Health Risks Analysis of Benzo(a) Pyrene's Exposure (BaP) among Student of 16 Bandung Junior High School in 2017

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ABSTRACT---- *Benzo(a)pyrene (BaP) is one of the PAHs. The IARC establishes Benzo(a)pyrene (BaP) as a cause of cancer in animals and possibly in humans. The sources of BaPcan befrom vehicle's disposal, wood burning from fireplaces, flying ash from coal-based power plants or other combustion processes. The research took place in some student of 16 Bandung JHS especially those who are in grade eight. The method that's used is the method of Environmental Health Risk Analysis (ARKL). The value of BaP's concentration at 10 points is equal to <0,002 ppm or <0,02 mg/m³. The median value of non-carcinogenic intake (CDI) for the life span duration was 0,0008 (mg/kg/day)⁻¹, the median value of intake non-carcinogenic real time (1,8 years) duration is $6,05 \times 10^{-5}$ (mg/kg/day)⁻¹, 3 years exposure duration was 0,0001 (mg/kg/day)⁻¹, 6 years exposure duration was 0,0002 (mg/kg/day)⁻¹. The median value of the carcinogenic intake (LADD) is 0,0003 (mg/kg/day)⁻¹. The median value level of risk of non carcinogenic (RQ) for the life span duration was $1,46 \times 10^6$, RQ for real time (1,8 years) duration is $1,05 \times 10^5$, 3 years exposure duration was $1,76 \times 10^5$, and 6 years exposure duration was $3,52 \times 10^5$. The value median level of carcinogenic risk (ECR) was 0,0006. The value of RQ is risk and ECR is safe. Risk management and health advisory are needed to minimize BaP exposure health risks.*

Keywords--- Benzo(a)pyrene (BaP), Student Junior High School 16 Bandung, Environmental Health Risk Analysis
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1. INTRODUCTION

Polycyclic Aromatic Hydrocarbons (PAHs) are organic compounds that come from incomplete combustion or from the high pressure process. PAHs are formed when complex organic substances are exposed to high temperature and pressure. PAHs consist of several types, one of which benzo (a) pyrene (BAP). BAP is generated through the burning of coal, wood, kerosene, burning the rest of polypropylene or polystyrene, and motor vehicle exhaust. BaP has the potential to cause cancer and be used as an indicator of environmental monitoring (ATSDR, 2009).

The research result Jung et al (2010) in New York, the air quality in indoor and outdoor, 45% of the air in the room containing the BAP, and 35% outside the room containing the BAP. Research Ramírez et al (2011) in Europe, the concentration of BAP in the industrial areas ranging from 34% -86%, increased when the temperature is lower than at high temperatures. Research Susmiati (2008) note that the health risk assessment of the police on Highway Margonda gets exposure BAP intake of 0.39 mg / m ³ is assumed to occur a lifetime, then the police got cancer risk of 2.6 x 10 ⁻⁴ (An estimated 2.6 additional cases per 10,000 population). Another study conducted in terminal Depok, BAP concentration on Terminal UPT office space (indoor) is 630.583 mg / m ³, whereas at the exit Terminal Depok (outdoor), ie 126.031 mg / m ³. The average concentration of BAP amounted to 378.307 mg / m ³ (Watanabe, 2014).

The city of Bandung is in the province of West Java, is the largest metropolitan city after Jakarta and Surabaya. The main sources of air pollutants in Bandung are transportation, household and industrial activities. According to the Central Statistics Agency (BPS) Bandung (2014), the number of public and private secondary schools (SMP) 214 schools, SMP Negeri amounted to 54 schools and private schools amounted to 160 schools. SMPN 16 Bandung is located at Jalan PH Hasan Mustafa No.53 which is a main highway traffic density bordering public transport terminal and public fueling station (gas station). The location of SMPN 16 Bandung has a risk of BaP exposure to school students.

WHO since 1995 initiated a healthy school that aims to improve the health of students and teachers in schools. Healthy School is a program held by the Ministry of Health in collaboration with the Ministry of National Education since 1984. Furthermore, a Healthy School Competition was held at TK / RA level, SD / MI, SMP / MTs, SMA / SMK / MA (Kemenkes RI, 2011). According to the US EPA (1993), human health risk analysis is a way of estimating the possible health effects of exposure to certain agents contaminating the present and future environments. Until now, studies have

rarely measured BaP exposure to school students. There needs to be a risk analysis of BaP exposure to students of SMPN 16 Bandung. This is reinforced by the absence of SMPN 16 Bandung into the category of healthy school level junior high school / MTs.

2. THEORY

The International Agency for Research on Cancer (IARC) (2010), benzo (a) pyrene (BAP) is a combination of five benzene rings are found in small amounts (<1 m) from the combustion of the particles originating from motor vehicle exhaust, wood-burning of fireplace, fly ash from power plant with coal material or other combustion process. As a class, PAHs have an aromatic ring structure. Benzo (a) pyrene (BAP) accounted for 5% of total PAHs in the atmosphere. The International Agency for Research on Cancer (IARC) set benzo (a) pyrene (BAP) to cause cancer in animals and possibly in humans (Group 2A).

Research Yang et al (2014) conducted at Midway Atoll, a potential source of PAHs from sources petrogenik (incomplete combustion), which is a military operation for 90 years so that the environment is contaminated. PAHs in food cooked higher than raw food is still being affected by season and sex as an intake (Duan et al, 2016). According to research by Xu et al (2015) in China, a city with the growth and rapid industrialization, many industries and transport affect the concentration of benzo (a) pyrene (BAP).

According to the Integrated Risk Information System (IRIS) 2017 exposure to benzo (a) pyrene (BAP) via inhalation may cause effects on the respiratory tract fiber effect on growth and development. Oral exposure can cause health effects on the liver and blood and the process of ovulation. Research Tuntawiroon et al (2007) in school children in Thailand who are exposed to PAHs, one of benzo (a) pyrene (BAP), the study sample are school children who live in Bangkok and Chon Buri in Thailand, shows the differences in the concentration of exposure to PAHs measured using biomarkers of benzo (a) pyrene (BAP) in the urine, in school children in Bangkok was higher than in the province. The average concentration of benzo (a) pyrene (BAP) in Bangkok at 19.59 ng / m ^{3} whereas in Chonburi at 1.35 ng / m ^{3}. High concentrations are associated with DNA-adducts that allow the occurrence of diseases such as cancer.

Integrated Risk Information System (IRIS) US EPA (2017) made a classification reference value toxicity for benzo (a) pyrene (BAP) into two, namely: Exposure to Oral (Oral Cancer Slope Factor): 1E + 0 (1) per (mg / kg / day) $^{-1}$ and exposure Inhalation (Inhalation Unit Risk): 6E-4 (6 x 10 $^{-4}$) per ug / m ^{3}. While Inhalation Reference Concentration (RFC) for BAP of 2 x 10 $^{-6}$ g / m ^{3}.

According to US EPA (1993) health risk analysis is a process to estimate the possible health effects of humans from exposure to biological agents and chemicals present in the environment. Risk analysis can predict quantitative levels of risk. According to NRC (1983) in Louvar & Louvar (1998) the risk analysis stage includes: hazard identification, source identification, exposure analysis, dose-response analysis, risk characterization, risk management, and risk communication.

3. METHOD

This study analyzed the approximate amount of risk due to exposure to benzo (a) pyrene (BAP) to health student of SMPN 16 Bandung using study approach Environmental Health Risk Analysis (ARKL), located in the city of Bandung. The data collection process was conducted in May 2017. The data was collected through the concentration of benzo (a) pyrene (BAP) in ambient air school environment. In school children, interviews and anthropometric measurements of respondents and field observations were conducted in the study area. The variable in this study is the concentration of benzo (a) pyrene (BAP) which generates the intake of benzo (a) pyrene (BAP) SMPN 16 Bandung and Risk Quotient (RQ) and Excess Cancer Risk (ECR). Intake (intake) of benzo (a) pyrene (BAP) is influenced by the characteristics of the respondents (weight and age) and activity patterns (time, frequency, and duration of exposure). Then formulated management and risk communication.

The population at risk in this study is a child SMPN 16 Bandung. Human sample in this research is class VIII SMPN 16 Bandung who fulfill inclusion criteria. Samples of exposure in the study, the ambient air in the environment SMPN 16 Bandung, namely: 4 BAP concentrations in indoor air and 6 BAP concentration in outdoor air taken during school activities take place. Sampling using purposive sampling method, a sample selection with specific characteristics that match the criteria. Calculation of the minimum number of samples of 32.85 which then rounded up to 35 people. Number of samples 35 people added 10% then exaggerated to 50 people to avoid the possibility of drop out.

The criteria that must be met in this study include inclusion and exclusion criteria. Inclusion criteria include: age 13-15 years old at the time of sampling, students or students of grade VIII SMPN 16 Bandung, have attended school at SMPN 16 Bandung for at least 1 year, and willing to cooperate in research. Exclusion criteria are: not in school during research.

Data collection is done by way of field and direct examination through interviewing activities with questionnaires related to variables. The respondents will be weighted and interviewed about the activity pattern. Sampling Exposure benzo (a) pyrene (BAP) is performed by Petrolab Jakarta.

The data collected will be analyzed using statistical data processing software. Data will be analyzed univariat. Univariate analysis was performed to show the frequency distribution of variables studied, including anthropometric characteristics (body weight and age), and activity patterns. Data collection is done using statistical test software. Then calculate the environmental health risk analysis (ARKL) to assess the health risks from exposure to benzo (a) pyrene (BAP).

4. RESULT

In this study, researchers obtained anthropmetric characteristics and activity patterns of respondents SMPN 16 Bandung in 2017. Furthermore, the results of univariate stratical analysis can be seen in table 1.

Table 1. Characteristics of Anthropometry and Respondent Activity

Variable	n	Range	Median	Average± SD	Distribution
Weight (kg)					
-Male	22	36,40- 104.40	44,90	52.19±17.88	Abnormal
-Female	28	34,70- 84.10	45,65	47.73±10,33	Abnormal
-Total	50	34,70- 104,40	45,15	49,69±14,18	Abnormal
The rate of intake (R, m^3/hour)					
-Male	22	0,51- 0,74	0,55	0,58±0,06	Abnormal
-Female	28	0,50- 0,69	0,57	0,56±0,04	Normal
-Total	50	0,50- 0,74	0,55	0,57±0,05	Abnormal
Frequency of exposure (f_E, day/year					
-Male	22	187- 222	219	212,36±12,86	Abnormal
-Female	28	192- 222	214	209,61±12,22	Abnormal
-Total	50	187- 222	219	210,82±12,45	Abnormal
Time of exposure (t_E, hour/day)	50	0	6	6.0±0	Normal
Duration of exposure (D_t real time, year)	50	0	1,8	1,8±0	Normal
	50	0	3	3.0±0	Normal
	50	0	6	6.0±0	Normal

Concentrations of benzo (a) pyrene (BAP) at 10 points in the environmental decision SMPN 16 Bandung can be seen in Table 2.

Table 2. Concentrations of *benzo (a) pyrene* (BAP) ambient air SMPN 16 Bandung Year 2017

Location's Name	Result of laboratory analysis		BaP in the air quality standards according to the European Environment Agency (EEA), 2014
	Ppm	mg/m^3	
Between class VIII-A and VIII-B	<0,002	<0,02	
Corridor class VIII-E Floor 2	<0,002	<0,02	
Corridor class VIII-J Floor 2	<0,002	<0,02	
Corridor class VIII-D Floor 2	<0,002	<0,02	
Sports Field I	<0,002	<0,02	
Sports Field II	<0,002	<0,02	1×10^{-6} mg/m^3
Security Pos	<0,002	<0,02	
Opposite School	<0,002	<0,02	
Home School	<0,002	<0,02	
Canteen	<0,002	<0,02	

Results of univariate analysis calculating the value of the intake / CDI (non-carcinogenic) and LADD (carcinogenic) can be seen in Table 3. Meanwhile, for the results of the univariate analysis RQ (non-carcinogenic) and ECR (carcinogenic) can be seen in Table 4.

Table 3. Univariate analysis of CDI and LADD Respondents Value SMPN 16 Bandung Year 2017

Variable	CDI Life Span	CDI			LADD
		Real Time (1,8 years)	Exposure (3 years)	Exposure (6 years)	
Minimal	$4,94 \times 10^{-4}$	$3,56 \times 10^{-5}$	$5,93 \times 10^{-5}$	0,0001	$1,76 \times 10^{-4}$
Maximum	0,001	$7,57 \times 10^{-5}$	0,0001	0,0003	0,0004
Mean	0,0008	5,92-05	9,86E-05	0,0002	0,0003
Median	0,0008	$6,05 \times 10^{-5}$	0,0001	0,0002	0,0003
Standard Deviation	0,0001	$8,63 \times 10^{-6}$	$1,44 \times 10^{-5}$	$2,89 \times 10^{-5}$	$4,28 \times 10^{-5}$
Distribution	Abnormal	Abnormal	Abnormal	Abnormal	Abnormal

*Kolmogorov-Smirnov̊ (p<0,05)

Table 4. Univariate Analysis Estimated Value of Non Carcinogenic Health Risks Respondents SMPN 16 Bandung Year 2017

Variabel	RQ Life Span	RQ		
		Real Time (1,8 years)	Exposure (3 years)	Exposure (6 yeras)
RQ>1	50 (100%)	50 (100%)	50 (100%)	50 (100%)
RQ≤1	0	0	0	0
Minimal	$8,64 \times 10^{5}$	$6,2 \times 10^{4}$	1.03×10^{5}	$2,07 \times 10^{5}$
Maximum	$1,84 \times 10^{6}$	$1,32 \times 10^{5}$	$2,2 \times 10^{5}$	$4,41 \times 10^{5}$
Mean	$1,43 \times 10^{6}$	$1,03 \times 10^{5}$	$1,72 \times 10^{5}$	$3,45 \times 10^{5}$
Median	$1,46 \times 10^{6}$	$1,05 \times 10^{5}$	$1,76 \times 10^{5}$	$3,52 \times 10^{5}$
Standard Deviation	$2,09 \times 10^{5}$	$1,5 \times 10^{4}$	$2,5 \times 10^{4}$	5×10^{4}
Distribution*	Abnormal	Abnormal	Abnormal	Abnormal

*Kolmogorov-Smirnov̊ (p<0,05)

5. DISCUSSION

Characteristics of Anthropometry and Activity

Anthropometric characteristics and activity patterns affect the value of the intake respondents. Characteristics of anthropometry measured is weight, data is used to find the intake rate. Weight affects the amount of intake received by the body orally or inhaled. Weight loss is inversely proportional to the amount of intake, means the greater the weight of respondents, the value of the intake will be smaller.

Susmiati's study (2008) of the exposed group's weight (police working on Margonda road) ranged from 53 to 100 kg, the comparison group ranged from 50-80 kg. The average combined weight of 73.63 kg. The rate of intake using a default value of 0.83 m³ / hr. Exposure time of the exposed group ranged from 8 to 12 hours / day with an average of 8.2 hours / day, the comparison group ranged from 8 to 15 hours / day, with an average of 13.89 hours / day. The duration of exposure is entirely using the default value of US EPA 30 years for non-carcinogens and 70 years for carcinogens. Exposure frequency of 336 days / year.

In this study, the weight of male respondents ranged from 36.40 to 104.40 kg, while the weight of female respondents ranged from 34.70 to 84.10 kg. Total weight of respondents ranged from 34.70-104.40 kg with an average of 49.69 kg and median value of 45.15 kg. In the previous study, there were 2 groups measured so that the combined mean weight was greater than this study.

The rate of individual intake obtained in units of m³ / day. The rate of intake obtained divided by 24 hours to convert the units into m³ / hour and is used to calculate the amount of intake (intake). The rate of intake is directly proportional to the intake, the greater of the rate so the intake. Previous research using default values set US EPA 20 m³ / day or 0.83 m

[3] / hr. While this research berdasarakan calculate the rate of intake of a logarithmic curve thus obtained average intake rate of 0.57 m ^{3} / hour, with a median value of 0.55 m ^{3} / hr.

The data of activity of the respondents measured in the study through interviews questionnaire covering frequency of exposure (f $_E$) (days / year), exposure time daily (t $_E$) (hours / day), and duration of exposure in real time (D $_t$) (year). Exposure frequency averaged 210.82 days / year, with a median value of 219 days / year. The default value of US EPA is 250 days / year. Obtained by way of 365 days minus the number of truancy, permits, illness, and national holidays. In the two previous studies, the exposure frequency exceeds the US EPA's default value of 250 days / year due to the longer-used range for workers.

The value of daily exposure time is obtained from the number of hours in the school which is then on average because it is different every day. Average daily exposure value 6 hours / day. Each respondent has the same daily exposure value due to not doing other activities at school such as additional tutoring. Thus, it can be concluded the value of daily exposure 6 hours / day. Previous research, the value of exposure is more varied each respondent because influenced by the length of work.

Real time exposure duration responden questionnaires obtained from interviews with the question how long the school. The majority of respondents entered since class VII so counted 1 year 10 months or 22 months of schooling. Researchers divided the duration of exposure duration of exposure into real time since the respondents attend school 22 months or 1.8 years, duration of exposure until graduating class IX for 3 years and duration of exposure during adolescence 6 years. For the duration of exposure to the life span is calculated using the US EPA default value of 25 years for non-carcinogens and 70 years for carcinogens. In the two previous studies, using the duration of exposure to a default US EPA 30 years for non carcinogens and 70 years for carcinogens.

Of the concentration, the rate of intake, duration of exposure, frequency of exposure, duration of exposure, body weight and the average time period of each respondent, then the value obtained intake of each individual. Exposure intake value of benzo (a) pyrene (BAP) describes the amount of intake of exposure received by the respondent in mg per kilogram of body weight per day. If the value of high intake, then the value of non-carcinogenic health risk (RQ) and the value of health risk carcinogenic (ECR) will be high, which means that the ambient air quality in the school environment is not safe from the effects of BAP.

The calculations show, the value of the intake (CDI) each respondent with the duration of the life span has not normal distribution in the range of 4.94 x 10 $^{-4}$ - 0.001 (mg / kg / day) $^{-1}$ an average of 0.0008 (mg / kg / day) $^{-1}$ and the median value of 0.0008 (mg / kg / day) $^{-1}$ Value intake with real time duration (1.8 years) ranged from 3.56 x 10 $^{-5}$ - 7.57 x 10 $^{-5}$ (mg / kg / day) $^{-1}$ an average of 5.92 x 10 $^{-5}$ (mg / kg / day) $^{-1}$ with a median value of 6.05 x 10 $^{-5}$ (mg / kg / day) $^{-1}$ Intake duration of exposure (3 years) ranges from 5.93 x 10 $^{-5}$ - 0.0001 (mg / kg / day) $^{-1}$ an average of 9.86 x 10 $^{-5}$ (mg / kg / day) $^{-1}$ the median value of 0.0001 (mg / kg / day) $^{-1}$ Intake duration of exposure (6 years) ranged 0,0001- 0.0003 (mg / kg / day) $^{-1}$ an average of 0.0002 mg / kg / day with a median value of 0.0002 (mg / kg / day) $^{-1}$

Value intake (intake) LADD used to calculate the health risk carcinogenic (ECR). The resulting data has a normal distribution, ranging from 1.76 x 10 $^{-4}$ - 0.0004 (mg / kg / day) $^{-1}$ an average of 0.0003 (mg / kg / day) $^{-1}$ and the value the median 0.0003 (mg / kg / day) $^{-1}$

Risk Characterization

Characterization of Non Carcinogenic Health Risk

Susmiati research (2008) got result in exposed group as many as 45 people had RQ> 1 and 1 person had RQ≤1, whereas in comparison group 1 person had RQ≤1 and 45 people had RQ> 1. Watanabe's study (2014) did not calculate non-carcinogenic health characterization so that RQ was not known.

The difference with the previous studies could occur due to the intake is influenced by the duration of exposure to real time school children classified as not long in contrast to workers who have been exposed for years. In this study, using a calculation formula RQ by way of intake (CDI) divided RFC while research Susmiati (2008) are taken into account in the analysis of the risk of exposure to benzo (a) pyrene (BAP) is the risk of exposure to dust TSP because it has not provided a reference for benzo (a) pyrene (BAP).

Characterization of Carcinogenic Health Risk

Characteristics of carcinogenic risk can be assessed from the Excess Cancer Risk (ECR), which means that an agent can not be accepted because of the risk of the organism, system, sub or population and abundance of cases of cancer in units of a particular population (Kemenkes RI, 2012). ECR value in this study derived from the value of the intake carcinogenic (LADD) multiplied by Cancer Slope Factor (CSF). CSF value obtained from lowering the risk of inhalation unit benzo (a) pyrene (BAP) set by the US EPA IRIS 6E-4 ug / m ^{3} inhaled into 2,068 (mg / kg / day) $^{-1}$.

Benzo (a) pyrene (BAP) has only one inhalation unit risk value of US EPA's IRIS, so that there is only one value of ECR. All respondents had ECR≤1E-4 values, a minimum score of 0.0003, a maximum value of 0.0008, an average of 0,0006, and a median of 0.0006. The ECR value has an abnormal distribution. Median value means that exposure to benzo (a) pyrene (BAP) indicates the possible risk of carcinogenic 6 cases per 10,000 population.

Research Susmiati (2008) produced two ECR, the ECR which uses SF RAIS value of 0.3 x 10 $^{-4}$. While the ECR using a value of SF California EPA (CalEPA) of 2.6 x 10 $^{-4}$, which means there will be 2.6 cases of cancer than 10,000 people. Research Watanabe (2014) ECR calculate the intake means (LADD) multiplied by the CSF. CSF obtained from the value of Cancer Risk Unit (UCR) multiplied by the average body weight divided by the rate of intake. Results ECR whole group amounted to 21.24 x 10 $^{-3}$ that means there will be 22 cases of cancer than 1,000 people since ECR larger population of E-4.

Benzo (a) pyrene (BaP) Exposure Source at SMPN 16 Bandung

According Cerniglia & Gibson (1979) benzo (a) pyrene (BAP) was found together with other PAHs in cigarette smoke, the food is baked, roasted or fried and byproducts of industrial activities and are widely distributed in terrestrial and aquatic ecosystems. Research Xu et al (2015) in China, a city with rapid growth and industrialization. Exposure to benzo (a) pyrene (BAP) occur through several channels. However, identification of exposure benzo (a) pyrene (BAP) that occurred in China comes from vehicle emissions and industrial.

SMPN 16 Bandung is located on a crowded highway traffic jam. Distance ± 50 meters after SMPN 16 Bandung there is an intersection towards Cicaheum and Cikutra. While ± 50 meters before SMPN 16 Bandung there is SPBU. In front of the school until the intersection is always jammed, becomes an angkot dismissal when leaving and coming home from school. Sources of benzo (a) pyrene (BAP) occurred at school because the roads are jammed, close to gas stations, markets, combustion derived from the stall at the back of the school.

Concentrations of benzo (a) pyrene (BAP) of 10 pick-up points have the same value, of 0.02 mg / m ^{3} after conversion. The value is relatively low. This can occur because of limitations of the tool, there are only two tools when measuring the concentration of benzo (a) pyrene (BAP) took place, a maximum of two innings later retrieval point onwards. Thus, the measurement can not be current and maximal.

Risk Management and Communication

Risk management is an attempt to regulate and control the risk that the value of the intake (intake) did not pose any health risks exceeded the risk limit unsafe. Carcinogenic and non carcinogenic risk level. To control non-carcinogenic health risks, non-carcinogenic intake is required which is not risky to respondents. The non-carcinogenic risk level in this study indicated a risk, but the carcinogenic risk level was safe. Recommendations Health (Health Advisory) needs to be done in this study to control exposure to benzo (a) pyrene (BAP), which is received by the respondent.

Other recommendations needed to reduce health risks due to BaP exposure include:

1. Conduct health education on BaP exposures occurring in the school environment through risk communication which is one component of a healthy school (CDC, 2012).

2. Use of Personal Protective Equipment (PPE) to reduce the exposure of BaP to each respondent. APD in question can be a mask that covers the nose

3. Building networks and alliances to develop a healthy school program accordingly (WHO, 1998) by following a healthy school program held city and provincial levels.

4. Reducing harmful chemical agents and contaminants in accordance (US EPA, 2007) by planting trees around the school as well as improved hygiene school.

Aspect of Regulation

Attachment of Government Regulation No.41 of 1999 has not put benzo (a) pyrene (BAP) as one of the parameters of national ambient air quality standard. The parameters that have been listed as a national ambient air quality standard are: SO_2, CO, NO_2, O_3, HC, PM_{10}, $PM_{2.5}$, TSP, Pb, Dustfall, Total Fluorides, Fluor Index, Khlorine & Khlorine Dioxide, and Suphat Index. Parameters that serve as the national ambient air quality standard, the measurement time, the method of analysis, and the equipment for measurement have been determined. In Indonesia, benzo (a) pyrene (BAP) is still considered to be a substance not pose a health risk to humans. In fact, IARC classifies benzo (a) pyrene (BAP) in Group 2A, which means to cause cancer in animals and possibly in humans. The absence of regulatory aspects regarding the time of measurement, quality standards, analytical methods, and apparatus for performing measurements become one of the obstacles in measuring the concentration of benzo (a) pyrene (BAP) in the ambient air of the school environment.

6. CONCLUSIONS

1. Concentrations of benzo (a) pyrene (BAP) at 10 points have the same value of <0,002 ppm is equal to <0.02 mg / m^3.
2. Anthropometric data of respondents SMPN 16 Bandung has an average body weight 46.69 kg, with a median value of 45.15 kg. The average rate of intake of 0.57 m^3 / hour with a median value of 0.55 m^3 / hr. The data of activity the respondent had an exposure period of 6 hours / day, the average value of the frequency of exposure to 210.82 days / year, with a median value of 219 days / year, *real time* duration (1.8 years), duration of exposure (3 years) and duration of exposure (6 years). The median value of CDI for the duration of the *life span* of 0, 0008 (mg / kg / day) $^{-1}$. While the median value of CDI *real time* duration (1, 8 years) of 6.05×10^{-5} (mg / kg / day) $^{-1}$, for the duration of exposure (3 years) of 0.0001 (mg / kg / day) $^{-1}$, for the duration of exposure (6 years) of 0.0002 (mg / kg / day) $^{-1}$. LADD median value of 0, 0003 (mg / kg / day) $^{-1}$.
3. Value of non-carcinogenic risk level (RQ) of the respondents had an average $1,436 \times 10^4$, with a median value of 1.46×10^6 for the duration of the *life span,* an average of 1.03×10^5, with a median value of 1.05×10^5 for *real time* duration (1.8 years), the average of 1.72×10^5, with a median value of 1.76×10^5 for the duration of exposure (3 years), the average of 3.45×10^5, with a median value of 3.52×10^5 for the duration of exposure (6 years). Value of carcinogenic risk level (ECR) on the respondent had median and average value of 0.0006.
4. Risk management and health recommendations needed to reduce the health risks from exposure to benzo (a) pyrene (BAP).

7. SUGGESTION

Government

1. Their latest Government Regulations regarding the national ambient air quality standard that refers of PP 41 of 1999.
2. The existence of a standard on ambient air measurement is not just in the work environment.

Bandung City Health Office

1. Involving all schools based on the level in the city to follow a healthy school competition.
2. Monitor and evaluate every school that has not been or has entered the category of healthy school.

Junior High School 16 Bandung

1. It needs education about air pollution that occurs in the school environment.
2. There is a need for improvement of school facilities that include ventilation, lighting, and cleanliness of the school environment.

Further Research

1. It needs a comparison group with the schools are close to the source of exposure to benzo (a) pyrene (BAP) in another big city or conducted a cohort study to find out more exposure to benzo (a) pyrene (BAP).

2. Supposedly measurement of the concentration of benzo (a) pyrene (BAP) in ambient air using high volumes of water samples by the method TO-13A were analyzed using gas chromatography issued by the US EPA (1999) instead of using NIOSH method 5515 for air in the workplace.

3. Measurement of the concentration of benzo (a) pyrene (BAP) is not only a one day but several days to avoid bias

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