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## **Pb Pollution on Water and Environmental Health Risk in Women Who Live in Belawan Coastal Area**

Sri Malem Indirawati<sup>a\*</sup>, Setiaty Pandia<sup>b</sup>, Herman Mawengkang<sup>c</sup>, Wirsal Hasan<sup>d</sup>

*<sup>a</sup>Doctoral Studies Program Natural Resources Management and Environment Postgraduate School  
in University of North Sumatera And Lecturer in North Sumatera STIKES*

*<sup>b</sup>Lecturer in Chemistry Technic Faculty in University of North Sumatera*

*<sup>c</sup>Lecturer in Technic Faculty in University of North Sumatera*

*<sup>d</sup>Lecturer in Public Health Faculty in University Of North Sumatera*

*<sup>a</sup>Email: Srimalem\_indirawati@yahoo.co.id*

### **Abstract**

Medan Belawan region is an industrial area, the port and residential areas. The east coast of North Sumatera waters includes in heavily polluted waters by domestic wastes, industrial wastes, and agricultural wastes including ponds wastes. Based on several researches Parameter of Pb in seawater increased significantly. Bore wells of resident were contaminated by Pb and sea water intrusion occurs. Housewife is a subject that is assumed consumes more drinking water and has a tendency at risk due to exposure of Pb in drinking water. This study aims to analyze the environmental health risk assessment (EHRA) on housewives who live in coastal Bagan Deli Belawan village. This study is a survey with 49 mothers as subjects sample and the numbers of sample objects are 49 Bore wells. The method of data analysis was using analysis of environmental health risks formula. The results from 49 samples Bore wells are on the average the Pb concentration was 0.006 mg / L, the highest Pb concentration was 0.026 mg / L (NAV = 0.015 mg / L).

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\* Corresponding author.

E-mail address: Srimalem\_indirawati@yahoo.co.id.

The amount of the highest consumption was 4 L / day. Based on the data analysis, there are 10 Bore wells with Pb exceeded environmental quality standards. Based on the calculation of the environmental health risk analysis obtained  $RQ < 1$  (the average  $RQ = 0.02$ ), ECR value  $< E-4$  means concentrations of Pb not cause a carcinogenic risk for housewives yet. However the environmental management is necessary so heavy metal pollution on resident wells can be overcome.

**Keywords:** Bore wells; Pb; EHRA; housewife.

## **1. Introduction**

Belawan Coastal in Medan is territorial waters as a mouth of rivers that have been through the residential areas, the location of industry, agriculture and other activities. Medan Belawan region is an industrial area, the port and residential areas. According to [1] the east coast of North Sumatera waters includes in heavily polluted waters by domestic wastes, industrial wastes, and agricultural wastes including ponds wastes.

Pelindo routinely every year found sea water sampling parameters for the heavy metals Pb increased significantly. Heavy metal pollution in Belawan coastal waters especially Pb found in shells' body that exceed the permitted threshold value [1]. The result of Purba's research [2], it was found that the water of Bore wells in Medan Belawan district has suffered pollution by 20% of 10 points samples taken. Two (2) among the samples had higher levels of Pb 0.052 and 0.051 mg / L which has exceed the Drinking Water Quality Requirements of 0.01 mg / L based on the Regulation of the Minister of Health of the Republic of Indonesia 492 / Menkes / Per / IV / 2010.

The result of study in [3], the water of Bore wells around Medan Industrial Area (KIM) has undergone a sea water intrusion, 18 sample points from 30 samples of Bore wells water has undergone sea water intrusion and 12 have not experienced sea water intrusion.

Pb can lead into the body through breathing 85%, digestion 14% and skin 1%, if the accumulation of Pb in the blood has reached 10p g / dl, the effect in adults is a disorder of kidney function, gastrointestinal tract, nervous system, lowered fertility, lowered sperm count and can cause spontaneous abortion [4].

Particularly in women when the heavy metal lead into the human body, then the heavy metals are accumulated in the tissues of the body and cannot be excreted out of the body again. In high levels in the human body, it will cause a negative impact on health, namely: inhibits the activity of the enzyme so that the metabolic process is interrupted, causing chromosomal abnormalities (gene), inhibit foetus development, lowering the fertility of women, inhibit spermatogenesis, reduced nerve conduction edge, inhibit the formation of haemoglobin, causing damage to the kidney, causing lack of blood or anaemia, swelling of the head (encephalopathy), and cause emotional and behavioural disorders [5].

This study aims to determine how much risk exposure of Pb in drinking water consumption by housewives who

live in Belawan coastal areas as assumed that housewives have a longer time to stay at home than other family members.

## 2. Material and Method

### 2.1 Study Area and Research Design

This study is an observational survey with cross sectional design. The study began in January to June 2014. The study was conducted in the coastal Bagan Deli village, Medan Belawan district.

### 2.2 Population and Sample

The population is all housewives who live in the study area and use the Bore well as a source of household drinking water. The sampling technique used was purposive sampling that determines the housewife who does not work outside the home, with the assumption that consumes more water. Number of samples is 49 mothers. Object sampling was conducted on 49 residents' wells and then analyzed in the laboratory. Calculation of environmental health risks analysis (ARKL) performed on the subjects sample are housewives.

### 2.3 Data Collection Methods

Primary data were obtained through interviews that include length or stay variable, the amount of water consumption per day in Litre, weight measurement, and analysis of the concentration of Pb in drinking water. Secondary data were obtained from the library literature and population data from the Bagan Deli Village Office.

### 2.4 Data Analysis

Data analysis was done in stages as follows:

- 1) Univariate analysis to obtain a description of each variable and to determine the risk levels of Pb on public health. Levels of Pb is measured by using atomic absorption spectrophotometer (AAS) in the laboratory.
- 2) The calculation of risk analysis is by applying the ARKL formula, by calculate the intake. Intake calculation by using the following formula:

$$I = \frac{C \times R \times f_E \times D_t}{W_b \times t_{avg}}$$

I= Intake mg / kg / day

C= risk agent concentration, mg / L for drinking water

R=intake or consumption rate, L / day for drinking water

f<sub>E</sub>=Frequency of exposure, day / year (residential 350 days)

$D_i$ =Duration of exposure, (the real time or projection, 30 years for residential default value)

$W_b$ =Weight, kg

$T_{avg}$ =the average of period time ( $D_i \times 365$  days / year for non-carcinogens, 70 years  $\times$  365 days / year for carcinogens) [6]

### 3) Valuation of Risk

The assessment to estimate the possibility or potential risk to human health, to the effects of non-carcinogens used formula (2)

Non-carcinogens risk (2)

$$RQ = \frac{I_{nk}}{RfD}$$

RfD (Reference Dose) is a quantitative non-carcinogenic toxicity, is an estimate of a daily exposure dose that is expected cannot cause an adverse effects of health although it continues throughout life [7]. Health risk exists and needs to be controlled if the  $RQ > 1$ . If  $RQ \leq 1$ , the risk does not need to be controlled but need to be maintained so that the numerical value of RQ not exceed 1.

### 4) Valuation of the cancer risk

Excess Cancer Risk (ECR) =  $I_k \times S \times F$

SF = 0.0004, RfD = 0.0035 mg / Kg [8].

## 3. Results

### 3.1 The Characteristics of Respondents

Based on the data of the respondents' characteristics of the lowest age range was 24 years old and the oldest was 60 years old. The lowest weight is 42 kg and the highest is 92 kg, the average of weight was 44.2 kg.

### 3.2 ECR ( Excess Cancer Risk)

Based on the calculation of risk analysis housewives who living in the coastal area have no risk with RQ values  $< 1$  (average of RQ = 0.02). The results of calculation of the risk of cancer showed a mean value of ECR = 1.58 E-8, with a maximum value 8.328 E-8 and the minimum value of the ECR 1.813 E-10. This means the Pb in their drinking water has no risk of cancer in which the value of carcinogens ECR  $< E-4$  [4].

**Table1:** The distribution of exposure pattern frequency of Pb on Housewife in Bagan Deli Village Belawan District

No	Information	C (mg/l)	R (L/day)	$f_E$ (day/year)	$D_t$ (year)	$t_{avg}$	$I_{nk}$	RQ
1	Min	0.00054	1	350	2	10950	0.0000001	0.00
2	Max	0.02623	4	350	51	10950	.0004858	0.14
3	X	0.0067	1.84	350.	21.38	10950	0.00009	0.02
4	SD	0.0069	0.72	0.000	14.90	0.000	.000089	0.03
5	V	0.000	0.52	0.000	222.112	0.000	0.000	0.001

3.3 Map of the distribution of Pb pollution in Bores wheel

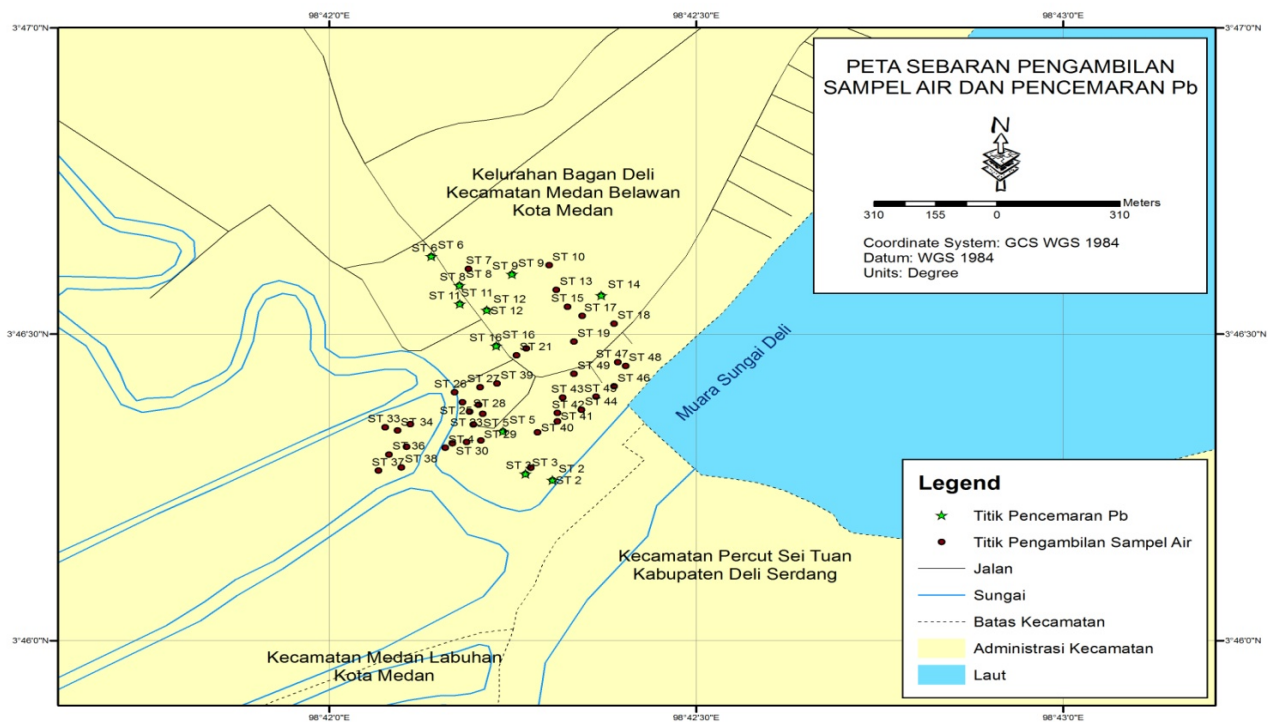


Figure 1: Map of distribution Pb in Bores wheels

4. Discussion

The results showed that the wells Bore water of community some of which have been contaminated with Pb

(Figure 1). There are 10 stations that have high levels of Pb in wells water exceeds the NAB, but based on the calculation of the environmental health risk analysis was obtained  $RQ < 1$ . This means that the presence of Pb in drinking water has no health risk to housewives.  $RQ$  is not only depending on the concentration of Pb in drinking water, the amount of consumption per day; weight and length of stay also play a role. If viewed from the highest Pb concentration in drinking water is  $0.026 \text{ mg / L}$ , mothers with Pb exposure conditions and maximum consumption 4 L per day not show a health risk with  $RQ = 0.14$ . Nevertheless, the nature of Pb accumulates in the body, if the content of Pb in drinking water has exceeded the NAB [9] feared for a long time will have an impact on health. The result of average and maximum value of ECR is  $< E-4$ . This means that Pb does not have a carcinogens risk. However, any dose above zero is always has effect.

In the human body, Pb fraction is excreted through urine or stool due partly bound to the protein, while others accumulate in various organs of the body [10, 11]. The sources of Pb pollution in humans not through consumption of food only, but can also by air (inhalation) and through the skin. Further research needs to be done to check the level of Pb in mother's blood because the Pb level condition in sea water has exceeded the NAB (previous studies).

## **5. Conclusion**

1. 20.1% (10 wells) source of drinking water has been polluted by Pb.
2. Results of non-carcinogenic risk analysis obtained  $RQ < 1$  it means that housewives do not have the risks of drinking water from their wells.
3. ECR value  $< E-4$  means concentrations of Pb not cause a carcinogenic risk for housewives yet.

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