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EFFECT OF LEAD ON EMPLOYEES WORKING IN FLUX AND PRINTING PRESS

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ABSTRACT

Awareness about the toxic effects of non-essential metals are still lacking in developing countries. Lead is one among them, which ranks second in the Agency for Toxic Substances and Disease Registry's top 20 lists of toxic metals.The more widespread environmental emissions of lead have been drastically reduced through the introduction of *unleaded petrol*. As a result, publicity about this common toxin has considerably diminished. However, there is still a problem from these sources in countries with less developed controls. Furthermore, there is still one source of lead regularly causing poisoning, namely colouring materials in printing and fluxes, on which this paper focuses. Lead poisoning has been known for centuries. Scientific studies of the harmful effects of lead exposure date to the 1700s. Lead concentrations of blood samples from printing industries in Rajajinagar were determined by meta-exchange reagent followed by Anodic Stripping Voltammetry. We have analyzed blood samples from 22 employees working in Flux and Printing press from Rajajinagar, the city of Bangalore to assess the feasibility of using the lead in solvents. Some of the solvents being used even now are known to contain this toxic metal at alarming levels. We have a list of persons who are quite often suffered from headaches and backaches.

Keywords: Lead toxicity, solvents, flux and printing press.

INTRODUCTION

Childhood poisoning from lead–based paints were first noted in 1897 in Australia, where children ate paint chips from porch railings [1-5]. Lead is highly used in paints for speeding up its drying and for giving them desired colors. A wide range of colors contain lead, for instance, yellow contains Lead (II) chromate, White color contains lead (II) carbonate[6].This prompted the City of Brisbane to pass specific legislation designed to prevent poisoning from lead–based paint. Lead is a metal found in the earth, it is a divalent (Pb^{2+}) and it is not at all having biological importance, it is a poison. For years, lead was used in paint, gasoline, plumbing and many other items. Lead is practically everywhere in today's environment[7]. It enters our bodies from many sources, including defective glazes (pottery), drinking water, contaminated soil, airborne particulate, leaded gasoline, paint and several other sources. There is no safe age to be exposed to lead. Adults can have problems from lead poisoning, but it is most harmful to children younger than age 6 (especially those younger than age because it can permanently affect their growth and development. A pregnant woman who is exposed to lead can pass it to her unborn baby (fetus) [8-11]. Lead can also be passed to a baby through the mother's breast milk. Lead reduces levels of antioxidant compounds that mop up toxic free radicals in the brain. Free radicals kill neurons in the hippocampus, the brain region that controls learning and memory.

Lead poisoning occurs when you absorb too much lead by breathing or swallowing a substance with lead in it, such as food, dust, paint, or water. The result can be damage to the brain, nerves, and many other parts of the body. Acute lead poisoning occurs when a person takes in a large amount of lead over a short period of time. Acute lead poisoning is rare. Chronic lead poisoning occurs when small amounts of lead

are taken in over a longer period. Chronic lead poisoning is a common problem among children. Too much lead in the body can cause irreversible problems in growth and development in children, including-

- Behavior problems.
- Hearing problems.
- Learning problems.
- Slowed growth.

In adults, lead poisoning can cause serious health problems, including high blood pressure and damage to the brain, nervous system, stomach, and kidneys[12]. Although it is not normal to have lead in your body, a small amount is present in most people. Lead can damage almost every organ system, with the most harm caused to the brain, nervous system, kidneys, and blood. The seriousness of lead damage depends on two factors: the amount of lead that gets into the body and the length of time it remains there. Over the long term, lead poisoning in children can lead to learning disabilities (see learning disorders entry), behavior problems, and mental retardation (see mental retardation entry). At very high levels, lead poisoning can cause seizures, coma, and even death[13].

This paper focuses on the source of lead that has not been completely eliminated in the Bangalore. Lead disrupts the functioning of almost every brain neurotransmitter, says David Bellinger, Ph.D., A psychologist and epidemiologist at Children's Hospital in Boston. Neurotransmitters are chemical messengers between the body's nerve cells. The messenger calcium, for example, is essential for nerve impulse transmission, heart activity and blood clotting, but if it doesn't work right, affected systems may also be askew. “Lead fits into binding sites that calcium should,” Bellinger says, “so it can disturb cellular processes that depend on calcium.Lead is absorbed by ingestion, inhalation and through the skin[14,15]. Absorption varies from individual to individual and depends on the chemical form of lead and type of exposure. The alimentary and respiratory tracts are the main portals of entry for lead into the body. It is estimated that 150-300µg of lead is ingested through the oral route and about 10-20 µg is inhaled via the respiratory tract daily[11]. The absorption of lead through oral route is 5-10% and 35-50% from respiratory tract in adults. Unlike adults, children absorb about 50% of ingested lead and retain 8% of dietary lead [4]. The organic lead compounds like tetraethyl or Tri alkyl lead can be readily absorbed through the unbroken skin. Approximately 90% of absorbed lead are reported to be stored in the bone with a half-life of 600-3000 days. The remaining 10% is stored in soft tissues like kidney, brain and liver. The half-life of lead in these tissues ranges from 100-200 days[6]. Lead passes through the placenta easily and fetal blood has almost the same lead concentration as maternal blood[16.] Ninety percent of the ingested lead is excreted in the stool and urine, whereas the inhaled lead is excreted through the renal pathway. Lead is also eliminated through sweat and mother's milk. The aim of this study is to report on levels of lead found in the employees working in Flux and Printing Press, providing a reminder that high concentrations certainly do still exist. A 1977 EC Directive requires that all paint containing more than 5,000 ppm lead should be labelled with a warning that it must not be applied to surfaces that are likely to be chewed or sucked by children. The same concentration has been specified as an abatement action level by the US Department of Housing and Urban Development (1990). This concentration has been considered as a ‘safety level’ for comparison with paint sample concentrations determined in this study to assess the extent of the hazard. It could be argued that this concentration is too high - the Toys (Safety) Regulations (Home Office, 1974a) specify that paint on toys should contain no more than 2,500-ppm and the Pencils and Graphic Instruments Regulations (Home Office, 1974b) state that paint coatings on pencils, pens and brushes should contain no more than 250 ppm.

EXPERIMENTAL

Subject

2ml of blood was collected for the analysis, from employees working in Flux and Printing press, ranging in age from 18 to 38years.

Approach

Concerning to this study, the starting point was a preliminary list preparation and discussion about how this project is to be executed and with the guidance of our Professor. We took up Rajajinagar as the site

area and moved on to the fieldwork i.e; visited the Flux printing and printing press owners, spoke to them, tried to convince. However, it was not an easy thing to convince them, with all the efforts and through some recommendations; finally they were convinced and agreed to give us the information as well as the blood samples for the analysis. Each of them searched for data's independently between the period of 1-2 months, then we prepared a case study sheet to know and to collect the personal information/data of each individual, authentically. We gave them the date and time of when we are coming to collect the blood samples (2ml) and with the guidance of Dr. Raviraja. A, the blood samples and as well as data of each individual were collected.

Sampling

Venous blood samples were collected in plain vaccutainer tubes with EDTA anticoagulant. All samples were measured using a 3010B ESA Lead Analyzer in St. John's Medical College (NRCLPI).

Analytical methods used

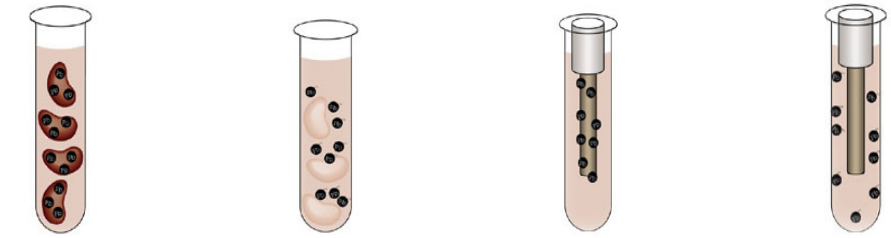
From one tube, 100 µlof blood was transferred to the meta-exchange reagent provided by the ESA Inc USA. Calibration of the 3010B analyzer was done using calibration standards supplied by the company. High, medium and low controls supplied by Control (USA) were used to check the efficiency of the methodology. Lead concentrations were then analyzed using an Anodic Stripping Voltammetry.Lead in blood may be bound to various binding sites on cells. Bound lead will not be plated onto the electrode and thus will not be detected by the lead analyzer. The Met - exchange reagent is designed to rapidly displace lead from the bound condition so that all lead in the sample is present in the unbound state.

Theory of Anodic Stripping Voltammetry (ASV)

Anodic Stripping Voltammetry is a highly precise, virtually interference-free method.

1. Whole blood is added to the reagent solution (Step-1),
2. Any lead present is released from the blood components (Step -2).
3. Now any lead in the reagent solution is concentrated (plated) onto a thin-film electrode during the plating step of the analysis cycle (Step -3).
4. The plated lead is removed from the electrode by applying a stripping current (Step -4) and the amount of lead is measured by integration of the electrical current released during this rapid electrochemical step.

The process is given in the following diagram-



The current released during the stripping step, is directly proportional to the amount of lead present in the blood sample. The Model 3010B provides the sensitivity you need for the detection of blood lead in childhood lead screening, industrial hygiene and occupational health monitoring programs.

Inclusion and Exclusion

The study is basically related to the workers of flux and printing press situated in and around Rajajinagar (Bangalore). The aim of this study is to report on levels of lead found in the employees working in Flux

and Printing Press, by collecting the blood samples and data as well, providing a reminder that high concentrations certainly do still exist. We have included employees working in flux and printing press as our site area and excluded some of the industries who were not willing to support with a fear that, the blood collected will be used for something else away from the project.

RESULTS AND DISCUSSION

The main aim of this study is to determine the blood lead level of the employees working in Flux and the printing press and the analysis report is shown below along with the graphical representation. The lead level is ranging from 8.3 to 14.7 (Fig.-1) in flux industries and 7.3 to12. 6 (Fig.-2) in the print press. Correlating with the values of control (Fig.-3) it was found that there was a small rise in the blood lead level than the normal.

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Table-1: Project Report of Employees working in Flux and Vinyl Printing (As on Date: 15 July 2008)

S. No	Name	Age/Sex	Years of exposure	Working Hours	Test	Result in µg/dl
1.	Sreedhar	20/M	3	8	BLL	14.7
2.	Ashok	31/M	Regular visitor	-----	BLL	13.4
3.	Chethan.B.T	19/M	1	8	BLL	13.7
4.	Kiran Kumar	20/M	2	10	BLL	8.3
5.	Sudhakar	21/M	1	8	BLL	13.2
6.	Rajeshwari	22/F	1	8	BLL	13.2
7.	Praveen Kumar	32/M	1	10	BLL	9.8
8.	Shankar	22/M	1	16	BLL	11.8
9.	Samba Murthy	55/M	35	12	BLL	11.5

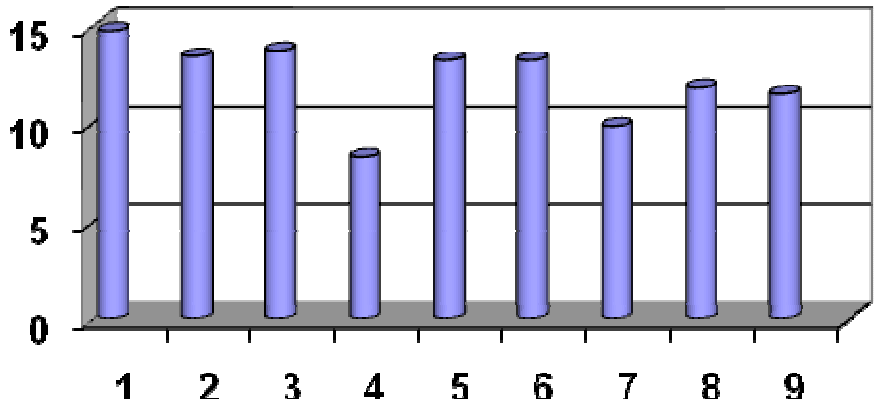

Fig.-1: Blood lead level of workers in Flux printing

Table-2: Project Report of Employees working in Printing Press (As on Date: 16 July 2008)

S. No	Name	Age/Sex	Years of exposure	Working Hours	Test	Result in µg/dl
1.	Naga.B.M	23/M	6	10	BLL	10.2
2.	Palaksha	22/M	1	8	BLL	9.7
3.	Gururaj	22/M	4	8	BLL	10.2
4.	Sreenivas.N	25/M	9	8	BLL	11.3
5.	Yelangavan	35/M	13	8	BLL	9.6
6.	Sandeep	23/M	1	8	BLL	7.5
7.	Dayananda	18/M	2 months	8	BLL	12.3
8.	Muniswamy	34/M	3	8	BLL	11.2
9.	Ashok Reddy	25/M	3	8	BLL	10.6
10.	Umesh	26/M	2	10	BLL	7.8
11.	Nagesh	26/M	8	10	BLL	7.3
12.	Kishore Kumar	28/M	4	8	BLL	11.7
13.	Basavraj	38/M	15	10	BLL	12.6

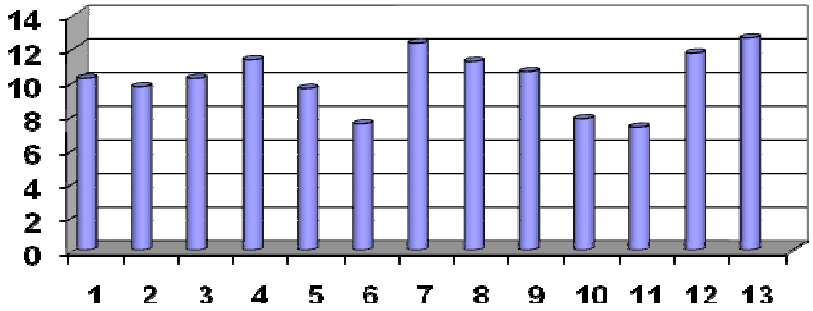

Fig.-2: Blood lead level of workers in printing press

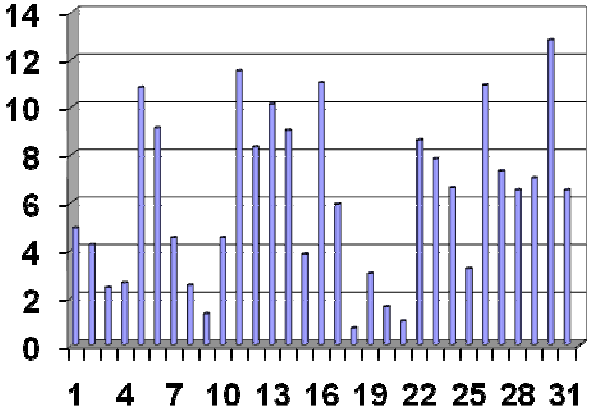

Fig.-3: Blood lead level of control

Table-3: Report of controls

S. No.	Test	Result in µg/dl
1.	BLL	4.9
2.	BLL	4.2
3.	BLL	2.4
4.	BLL	2.6
5.	BLL	10.8
6.	BLL	9.1
7.	BLL	4.5
8.	BLL	2.5
9.	BLL	1.3
10.	BLL	4.5
11.	BLL	11.5
12.	BLL	8.3
13.	BLL	10.1
14.	BLL	9
15.	BLL	3.8
16.	BLL	11
17.	BLL	5.9
18.	BLL	0.7
19.	BLL	3
20.	BLL	1.6
21.	BLL	1
22.	BLL	8.6
23.	BLL	7.8
24.	BLL	6.6
25.	BLL	3.2
26.	BLL	10.9
27.	BLL	7.3
28	BLL	6.5
29.	BLL	7
30.	BLL	12.8
31.	BLL	6.5

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