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INDUSTRIAL HYGIENE SURVEY REPORT - PLASTIGAMA
(LABORATORY SUBMISSION: F83-057, 058, 059 AND 060)

Enclosed is the report of the industrial hygiene survey which was conducted at Plastigama during the week of March 14, 1983.

Survey findings reveal that occupational exposures to vinyl chloride, organic solvents, and PVC dusts were well within permissible levels. Employee noise exposures were high, but will be greatly reduced after the rope making machines are relocated to a new site.

General comfort ventilation at Plant I should be improved. Major recommendations include the installation of five roof exhausters and an additional wall fan on the front wall.

I would like to thank you and Messrs. R. Angles, J. Quiroga, and L. Landivar for the cooperation and courtesy extended to me during this visit. Please feel free to contact me at (713) 754-2986 if you have any questions regarding this report.

Robert T. Cheng

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Regional Industrial Hygiene Director

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INDUSTRIAL HYGIENE SURVEY

OF

PLASTIGAMA, S.A.

MARCH, 1983

Submitted By: Robert T. Cheng, Ph.D., P.E.
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I. SUMMARY

A comprehensive industrial hygiene survey was conducted at Plastigama's manufacturing facilities in Guayaquil, Ecuador during the week of March 14, 1983. Plastigama has two manufacturing plants. Plant I makes films, bags, bottles, tapes and ropes from polyethylene and polypropylene resins. The newer Plant II makes pipes, electrical conduits, and plastic injection products from polyvinyl chloride (PVC) and polyethylene resins. During this industrial hygiene survey, the major emphasis was placed on the evaluation of occupational exposures to vinyl chloride monomer, vapors of organic solvents, PVC dust, and noise. Workplace ventilation, problems related to sanitation, and hygienic work practices were also assessed. The more important findings of this survey are summarized as follows:

A. Occupational exposure to vinyl chloride monomer (VCM) was found to be minimal. The residual VCM concentration within an unopened bag of PVC resin was less than 0.5 ppm.

B. Exposures to vapors of organic solvents (MEK, MIBK, THF, IPA, ethyl acetate and ethyl alcohol) at the Hand-Made Fitting Area and at the printers were well within the permissible exposure limits for these compounds.

C. Exposures to dust of PVC resin in the Compounding Area and near the pipe extruders were within the permissible limit for nuisance dusts.

D. Ozone concentrations at the film extrusion machines and carbon monoxide concentrations inside the warehouses were also well within safe levels.

E. A majority of workers at Plant I and many workers at Plant II showed noise exposures which exceeded an 8-hour time-weighted average of 85 dBA. It was noted that Plastigama presently has in

place a fairly effective ear protection program, but not a complete hearing conservation program.

F. A significant reduction of noise levels at Plant I will result when the rope making machines are moved to their new site at Plastifibra.

G. General comfort ventilation was inadequate for Plant I. Inoperative fans and plugged window screens aggravate the workplace heat stress problem.

H. Housekeeping at Plant II was fair. Its restroom and shower facility were maintained in a sanitary condition. Housekeeping at Plant I needs improvement. The restroom and shower facility at Plant I were dirty and odorous.

II. MAJOR RECOMMENDATIONS

Listed below are the major recommendations offered as a result of the survey. Some additional minor recommendations are also contained in the text.

A. Propellar fans or tube-axial fans should be installed at each of the five existing natural-draft roof ventilators to improve the general comfort ventilation in Plant I. The minimum exhaust capacity should be 5,000 cfm for each fan. It may be necessary to remove a major part of the existing sheet-metal rain covers to promote easy air movement.

B. Repair and maintain in good condition the six existing wall fans in Plant I. The three wall fans in the rear of the building should blow cool air into the building (this will take advantage of the prevalent wind direction), while the three fans on the front wall should exhaust the warm air out of the building.

C. Install an additional wall fan of 10,000 cfm capacity on the front wall near the film extruders to relieve heat stress in this hottest section.

D. Provide as many openings as possible and make certain that the existing windows, doorways, and wall gaps along the lower sides of Plant I are unblocked, so that cooler outdoor air can flow into the building. Clean out or simply remove the dirt-plugged screen windows near the ceiling of the building so that hot air can flow out.

E. Install wall fan(s) and/or roof exhauster(s) of approximately 1,000 cfm total capacity to vent the Plant I restroom and shower facility.

F. Provide additional exhaust ventilation for the ink warehouse to prevent accumulation of solvent vapors inside this room.

G. Improve the existing hearing conservation program to include noise exposure monitoring, audiometric testing, employee training, and recordkeeping, as well as, the use of ear protectors.

H. Enforce the wearing of hearing protectors by the following groups of employees: rope makers. bag makers, printer operators, slitter operators, blow molder operators, cord makers, scrap grinder operators, compounding workers, film extruder workers, and pipe extruder workers.

I. Engineering noise reduction should be considered for the future Plastifibra operation. A noise reduction of 5 dB can be achieved by installing a see-through plexiglass cover on the outside of the steel wire cage of the rope makers. It may be necessary to convert the cage opening mechanism from a sliding type to a hinged, lift-up type, so that a tighter enclosure can be obtained. The electrical motor of the rope makers should also be covered.

J. Improve sanitation in the Plant I restroom and shower facility, and upgrade the cleanliness standard in the kitchen.

K. Conduct periodic tests of the Plant's potable water system for free residual chlorine. A free residual chlorine level of 0.5 mg/l should be maintained at the water distribution outlets.

III. VINYL CHLORIDE EXPOSURE

At Plant II, imported polyvinyl chloride (PVC) resins are compounded and fabricated to end products, principally pipes and electrical conduits. The presence of gaseous vinyl chloride monomer (VCM), if any, is from the residual VCM entrapped in the PVC resins and released during the fabrication processes. Fifteen (15) grab area samples were collected with direct-reading VCM detector tubes for determining workplace airborne VCM concentrations. Table I summarizes the air sampling results. All 15 samples showed VCM concentrations less than 0.5 ppm, which is the lower detection limit of this analytical technique.

Occupational VCM exposures were evaluated by collecting personal VCM samples. These samples were collected with 3M Brand Organic Vapor Badges attached onto workers' lapels during their 8-hour workshift. The badge samples were analyzed by Gulf's Industrial Hygiene Laboratory via gas chromatography. The results, as time-weighted average exposure concentrations, are tabulated in Table II. All twelve workers monitored showed VCM exposures well within the permissible exposure limit of 1 ppm for VCM.

Since 1974, the year VCM was identified as a human carcinogen, tremendous progress has been made industry-wide to reduce residual VCM in PVC resin. Consequently, occupational VCM exposure problems at PVC fabrication plants have virtually disappeared.

TABLE I

WORKPLACE AIRBORNE VCM CONCENTRATIONS AT PLASTIGAMA
MARCH 1983

ANALYZED BY BENDIX GASTEC VCM DETECTOR TUBE METHOD*

Sample Location	VCM Concentration
Compounding Area (3 samples)	<0.5 ppm
Compounding Area, inside blender M-02	<0.5 ppm
Compounding Area, upper level of platform	<0.5 ppm
Extruder XT-31, Conduit Extruder	<0.5 ppm
Extruder XT-22, Wastewater Pipe Extruder	<0.5 ppm
Dumping PVC Resin into Extruder Hopper	<0.5 ppm
Within Unopened PVC Resin Bags (2 samples)	<0.5 ppm
Hand-made Fitting Room (2 samples)	<0.5 ppm

*Lower Detection Limit of this analytical method is 0.5 ppm of VCM

TABLE II

OCCUPATIONAL TIME-WEIGHTED AVERAGE VCM EXPOSURES
FOR SELECTED WORKERS AT PLASTIGAMA

MARCH 1983

Employee	Location and Job Title	VCM PPM
Cepeda, E.	Hand-made Fittings Worker	<0.060
Barreto, M.	Hand-made Fittings Worker	<0.060
Moran, L.	Hand-made Fittings Worker	0.034
Caceres, J.	Compounding Area Foreman	0.034
Martinez, P.	Compounding, M-02 Operator	0.068
Franco, G.	Compounding, M-03 Operator	0.034
Pinargote, D.	Compounding, M-02 Operator	0.034
Quijije, M.	Compounding, M-02 Operator	*
Bonylla, B.	Compounding, M-03 Operator	<0.034
Cepeda, E.	Hand-made Fittings Worker	0.034
Barreto, M.	Hand-made Fittings Worker	0.034
Criollo, P.	Hand-made Fittings Worker	0.034
Blank #1		
Blank #2		

*This sample showed some unidentified light hydrocarbons with residence time similar to that of VCM.

NOTE: Gulf Exposure Limit for VCM is 1.0 ppm

TABLE III

TIME-WEIGHTED AVERAGE EXPOSURES TO ETHYL ALCOHOL, ISOPROPYL ALCOHOL AND ETHYL ACETATE FOR PRINTER OPERATORS AND OTHERS AT PLASTIGAMA

MARCH 1983

Employee	Job	Ethyl Alcohol PPM	Isopropyl Alcholol PPM	Ethyl Acetate PPM
Reyes, A.	Slitter, C-01	22	3.0	0.11
Cordero, C.	Operator, XP-12, XP-30	22	2.1	0.37
Echeverria, I.	Printer, I-01	110	6.0	1.7
Medina, J.	Printer, I-01	130	7.4	<0.028
Valarde, F.	Printer, I-02	35	4.7	<0.028
Paredes, E.	Printer, I-02	43	5.6	<0.028
Reyes, T.	Ink Warehouse	63	28	<0.028
Lara, D.	Printer, I-03	72	13	<0.028
Garcia, A.	Helper, I-03	58	5.9	0.91
Antepara, J.	Printer, I-03	89	6.1	0.48
Quiroz, L.	Assistant, I-03	81	19	0.34
Holguin, C.	Printer, I-02	24	5.0	0.20
Parades, E.	Assistant, I-02	31	2.7	0.26
Puley, M.	Assistant, I-01	51	6.3	0.26
Quimi, J.	Printer, I-01	65	7.5	0.34
Echeverria, I.	Printer, I-01	47	14	0.68
Lara, D.	Printer, I-03	57	5.0	0.37
Vera, F.	Printer, I-02	28	3.6	0.028
Medina, J.	Printer, I-01	67	25	0.68
Reyes, T.	Ink Warehouse	52	16	0.99
Quimi, J.	Printer, I-01	100	5.2	0.97
Antepara, J.	Printer, I-03	20	1.6	0.028

Gulf Exposure Limits are:

Ethyl Alcohol	1000 ppm
Isopropyl Alcohol	400 ppm
Ethyl Acetate	400 ppm

TABLE IV

TIME-WEIGHTED AVERAGE EXPOSURES TO MEK, MIBK, AND THF
FOR WORKERS AT HAND-MADE FITTINGS ROOM OF PLASTIGAMA

MARCH 1983

Employee	MEK PPM	MIBK PPM	THF PPM
Cepeda, E.	27	3.2	9.2
Barreto, M.	8.9	1.0	3.4
Criollo, P.	17	1.5	4.6
Moran, L.	4.1	0.18	0.69
Cepeda, E.	9.1	0.64	2.4
Barreto, M.	2.1	0.29	0.42

Gulf Exposure Limits are:

Methyl Ethyl Ketone (MEK) = 200 ppm
Methyl Isobutyl Kentone (MIBK) = 50 ppm
Tetrahydrofuran (THF) = 200 ppm

V. DUST EXPOSURE

In the Compounding Room of Plant II, compounding ingredients, including plasticizer, stabilizer, lubricant, and pigments, are weighed, added, and mixed with PVC resin in two mixers. The powdery ingredients are titanium dioxide, wax flakes, calcium stearate, and calcium carbonate. These are weighed in one corner of the room where a small wall-fan provides local exhaust ventilation.

Results of a ventilation adequacy test conducted with a smoke tube indicated that the wall fan provided effective control of fine airborne dusts of the compounding ingredients. In addition, workers wore dust masks for protection against inhaling dust.

Historically, PVC resin dust has been considered as an inert, non-toxic, nuisance dust. However, a few recent reports in the United States and other countries have shown inconclusive evidence of excessive pneumoconiosis (dust-caused lung disease) among workers at vinyl chloride polymerization plants and PVC fabrication operations. In a Federal Register notice (December 18, 1979), the U.S. Occupational Safety and Health Administration noted its particular concern with PVC resin dust. However, a new health standard for PVC dust has <u>not</u> been proposed. The existing standard limits the time-weighted average exposure to PVC dust at 10 mg/m^3 as airborne total dust, or 5 mg/m^3 as respirable dust. Respirable dust is generally defined as dust smaller than 10 micrometers in diameter.

Evaluation of the workplace airborne dust concentrations was conducted employing a GCA dust counter. This is a direct-reading instrument which indicates the concentration of airborne total dust after a very brief (1 minute) sampling duration. Table V summarizes the air sampling results for samples collected from various work locations. The highest dust concentration, 4.8 mg/m3, was encountered at the additive weighing bench during the weighing of tantanium dioxide powder. All other samples showed airborne total dust concentrations were significantly below the 10 mg/m^3 standard for total nuisance dust.

Full-shift, personal breathing-zone dust samples were collected with personal air sampling pumps. Air is drawn across a PVC filter contained in a cassette at a flow rate of approximately 2.0 liters per minute. The filters are weighed prior to sampling and then after sampling to obtain the weight of dust collected. For respirable dust sampling, a small cyclone is mounted in front of the filter cassette to separate the larger dust particles and to allow only the respirable dust to reach the filter.

Table VI presents results of 8-hour time-weighted average dust exposures for workers in the Compounding Room. Three workers showed moderate exposures to total dust at 2.5, 3.4 and 4.1 mg/m^3, respectively. All other personal samples showed very low dust exposures.

It should be noted that workers in the Compounding Room routinely wore organic vapor face masks (sometimes in combination with a dust filter). Because the gaseous vinyl chloride monomer no longer poses a hazard to workers in the Compounding Room, and because organic vapor respirators are ineffective for protection against dust inhalation, it is recommended that only dust (filtration) masks should be issued to the workers.

Conclusion: Occupational exposures to airborne dusts of PVC resin were within the permissible limit for nuisance dusts. It is a good hygiene practice to encourage workers to use respirators in the Compounding Room, however, discontinue the use of organic vapor respirators and provide only dust masks.

TABLE V

WORKPLACE AIRBORNE DUST CONCENTRATIONS
AT PLASTIGAMA PLANT II

MARCH 1983

Sampling Location and Task Description	Number of Samples	Dust Concentration mg/m^3
Compounding Room, general area	3	0.2 - 0.5
Weighing waxy flakes	2	0.5 - 0.7
Weighing titanium dioxide powder	3	1.3 - 4.8
Dumping PVC resin to mixer hopper	2	1.2 - 3.0
Mixer M-03 platform	2	0.5 - 1.2
Mixer M-02 platform	2	0.4 - 1.8
Beside Toledo Scale RM-23	1	0.9
Dumping PVC resin to top hopper	1	4.3
Loading mixed product into bags	3	1.8 - 3.2
Plant II main floor	2	0.1 - 0.2
Pipe Extruder XT-22, XT-26	2	0.2
Addition of PVC resin to extruder hopper	2	0.5 - 1.9
Hot oil fume (pipe warming)	1	1.0
Grinding of PVC pipes	2	0.5 - 1.2
Compounding Room, sweeping of floor	2	2.5 - 3.1

TABLE VI

OCCUPATIONAL TIME-WEIGHTED AVERAGE DUST EXPOSURES
FOR COMPOUNDING ROOM WORKERS
PLASTIGAMA, MARCH 1983

Employee	Job Description	Respirable Dust Conc. mg/m^3	Total Dust Conc. mg/m^3
Nava, R.	Compounding ingredients weighing	0.38	---
Vargas, F.	Assist in weighing ingredients	0.46	---
Intriago, A.	Mixer operator	0.03	---
Rocafuerte, J.	Mixer operator	---	0.29
Sarco, J.	Dump additives and bag products	---	2.5
Nava, R.	Compounding ingredients weighing	---	3.4
Intriago, A.	Helper in weighing ingredients	0.07	---
Rocafuerte, J.	Mixer operator	---	0.53
Sarco, J.	Bag products	---	4.1
Gomez, J.	Mixer operator	---	0.26

NOTE: The Gulf Exposure Limits for PVC resin, titanium dioxide, and other nuisance dusts are 5 mg/m^3 for respirable dust, and 10 mg/m^3 for total dust.

VI. VENTILATION

An acceptable working environment is fundamental to the healthful and profitable operation of industry. While standards of acceptable working conditions vary considerably from one industrial occupation to another, it has been demonstrated that money spent for providing a comfortable working environment will be rewarded many times over by increased productivity.

General comfort ventilation at Plastigama's Plant I was inadequate. The temperature inside the main building was high and there was, in general, a lack of air movement. There were many defects in and lack of maintenance of the existing ventilation systems. For example, only one of the three wall fans on the front (north) wall was working. The screen windows near the top of the building were essentially plugged by dirt, and a local exhaust fan on a printer was missing.

Consideration should be given to the implementation of the following recommendations:

A. Establish a favorable air flow pattern. From the local weather station, it was determined that the prevalent wind direction is from the southwest. Therefore, the three existing wall fans at the rear (south) of the plant should blow air into the plant, while the three existing fans in the front should exhaust air out of the plant. This air flow pattern not only takes advantage of the prevalent wind, but also moves the air from the cooler plant section to the hotter section (film extrusion).

B. Replace the missing exhaust fan on one of the printers. Repair and maintain the six existing wall fans in top operating shape.

C. Install a propellar fan or a tube-axial fan at each of the five existing natural-draft roof ventilators. The minimum exhaust capacity should be 5,000 cfm (140 cubic meter per minute) for each fan. It may be necessary to remove a major part of the existing sheet-metal rain covers to promote easy air movement. Forced-draft roof ventilators are the most

efficient and fairly economical method to remove excessive heat from a hot industrial plant.

D. Install an additional wall fan of 10,000 cfm capacity on the front wall near the film extruders to relieve heat stress at this hottest section of the plant.

E. Provide as many openings as possible and make sure that the existing windows, doorways, and wall gaps along the lower sides of the plant are opened and unblocked, so that cooler outdoor air can flow into the building. Also clean out or simply remove the dirty screen windows near the ceiling of the building so that hot air can move out.

F. The Ink Storage Warehouse should not be tightly closed. Additional exhaust ventilation (can be as low as 100 cfm) should be provided to prevent accumulation of solvent vapors inside this room.

G. The restroom and shower facility in Plant I were odorous. Wall fans and/or roof exhausters of approximately 1,000 cfm total capacity should be installed.

VII. NOISE EXPOSURE

A noise engineering survey was conducted in April 1979 at Plastigama by William R. Thornton, Ph.D. of Gulf's Medical & Health Resources Division. Several noise control engineering measures were recommended by Dr. Thornton, yet most of his recommendations were not adopted.

During this industrial hygiene survey, it was noticed that the Plastigama management has successfully implemented an effective hearing protection program. Employees in high noise work areas were issued ear muffs and/or ear plugs. It was observed that in the noisy Bay Printing Section of Plant I, fifteen out of seventeen workers were wearing ear plugs on the job. In the Compounding Area of Plant II, five out of six workers were noted to be wearing ear muffs.

The fact that high noise levels exist at Plastigama does not automatically mean that all employees receive high noise doses. The best method for establishing the significance of noise environments, in relation to employee work patterns, is through use of the noise dosimeter. A noise dosimeter worn by the employee automatically integrates the intensity of measured sound with the duration of exposure.

Noise dosimeters by Metrosonics (Model dB-301 Metrologger) were employed in this noise dosimetry survey. The dB-301 Metrologger is a small, battery-operated recording device which is carried on the worker's belt with the microphone clipped to the worker's collar near his ear. At the end of the workshift, a printout of the employee's noise exposure is produced from a readout device.

The current noise exposure standard in the United States permits maximum exposure of 90 dBA for an 8-hour workday. This permissible exposure limit is rated at 100%. Exposures above 100% exceed the standard. In addition, employees with an exposure greater than 50% of the permissible exposure limit are required to be included in a comprehensive hearing conservation program

(audiometric testing, periodic noise monitoring, employee training, use of hearing protection, recordkeeping, etc.).

Only those plant operating jobs judged to be heavily exposed to high noise sources were selected for inclusion in this dosimetry survey. Table VII presents the noise dosimetry results. A review of the employee dosimetry results and the sound level survey of the noise sources lead to the following conclusions:

A. At Plant I, the rope maker operators and the blow molding grinder operator showed noise exposures in excess of the permissible exposure limit (i.e., 100%).

B. The blow molding grinder works in a noisy area that is isolated from the rest of Plant I operations with partition walls. The grinder operator appears to be well protected from noise induced hearing damages through the use of ear muffs. Therefore, no additional noise control measures are being recommended.

C. Noise levels generated by the rope makers were measured to be as high as 97 dBA in and around the work area. The rope makers are the predominant noise producing source in Plant I. These rope makers are to be relocated to a new plant site at Plastifibra. Therefore, noise reduction for the rope makers should be investigated with regard to their future plant environment.

D. Printer operators, slitter operators, and bag maker operators received a major portion of their noise exposure from the rope makers. It is believed that once the rope makers are removed from Plastigama and relocated to their new plant site at Plastifibra, noise exposures experienced by printer operators, slitter operators, and bag maker operators will be reduced to an acceptable level (i.e., ear protection will not be required).

E. The blow molding operator showed a moderately high noise exposure (77% of the permissible dose) due to discharge noise (air hissing). As

recommended by Dr. Thornton in his 1979 survey, air ejector mufflers should be installed on these machines.

F. The film extruder operators were also exposed to moderate levels of noise (56 to 70% of the permissible dose). Part of the noise exposure is due to the rope makers, but another major source of noise are the electrical arc discharges. Dr. Thornton made engineering control recommendations which turned out to be economically and operationally infeasible. After the rope makers are removed, perhaps noise exposures experienced by the film extruder operators will be significantly reduced.

G. Noise exposures to operators of the tape extruders and cords makers were slightly above the 50% permissible noise exposure limit. Their exposures will be reduced to below 50% after the removal of the rope makers.

H. At Plant II operators of the pipe and electrical conduit extruders showed noise exposures slightly above 50% of the permissible level. The intermittent noise from the pipe sawing operation reached 114 dBA. It was noticed that many workers used ear muffs during their workshift. This is a good work practice and should be continued. In the Compounding Area, workers' noise exposures were moderately high (62 to 81%). It was noted that nearly all workers wore ear muffs during their workshift. The use of hearing protection by these employees should be continued.

I. For the future Plastifibra operation, a noise reduction of 5 dB can be achieved by installing a see-through plexiglass cover on the outside of the steel wire cage of the rope makers. It may be necessary to convert the cage opening mechanism from a sliding type to a hinged lift-up type, so that a tighter enclosure can be obtained. The electrical motor of the rope makers should also be enclosed.

TABLE VII

PLASTIGAMA NOISE DOSIMETRY SURVEY RESULTS
MARCH, 1983

Location and Job	Employee	% of Permissible Exposure
Plant I, Blow Molding Grinder	Gorotiza, E.	123
Plant I, Rope Maker, T-49	Molina, L.	134
Plant I, Rope Maker, T-50	Pinto, J.	100
Plant I, Rope Maker, T-57	Lara, L.	100
Plant I, Rope Maker	Chang, R.	97
Plant I, Printer Operator	Antepara, J.	90
Plant I, Printer Operator	Quimi, Jr.	93
Plant I, Slitter Operator	Reyes, A.	112
Plant I, Bag Maker F-05	Vargas, G.	86
Plant I, Bag Maker F-08	Villamar, R.	84
Plant I, Blow Molding Operator	Diaz, J.	77
Plant I, Film Extruder, XP-13	Chauez, P.	61
Plant I, Film Extruder, XP-08	Alcivar, R.	70
Plant I, Film Extruder	Mite, J.	56
Plant I, Tape Extruder, XC-27	Ascencio, J.	54
Plant I, Tape Extruder	Moreira, V.	35
Plant I, Tape Extruder	Chiyvilo, W.	53
Plant I, Cords Maker	Moran, C.	54
Plant II, Extruder XT-37	Villamarin, V.	52
Plant II, Extruder XT-34	Macamoros, T.	58
Plant II, Extruder XT-09	Guerrero, C.	49
Plant II, Extruder XT-04	Delgado, V.	53
Plant II, Compounding Operator	Caceres, J.	81
Plant II, Compounding Operator	Quijije, M.	62

VIII. HOUSEKEEPING AND SANITATION

Housekeeping was fair at Plant II. The Compounding Area was swept every day to rid of dust accumulation. The restrooms and shower facilities were maintained in sanitary condition.

Housekeeping needs improvement at Plant I. Moving the rope making operation to Plastifibra should provide relief to the current problem of work space congestion. The restrooms and shower facility were dirty and odorous. Installation of exhaust fans and better janitorial service should correct the unsanitary conditions.

The dining room was kept in clean and pleasant condition, but the kitchen needs attention in upgrading its cleanliness standards. Special emphasis should be placed on putrescible gargage removal, food service personnel hygiene practices, and the medical examination requirement for food service personnel.

Plastigama obtains its water from the municipal water supply. Dry chlorine compound is added to the water at the cistern, and the water is then pumped up hill to the seven storage tanks in the back of Plant II. It is recommended that the Plant's potable water supply be tested for free residual chlorine on a regular basis. A free residual chlorine level of 0.5 mg/l should be maintained at the water distribution outlets.