Lead Exposure on Fire Assay Workers Laboratory

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QC Laboratory is a laboratory that operates on the field of metallurgic analysis on materials such as copper (Cu), gold (Au) and silver (Ag). In the analytical activities on metallurgy, hazardous and toxic materials (B3) are used.

In the containment analysis of gold and silver there is heavy Pb as PbO which is possible to emit in an environment. The greatest exposure happens to an analyst being in close contact including preparing and fire testing.

On one exposure case, chronic Pb intoxication goes slowly. Tiredness, fatigue, irritability and gastrointestinal disturbance are the early signs of chronic Pb intoxication. Gradual exposure on center nerve system shows symptoms such as insomnia, confusion or thinking disorder, less concentration and memory disturbance.
Preface

One of the attempts is by doing medical test on Pb exposed worker. The test includes:

1. Work history
   Emphasised on individual exposure and the hygiene of work site

2. Physical test
   Emphasised on the lungs condition. Based on the lungs condition there will be an evaluation on respiratory protection suit.

3. Blood test
   Pb containment in blood, zinc protoporphyrin or eritrosit forfirin

4. Miscellaneous test
   Undergone if there are other clinic indications.
Method

The research is case-referent study or retrospective which is an observational analytical epidemiology study to study the relation between worker’s health and certain risks.

The research done in QC laboratory especially for fire assay workers at PTFI and the subjects are 49 workers.
Result and Discussion

Based on the result of Pb concentration measurement, the average Pb exposure is 0.040mg/m³ and the average intake is 0.018mg/m³. Occupational Exposure Limit (OEL) is based on Regulation of Minister of Manpower & Transmigration Indonesia No. PER. 13/MEN/X/2011 which is 0.050mg/m³. It means the result is still below the limit.

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\text{intake} \left( \frac{mg}{kg \text{- day}} \right) = \frac{CAP \times IR \times ET \times EF \times ED}{(BW \times AT)}
\]

Based on the equation the average intake for each worker is 0.007 mg/kg-day.
Result and Discussion

Figure 1. Lead Contamination and Blood Lead in µg/dL
Result and Discussion

The PbB analysis on 49 workers shows they still risk general Pb exposure every day during metal burning process. The normal Pb exposure is 0-14µg/dL. In 2014 there are nine workers with Pb in their blood above normal. It shows that cumulatively the workers in fire assay laborturium are above limit.
Result and Discussion

Based on the graphic above, PbB concentration increases significantly from 2012 to 2015. The average in four years is still in range interval reference 0-14 µg/dL but there is slight increase in 2012-2014.

*Figure-2. Average Blood Lead from 2012 until 2015*
Result and Discussion

Statistic test shows measurement score is 0.237 on significance $p>0.05$ so the work hours does not influence PbB concentration extremely. It is possible because the average intake is below Occupational Exposure Limit (OEL) and it takes long to affect PbB concentration to give negative effects.

It is so under some circumstances which are fire assay laboratorium has applied prevention and decrease by doing well technical engineering and there is air ventilation and hygiene on work site.
Result and Discussion

From the explanation above, these are the reasons why range reference interval is 0-14µg/dl, although some workers have PbB concentration above 14µg/dl:

1. Discipline in obeying Standard Operating Procedure (SOP) in fire assay laboratorium.
2. Obedience in wearing self protecting tools in fire assay laboratorium.
3. Workers’ life style which affects blood lead whether they smoke or do exercise.
Conclusion

Based on the discussion, the conclusions are:

1. Daily intake of workers in laboratorium fire assay is 0.007 mb/kg-day.

2. Cumulatively the workers at Fire Assay Laboratory Concentrating Division are still in range reference interval 0-14 µg/dl.

3. There is a slight increase of PbB concentration from 2012 to 2015.
Suggestion

1. Routine maintenance on air ventilation system by ensuring the fresh air is not contaminated with Pb.

2. Workers’ health supervising every at least six semesters and if possible there is laboraturium to test zinc protoporfyrin or eritrosit forfirin.

3. Work shift for workers if there is Pb in blood above reference range interval.

4. Workers’ obedience on Standard Operating Procedure to work safely in laboraturium fire assay.
Reference


THANK YOU
For Your Attention