WALK-THROUGH SURVEY REPORT:

CONTROL TECHNOLOGY FOR AIRLINE MAINTENANCE FACILITY AT:

United Airlines Maintenance Facility
San Francisco, California

REPORT WRITTEN BY:

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Division of Physical Sciences and Engineering
Engineering Control Technology Branch
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PLANT SURVEYED:	United Airlines Maintenance Facility San Francisco International Airport San Francisco, California 94128
SIC CODE:	3721 (assembly of complete aircraft)
SURVEY DATE:	June 17, 1983
SURVEY CONDUCTED BY:	Bruce A. Hollett, C.I.H., P.E.
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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. When the perceived need for research requires further definition, a pilot study is undertaken to assess the need for bench research and/or validation of existing capabilities. If it is determined that field studies are needed, 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.

The objective of this pilot study is to determine the state-of-the-art of High Velocity Low Volume (HVLV) technology and to what extent it has been successfully applied in various industries. It will provide an assessment of the need for research and/or validation of existing capabilities and their potential for transfer to other industries. The purpose of this visit was to explore the potential for use of this technology in the airline maintenance industry.

II. PLANT AND PROCESS DESCRIPTION

Plant Description:

The United Airlines Maintenance Facility includes 140 acres and 3 million square feet of buildings. They accomplish the repair and maintenance of United Airlines aircraft. About 6000 workers are presently employed. As many as 8000 workers have been employed. There are HVLV systems installed in five shops: carpentry, plastics, vacuum forming, tool grinding, and body and trim. The tool grinding installation is a fixed application while the rest are primarily for hand tools.

Process Description:

The carpentry panel shop employs about 22 workers. They work with glassfiber, wood, and plexiglass. The floor-mounted equipment is connected to the exhaust system and approximately fifteen ceiling drops are hung over work benches. At the time of the survey, two 6" Dual Flex sanders were in use on large 4' X 4' glassfiber sheets. Another worker was using a smaller 3" disk sander along the edge of a glassfiber part. He held the vacuum hose next to the sanding disk to catch the dust as it left the wheel. This worker was aware that there had been small tool shrouds designed for use with the smaller sander, router, and drill bits, but he had not used them in a long time and none were immediately available in his tool cabinet. He felt that they got in the way and were not necessary.

The plastics shop employs about 50 workers. They work with plexiglass, glassfiber, and resins. They repair a variety of aircraft parts including the cabinetry, plexiglass canopies, and radomes. Historically, this was considered a very dirty place to work. Turnover rates were very high, an oldtimer was someone over 6 months in the shop. Earlier efforts to provide booths for each work station resulted in workers standing between their work and the exhaust. The addition of HVLV reportedly solved this problem and greatly reduced the incidence of dermatitis. The system was observed in use by one worker who held it next to a 3" disk sanding operation. In the radome area, an 8" ARO sander was in use with the perforated base HVLV exhaust system. The worker considered it to function well.

The vacuum forming panel shop employs about 6 workers. They are exposed primarily to wood dust from the fabrication of dies used in the vacuum forming activity. There were no HVLV tools observed in this area, although workers stated that the system was used frequently both attached to sanders and by holding the vacuum hose next to the work.

The bonding and trim shop sanding room is utilized by about 11 workers. They work with honeycomb bonded to laminated Kevlar, glassfiber, and graphite fiber materials. In this area, the HVLV exhaust is primarily used for sanding. The workers demonstrated the use of the free standing vacuum hose next to a small part as it was being sanded. The video tape taken at that time shows a stream of particles captured by the vacuum hose. The part was concave, which the worker volunteered, would make use of the shroud difficult. He did report still using the shroud on some larger flat surfaces.

Potential Hazards:

The glassfiber exposures found in all but one of these shops would appear to be the predominant dust hazard. Glassfiber is a primary irritant. The plastic and resins dusts are nuisance dusts. There is also a potential for hazards from removal of surface coating materials such as leaded paints and chromate primers when present.

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, including engineering measures (material substitution, process/equipment modification, isolation or automation, local ventilation) and work practices, are generally the preferred and most effective means of control both in terms of occupational and environmental concerns. Controls which may be applied to hazards that have escaped into the workplace environment include dilution ventilation, dust suppression, and housekeeping. Control measures may also be applied near individual workers, including the use of remote control rooms, isolation booths, supplied-air cabs, work practices, and personal protective equipment.

In general, a system comprised of the above control measures is required to provide worker protection under normal operating conditions as well as under conditions of process upset, failure, and/or maintenance. 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 ensure 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 aircraft maintenance activity is discussed below.

Engineering Controls:

The carpentry panel shop has a Hoffman HVLV system which was installed in 1968. It is powered by a 75 Hp blower which pulls 2000 CFM at 10" of mercury.

The plastics shop has a Hoffman HVLV system which was installed in 1969. It is powered by a 75 Hp blower which pulls 2000 CFM at 10" of mercury.

The vacuum forming shop has a Hoffman HVLV system which was installed in 1974. It is powered by a 50 Hp blower which pulls 1800 CFM at 11" of mercury.

The bonding and trim shop has a Spencer system which was installed in 1978. It is powered by a 60 Hp blower which pulls 1800 CFM at __" of mercury.

The design of these systems called for a vacuum capacity sufficient for 50% of the drops to be utilized at any time while maintaining a shroud velocity of

10,000 fpm to assure effective capture. These systems have been expanded by adding drops until they now exhaust less than the design levels.

To avoid surge conditions, which might occur with all outlets shut off, a bleed bypass was installed. This keeps the pumps from jumping off their mounts.

Work Practices:

Most HVLV tool shrouds had been removed because they were thought to interfere with the job, however, in many cases the worker thought dust control was important enough to attempt to hold the exhaust hose close to the work with one hand and operate the tool with the other hand.

Monitoring:

Environmental monitoring has been conducted in all these areas, however, they are not on a periodic schedule. Additional measurements would be required if there were process changes.

Medical monitoring includes pre-employment physicals, respirator qualification examinations, and periodic examinations as appropriate for the worker's occupational environment.

Personal Protection:

It was reported that dust exposures in these areas were not high enough to require use of respiratory protection.

Other Observations:

The small detachable hoods designed for their tools were no longer in use, although they appeared to have been well designed for convenience.

Conclusions and Recommendations:

United has had an unusually long experience with using the HVLV system and has developed a detachable small tool shroud. Yet, it is apparent that the systems are not being used in the originally intended configuration. There is a familiar pattern of workers adapting the hose to provide local exhaust in the vicinity of the work piece. The continued use of the shroud on larger sanders in the radome glassfiber area is also similar to others experiences. There is general agreement that there is a need for effective HVLV collection devices which are compatible with the work tasks and can achieve a high level of worker acceptance.