

PRELIMINARY SURVEY REPORT:

Plating Shop  
Braniff Airways  
Love Field  
Dallas, Texas

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## Introduction

Several electroplating processes involve recognized occupational health hazards. Potential sources of these hazards include cyanide, various acid mists, and toxic metals such as chromium.

The Engineering Control Technology Branch of NIOSH is conducting a research study to assess and document control methods in the plating industry. Preliminary surveys are conducted to observe the processes and controls in actual industrial settings and to determine which industrial sites are suitable for in-depth study.

On this preliminary visit, the NIOSH survey team met with Mr. Jake Harvey, Mr. E. G. Hinchliffe, and Mr. Al Edwards. Mr. Harvey is the manager of the base shops. Mr. Hinchliffe, the primary contact for this visit, is the foreman of the plating shop. Mr. Edwards represented the International Association of Machinists and Aerospace Workers, Local 2208.

## Description of Facilities

Braniff Airways' maintenance and engineering facilities are located on the eastern side of Love Field, just a few miles northwest of the center of Dallas. The periodic inspection and major maintenance of Braniff's fleet of aircraft is performed here. The capabilities include engine rebuilding, avionics repair, landing gear maintenance, and complete repainting. The three story concrete and steel structure was built and occupied by Braniff in 1958. The plating shop is located on the ground floor, close to the landing gear and engine overhaul areas for which it provides plating service.

The layout of the plating shop area is diagrammed in Figure 1. The plating shop is a separate room within the building, approximately 4000 square feet in area with a 20 foot ceiling height. The grit blasting booth is located on the other side of the west wall of the plating shop. A small laboratory for analyzing plating bath concentrations is located adjacent to the entrance to the shop. The area on the other side of the north wall is a bay for stripping and painting airplanes.

The shop is nicely painted and well-maintained. The concrete floors are covered with wood-slatted platforms around the tanks. Local exhaust ventilation is installed on the hard chrome tanks and some of the pretreatment tanks. Two main branches of duct work lead from the plating shop. The exhaust from the grit blasting booth joins the longer outside duct just before its junction with the other duct.

There are three hard chrome plating tanks. One of the two 1100 gallon tanks was not in use at the time of the survey. Other than piece size, there are no major differences in the plating done in the 225 gallon tank as opposed to the larger tank(s).

There are three cadmium tanks differing in size and function. The largest of the three (825 gal.) is for bright cadmium plating. The dull or low hydrogen cadmium plating tank is slightly smaller (625 gal.) and differs in chemical

concentrations. The smallest one (60 gal.) is a cadmium barrel plating tank having approximately the same concentrations as the largest cadmium tank. None of the cadmium tanks are ventilated.

The other tanks include nickel, nickel strike, silver, silver strike, copper, certain acids, rinses, strippers, cleaners, and a vapor degreaser. All of these are small (less than 300 gal.) except for the vapor degreaser. Some of the acid, rinse, and stripper tanks are ventilated.

Three platers currently work in the shop. Their ages are 46, 60 and 63 years with 26, 35 and 28 years of plating experience, respectively.

#### Process Descriptions

Before being plated, most pieces undergo some surface preparation. This pretreatment may include grit blasting, shot peening, rust stripping, and cleaning in acid, alkaline, or electrolyzed baths. Areas not to be plated are masked. Braniff uses 150 grit aluminum oxide for grit blasting and a synthetic beeswax or an adhesiveless tape for masking.

Chrome plating is accomplished at a rate of 0.001 inch per hour. The chromic acid concentration of the plating bath is 40 oz/gal with 0.4 oz/gal sulfuric acid. The current is adjusted to achieve a current density of 2 A/in<sup>2</sup> of estimated area to be plated. The bath temperature is maintained at 135°F using submerged steam lines as the primary source of heat.

The pretreatment for chrome plating involves masking with synthetic beeswax and grit blasting. After plating, the synthetic beeswax is removed and the piece is placed in a vapor degreaser to clean any residue remaining from the wax coating.

The vinyl platers' tape is preferred for masking pieces to be cadmium plated. Different pretreatment schemes are necessary for different materials. Acid treatment is not used on high strength steel. None of the cadmium tanks are heated.

The dull cadmium plating solution metal concentration is maintained between 6.5 and 7.5 oz/gal with a cyanide concentration between 9 and 15 oz/gal as sodium cyanide. The sodium hydroxide concentration is kept between 3.5 and 5 oz/gal and the sodium carbonate concentration is 8 oz/gal.

This "low-hydrogen" cadmium bath is used for high-strength steel. The plating cycle for this material involves only grit blasting, plating, and then baking for 23 hours at 390°F. The heat treatment relieves any stresses that may have been developed during plating.

Both the bright cadmium and the cadmium barrel solutions contain 3.0 to 4.5 oz/gal cadmium oxide and 11.5 to 17.5 oz/gal total cyanide. The ranges for sodium hydroxide and sodium carbonate on these baths are 2.1 - 3.2 and 4 - 8 oz/gal, respectively.

Pieces to be bright cadmium plated may be pretreated in the rust stripper, electrocleaner, hydrochloric acid, and cadmium stripper prior to plating. The actual combination will depend on the condition of each piece.

The copper bath, which uses a Rochelle Salt, contains 3.5 oz/gal copper cyanide and 5.5 oz/gal sodium cyanide. The nickel solution is a Barrett (manufacturer's name) nickel sulfamate. The silver plating solution contains 5 to 9 oz/gal silver cyanide and 8 to 12 oz/gal potassium cyanide.

#### Description of Controls

The large hard chrome plating tank in use at the time of our study is ventilated by slot hoods on each side of the tank. On this tank, each side becomes a separate duct up to the main branch on the north wall. The other large tank, which was not being used during our visit, also has bilateral slot hoods, but these are joined with a plenum before ducting to the north-wall main branch, and one of the slot boxes has a second slot on the other side which ventilates an adjacent rust stripper tank. Two other small tanks along the east wall (a cadmium stripper and a hydrochloric acid dip) are ventilated by single slots which feed a duct that is the initial tributary to the north-wall subsystem. The main branch of the south-wall subsystem is fed by a duct which provides single slot ventilation of the small hard chrome tank, and similarly sized acid dip and hot water rinse tanks. Polypropylene balls and chips, floating on the surface of the hard chrome tanks, reduce the emission of acid mist.

Good work practices include draining and rinsing pieces over the plating tanks. Gloves are worn when removing pieces from the acid dip and plating tanks, and the workers wear face shields when working around the nitric acid tank. Safety glasses are to be worn when performing buffing and grinding operations. No other personal protective equipment is required.

Eating in the shop, a practice which is not recommended, was observed during the survey. Although good housekeeping and personal hygiene can minimize the dangers, the fact remains that silver, cadmium, and chromium are health hazards which can be ingested. A break room is located in each bay, and there is a cafeteria in the main building.

The fiberglass ductwork is part of the original construction. The main branches are large rectangular ducts, approximately four or five square feet in cross-sectional area. The fan was replaced in February of 1979.

Originally, make-up air was supplied by a blower and duct, and this worked for a while. However, eventually, the odor of the plating shop was noticed in the adjacent shop areas; and, when other corrective actions failed, the make-up air system was disabled. Now the make up air enters the shop through the open doorway. This air is supplied to this floor of the building by the mixed--plenum heating and air conditioning system which originally was the sole system for the entire building. The mixture of outside air to recirculated air varies with the inside and outside conditions. The building maintenance section of this Braniff facility did not know the volumetric flow rates.

#### Description of Occupational Health Programs

Braniff does not have an industrial hygienist. The shop foreman informs the workers about potential hazards in the plating shop and instructs them on the

use of a cyanide antidote kit. Braniff's insurance carrier has not performed any industrial hygiene sampling in the plating shop.

There is no safety director for this facility. Each shop foreman is responsible for his own safety program. Mr. Hinchiffe conducts monthly safety seminars, which usually consist of a film and discussion.

Pre-employment physical exams are required of each employee, but periodic physicals or screening tests are not given. Each employee is covered by a medical/hospitalization plan for work-related injuries and illnesses, and there is a clinic nearby.

Each shop takes care of its own housekeeping procedures. However, cleaning and maintenance of the ventilation system is provided by an outside service.

#### Conclusions and Recommendations

Since no chrome plating took place during our visit, no evaluation of the control effectiveness is possible other than the observation that the controls appear to be more than adequate. If sufficient plating workload would be available for three full work days, this facility would be a strong candidate for an in-depth study; but it appears this is unlikely through December 1981, which concludes our field study phase.

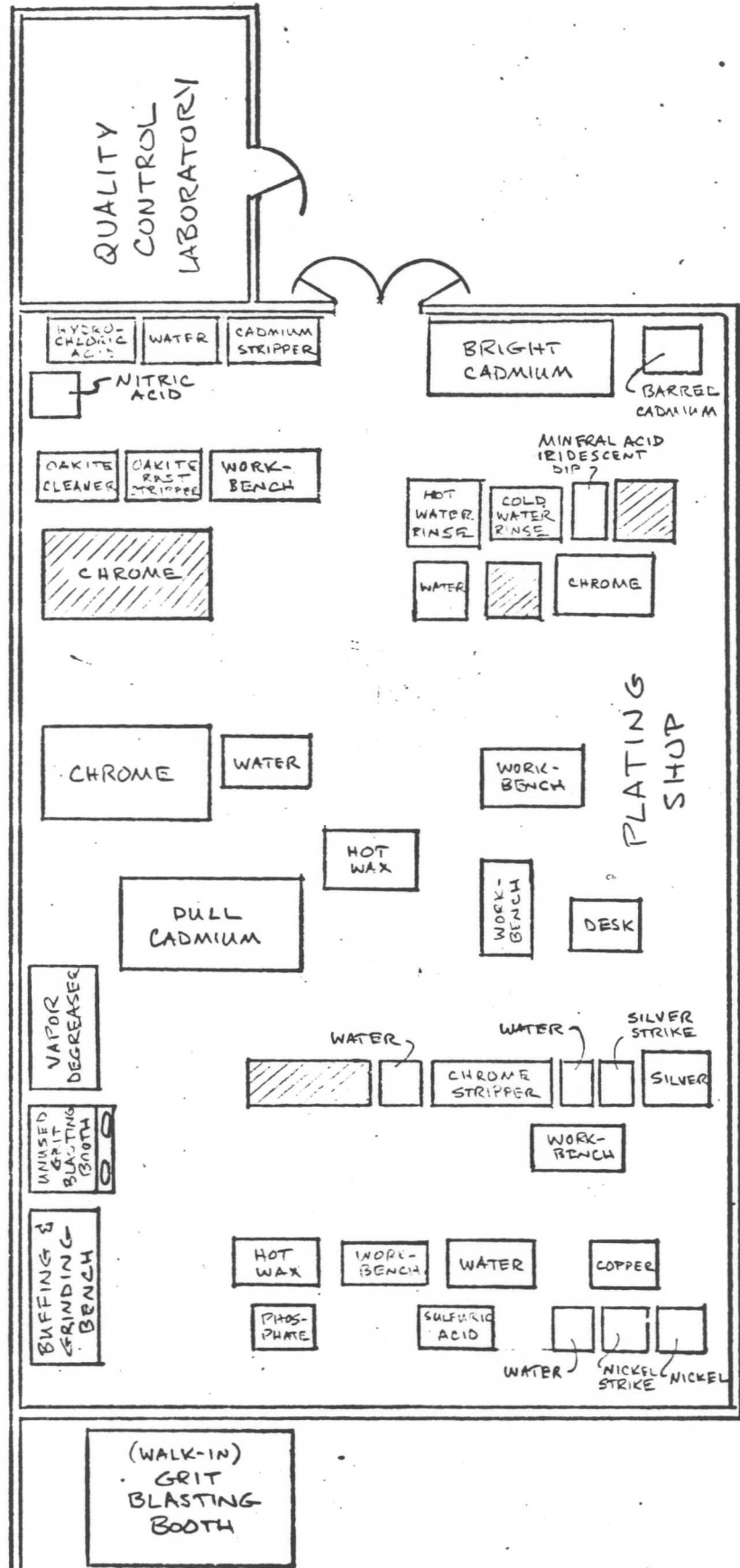


Figure 1. Plating Shop Layout

INDICATES TANK NOT IN USE

