FINANCIAL DATA

Lucent Technologies implemented a carbon dioxide blast cleaning process identifies various parts being cleaned by manual processes and the part being cleaned with the CO2 blast process.

Table 2 is a cost comparison of manual cleaning methods, including the use of solvents, acids, abrasive pads and scrapers, to the dry ice blast method of cleaning (Rauchut, 97). The figures are based upon time to clean each part. It does not take into consideration any of the hidden cost benefits from not using solvent cleaning processes.

Throttle valve assemblies required two hours per unit to clean versus two minutes to clean with the CO2 process creating 82,836 dollars of profit annually. The Applied 5000 screens can be cleaned using the CO2 process. These were previously junked as a result of wet manual processes that were unable to clean the parts. The cost of the screens was 22,500 dollars. CO2 processes cleaned the part for 27 dollars annually. Isolation Valves required two hours per unit to clean versus seven minutes to clean with the CO2 process creating 105,768 dollars of profit annually. The payback for the system was 3.34 months.

Case Corporation (Table 3) previously used methylene chloride and methyl alcohol to remove resins on sand casting mold halves. Case switched to a CO2 blast unit as an alternative to remove these resins. The result of implementation was a reduction in part cleaning times by 49.6 percent. 3,427 hours with the solvent processes to 1,702 hours with the new system (Case Corporation, 95).

Case Corporation Cleaning Comparison

Process	Cleaning Times (Hours/Year)	Cost (Dollars)
CO_2 Blast	1,702	69,000
Solvent Cleaning	3,427	138,000

TABLE 3

SUMMARY

The adverse health effects, wastewater consumption, hazardous waste generation, and hidden costs associated with wet manual cleaning processes are eliminated or reduced by the implementation of a carbon dioxide blast cleaning system.

There is a decrease in part cleaning times with CO_2 as compared with wet processes. CO_2 blast cleaning, cleans parts faster, at or above specified cleanliness levels and produces no significant wastestreams to manage.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

INTRODUCTION

The purpose of the study was to analyze the risk exposures and costs involved in cleaning parts, equipment, and tooling in the semiconductor industry using wet manual processes and compare carbon dioxide as an alternative cleaning process.

The goals of the study were to:

1. Analyze wet manual cleaning processes and the risks exposures that these processes pose to an organization, specifically health exposures to employees, environmental impacts, facility exposures, and liability issues.
2. Examine using carbon dioxide as an alternative method to cleaning parts that reduce or eliminate the above-mentioned exposures.
3. Provide financial justification for the implementation of an alternative system to clean parts, tools, and equipment used in the manufacturing process.

CONCLUSION

The risk exposures were to employee health (respiratory illness, sensitization, skin disorders, CNS interruption, carcinogenic effects), facility fires, environmental reporting and disposal costs along with the cradle-to-grave liability with hazardous wastes, productivity losses, water consumption treatment and discharge costs, and a list of other hidden costs associated with wet cleaning processes.

Carbon dioxide cleaning processes utilize CO_2, a non-toxic, non-hazardous, non-flammable, and have no ozone depleting characteristics to clean parts. There is no liquid wastestream to manage after the cleaning and no solvent baths to monitor and change out. Cleaning effectiveness of CO_2 processes meets or exceeds that of conventional processes capable of cleaning in the sub-micron particle range. The use of water as part of the cleaning medium is non-existent in CO_2 cleaning. CO_2 sublimates to a gaseous form upon impact with the substrate. The substrate remains undamaged as compared to abrasive media blasting and cleaning solutions with PH levels out of range.

Financial justification for the implementation of carbon dioxide blast cleaning process are evaluated based on the productivity gains as well as the elimination or reduction in costs that are associated with wet manual cleaning processes. The figures shown do not take into account the hidden costs incurred from the solvent processes. These include profits and reduced costs from not using rinse water, drying times and equipment, disposal costs, employee training, reporting requirements, and may include any health problems that have ceased due to the reduced exposure to solvents.

AT&T realized an annual net profit after equipment and operating expenses of 266,339 dollars by switching to the carbon dioxide blast cleaning system with a return on investment of 3.4 months. Case Corporation implemented a CO_2 blast system. The initial capital investment for the blast unit and associated equipment was 185,000 dollars. The return on investment was 2.68 years with an annual profit of 69,000 dollars.

RECOMMENDATIONS

Dry cleaning processes are the cleaning direction of the semiconductor industry. A careful analysis should be done when considering implementing carbon dioxide as an alternative to wet manual cleaning processes.

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