PRELIMINARY SURVEY REPORT:

CONTROL TECHNOLOGY FOR NEW MATERIALS

AT

INTERNATIONAL HARVESTER, COLUMBUS PLASTICS PLANT
COLUMBUS, OHIO

REPORT WRITTEN BY:
Dennis M. O'Brien
William F. Todd

REPORT DATE:
August 1984

REPORT NO.:
148-16

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
Division of Physical Sciences and Engineering
Engineering Control Technology Branch
4676 Columbia Parkway
Cincinnati, Ohio 45226

PLANT SURVEYED:	International Harvester Columbus Plastics Plant 800 Manor Park Drive Columbus, Ohio 43228
SIC CODE:	3713 (Truck and Bus Bodies)
SURVEY DATE:	April 10, 1984
SURVEY CONDUCTED BY:	Dennis O'Brien William Todd Dan Habes
EMPLOYER REPRESENTATIVES CONTACTED:	Dave Gallimore Plant Manager Columbus Plastics Plant Secora Smith Plant Safety Columbus Plastics Plant Thomas Slavin Manager, Industrial Hygiene International Harvester
EMPLOYEE REPRESENTATIVES CONTACTED:	Paul Van Order Health and Safety Representative IAM Local 1471
ANALYTICAL WORK PERFORMED BY:	G. S. Bajwa UBTL 520 Wakara Way Salt Lake City, Utah 84108

I. INTRODUCTION

The National Institute for Occupational Safety and Health (NIOSH) is the primary Federal agency engaged in occupational safety and health research. Located in the Department of Health and Human Services (formerly DHEW), it was established by the Occupational Safety and Health Act of 1970. This legislation mandated NIOSH to conduct a number of research and education programs separate from the standard setting and enforcement functions carried out by the Occupational Safety and Health Administration (OSHA) in the Department of Labor. An important area of NIOSH research deals with methods for controlling occupational exposure to potential chemical and physical hazards. The Engineering Control Technology Branch (ECTB) of the Division of Physical Sciences and Engineering has been given the lead within NIOSH to study the engineering aspects of health hazard prevention and control.

Since 1976, ECTB has conducted a number of assessments of health hazard control technology on the basis of industry, common industrial process, or specific control techniques. Examples of these completed studies include the foundry industry; various chemical manufacturing or processing operations; spray painting; and the recirculation of exhaust air. The objective of each of these studies has been to document and evaluate effective control techniques for potential health hazards in the industry or process of interest, and to create a more general awareness of the need for or availability of an effective system of hazard control measures.

These studies involve a number of steps or phases. Initially, a series of walk-through surveys is conducted to select plants or processes with effective and potentially transferable control concepts or techniques. Next, in-depth surveys are conducted to determine both the control parameters and the effectiveness of these controls. The reports from these in-depth surveys are then used as a basis for preparing technical reports and journal articles on effective hazard control measures. Ultimately, the information from these research activities builds the data base of publicly available information on hazard control techniques for use by health professionals who are responsible for preventing occupational illness and injury.

This report concerns a walk-through survey conducted of control measures to minimize exposure to styrene in the sheet molding compound (SMC) process at the Columbus Plastics Plant of the International Harvester Company.

In a preliminary telephone conversation, International Harvester noted a high incidence of Carpal-Tunnel Syndrome among the SMC process workers, associated with the use of cutting and finishing tools. Dan Habes, NIOSH DBBS, accompanied the writers on this survey to evaluate certain work changes initiated by the company Harvester and to suggest additional improvements. He videotaped the operations for later ergonomic analysis. The results of his analysis are included as a separate report to be released later.

II. PLANT AND PROCESS DESCRIPTION

PLANT DESCRIPTION

The Columbus Plastics plant produces truck hood and fender assemblies, vehicle air conditioner cases, small parts used in International Harvester trucks and automobile fascias for a major automobile manufacturer. The plant operates on two shifts and at the time of the survey employed 134 hourly and 35 salaried workers. The plant was purchased by International Harvester from Rockwell about three years ago.

PROCESS DESCRIPTION

All parts are manufactured using the SMC process. In this process, a thickened (with calcium carbonate) styrene/polyester resin is combined with chopped glass and sandwiched between sheets of plastic film. The resulting mat is allowed to age at 80°F. At the presses the mat is rough cut and the film removed, hand trimmed to the desired shape, then molded and cured in a steam heated press. After removal from the press, the parts are trimmed, cut, and sanded as necessary. The parts are prime coated prior to shipment. A schematic diagram of the process is included as Figure 1.

Four workers were observed in the production of the SMC mat. One worker is responsible for compounding the resin; another tends the SMC machine. The remaining two primarily load the SMC machine with plastic film and remove to storage the finished SMC mat.

About 22 workers were observed in the press room. Two large (2500 ton) presses produce hood and fender assemblies for trucks. Two workers cut and load the SMC mat into the press; two additional workers remove the part from the press, deflash, drill and punch. Seven smaller presses produce the automotive fascias, reinforcements, and other parts. Two operators work the smaller presses: one cutting and loading the SMC, the other unloading and deflashing the part.

POTENTIAL HAZARDS

Styrene vapor would appear to be the major inhalation hazard in the production and handling of the sheet molding compound, primarily because it is the major volatile constituent of the product mix. Styrene vapor produces narcosis and irritation of the eyes and upper respiratory tract. Exposure to styrene has been implicated in the production of other adverse effects such as peripheral neuropathy, abnormal pulmonary function, liver toxicity, teratogenicity, and carcinogenicity. To minimize the risk of these effects, NIOSH has recommended that worker exposure to styrene should not exceed 50 ppm as a time weighted average (TWA) concentration for up to a 10 hour workshift. To minimize irritation from styrene, NIOSH has recommended that worker exposure should not exceed 100 ppm, as determined for any 15 minute period. The current permissible exposure limit (PEL) for styrene of the Occupational Safety and Health Administration (OSHA) is 100 ppm, expressed as a 8 hour TWA concentration.

Fiber glass is not likely to become airborne in the production of the sheet molding compound, but large volumes of fiber glass dust are produced in the trimming, cutting, and sanding of the molded products. Fibrous glass is considered to be a nuisance dust by the American Conference of Governmental Industrial Hygienists. They have assigned a Threshold Limit Value (TLV) of 10 mg/m^3 for fibrous glass. NIOSH recommends that exposures be limited to 5 mg/m^3 as a TWA concentration.

III. CONTROLS

PRINCIPLES OF CONTROL

Occupational exposures can be controlled by the application of a number of well-known principles, including engineering measures, work practices, personal protection, and monitoring. These principles may be applied at or near the hazard source, to the general workplace environment, or at the point of occupational exposure to individuals. Controls applied at the source of the hazard are generally the preferred and most effective means of control. Process and workplace monitoring devices, personal exposure monitoring, and medical monitoring are important mechanisms for providing feedback concerning effectiveness of the controls in use. Ongoing monitoring and maintenance of controls to insure proper use and operating conditions, and the education and commitment of both workers and management to occupational health are also important ingredients of a complete, effective, and durable control system.

These principles of control apply to all situations, but their optimum application varies from case-to-case. The application of these principles in the SMC process is discussed below.

ENGINEERING CONTROLS

Sheet production emissions were controlled by local exhaust ventilation at the resin spreaders and glass choppers on the SMC machine and by dilution ventilation. Local exhaust at the resin spreaders consisted of a 10 inch wide by 6 foot long canopy style hood located about 2 feet above each of the resin spreaders and a single 18 inch wide by 6 foot long canopy style hood above the glass chopper. Lack of proper access prohibited measurement of total airflow from these hoods. Air velocity induced by these hoods around the perimeter of the resin spreaders was less than 50 fpm. Press area emissions were controlled by dilution ventilation and pedestal fans directed at the workers.

WORK PRACTICES

The placement of the pedestal fans in the press room was the major work practice that may have contributed to worker exposure. The press operators work between the press and a cutting table. Styrene is liberated from the uncured resin as it is cut and trimmed on the work table. There is no good position for the fans: fan placement opposite the worker can increase exposure to styrene; fan placement behind the worker would blow hot air from the press area into the work area; positioning the fans to the side of the work area could result in cross contamination of work stations. A fixed shower of fresh air located above each work area might offer a solution.

EVALUATION OF CONTROLS

Detector tube measurements indicated that styrene was well controlled in the SMC machine area. Detector tube measurements were performed with a

Draeger hand operated pump using Styrene 50/a tubes. Detector tube measurements are summarized in Table 1. Styrene levels appeared highest near the presses, especially during cutting and handling of the uncured mats. Charcoal tube samples for styrene were collected using personal sampling pumps operated at approximately 20 cc/min for a period of 2 to 3 hours. Samples were collected on selected workers producing the SMC mat, several press operators, and at the SMC machine. Results of the charcoal tube sampling are presented in Table 2. These results confirm the detector tube measurements. Assuming that the sampling period was representative of the entire work shift, all the exposures to styrene would be within the limits set forth by OSHA. One sample on a press operator exceeded the NIOSH recommendation of 50 ppm.

OTHER OBSERVATIONS

At the request of Mr. Van Order, the union health and safety representative, the survey team visited a spray booth where sound deadener was sprayed on an engine cover. The sound deadener was a mastic material which contained asbestos. This process was not in operation during the survey; however the condition of the spray booth was such that maintenance was clearly in order.

IV. CONCLUSIONS AND RECOMMENDATIONS

The SMC process appears to present less of an exposure hazard than the hand layup of fiberglass reinforced plastic parts. It can be considered as an alternative to hand layup for medium-to-high volume production of small parts. Controls are well developed for the SMC machine, but little has been done in the press room area. A fresh air shower located above the press operators' work stations should be capable of lowering exposure to styrene for these workers.

One problem area that the SMC process shares with other reinforced plastics processes is the exposure to fiberglass and plastic dusts from the extensive manual trimming and finishing operations. International Harvester might consider a program to develop dust controls for small tools such as saws, drills, grinders, and sanders.

The sound deadener application booth clearly required a new set of filters. The extent of the asbestos hazard could not be ascertained in this visit. The mastic may render the asbestos relatively dust free, but this supposition must be validated by environmental measurements. Substitution of a non-asbestos material such as fiber glass for use in the sound deadener would be recommended as the only reliable long-term solution.

Table 1. Results of Detector tube measurements for styrene.

Location or operation	Concentration (ppm)
SMC machine (take up roll)	50
SMC machine (by doctor blade)	70
Press #209 (operator breathing zone during unroll and cut)	130
Press #205 (downwind of worker)	50
' ' ' ' (breathing zone)	70

Table 2. Results of charcoal tube measurements for styrene.

Location	Tube no.	Start time	Stop time	Volume (1)	Concentration (ppm)
Operator, press #207	442	0950	1154	3.35	36
Operator, press #208	443	0948	1153	3.63	79
Operator, press #205	446	0953	1155	2.81	27
Operator, SMC machine	447	0845	1142	5.49	21
Test bench by SMC machine	444	0841	1141	5.04	31

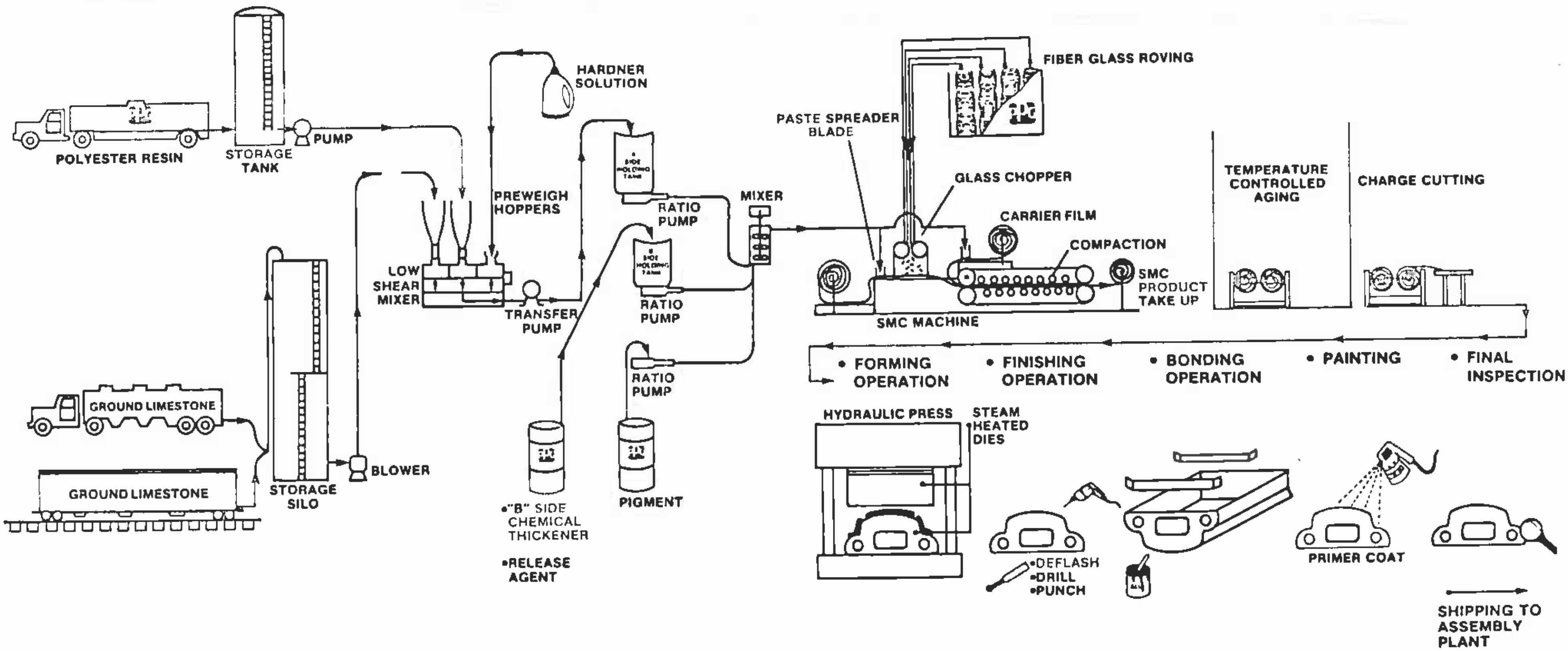

Figure 1. Schematic diagram of the sheet molding compound process.
(Diagram courtesy of International Harvester)