

Target Cancer Risks of Exposure to Carbon Monoxide and Plumbum among Attendants of Parking Lots in Panakkukang Mall and Panakkukang Square Makassar City

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ABSTRACT

Parking attendant is one profession that could be at risk of exposure to car fumes caused by breathing polluted air in the parking lot. This research aimed to analyze the health risks as the result of the exposure to the carbon monoxide (CO) and plumbum (Pb) on the attendants of the parking lots of Panakkukang Mall and Panakkukang Square, Makassar City. The research used the observational design with the approach to Environmental Health Risk Assessment. The research samples consisted of two types, namely the environment samples taken from 6 points of the air measurement in the parking places, and the human samples comprising 30 respondents. The sampling technique used was the simple random sampling technique. The data were analyzed using the ARKL method and processed using the Excel and IBM SPSS version 21. The results of the air measurement in the parking lots with the concentration of carbon monoxide (CO) indicated that the concentration was under 30 mg/m³. The highest concentration of CO was 0.54744 mg/m³, and the lowest concentration of CO was 0.34349 mg/m³. Thus the mean concentration of CO was 0.4469208 mg/m³. Meanwhile, the results of the measurement of the concentration of plumbum (Pb) was still under 0.002 mg/m³.

The highest concentration of Pb was 8,10.10⁻⁵ mg/m³, and the lowest concentration of Pb was 3,65.10⁻⁵ mg/m³. Thus, the mean concentration of Pb was 6,12.10⁻⁵ mg/m³. The Target Hazard Quotient (THQ) of the exposure to carbon monoxide (CO) and plumbum (Pb) with the character of non-carcinogenic in realtime and lifetime of the 30 respondents had the THQ value 1 or no risk, while the value of Target Cancer Risk (TcR) of the carcinogenic risk of plumbum (Pb) in realtime and a lifetime manner of the 30 respondents had the value of TcR ≤ 10⁻⁶ or no risk. As for the Risk quotient (RQ) of non-carcinogenic exposure to CO and Pb, RQ had 1 or not at risk, while Excess Cancer Risk (ECR) carcinogenic exposure to Pb had 1 or not at risk.

KeyWords: Environmental health risk assessment, carbon monoxide, plumbum, parking attendants.

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INTRODUCTION

Air pollution especially in big cities has caused a decrease in air quality. The decline in air quality is mainly due to the use of fossil fuels for transportation and industrial facilities which are generally concentrated in large cities, in addition to household activities and forest / land fires (Bachtiar et al., 2013). Air pollution especially in big cities has caused a decrease in air quality. The decline in air quality is mainly due to the use of fossil fuels for transportation and industrial facilities which are generally concentrated in large cities, in addition to household activities and forest / land fires (Bachtiar et al., 2013).

In Indonesia, approximately 70% of air pollution is caused by motor vehicle emissions. Motorized vehicles issue hazardous substances that can have a negative impact on both human health and the environment. An increase in the number of motorized vehicles will increase the use of gas fuel, and this will carry the risk of adding toxic gases in the air (Indah, 2014). The source of CO pollution is 9.6% from the industrial sector; at 7.8% of solid waste disposal, stationary combustion contributed 1.9% and 63.8% came from the transportation sector; other sources of 16.9%. The transportation sector contributes CO pollutants which is 59% of gasoline cars; 0.2% of diesel cars; 2.4% of aircraft; 0.1% of trains; 0.3% of ships and motorbikes and others of 1.8% (Wardhana, 2004).

The level of pollution of the parking space is influenced by the presence or absence of air vents, the parked traffic flow of vehicles and the types of parking spaces, namely open parking spaces, semi-open parking spaces and closed parking spaces. This can cause pollution, especially air pollution, due to exhaust gases of motorized vehicles. Increasing motor vehicle exhaust emissions can have a toxic effect on the functions of parking attendant organs, and parking ticket attendants (Wardhana, 2004).

High CO levels in a room can harm humans because it can cause tissue hypoxia with symptoms of weakness, nausea, vomiting, vertigo, and even death. Tissue hypoxia is caused by CO poisoning can reduce the ability of hemoglobin (Hb) to transport oxygen, because the strength of the bond between carbon monoxide and hemoglobin is stronger than the strength of the bond between oxygen and hemoglobin (Rorah et al., 2014). Plumbum (Pb) is a material that can poison the environment and has an impact on the entire system in the body. plumbum (Pb) can enter the body through inhalation, food and drink and absorption through the skin (Hasibuan et al., 2012).

The results of the study on the study of the correlation of the level of traffic density on three different road segments in the city of Semarang towards the concentration of CO and Pb with the Gaussian model showed that the highest traffic density occurred in the morning (6.30-7.30 WIB) and in the afternoon (16.30-17.30 WIB). While the highest CO concentration in the three road sections also occurred in the morning (6.30-7.30 WIB) and in the afternoon (16.30-17.30 WIB). Furthermore, it is explained that the volume of vehicles as a source of emissions is directly proportional to the concentration of CO in the air (Widayani, 2004).

Research conducted in Yogyakarta shows that from the results of risk calculations, the value of the risk of exposure to Pb is still below one. This indicates that all its plumbum content locations are so small that they are not at risk and are still safe for health. Even so, it is possible for humans who engage in activities in the area to be exposed to diseases due to plumbum exposure even in small quantities, but not directly and for a long time, ie more than 30 years and can also be affected by several factors such as the number of vehicles and length of stay in areas exposed to Pb (Blongkod et al., 2014). Basic information about exposure characteristics of carbon monoxide and plumbum to parking attendants is the length of exposure of parking attendants, body

weight, CO and Pb exposure intakes inhaled by parking attendants at work. Based on these facts, it supports the authors to conduct research on the risk analysis of exposure to carbon monoxide (CO) and plumbum (Pb) to Panakkukang Mall Parking Officers and Panakkukang Square in Makassar City.

MATERIALS AND METHOD

This research was conducted at the Mall Panakkukang parking lot and Panakkukang Square in Makassar City. This type of research is an observational analytic study with a draft Environmental Health Risk Analysis (ARKL) due to exposure to carbon monoxide (CO) and plumbum (Pb).

The object population in this study was ambient air in the parking area of Mall Panakkukang and Panakkukang Square in Makassar City. While the population of subjects in this study is the parking attendant. Sampling was done by simple random side, so that air samples were obtained at 6 points with 2 times sampling, ie in the morning and evening and human samples as many as 30 respondents.

Air sampling was taken directly at the Mall Panakkukang and Panaakkukang Square parking lots with assistance from the Makassar Health Laboratory Center (BBLK Makassar). Measurements were taken 2 times in the morning and evening. Primary data on air concentration in space is obtained by measuring the concentration of carbon monoxide (CO) and plumbum (Pb) and then conducting an examination in the laboratory. Risk analysis data in the form of respondent intake was obtained by using a questionnaire and weighing the respondent's weight using a weight gauge. Secondary data were obtained from books, literature, research results, agency data, and readings related to the theme in this study. Analysis of research data using the Environmental Health Risk Analysis (ARKL) approach includes hazard identification (hazard potential identification), exposure analysis (dose assessment), dose-response analysis and risk characterization. Furthermore, the data is processed using the Microsoft Excel 2013 program and IBM SPSS Version 21.00. Presentation of results of data analysis in the table form accompanied by narration.

RESULTS

Table 1 shows the level of air concentration in the exposure area of carbon monoxide (CO) and plumbum (Pb) in the parking lot of Mall Panakkukang and Panakkukang Square parking in Makassar City. The measurement results of CO concentrations from all house points are still below the maximum permissible limit of 30 mg / m³ (South Sulawesi Governor Regulation No. 69 Year 2010).

Table 1. Distribution of Measurement of Concentration of CO and Pb Mall Parking Lot Panakkukang and Panakkukang Square Makassar City in 2016

Location	Time	Concentration CO (mg/m ³)	Average of Concentration of CO (mg/m ³)	Conc. Pb _s (mg/m ³)	Average of Concentration of Pb (mg/m ³)
Point 1	Morning	0,41506	0,413445	7,16.10 ⁻⁵	8,1.10 ⁻⁵
	Afternoon	0,41183		9,04.10 ⁻⁵	
Point 2	Morning	0,34708	0,34349	7,16.10 ⁻⁵	7.10 ⁻⁵
	Afternoon	0,3399		6,84.10 ⁻⁵	
Point 3	Morning	0,38287	0,40941	5,06.10 ⁻⁵	4,43.10 ⁻⁵
	Afternoon	0,43595		3,8.10 ⁻⁵	
Point 4	Morning	0,50608	0,479345	3,18.10 ⁻⁵	3,65.10 ⁻⁵
	Afternoon	0,45261		4,12.10 ⁻⁵	
Point 5	Morning	0,66195	0,547435	4,03.10 ⁻⁵	6,22.10 ⁻⁵
	Afternoon	0,43292		8,41.10 ⁻⁵	
Point 6	Morning	0,6369	0,4884	2,15.10 ⁻⁵	7,315.10 ⁻⁵
	Afternoon	0,3399		1,248.10 ⁻⁴	
Note:	The maximum allowable CO is 30 mg/m ³ The maximum allowable Pb is 0,002 mg/m ³				

The highest concentration of CO exposure is 0.54744 mg / m³ (point 5) and the lowest is 0.34349mg / m³ (point 2). The average concentration of CO is 0.4469208 mg / m³ with a standard deviation 0.06708278. While plumbum exposure (Pb) from all points is still below NAV 0.002 (South Sumatra Governor Regulation No. 69 of 2010). The highest concentration was 8.10.10⁻⁵ mg / m³ (point 1) and the lowest concentration was 3.65.10⁻⁵ mg / m³ (point 4). The average exposure to PB is 6.12.10⁻⁵ mg / m³ with a standard deviation of 1.61.10⁻⁵ mg / m³. Table 2 shows the level of risk of Realtime and lifetime carbon monoxide (CO) exposure to parking attendants of 30 respondents categorized as not risky because of the value obtained by THQ 1. From these results, all respondents did not show non-carcinogenic health risks, so health risks were not necessary controlled but it needs to be maintained so that THQ values do not exceed 1. While the realtime and lifetime levels of plumbum exposure (Pb) at parking attendants of 30 respondents are categorized as not risky because of THQ 1. From these results, all respondents have not shown non-carcinogenic health risks, so that health risks do not need to be controlled but need to be maintained so that THQ values do not exceed 1.

Table 2. Target Hazard Quotient (THQ), Carbon Monoxide (CO), and Plumbum (Pb) Hazard at Panakkukang Mall and Panakkukang Square Parking Officers Makassar City in 2016

Real time						
	THQ CO Non Karsinogenik			THQ Pb Non Karsinogenik		
	THQ ≤1	THQ>1	Total	THQ ≤1	THQ>1	Total
n	30	0	30	30	0	30
%	100	0	100	100	0	100
Lifetime 30 years						
	THQ CO Non Karsinogenik			THQ Pb Non Karsinogenik		
	THQ ≤1	THQ 1	Total	THQ ≤1	THQ 1	Total
n	30	0	30	30	0	30
%	100	0	100	100	0	100

Table 3 is the result of an analysis of the cumulative risk between 2 types of pollutants studied, namely CO and Pb. The cumulative Hazard Index (HI) of 30 respondents all have HI values ≤ 1 both for realtime and lifetime exposure. The results stated that all respondents did not show non-carcinogenic health risks, so that these health risks need not be controlled but need to be maintained so that the numerical value of the Hazard Index (HI) does not exceed 1.

Table 3. Hazard Index (HI) carbon monoxide (CO) and plumbum (Pb) in Parking Officers Panakkukang Mall and Panakkukang Square Makassar City in 2016

Real-time						
	Hazard index (CO) Non-Carcinogenic			Hazard index (Pb) Non-Carcinogenic		
	HI ≤1	HI>1	Total	HI ≤1	HI> 1	Total
n	30	0	30	30	0	30
%	100	0	100	100	0	100
Lifetime 30 years						
	Hazard index (CO) Non-Carcinogenic			Hazard index (Pb) Non-Carcinogenic		
	HI ≤1	HI>1	Total	HI ≤1	HI> 1	Total
n	30	0	30	30	0	30
%	100	0	100	100	0	100

Table 4 is the result of an analysis of the risks of carcinogenic Pb exposure. Real-time and lifetime TcR values for parking attendants from 30 respondents were categorized as not at risk of carcinogens because the values obtained by TcR were 10⁻⁶. From these results, all respondents have not shown any carcinogenic health risks due to exposure to Pb pollutants, so health risks need not be controlled but need to be maintained so that the TcR value does not exceed 10⁻⁶.

Table 4. Target Cancer Risk (TcR) Plumbum (Pb) carcinogens in Panakukang Mall and Panakukang Square Parking Officers in Makassar City in 2016

	Real-Time			Lifetime 70 Years		
	TcR ≤ 10 ⁻⁶	TcR >10 ⁻⁶	Total	TcR ≤ 10 ⁻⁶	TcR>10 ⁻⁶	Total
n	30	0	30	30	0	30
%	100	0	100	100	0	100

DISCUSSION

This study showed that measurements of CO and Pb concentrations were all still below the standard quality threshold based on the Governor of South Sulawesi Regulation no. 69 of 2010. Meteorological factors that affect the air in the parking lot are temperature and humidity. Temperature measurements were obtained in the range of 29.20C-32.50C with an average air temperature of 32.430C. Measurement of air humidity from the range of 56.70% -63.80%. This study can be seen that at the air sampling point at the location of the study showed that the higher the temperature the smaller the concentration of pollutants, on the contrary, the lower the temperature, the higher the concentration of pollutants in the air. Temperature and humidity are diffusion factors related to the atmosphere and the photographic environment. The effect of very large meteorological conditions on the measured concentration at an observation point, because of variations that are very different from time to time. This variation in meteorological parameters will determine the ability of the atmosphere to dilute, disseminate and diffuse pollutants present in the air (Choi et al., 2010).

Arifiyanti et al. (2012) study, in Semarang, stated that large CO concentrations in the air have a significant relationship with humidity and temperature at the Jrahah intersection. The CO concentration at the Jrahah junction has a positive and very strong relationship with humidity and temperature having a negative and strong enough relationship to CO concentrations at Intersection and wind speeds have a negative and strong relationship to CO concentrations at the Jrahah Junction. Winardi (2014) states that the increase in temperature will cause the concentration of Pb in the air to drop because at higher temperatures the air will expand more easily which will cause the concentration of pollutants to become more dilute (dilution) and the increase in the humidity causes a rise in pollutant concentration. In more humid air pollutants are not easy to move vertically upwards, and are more difficult to dilute. CO pollution is generally high in areas visited by vehicles such as traffic and parking areas because these vehicles contribute around 60% of all CO emissions. The CO concentration in vehicles is generally 25 ppm and the level depends on the density of the vehicle. The denser the vehicle, the higher CO pollution can be (Fierro, 2000). The effect of CO on humans including parking attendants is caused by a reaction between CO and hemoglobin (Hb) in the blood to form carboxyhemoglobin if the

reaction occurs then the ability of the blood to transport oxygen is reduced (Tiwary et al., 2012). Claude Bernard in 1857 found the toxic effects of carbon monoxide caused by the release of oxygen bonds from hemoglobin to a carboxyhemoglobin form (Sinaga et al., 2013).

Huboyo's research (2012), the plumbum value in the upper ground parking lot in one of the supermarkets in Semarang is $0.11 - 0.22 \mu / m^3$ is still below the threshold, but with the increasing density of vehicles the plumbum concentration can increase. The presence of plumbum in parking lots comes from gas emissions of motor vehicles that can be harmful to health if it enters the body because it can cause poisoning (Murphy, 2012). About 40% of the plumbum that enters through breathing is absorbed into the respiratory tract and about 5-10% of the incoming plumbum compounds are absorbed by the gastrointestinal tract (Tiwary et al., 2000). Increased Pb in the blood is caused by exposure to Pb air, this is because Pb that enters the blood through the respiratory tract, skin, and ingestion will accumulate 95% into the blood and the greatest Pb absorption is through breathing so that Pb in the air contributes most of the Pb in the blood (Flora et al., 2012).

This study uses the intake indicator. The parking attendant's working hours are 8 hours a day. The length of exposure is directly related to the number of sources of CO and Pb pollutants, even though the inhaled daily is still below the threshold based on the measured concentration value, but if the pollutants are inhaled every day during work it will affect the amount of intake from exposure itself.

Parking attendants often increase overtime hours, especially at busy times in shopping centers, which can increase the risk of exposure to CO pollutants from motor vehicle fumes (Bachtiar et al., 2013). The number of long working hours can be at risk of exposure to plumbum (Pb) in the body, this is specifically for workers whose activities are outside the building (Blongkod et al., 2014).

The results of Rose and Tualeka. (2014), that Traffic Police found that the number of working days of Traffic police in a week revealed that the average the Traffic police worked 8 hours per 7 days per week, the highest intake received by the Traffic Police for the CO parameter was $0.1918 \text{ mg} / \text{kg} / \text{day}$ and the value of $RQ < 1$. Research Wardani (2012), the number of working hours of parking attendants can reach 12 hours a day even though no one works up to 7 days a week and on average has worked more than 5 years.

Time, frequency, duration of exposure greatly influences the size of the intake obtained. This factor has the same unit, namely the time at which the concentration will accumulate in the respondent's body depending on how long it takes. The greater the value of time, frequency, and duration of exposure, the larger the intake will be. Research on parking attendants, street vendors, and traffic police can be seen from the calculation of the intake of daily exposure times and the frequency of one's annual exposure directly proportional to the value of intake, meaning that the longer the daily exposure or annual frequency someone with a risk agent, the greater the intake value received and the more he is at risk of health problems due to exposure to the risk agent (Wardani, 2012). This study shows that the average inhalation rate is $5.7 \text{ m}^3 / \text{day}$. Rate inhalation ranges from $4.56670 \text{ m}^3 / \text{day}$ to $6.43330 \text{ m}^3 / \text{day}$. The estimated interval from 95% is believed to be inhaled between $5.4512 \text{ m}^3 / \text{day}$ and $5.9488 \text{ m}^3 / \text{day}$. The calculation of the inhalation rate in this

study is based on standard default values based on sex and age (US.EPA, 2011).

Research by Rose and Tualeka. (2014), the weight determines the inhalation rate of the respondents, the greater the value of the measured weight, the higher the value of the respondent's inhalation rate. Research on the Police The minimum traffic weight of respondents is 70 kg with a frequency of 3 people and the maximum bodyweight of respondents is 93 kg with a frequency of 1 person, so that the intake value for CO exposure is $0.1918 \text{ mg} / \text{kg} / \text{day}$. In this study, the risk of exposure to real-time and lifetime of 30 years exposure to carbon monoxide (CO) and plumbum (Pb) that are carcinogens is not at risk because of the value obtained from THQ 1 so that it indicates a small risk for the occurrence of health problems so the condition needs to be maintained. The Hazard Index (HI) also shows an indication of the small risk of parking attendants where HI 1. Syafita et al (2010) study, about CO exposure in Kudus, obtained Hazard value The highest index (HI) is in the location of Rendeng Village, Elementary School 3 Rendeng, which is equal to 6.238764×10^{-9} with intake values of CO 5.739663×10^{-8} . Whereas the lowest HI value in Desa Pedawang RT 01 / RW 07 is 1.408753×10^{-9} with intake CO 1.296053×10^{-8} and the average HI value has not exceeded the risk value of $HI < 1$ so that it has not posed a risk to respondents who are exposed CO.

CONCLUSIONS AND RECOMMENDATIONS

This study concluded the highest exposure to carbon monoxide (CO) $0.54744 \text{ mg} / \text{m}^3$ with an average value of $0.4469208 \text{ mg} / \text{m}^3$. Plumbum exposure concentration (Pb) the highest was $8.10.10^{-5} \text{ mg} / \text{m}^3$ with an average of $6.12.10^{-5} \text{ mg} / \text{m}^3$. The level of risk of exposure to CO and Pb in real time and life time of 30 respondents has THQ 1 value or is not risky. This has not shown any non-carcinogenic health risks, so health risks do not need to be controlled but need to be maintained so that THQ values do not exceed 1. It is recommended that parking officers periodically check their health, control received nutrition so as to minimize the risk of exposure, use of protective equipment self (PPE) during work, the Government should be able to provide assistance for personal protective equipment (PPE), counseling workers about the risk of exposure due to polluted air from motorized vehicles, and further research to calculate the risk of exposure to CO and Pb from sources other.

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