Enviromental Health Risks on Community in Coastal Area As a Results The Presence of Pb in Sea Water and Drinking Water.

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Abstract. The burden of pollution due to industrial waste, ports, community activities and marine intrusion further exacerbate environmental quality. This pollution causes drinking water sources polluted. This study aims to analyze Pb contamination in marine, and drinking water from wellbores and measure the magnitude of health risks. This is cross sectional study and quantitative research that analyzes Pb concentrations in marine and drinking water. The sample are 250 people who live in coastal area and drink water from wellbores. Water samples were examined in certified laboratories by using Atomic Absorbtion Spectrophotometer method, health risk was analyzed by the environmental health risk (EHRA) method. Pb concentrations average in marine is 52 μgl⁻¹. Pb concentration from 92 samples of drinking water average is 4.5 μgl⁻¹ and range 5.4 – 26.2 μgl⁻¹. The amount of health risk RQ <1, which means that it has not shown risk yet. Pb exceeded the environmental quality standard in marine, There are 14.7% of people consuming Pb contaminated drinking water. Community complaints found at the study sites were diarrhea 22.8% and dizziness 17.2% and skin disease 17.2%, upper respiratory tract infection, rheumatism and hypertension.

Keywords: Pb, sea water, drinking water, health risks

1. Introduction

Major cities in Indonesia are generally located in coastal areas, the characteristics of coastal areas with characteristics towards the land affected by the physical properties of the ocean such as tidal, wind, wave and intrusion and seaward influenced by natural processes on land such as sedimentation, the flow of fresh water from the stream watersheds, domestic sewage, industrial and agricultural. Environmental pollution in coastal areas make the waters along the shoreline and the beach itself becomes unfit for use by the general public and has become a global health problem[1].

Health quality of the coastal environment is very critical due to sea water pollution by industrial waste, ports, marine transportation, domestic waste and community activities. Polluted sea will have an impact on the environment, especially the quality of community water sources. Belawan is a coastal area in Medan city, heavy metal pollution has taken place in the region's waters...
of Belawan, as in previous studies which found marine life that has been contaminated with heavy metals Pb, Cd and Cr [2]. Heavy metals are persistent elements and can accumulate through the food chain (bioaccumulation). The accumulation of heavy metals (Cd, Pb, Hg and Cr) was measured by atomic absorption spectrophotometry in water, sediment, plankton and fish samples collected from Lake Beyşehir. It was Pb > Cd > Cr > Hg (p < 0.05), in addition to this, accumulation orders of heavy metals in the food web was also found to be water > plankton > sediment > fish tissues, except for Cr [3].

Another phenomenon the location of this study has been found Pb of freshwater resources of the communities living in coastal areas. Seawater intrusion is suspected as the primary cause in which there has been a process of sea level rise that sea water into the wells of the population. Seawater intrusion assumed that it could cause heavy metal pollution of freshwater resources population that is shallow wells and deep wells. Belawan coastal Presence of heavy metals Pb, As and Mn in drinking water cause effects on the health effects, especially in infants of pregnant women who consume water that has been contaminated with heavy metals [4]. Research on the risk of consuming contaminated drinking water in Kohistan, North Pakistan in measuring the risk of contamination of Cu, Co, Cr, Mn, Ni, Pb, Zn and Cd in drinking water of the population. The pollution comes from activities geogenik the process of weathering, erosion and anthropogenic activities are mining, industrial waste, domestic and agriculture [5] communities still exist that utilize the artesian well water as a source of drinking water [6].

Pollutants such as heavy metals pose a threat to the health of coastal communities, especially Belawan, seawater intrusion phenomenon allows community water sources polluted by heavy metals. People who use the water as drinking water in particular will be exposed to heavy metals contained in their drinking water. Further studies can be done is to analyze the risk in people who consume drinking water sourced from clean water from wells in coastal areas.

Studies of environmental health risk analysis is one method of study environmental effects on health. This method is very suitable for the study of environmental impact on public health in the Environmental Impact Assessment is being able to predict the risk of exposure by the projection period ahead. Enviromental health Risks Assessment (EHRA) consists of four stages of assessment, namely hazard identification, dose-response analysis, exposure analysis and risk characterization. These measures should not be done sequentially, unless the risk characterization as the last stage The study method is the result of research EHRA exposure to arsenic in drinking water in Bangladesh society cause of death based on the cohort study [7].

The phenomenon of environmental quality in coastal Belawan pollution source of some concern to human activities cause pollution both at sea and on community water sources. This condition if it continues to be an impact on public health. Based on these studies will be needed to analyze the presence of heavy metals in the coastal environment and quantify health risks in people who are exposed to heavy metals.

2. Materials and Methods
This study is a quantitative study is to analyze the levels of heavy metals in the coastal environment is by measuring the levels of Pb in the waters, Pb in drinking water sources and the population large measure on the public health risks. The sample was seawater, drinking water that comes from wellbore and the people who live in coastal consume drinking water from the source of the wellbore. The data analysis research variables are as follows:

a. Seawater samples taken 10 points in the territorial waters of the subdistrict of Medan Belawan (see fig 1), Parameters measured were physical quality (odor, taste, clarity), chemical (temperature, DO and PH, Pb), then the results were compared with Water Quality Criteria US EPA [8].
b. Samples of drinking water taken from wellbores in the study site there are 92 samples of the wellbore, the sampling technique uses purposive sampling, parameters measured is the concentration of Pb in drinking water. The results are then compared with WHO guidelines for drinking water for Pb; 5 µg/l [9]. Fig. 2 below is the map of wellbore sample point content of Plumbum

Figure 1. Marine Water Point Map
Sources: Data obtained from the measurement results in the field

Figure 2. Map of the Wellbore Sample Point
Sources: Data obtained from the measurement results in the field by using GPS
C. Analysis of environmental health risks conducted the analysis stage of exposure, dose response analysis, risk characterization and risk management. EHRA method by measuring the variables of the public to sample analysis stage exposure is measured variable; concentration of drinking water consumed (mg/l), the rate of intake (l / day), weight (kg), the duration of exposure (years), the time period average (Dt x 365 days) all these variables to measure Intake (intake)[7].

Data collection using questionnaire. The Variables is described below:

1: Intake mg / kg / day
C: Risk Gent concentration, mg / L for drinking water
R: Intake or consumption rate, L / day for drinking water
fE: Frequency of exposure, day / year (residential 350 days)
Dt: Duration of exposure, (the real time or projection, 30 years for residential default value)
Wb: Weight, kg
Tavg: the average of period time (Dt x 365 days / year for non-carcinogens, 70 years x 365 days / year for carcinogens)

Reference Doses of Pb (RfD Pb) = 3.5 x 10⁻⁴ [7]

The next step is to calculate the risk characterization of numerical risk estimates, by estimating risk by calculating the ratio of intake with reference dose (RfD) with the formula below (1)

\[
\text{Risk Quatient (RQ)} = \frac{\text{Intake (mg / kg day)}}{\text{RfD}}
\]  

(1)

3. Results And Discussion

A. Pb and Cd Concentration in The Seawater

Based on laboratory test results to the results obtained tidal conditions that is Pb concentration is above the quality standard of value, this means has been heavily polluted coastal waters. Suspected pollution sources come from domestic sewage, industrial and harbor. This location has 8 major industries, 15 industries and 32 small home industries.

Table 1. Pb Concentration in the Sea Water in Belawan

| Sample Location | Pb (µg/l) | pH  | DO  |
|-----------------|----------|-----|-----|
| MEDAN BELAWAN   |          |     |     |
| 1. N 03.79010⁰  | Tidal    | 64  | 7.6 | 5.0 |
| E 098.69701⁰    |          |     |     |
| 2. N 03.78963⁰  | 32       | 6.8 | 5.03|
| E 098.68475     |          |     |     |
| 3. N 03.78898⁰  | 60       | 6.6 | 4.77|
| E 098.67907⁰    |          |     |     |
| Mean:           | 52       | 7.0 | 4.93|
| 1. N 03.79010⁰  | Low      | 56  | 8.5 | 8.0 |
| E 098.69701⁰    | Tide     |     |     |
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Table 1. describes the results of laboratory tests of seawater quality that include levels of Pb. The sample is taken from 3 point location with the condition of tide and low tide condition to see difference of metal concentration of Pb. The concentrations of Pb exceed the environmental quality standard, the threshold value based on the US EPA standard for marine water [8]. The mean of Pb in seawater also exceeds the environmental quality standard in tidal conditions (52 µg/l1) and low (57 µg/l1) the standard is 10 µg/l1. Specifically for PH is still in standard condition pH 6.6 – 8.5 whereas DO level for tidal condition exceeded the standard of environmental quality standard (NAB> 5). This condition describes the pollution has occurred in marine of Medan Belawan.

B. Metal Pollution in Wellbores

The measurement results Sample some 92 wellbore used by the people as the main source of drinking water in the obtained results mean Pb concentration is 4.5 µg/l1, with a value of Standard Deviation (SD) = 0.057 and a maximum value is 26 µg/l1. There are 13 (14.6%) wellbore have concentrations of Pb exceeds the threshold limit value for Pb based on drinking water quality from WHO is 5 µg/l1. [9]. Pollutant sources are assumed waters, seawater intrusion factor as originator of the contamination of the wellbore which is used by the people as a source of drinking water. Sea water intrusion in the city of Medan had reached 13 Km [10] and the results of the health center reports there are some 48.7% reported unhealthy home, wastewater disposal systems directly into the sea.

C. Environmental Health Risks Assessment

A total of 34 respondents consume drinking water that has been contaminated with Pb, but poses no risk of this can be explained from the calculation analysis of health risks from exposure to lead in drinking water (see table 3). Results The mean RQ = 0:04, RQ = 0.020 minimum value, maximum value 0.325 with SD = 0.52. The magnitude of health risks (RQ) is still under one (RQ <1) This means that at the time of the study there is no health risk, meaning Pb in drinking water that are resident at the time of measurement do not pose a risk despite being polluted. Pb heavy metal is said to be very dangerous to human health that cannot be destroyed by micro organisms and accumulates in the environment, especially the water-component parts to form a complex compound together with the organic and inorganic compounds by adsorption and combined [4].

The results of the samples of underground water in Bagjata India with resources obtained mining waste contamination Pb levels in drinking water sources 28 µg/l1 with RQ > 0.1 [11]. Although the RQ <1 but the exposure will take place throughout the period, the nature of Pb in the body accumulate and accumulate currently not at risk, but a few years later is likely to cause health effects for society. Symptoms of lead poisoning in the community such as abdominal pain, nausea, diarrhea, neuropathy peripheral nerves, muscle weakness, hands and feet, headaches, depression and anemia. Pb is neurotoxic which can accumulate in the body, Pb high in the body causing disorders of hemoglobin synthesis of blood, neurological disorders (nervous), disorders of the kidneys, the reproductive system, acute or chronic nervous system, and impaired function of the lungs. In addition, it can lower the IQ of young children if there are 10-20 µg/l in the blood, every increase of 10 µg/l in the blood would reduce IQ by 4 points [12][13].
Table 2. Result Of Risk Assesment Analysis And Risk Quatation Of Pb (RQ Pb)

| Variable                          | Mean  | Median | Min   | Max  | SD   |
|----------------------------------|-------|--------|-------|------|------|
| Concentration (C) mg/L           | 0.0045| 0.0025 | 0.0054| 0.026| 0.056|
| Consumption Rate (R), L/day      | 1.8795| 2.0    | 1     | 5    | 0.69 |
| Frequency of exposure (f_e) day / year | 323   | 350   | 48    | 350  | 59.56|
| Duration of exposure (D_t) in year | 23.2  | 20.0  | 1     | 70   | 15.96|
| Weight (W_t), Kg                 | 56.38 | 59.00 | 20    | 94   | 16.06|
| T_avg the average of period time (D_t = 365 days / year for non-carcinogens) | 8470  | 7300  | 365   | 25550| 5826 |
| Intake (I)                       | 8 x 10^{-5} | 5 x 10^{-5} | 5 x 10^{-6} | 5 x 10^{-4} | 8.7 x 10^{-5} |
| RQ Pb                            | 0.0419| 0.0241 | 0.02  | 0.325| 0.525|

Data Source: Results Field interviews and risk analysis By using formula (I)

Refer to Table 4, the maximum value for Cd 0.78 RQ (RQ <1), this means that the content of cadmium in drinking water do not pose a risk community at the time of measurement lasts. Similarly, the risk Pb at the time of measurement, but still there is no guard against for the foreseeable future.

4. Conclusion
Pb and Cd exceeded the environmental quality standard in marine, There are 14.7% of people consuming Pb contaminated in drinking water but the amount of health risks RQ <1.

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