

ASSESSMENT AND CONTROL OF PERSONAL EXPOSURE IN AN ELECTRONIC MANUFACTURING INDUSTRY

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Abstract — This paper specifies requirements for an occupational health and safety (OH&S) management system which is followed in one among the person, and provides guidance for its use, to enable organizations to provide safe and healthy workplaces by preventing work-related injury and health issues, furthermore as by proactively improving its OH&S performance. This paper helps organization that wishes to develop, implement and maintain an OH&S management system to promote occupational health and safety, eliminate hazards and minimize OH&S risks (including system deficiencies), profit of OH&S opportunities, and address OH&S management system nonconformities related to its activities. This paper helps a company to achieve the preferred results of its OH&S management system. According to the organization's OH&S policy, the intended outcomes of an OH&S management system include a) Continual improvement of OH&S performance b) Fulfillment of Statutory requirements and other requirements c) Achievement of OH&S objectives

Keywords: Health, PPE, Hazards, Exposure

I. INTRODUCTION

1. Work processes within the industry

Wafer fabrication—marks the start of each electronic product where circuits are etched onto wafers made from silicon.

2. *Integrated circuit assembly*—the composing and testing of the encapsulated integrated chip.

3. *Printed circuit board (PCB) fabrication*—the boards usually made of a plastic resin compound which is heated, mixed with a filler material, laminated with metal, cleaned and etched, and subsequently designed.

4. *Printed circuit board (PCB) assembly*—integration of assorted electronic components on the PCBs which

involves “stuffing” of components into the boards, cleaning, fluxing, soldering, trimming, and testing.

5. *Final product assembly*—the assembled PCB is then incorporated with various other components to make the ultimate electronic product.

Each process step uses a weird set of chemicals and machinery, and thus has specific occupational health and safety concerns. The workforce in the electronics industry is unevenly distributed.

There are out and away, more workers within the assembly processes than within the fabrication processes. The gender distribution is additionally uneven. Generally, more males work add the fabrication works, maintenance related tasks and management, while females dominate the mechanical system tasks. Employees are often required to perform shift work.

The majority of electronics mechanical system workers are female.

Chemical toxicities at the electronic manufacturing cause cancer, adverse reproductive problem and also environment has been affected additionally, for huge quantities of hazardous waste and wastewater from electronic manufacturing would require disposal and corrective treatment.

A. Hazards in electronic industry

Workers expose to numerous hazards in the electronic industry. They are

1. Chemical
2. Physical
3. Ventilation
4. Others

II. PROBLEM IDENTIFIED

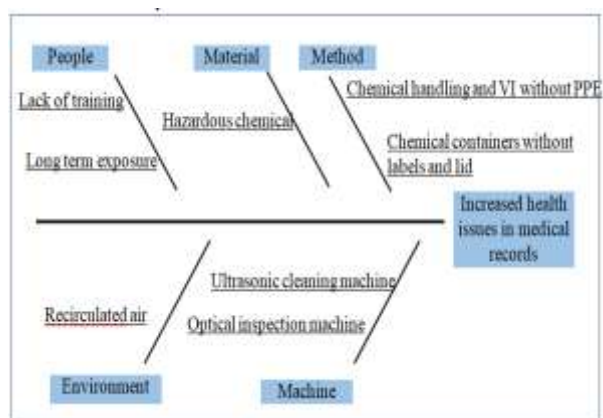
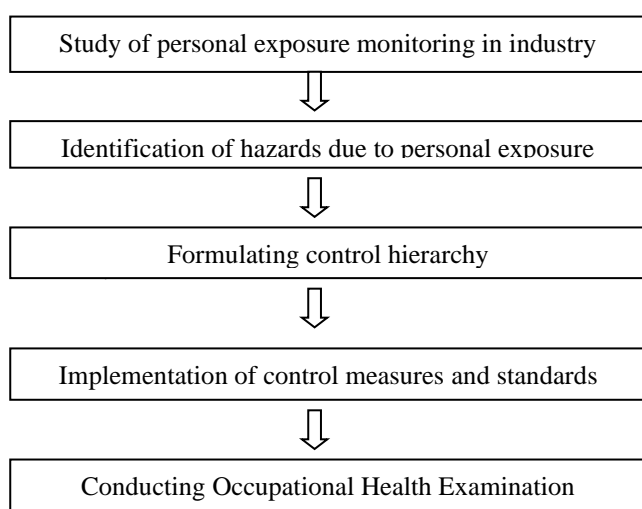


Fig.1. Fish bone diagram of existing hazards in company

III. METHODOLOGY

The proposed methodology is presented in below diagram. This describes the procedure in which the work would be carried out.



A. Risk Assessment

Sl. No.	Activity/D description	Potential hazards	Risk Rating			Implemented Measures against identified risk
			Probability	Severity	Risk Rating Score	
1.	Chemical handling without appropriate PPE during entire Shift	High chance of Inhalation, Skin contact, Ingestion cause Health problems	3	4	12 High	1. PPE for workers whoever handling chemicals has been provided. 2. Training for better understanding of the chemical hazard has been provided. 3. Safety signage about chemical hazard and Safe procedures to handle them has been displayed. 4. Adequate supervision provided.
2.	Workers using Solvents in a bottles for cleaning which has no Lids/Caps	Vaporized Solvents recirculated in the Clean rooms and inhaled by other workers who are not handling chemicals	4	4	16 Extreme	1. Lids/Caps for solvent bottles are maintained when not in use. 2. Training provided for better understanding of the chemical hazard. 3. Safety signage displayed about chemical hazard and Safe procedures to handle them. 4. Adequate supervision provided.

3.	Workers wearing Earthing Wrist strap to prevent ESD contains Nickel Pin	Constant exposure to Nickel cause to Skin problems (Dermatitis)	4	2	8 Moderate	Nickel pin changed into plastic button/Velcro tape
4.	Workers not using Goggle while Visual Inspection using UV light and working near Optical inspection machine	Eye problems	2	3	6 Moderate	1. Appropriate goggles are provided to operators who involved VI. 2. Training provided for better understanding of the UV hazard. 3. Safety signage about UV hazard and Safe procedures to handle them are displayed. 4. Adequate supervision provided.
5.	Working in X ray room for without appropriate PPE	Exposure to radiation causes cancer, reproductive problems	1	4	4 Low	1. Appropriate goggles provided. 2. Training provided for better understanding of the UV hazard. 3. Safety signage displayed. 4. Adequate supervision provided.

Table.1. Risk Assessment sheet

B. Education of workers

Education of workers related to personal exposure of hazardous process has done to all employees. The following information was communicated in training:

- Ability to recognize hazards
- Acute vs. chronic hazards
- Routes of exposure
- Hazard signage and Pictograms
- Material Safety Data Sheet (MSDS)
- Emergency mock drill- chemical spill, fire, etc.
- Basic first aid
- Importance and usage of PPE

C. Implementation of IS standards

Sl. no.	Activity	IS Standards (IS 4209-2013)	Deviations	Corrective action
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1	Chemical handling	5.8.2 Always use the Safety appliances recommended while handling chemicals and avoid skin contact with chemical substances	No safety appliance for chemical handling and chance of exposure to skin while handling chemical	Operators use gloves, aprons, goggles while handling chemicals.
2	Chemical container	5.8.3 Chemical should only be used when the container containing them are clearly labelled and their identity confirmed	Chemical container with no label	Chemical name with hazard pictogram labelled in chemical container.
3	Control of chemical Spill	5.8.4 Keep suitable material to chemically treat spillage, or physically containing, if necessary	No spill kit found	Spill kit placed in every chemical storage room.
4	Volatile Chemical handling	5.8.9 The containers of chemicals that are highly volatile or decompose or moisture sensitive should be carefully opened and isolated from the surrounding.	Volatile chemical are used in open containers and left in a container without lid	Chemical containers used in manufacturing line contains press type lid.
5	Transfer of chemical	5.8.10 Whenever chemicals are transferred from old containers to new containers, all relevant details should be transferred to labels on new container.	Details not to be transferred from old container to new container	Respective Incharge for each operational line assigned for monitoring chemical

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Table.2. Implementation of IS standard

D. Occupational Health Examination

Employee details who are all involved in hazardous process were collected for the occupational examination. As per the factories act 1948 and Tamil Nadu factory rules 1950, **Form no 27** certificate of fitness (prescribed under rule no 95: dangerous operation) were filled and occupational medical checkup was done for people who involved in hazardous process. Operators with deviated results are planned to do an employment rotation

IV. RESULTS AND DISCUSSIONS

A. Outcome after Implemtation of Training:

We can clearly see the reduction in risk of each hazard after a period of 5 months from November 2020 to March 2021 in which proper training were provided to employee.

TRAINING	INHALATION RISK	EYE HAZARD	SKIN EXPOSURE	X RAY HAZARD	CHEMICAL HANDLING
BEFORE TRAINING	9	6	6	4	20
AFTER TRAINING	3	0	2	1	5

Table.3. Outcome after training to employee



Fig.2.Training Result

B. Usage of PPE and chemical handling on monthly basis:

Usage of improper Personal protective equipment for an appropriate job has been decreased after educating the employee on its proper usage for over a period of 5 months,

Training on how to handle hazardous chemical have also provided positive result even though employees did not show much interest in it on early phase of training

MONTH	IMPROPER PPE	POOR CHEMICAL HANDLING
NOVEMBER	25	20
DECEMBER	22	20
JANUARY	15	13
FEBRUARY	7	5
MARCH	2	1

Table.4. Outcome after training to employee on monthly basis

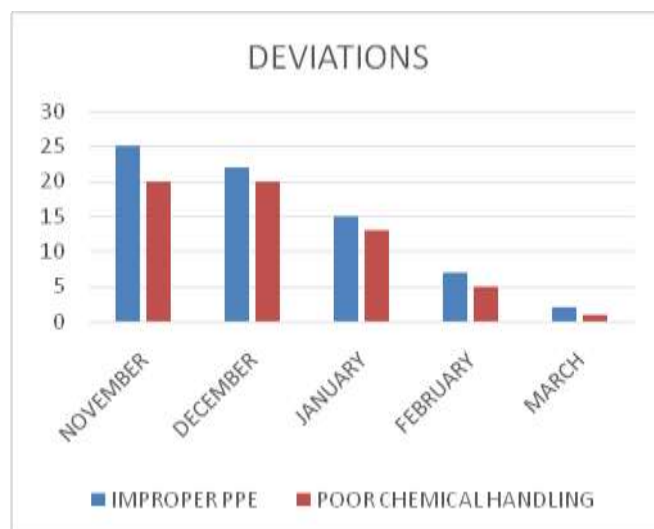


Fig.3. Deviation from proper usage of PPE and chemical handling

C. SITE Wise improper PPE usage on monthly basis:

MONTH	SITE 1	SITE 2	SITE 3	TOTAL
NOVEMBER	7	9	9	25
DECEMBER	10	7	5	22
JANUARY	7	5	3	15
FEBRUARY	3	3	2	8

MARCH	1	1	0	2
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Table.4. SITE Wise Deviation from proper usage of PPE on monthly basis

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SITE 1 is Manufacturing unit with employee count of 70

SITE 2 is Assembly unit with employee count of 120

SITE 3 is Testing unit with employee count of 30

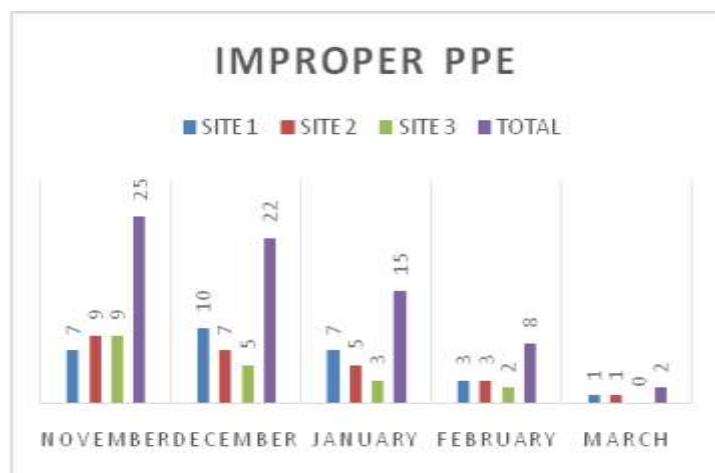


Fig.4.SITE Wise Deviation from proper usage of PPE

D. Poor chemical handling on monthly basis:

MONTH	SITE 1	SITE 2	SITE 3	TOTAL
NOVEMBER	9	6	5	20
DECEMBER	8	6	6	20
JANUARY	5	3	4	12
FEBRUARY	2	2	1	5
MARCH	1	0	0	1

Table.4. SITE Wise Deviation from proper usage of chemical handling on monthly basis

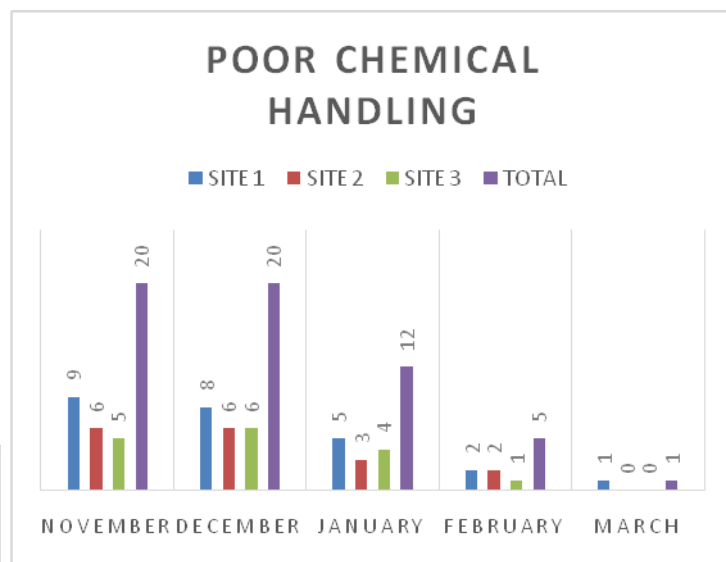


Fig.5.SITE Wise Deviation from proper usage of chemical handling

CONCLUSION

It is observed the personal exposure to hazards in an electronics manufacturing industry can be reduced within a span of 5 months with the help of appropriate assessment, testing and training techniques, As our work has shown 92% reduction in improper PPE usage and 95% reduction in poor chemical handling.

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