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Jatibarang Final Solid Waste Dumping Site of Semarang City and Its Problems

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Abstract *- Solid waste is big problem in most cities in Indonesia. The problem which often raises, is the difficulty to find the land for solid waste dumping site. The local inhabitants could not accept if the dumping site location is closed to their residential. Therefore, the existing final dumping site is pushed to accommodate and receive solid waste from the entire of the city, although really the service time of the facility is over.This situation is occured on the Jatibarang Final Solid Waste Dumping Site (TPA Jatibarang) of Semarang City, recently.The Municipal of Semarang City, has no other choice for final dumping site exept extending the service time of the TPA Jatibarang. Beside this, the TPA Jatibarang has specific situation, because its location is closed to the Kreo River, one of the tributaries of Garang River, which at the down stream of this river is located intake of the city water supply treatment plant.The leachate of the solid waste is discharged into the Kreo River, which treated by using ordinary aeration method. Of course, this situation is the disadvantage of the TPA Jatibarang. This paper describes the condition of TPA Jatibarang, and its problems and how the efforts of the Municipal of Semarang to overcome this situation.*

Keywords : *TPA Jatibarang, Leachate, pollution.*

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1. Introduction

The Jatibarang Final Solid Waste Dumping Site (TPA Jatibarang) is located in west side of Semarang City, in southern site precisly on Jatibarang Village covering 46.1830 hectares. From the entire of this land, 60% is used as solid waste dumping site, and 40% is used for leachet pond infrastructure, green belt and covering land/ borrow pit for land fill stock. Capacity of the dumping site is about 4.15 million m^3 solid waste.

Topographical of the dumping site is hilly land with slope greater than 24 % to Kreo River direction, the elevation about 63 – 200 m above sea level. In bottom side, leachate of the solid waste is discharged to Kreo River. Every day about 800 ton of solid waste from entire of the city is dumped to this site. This final dumping site has been operated since May 1992, which really its service time is already over in 2008. But because of the Municipal of Semarang is difficult to find the new land for final solid waste dumping site, so with land modification, service time of the final dumping site could be extended. If Municipal of Semarang still could not find the new land for location of city final dumping site, so the municipal Leachate treatment system :

Leachate treatment unit are consisted of leachate storage pond which provided with spill way, especially capacity reach to 1,500 m^3. There are 3 ponds which built in series which flow in drop system. There are 3 surface should make new method for solid waste treatment. This research purpose is to analyse leachate quality which comes from TPA Jatibarang, consider the leachate is discharged to Kreo River which its water is used as raw water for Garang River water supply treatment plant, where its intake is located in down stream of TPA Jatibarang.

The problem reached is the leachate of the waste difficult to be controlled, its facility is not sufficient, land fill sanitary control is difficult to be implemented, so solid waste could slide to Kreo River. The serious problem is related to the water quality of Kreo River as one of water sources for water supply of Semarang City.

2. Research procedure

From research location, in TPA Jatibarang is taken 3 (three) samples, from location as follows [1]:

SW 1 : at Leachate Storage Pond
SW 2 : at Leachate Channel before entering Leachate Treatment Plant
SW 3 : at outlet channel after Leachate Treatment Plant before entering to Kreo River.

it will efective in rainy season, leachate channel to leachate water treatment installation, which formed a pond with its aerators in pond I and pond II, which are hoped could supply oxygen to water. Leachate samples is analysed in

laboratory, with some parameters which to be analysed as follows : pH, DO, BOD, COD, ORP, SS, Cuprum, Cromium, Cadnium, Zink, Plumbum, Aresenicum, Selenium, Cyanide (total).

Result of the samples analysis parameters are compared to quality standard of the Extraction Result Test/Leachate (TCLP) Toxicity Leaching Procedure [2].

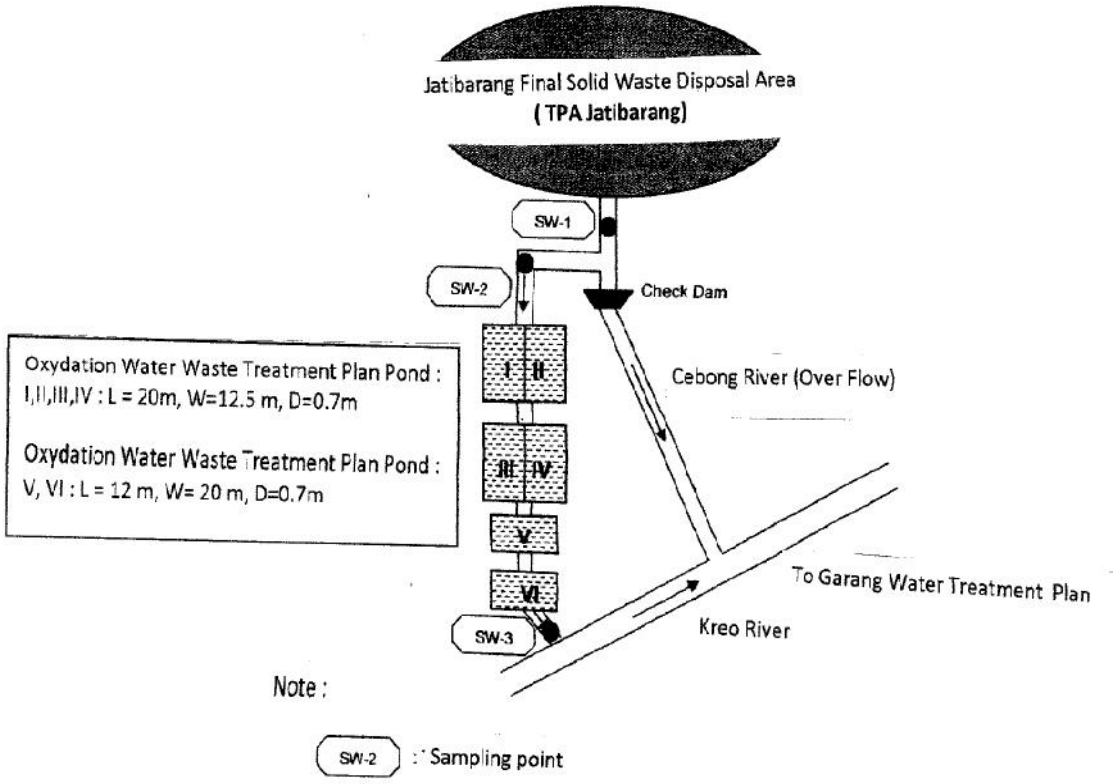


Figure 1. Situation of Jatibarang Final Solid Waste Dumping Site and sampling points [3].

3. Results and Discussion

Before and after treatment of the leachate quality is shown in this table :

Table 1. Analysis Result of Leachate samples on TPA Jatibarang [4]

No.	Parameters	Unit	SW - 1		SW - 2		SW-3		Standard Quality
			(1)	(2)	(1)	(2)	(1)	(2)	
1	pH	-	8.3	8.1	8.3	8.3	8.4	8.3	-
2	BOD	mg O_2/l	288	334	418	428	302	311	-
3	COD	mg O_2/l	1,858	1,543	1,788	1,513	1,508	1,354	-
4	ORP	mV	-306	-125	-260	-123	-259	-120	
5	SS	mg/l	144	137	156	130	220	125	
6	Cuprum	mg/l Cu	0.082	0.080	0.079	0.076	0.066	0.059	
7	Chromium	mg/l Cr	0.198	0.192	0.198	0.190	0.131	0.129	10
8	Cadnium	mg/l Cd	0.017	0.014	0.017	0.013	0.014	0.010	10
9	Zink	mg/l Zn	0.209	0.198	0.177	0.142	0.159	0.123	1.0
10	Plumbum	mg/l Pb	0.143	0.145	0.140	0.142	0.209	0.123	50
11	Arsenicum	mg/l As	0.032	0.03	0.032	0.03	0.041	0.02	5.0
12	Selenium	mg/l Se	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	1.0
13	Cyanide (Total)	mg/l CN	0.024	0.012	0.021	0.012	0.015	0.009	20.0

Source : Analyzed result of Primary data, Based on Kep Dal No. 04 year 1995.

Notes :
SW-1 : leachate water from solid waste disposal storage on storage pond
SW-2 : leachate water which is flew to leachate water treatment instalation
SW-3 : leachate water which already has been treated on leachate water treatment instalation.

From data mention above it is shown that leachate water treatment instalation practically is not function, considering to CODand BOD contents before and after treatment practically are the same. Heavy metals such Cu, Cr, Cd, Zn, Pb, As, Se are still detected in water waste which flew to Kreo River.

From the analysis above, it is shown that the key parameters in leachate are still far below quality standard of TCLP test (Extraction Results/leachate). But considering to situation which in down stream side of the TPA Jatibarang is located water supply treatment plant, therefore discharging leachate water to Kreo River needs special attention, because water quality of Kreo River and Garang River has to be reached as raw water for drinking water (Water Quality Standard Class I). Comparison between treated leachate water quality (SW-3) and water quality standard Class 1, is mentioned in table 2.

Table 2. Analysis Result of Leachate Water Sample at SW-3 TPA Jatibarang comparing to Water Quality Standard Class I

No.	Parameter	Unit	SW - 3		Water Quality Standard Class I
			(1)	(2)	
1	pH	-	8.4	8.3	6-9
2	BOD	mg O_2/l	302	311	2
3	COD	mg O_2/l	1,508	1,354	10
4	ORP	mV	-259	-120	-
5	SS	mg/l	220	125	-
6	Cuprum	mg/l Cu	0.066	0.059	0.02
7	Chromium	mg/l Cr	0.131	0.129	0.05
8	Cadnium	mg/l Cd	0.014	0.010	0.01
9	Zink	mg/l Zn	0.159	0.123	0.05
10	Plumbum	mg/l Pb	0.209	0.123	0.03
11	Arsenicum	mg/l As	0.041	0,02	0.05
12	Selenium	mg/l Se	<0.005	<0,005	-
13	Cyanide (Total)	mg/l CN	0,015	0,009	0.02

Source : Analyzed result of Primary data.

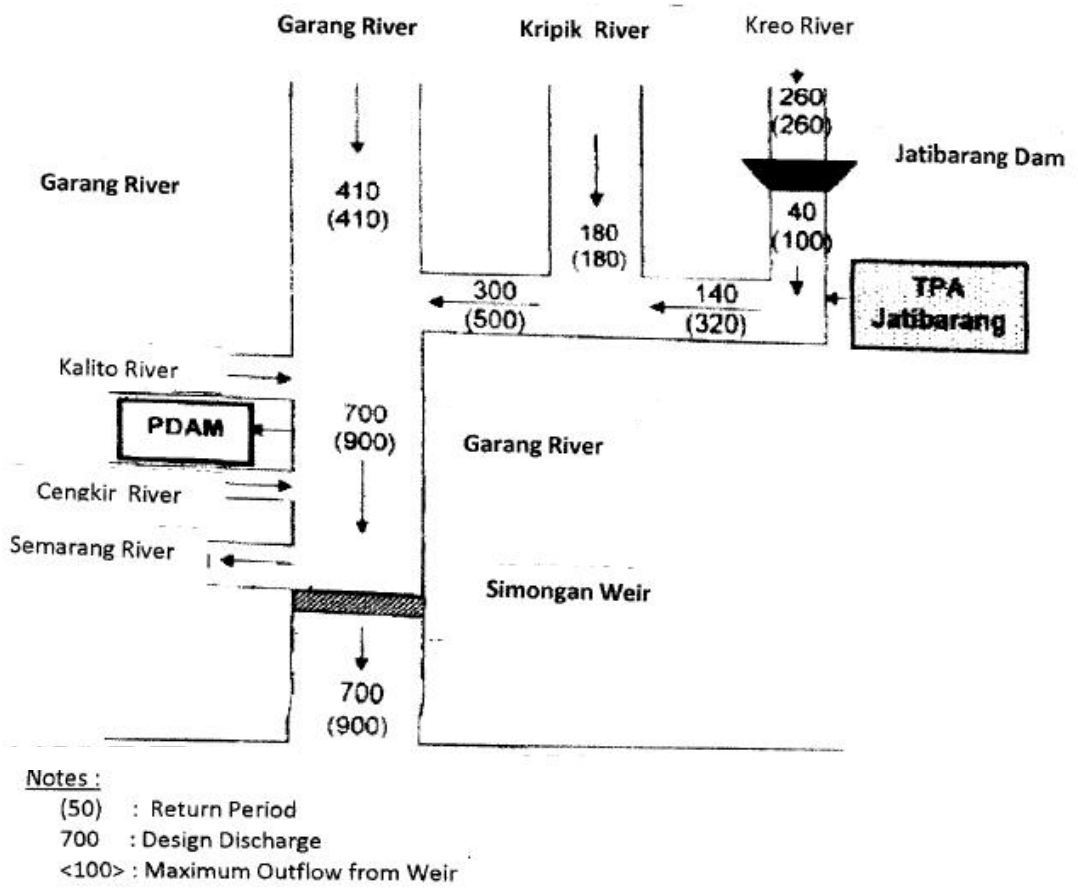
From the analyzed result it is known, that treatment leachate water quality in SW-3 which already treated in SW- I is still exceed much higher than water quality standard Class I, therefore it is needed special attention for its treatment before passing to Kreo River. In order to reach that goal means water quality in Kreo River reach standard Class I, it is needed additional facility to treat leachate or intensification of the existing waste water treatment instalation facility by installing additional aerator facility and extend its operation time.

It is hoped by adding facility/intensification, water of Kreo River could reach water standard Class I (as raw water for water supply). Since May 2014, Jatibarang Reservoir in upstream side of TPA Jatibarang is already finished and starting operation. This is good news for Kreo River, because the reservoir release water to Kreo River in 1.050 m^3/second to supply Garang River Water Supply Treatment Plant (PDAM) and it would dilute water of Kreo River.

Any way up dating leachate data of TPA Jatibarang and water quality in Kreo River just at outlet of Jatibarang waste water channel and on Garang River upstream of water supply intake are needed to ensure that water of Kreo and Garang Rivers is safe.

It has been found that leachate contains high concentrations of organic and inorganic constituents beyond the permissible limits [6]. Overall, the selection of the most suitable treatment for leachate depends on its characteristics, technical applicability and potential constraints, effluent limit required, cost-effectiveness, regulatory requirements and long-term environmental impacts [7]. In most countries, sanitary landfill is nowadays the most common way to eliminate municipal solid wastes (MSWs). However, sanitary landfill generates large quantity of heavily polluted leachate, which can induce ecological risk and potential hazards towards public health and ecosystems [8]. A characterization scheme based on landfill leachate chemical signatures could support studies of leachate evolution over time and liner performance, and help confirm or disprove potential leachate contamination of groundwater [9]. This research sought to understand the behavior of engineered nanoparticles in landfill leachate by examining the interactions between nanoparticles and leachate components [10]. Leachate is the landfill waste that dissolves many compounds that contain pollutants from both organic substances and heavy metal origin. The results show that there are some indications that the quality of groundwater has been polluted by the leachate of both organic substances and heavy metals produced by the landfill. [11]. The organic contents of leachate are dependent upon the kind of decomposition conditions (aerobic, anaerobic acetic production or anaerobic methane production). With anaerobic acetic production the volatile fatty acids produced in leachate have a high COD and BOD_5 [12]. When landfill waste degrades and

rain rinses the resulting products out, leachate is formed. The black liquid contains organic and inorganic chemicals, heavy metals as well as pathogens; it can pollute the groundwater and therefore represents a health risk [13]. A large portion of municipal waste, disposed in landfills, is organic in nature. This organic material starts decomposing soon after the disposal in landfills. The decomposition leads to the generation of in situ leachate, and this leachate can contain substantial amounts of contaminants [14]. The limitation of designable system for Municipal Solid Waste (MSW) management led to serious problems regarding environment and human health. [15]. Sanitary landfilling is nowadays the most common way to eliminate municipal solid wastes, although waste management hierarchy considers landfilling as a last option [16].



PDAM : Municipal Water Supply Company.

Figure 2. Situation of Kreo River and Garang River and its design flood [5].

4. Conclusions

Conclusion of this research are as follows: (1). It is needed proper waste water treatment instalation, to reduce water pollution in Kreo River, (2). Up dating water quality data in Kreo River just outlet of TPA Jatibarang and in upstream side of Garang River Water Supply intake are needed, because the previous data was taken before Jatibarang Reservoir existed.

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