PRELIMINARY SURVEY REPORT:

Lockheed Corporation
California Division
Burbank, California

SURVEY CONDUCTED BY:
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DATE OF SURVEY:
November 23, 1981

REPORT WRITTEN BY:
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DATE OF REPORT:
February 2, 1982

REPORT NO.:
ECTB 108-20a

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

PURPOSE OF SURVEY:

To observe the processes involving adhesives in a commercial aviation manufacturing facility, with emphasis on the method of application and the associated occupational health hazard controls.

EMPLOYER REPRESENTATIVES CONTACTED:

Paul Shiroma, Safety & Industrial Hygiene Administrator, Lockheed/California
Steve Bitter, Industrial Hygienist, Lockheed/California
Leon Fitzgerald, Manager, Department 1935
Bob Epperson, Manager, Department 1925
D.C. Roccoforte, Supervisor, Department 1953

EMPLOYEE REPRESENTATIVES CONTACTED:

Al Carter, Shop Steward, IAM Local #727

STANDARD INDUSTRIAL CLASSIFICATION CODE OF PLANT:

3721 - Aircraft

ABSTRACT

A preliminary survey of selected manufacturing facilities of Lockheed Corporation's California Division was conducted as part of a NIOSH study of occupational health hazard controls associated with the industrial use of adhesives. The production processes, especially those involving epoxy film adhesives and potting compounds and polysulfide sealants, were observed.

The most significant hazard associated with film adhesives is the solvent carrier in the requisite primer. Engineering controls included ventilated primer spray booths and drying ovens. The low solvent contents of the othe adhesives and the small amounts used do not constitute an occupational health hazard.

Introduction

Industrial adhesives may involve agents, such as formaldehyde, organic solvents, and a variety of additives, which pose potential occupational health hazards. An appropriate implementation of control technology may prevent the overexposure of workers to these substances.

The Engineering Control Technology Branch of NIOSH is conducting a research study to document control methods associated with the industrial use of adhesives. The first phase of this project involves preliminary surveys to assess the application of control technology in conjunction with the use of adhesives in a number of industries. The information gathered will be used to focus future efforts on the industries which can benefit most from further study and to plan for a second, more detailed survey at those plants which are selected for in-depth study.

The primary contact for this visit was Mr. Paul Shiroma, the Safety and Industrial Hygiene Administrator for Lockheed's California Division. We met and toured the Building 175 facilities (Department 1935) with Mr. Leon Fitzgerald, Department Manager, Mr. Steve Bitter, a corporate Industrial Hygienist, and Mr. Al Carter, a shop steward for the International Association of Machinists Local # 727. We visited two other shops (Departments 1925 and 1953), and, at each, met briefly with the respective department supervisor, Mr. Bob Epperson and Mr. D. C. Roccoforte.

Description of Facilities

Lockheed manufactures components primary for commercial aircraft on this sprawling complex on the northwest corner of Burbank. At one time, entire airplanes were built here and delivered from the Glendale-Burbank municipal airport adjacent to one of the buildings. Now the final assembly point is in Palmdale, but a majority of the components manufactured by Lockheed are still produced in these facilities.

Building 175 houses Department 1935, which produces honeycomb panels. In addition to metal pretreatment tanks, including a well-controlled vapor degreaser, within this building are two spray booths and a drying oven for applying primer. A number of rooms have been constructed, some with expensive air conditioning and dust filtration equipment, for working with the film adhesives. The building also contains autoclaves for curing the adhesive. Offices are located adjacent to these work areas.

In another large building (125), Department 1925, which produces large fuselage panel sections, coexists with the department (1923) which paints them. Facilities for building up the panels include an automated pretreatment line; a pair of spray booths, in series for priming both sides of the panels; and a large dust free room for assembling the fuselage sections with film adhesives. The paint spray booth is at one end of the building. An open office area is in the midst of these operations.

Adhesive materials are also used to seal, and aid in bonding, panels which are riveted to some sections of framework. This operation (Department 1953) is performed in a large hangar-type structure (building 74) across Buena-Vista

Blvd, close to the Burbank airfield. A network of scaffolding allows the workers to access all areas of the large fuselage sections being fabricated.

Description of Process

Most honeycomb panels consist of a layer of honeycomb material between two aluminum sheets, bonded with a film adhesive. The aluminum must first be treated to prepare the surface for bonding and prevent it from corroding. As a final step, a coat of primer is sprayed onto the side which will be bonded. Depending on the film adhesive to be used, the primer is either BR 127 or BR 100-49, both American Cyanamid products. BR-127 is an epoxy phenolic primer, 90% of which is solvent. The solvent mixture including methyl ethyl ketone (MEK), for which a time-weighted average (TWA) threshold limit value (TLV) of 200 parts MEK per million parts of air (ppm) has been adopted by the American Conference of Governmental Industrial Hygienists.

BR 1000-49, an epoxy modified polyamide, has a solids content of from 10 to 20 percent in a solvent blend containing ethylene dichloride and methanol, which have (TWA) TLV's of 10 ppm and 200 ppm, respectively.

After the primer has been dried, the panel is assembled and encased in a plastic envelope. This plastic is sealed and fitted so that the contained air can be evacuated, pulling the pieces of aluminum to the honeycomb to effect a strong bond. With a vacuum being pulled on the encapsulated panel, the adhesive is cured in an autoclave. One of two epoxy film adhesives are used, depending on the application: both are American Cyanamid products containing less then 2% volatiles. FM-137 is a nitrile-modified epoxy, which cures for 30 minutes at 250°F; FM 1000-EP 15, an epoxy modified polyamide, cures for 1 hour at 350°F.To complete the panel, the edges are filled and holes are drilled and finished. The finishing involves installing inserts in which to anchor threaded fasteners. The hole is sealed and the insert is held in place by a two-part, room-temperature curing, epoxy adhesive. This same product is also used to fill the edges where open honeycomb cells are exposed. The adhesive, specified under LCM 1029B - type 8, may be procured from a number of different sources. It is supplied and stored frozen in small cartridges. When thawed, a special dispenser is used to apply the syrup-like liquid, and it remains workable for a few hours.

The large panels are fabricated similarly to the honeycomb-core panels, except that honeycomb material is not used. Instead, two and sometimes three, layers of aluminum sheets, many cut from special patterns, are bonded together. Film adhesive FM-137 is used exclusively here. Prior to bonding, the aluminum is pretreated and primed on one or both sides. Applying the adhesive and assembling the panel takes place in a dust free room.

Large panel sections are riveted to framework in Building 74. An adhesive/sealant is applied to the frame prior to attaching the panel for certain sections. For this application, the liquid adhesive, a polysulfide sealant with solids content of over 90%, is brushed on and then spread over the framework with a small roller. Then the panel is manuvered into place and secured with straps. The panel is still riveted to the frame, however, the adhesive aids in stress distribution and acts as a sealant.

The adhesive used in this rivet-bonding application, PR-1431-G, typically contains 5% toluene, which as a (TWA) TLV of 100 ppm. Other, similar adhesives made by Products Research, Inc. are also used. PR-1422, used as a fuel tank sealant, contains 2% MEK and 7% toluene. Threaded fasteners are coated with PR-1436C, which contains 12% toluene, prior to insertion. Description of Controls

All the primer spray booths are ventilated, although none were observed operating on the day of the survey. One in Building 175 has two roll-type filters which automatically advance when the pressure drop across the filter becomes too great. All booths are interlocked so that the pump air is not supplied if the ventilation is not operating. The priming booths in building 125 have water-quenched exhaust ventilation. Drying ovens and autoclaves are also vented to the outside.

The spray painters are supplied respirators. AN MSA "Comfo" half-face mask with #459315 organic vapor cartridges (NIOSH approval # TC-23C-40) was used by a worker in Building 175. Workers who bond panels together with film adhesives wear white gloves, which minimize skin contact with the adhesive in addition to preventing the undesired touching of metal surfaces with bare skin. Coveralls are also supplied by Lockheed, although a laundry service is not provided.

The film adhesive could itself be considered a control technique. If the adhesive was not packaged as a film with a release paper, a coating or spraying operation would be necessary, followed by exposure to the air while the adhesive was drying and being worked with.

Other Factors Affecting Occupational Health and Safety

Lockheed has a Safety and Industrial Hygiene Department in its California Division. There are two Industrial Hygienists and eight Safety Engineers. Certain job classifications have written certification requirements which include safety procedures and good work practices.

Much of the responsibility for on the job safety is placed on the department managers and supervisors. A meeting is held each month to discuss safe work practices and the correction of detected safety hazards. Each worker is responsible for maintaining a clean work area.

Lockheed is self-insured for industrial injury compensation. Two health benefits plans are available to the employees. One provides free medical care through the Kaiser Hospital System. The other plan permits the worker to select the provider, but he must then share a percentage of the cost.

Conclusions and Recommendations

If the aerospace industry is selected for further study, Lockheed would be a prime candidate for an in-depth survey. The spray booths seem well-designed, and there is an overall positive corporate approach to occupational health and safety.

The film adhesives are inherently safe. Sampling would be directed primarily

towards the liberation of solvent vapors during the spraying and drying the primers. Both departments 1935 and 1925 should be included in the study. Other areas to look at would be machining (drilling, sanding, etc.) the hardened edge- and hole-filling adhesive and working with (brushing, rolling, etc) the polysulfide sealant during the rivet-bonding process.