 15, 1975. (All sample results expressed as milligrams of compound per cubic meter of air sampled - mg/M^3)

JOB DESCRIPTION OR LOCATION	SAMPLE NUMBER	TIME	AIR VOLUME LITERS	DUST OR* PARTICULATE	Cr_2O_3* (as Cr)	STANNOUS OCTOATE* (as Sn)
Working Foreman	M-20-T	7:30-10:22 AM	292	2.5	.04	ND
Working Foreman	M-30-T	10:22--3:20 PM	506	75.0	.29	.02
Weight Station Operator	M-22-T	7:38-10:31 AM	294	11.0	.23	.02
Weight Station Operator	M-32-T	10:31--3:22 PM	494	77.0	.38	.03
Fill Station Operator	M-23-T	7:42-10:35 AM	294	1.5	.03	ND
Fill Station Operator	M-33-T	10:35--3:15 PM	476	54.0	.31	.03
Support Operator	M-21-T	7:35-10:29 AM	295	8.0	.03	ND
Support Operator	M-31-T	10:29--3:10 PM	477	31.0	.27	.02
Weight Station Area	M-24-R	8:00--2:15 PM	637	1.0	.02	ND
Weight Station Area	M-25-T	8:00--2:15 PM	637	11.5	.17	.01
Fill Station Area	M-26-R	10:00--2:30 PM	459	16.5	.01	ND
Fill Station Area	M-27-T	10:00--2:30 PM	459	27.0	.20	.02

TABLE II-B

SUMMARY OF ENVIRONMENTAL RESULTS FOR TRIMELLITIC ANHYDRIDE (TMA) DURING DECONTAMINATION OPERATIONS IN THE POWDER COATINGS DEPARTMENT AT COOK PAINT AND VARNISH COMPANY ON SEPTEMBER 15, 1975. (All sample results expressed as milligrams of compound per cubic meter of air sampled - mg/M^3)

JOB DESCRIPTION OR LOCATION	SAMPLE NUMBER	TIME	AIR VOLUME LITERS	TMA*
Working Foreman	G-20-T	7:30-10:22 AM	292	0.24
Working Foreman	G-30-T	10:22--3:20 PM	Sample Lost - VOID	
Weight Station Operator	G-22-T	7:38-10:31 AM	294	7.5
Weight Station Operator	G-32-T	10:31--3:22 PM	494	7.1
Fill Station Operator	G-23-T	7:42-10:35 AM	294	0.31
Fill Station Operator	G-33-T	10:35--3:15 PM	476	2.0
Support Operator	G-21-T	7:35-10:29 AM	295	ND
Support Operator	G-31-T	10:29--3:10 PM	477	2.7
Weight Station Area	G-24-R	8:00--2:15 PM	637	0.57
Weight Station Area	G-25-T	8:00--2:15 PM	637	2.8
Fill Station Area	G-26-R	10:00--2:30 PM	459	0.26
Fill Station Area	G-27-T	10:00--2:30 PM	459	3.9

*ACGIH Standards for Eight-Hour Time-Weighted Average - Threshold Limit Value for above compounds are as follows:
Total Dust or Particulate - 10 mg/M^3
Respirable Dust or Particulate - 5 mg/M^3
Chromic Oxide (Cr_2O_3-- as Cr) - 1.0 mg/M^3
Stannous Octoate (as Sn) - 2.0 mg/M^3)

There are no current suggested limits, TLV's or other health standards for Trimellitic Anhydride (TMA); although it is considered a potent skin, eye and upper respiratory irritant. (ND = None Detectable)