Environmental Health Risk Assessment of Inhaled Dust Exposure on Workers at Industry Crumb Rubber Palembang City 2016.pdf

by Dr.m. Zulkarnain

Submission date: 05-Dec-2019 02:26PM (UTC+0700)
Submission ID: 1227569703
File name: sure_on_Workers_at_Industry_Crumb_Rubber_Palembang_City_2016.pdf (1.51M)
Word count: 4395
Character count: 25996

ISSN-0976-0245 (Print) • ISSN-0976-5506 (Electronic)

[redacted]ber 2017

Indian Journal of Public Health Research & Development

An International Journal

SCOPUS IJPHRD CITATION SCORE

Indian Journal of Public Health Research and Development
Scopus coverage years: from 2010 to 2016 Publisher:
R.K. Sharma, Institute of Medico-Legal Publications
ISSN:0976-0245E-ISSN: 0976-5506 Subject area: Medicine:
Public Health, Environmental and Occupational Health
CiteScore 2015- 0.02
SJR 2015- 0.105
SNIP 2015- 0.034

Indexed by EMBASE, Scopus, Approved by MCI

Website:
www.ijphrd.com

Print-ISSN: 0976-0245-Electronic-ISSN: 0976-5506, Frequency: Quarterly (Four issues per volume)

Indian Journal of Public Health Research & Development is a double blind peer reviewed international journal. It deals with all aspects of Public Health including Community Medicine, Public Health, Epidemiology, Occupational Health, Environmental Hazards, Clinical Research, and Public Health Laws and covers all medical specialties concerned with research and development for the masses. The journal strongly encourages reports of research carried out within Indian continent and South East Asia.

The journal has been assigned International Standards Serial Number (ISSN) and is indexed with Index Copernicus (Poland). It is also brought to notice that the journal is being covered by many international databases. The journal is covered by EBSCO (USA), Embase, EMCare & Scopus database. The journal is now part of DST, CSIR, and UGC consortia.

Website : www.ijphrd.com

Editor

Dr. R.K. Sharma
Institute of Medico-legal Publications
501, Manisha Building, 75-76, Nehru Place,
New Delhi-110019

Printed, published and owned by

Dr. R.K. Sharma
Institute of Medico-legal Publications
501, Manisha Building, 75-76, Nehru Place,
New Delhi-110019

Published at

Institute of Medico-legal Publications
501, Manisha Building, 75-76, Nehru Place,
New Delhi-110019

Indian Journal of Public Health Research & Development

www.ijphrd.com

Contents

Volume 9, Number 2 February 2018

Environmental Health Risk Assessment of Inhaled Dust Exposure on Workers at Industry Crumb Rubber Palembang City 2016

A. Fickry Faisya[1], Tan Malaka[2], Hilda Zulkifli[3], M.Zulkarnain[2]

[1]Environmental Science Study Program, Public Health Faculty, [2]Medical Faculty, [3]Mathematical and Science Faculty, Sriwijaya University, Indonesia

Abstract

Rubber dust produced from the destructive rubber processing production process can cause respiratory health risks for workers. This study analyzed the risk of exposure to dust that is inhaled in the working environment of industrial workers of crumb rubber production. This research used descriptive study design, to calculate exposure risk of inhalation dust with environmental health risk analysis method to know the intake of individual exposure per day based on concentration of concentration agent, activity pattern and anthropometry. The sample this research were 156 workers from 450 workers. The technique for collecting the data used simple random sampling. Crude rubber dust samples in the work environment were took 25 points based on SNI 7230 of 2009. The concentration of dust being inhaled on the workers was measured using IOM Dust Sampler brand Cat 225-79A SKC, anthropometry using scales to measure the weight and pattern of worker activity was obtained using questionnaires . The mean dose concentration was 2.15 mg/ m_3, weight 57.7 kg, exposure time of 10.6 hours/day, frequency of exposure 286.6 days /year, exposure time of 10.6 years, 0.064 mg/m_3 intake and Risk Quotient Non Carcinogenic> 1 is RQ 1.44 as many as 65% of workers. Risk management can be done by minimizing or equalizing the intake value by rfc 0.0442 mg/m_3.

Keywords: *Inhaled dust, risk agent, ARKL*

Introduction

Increased industrialization activities will directly have a negative impact on increasing air pollution, both ambient air and air in the workplace environment. These conditions can be risk factors for various lung diseases, including pneumoconiosis, farmer's lung, chronic bronchitis, pulmonary fibrosis, and asthma. Industrial dust contained in the air by type can be grouped into two, namely inorganic and organic dust. Dust with a size of 5-10 microns when inhaled will be retained and buried in the upper respiratory tract, while the size between 3-5 microns retained and buried in the middle airway. Industrial dust sucked continuously for a long time can cause lung damage, thus reducing the elasticity of the alveoli in accommodating the volume of air (oxygen)[1,2]. Factors that contribute to the magnitude of respiratory health problems due to dust, including airborne dust levels, dust size, dust properties, reactivity of working weather dust, duration of exposure and individual sensitivity[3,4]. Crumb rubber industry performs its production activities by processing raw materials derived from raw natural rubber from the process of tapping, clumping into rubber in the form of bearings (slab) obtained from farmers further with mechanical processes such as processing, crushing, milling and packing will produce rubber crumbs and dust as a result of its production[5,6] . The production process of crumb rubber processing has the potential risk of exposure to dust on workers in the processed enumeration of processed rubber or slab, milling of rubber products into rubber sheet (blanket) and drying room of rubber sheet (hanging). Workers exposed to organic dust in their workplace have a high risk of developing respiratory health problems[7,8]. Rubber dust can be classified as organic dust, the permitted dust limit is inhalable 10 mg/ m_3 and respirable 3 mg/m_3 [9,10]. Respiratory disorders associated with the workplace, ie 6-30% of workers who have high exposure to organic dust[11]. An environmental health risk assessment is an approach that can be used to look at the health risks of hazard exposure in an environment that can have an effect on the health

of exposed populations[12]. A preliminary survey of 20 crumb rubber industry workers showed symptoms of respiratory illness that 35% of workers complained of cough, 20% had sputum in the respiratory tract and 25% of workers experienced shortness of breath / wheezing.

Methodology

This research used descriptive study design, to calculate exposure risk of inhalation dust with environmental health risk analysis method to know the intake of individual exposure per day based on concentration of concentration agent, activity pattern and anthropometry. The research was conducted from August to December 2016. The location of this research in the production of PT XXX Crumb Rubber Industry Palembang City. Research sample 156 workers drawn from a population of 450 workers. The technique for collecting the data used simple random sampling.. Crushed rubber dust samples in the work environment were taken 25 points based on SNI 7230 in 2009. Collecting data of respondent characteristics using questionnaires and weight weighing the respondents. Measurement of inhaled dust level in working environment using IOM Dust Sampler brand Cat 225-79A SKC with NMAM 0500 method, and dust concentration analysis was done in laboratory of Balai Hyperkes Provinsi Sumatera Selatan using gravimetric method. The dust gauge in the working environment is placed at predetermined measurement points and the device is placed as high as the worker's breathing zone for 8 hours. Furthermore, the data of the research results is a health risk analysis is a process of estimating the magnitude of health problems and the resulting consequences at any given time. The environmental health risks analysis consists of 4 (four) stages, ie hazard identification, ie the process of recognizing and knowing the type of hazard from a source.[13,14] Response dose analysis is the determination of toxicity value of a risk agent, exposure analysis, is a contact assessment to know the amount of received risk agent intake and risk characteristics is the probability of negative impact due to exposure to risk agent.[15] Data of inhaled dust levels and workers anthropometry were analyzed to obtain realtime and lifetime exposure intake values using the following equations:

$$I = \frac{C \# R \# t_E \# f_E \# D_t}{Wb \# t_{avg}} \quad \ldots(1)$$

I is the intake/intake (mg/kg/day), C is the concentration of the risk agent (mg/m3), R is the inhalation rate (m3/h), tE is the time of exposure (hour/day), fE is the frequency of exposure/year), Dt is the duration of exposure (year), Wb is body weight (kg), and tavg is the daily average period (30x365) days/year for non-carcinogenic substances. Dt default, which is 30 years, R based on USEPA, R value is 20 m3/day for 70 kg weight. The anthropometry of Indonesian society inhalation rate follows the equation y = 5.3ln (x) -6.9 with y = R (m3/day) and x = Wb (kg),[16]. The reference dose for inhaled dust is not yet available in the IRIS list. Based on safe concentration I = Rfc and Rfc value for inhalable dust used in this study as follows[17]:

$$Rfc \text{ dust } \frac{0{,}4416}{1 \# 10} \quad \ldots(2)$$

$$= 0{,}0442 \text{ mg/kg/day}$$

Risk characteristic is an attempt to estimate an adverse risk that can occur in humans due to risk agent exposure. Risk characteristics are quantified risk estimates of the probability of occurrence of health risks based on hazard identification, effects analysis, and exposure analysis. Risk characteristics can be calculated by the equation below[13]:

$$RQ = \frac{I}{Rfc \text{ atau } Rfd} \quad \ldots(3)$$

Health risk needs to be controlled if RQ> 1, if RQ 1 risks need not be controlled, but conditions must be maintained to keep the RQ value not exceeding 1. Risk management formulated at risk respondents (RQ> 1) by calculating safe concentration, (safe tE) and annual exposure frequency (fE safe).

$$\text{Cnk (safe)} = \frac{wb \# t_{avg} \# Rfc}{R \# t_E \# f_E \# Dt} \quad \ldots(4)$$

$$\text{tEnk (safe)} = \frac{wb \# t_{avg} \# Rfc}{c \# R \# f_E \# Dt} \quad \ldots(5)$$

$$\text{Dt nk (safe)} = \frac{wb \# t_{avg} \# Rfc}{c \# R \# f_E \# t_E} \quad \ldots(6)$$

$$\text{fEnk (safe)} = \frac{wb \# t_{avg} \# Rfc}{c \# R \# f_E \# Dt} \quad \ldots(7)$$

Results and Discussion

Characteristic data of anthropometry, activity pattern and concentration of crumb rubber dust production part of PT XXX industrial crumb rubber can be seen in table 1.

Table 1: Frequency Distribution by Dust Concentration Inhalable Activity Pattern, Anthropometry of Production Workers PT XXX Crumb Rubber Industry Palembang City 2016.

Population Group at Risk	n 156	Mean	Median	SD	Min-Max
Age (yr)		33,53	32	6,04	22-47
Concentration (mg/m3)		1,60	2,15	0,6	0,97-2,15
Exposure Time (hr/hr)		10,47	11,00	1,2	8-12
Exposure Frequency (hr/yr)		286,6	293,0	15,2	171-293
Exposure Duration (yr)		12,0	11,0	6,4	2-26
Inhalation Rate / R (m3/hr)		0,61	0,61	0,43	0,51-0,83
Weight (Kg)		57,7	57,5	10,2	37-75

The average age of the workers in the production section were 33.53 years, the concentration of inhalable dust resulted from the lowest personal measurement of 0.97 mg/m3 with an average concentration of 1.60 mg m3 and maximum dust concentration in the production section of 2.15 mg/m3. The concentration of dust obtained is still below the dust threshold in the working environment of 10 mg/m3 for inhalable[9]. The exposure time was found to be 8-12 hours per day with a mean of 10.47 hours/day. Frequency exposure per year 171 days the lowest and highest 293 working days this condition is still below the maximum limit of 365 days per year[9] Inhalation rate obtained average of 0.61 m3/ hour calculated using the weight of Indonesian society of 55 [15,16] . The duration of the exposure shows the length of the worker exposed at work. The longer a person is exposed to the hazard it will increase their risk for health problems due to the exposure of the hazard. This study used the duration of realtime exposure calculated based on the working life and 30 years projection lifetime, this is because parameters analyzed do not have carcinogenic risk to health. The lifetime duration of exposure is differentiated by the type of risk agent used, the risk agent having a carcinogenic risk using a 70-year projection while the risk agent that has no carcinogenic risk uses a 30-year projection[5]. The duration of exposure in realtime is calculated based on the working period of workers working at PT. XXX, the average duration of realtime exposure calculated based on the mean cut of point value of 12 years. The duration is high enough and potentially pose a health risk[12]. A person's weight is inversely proportional to the intake risk agent a person receives[15]. The greater a person's body weight the smaller the internal dose received the smaller the body weight the greater the internal dose received. This is caused because a person with a large body weight had more nutrients that can inhibit the absorption of a risk agent so that the risk agent absorbed by the body is smaller, the health risks that the consequences will be less too[18].

The exposure analysis was conducted based on two categories namely realtime exposure and lifetime exposure. Realtime exposure uses actual duration of exposure (Dt), duration of respondent working or activity in research location with year unit. The amount of inhalation rate (R) is based on the equation y = 5.3 ln (x) -6.9 with the provisions y = R (m3/day) and x Wb (kg)[16] . The calculation of dust intake area on workers in production can seen in table 2.

Table 2: Intake Dust Personal Inhalable, Realtime and Lifetime At Workers in Production Section PT Crumb Rubber Industry, Palembang City 2016.

Exposure Group	Intake DPI (mg/kg/day)		
	C Min (0, 97)	C Mean (1, 60)	C Maks (2, 15)
Realtime			
Drying Room	0.004	0.02	0.064
Non Drying Room	0.0008	0,.04	0.015
Lifetime			
Drying Room	0.020	0.05	0.10
Non Drying Room	0,.09	0.01	0.046

Description : DPI (Dust *Personal Inhalable*)
C Min *(Concentrasi Minimum)*, C Mean *(Concentrasi mean)*,
C Maks *(Concentrasi Maksimum)*

The above data shows that the exposure group in the drying room has an inhalable and respirable area intake rate higher than the non-drying exposure group for realtime and lifetime exposure. The size of the toxicity of a risk agent with non-carcinogenic effects in the environmental health risk assessment for inhalation is expressed in Reference Concentration[13,19]. The Rfc value for inhalable dust used in this study refers to the results of the study of 0.0442 mg/m3. [17] .The value of the

exposure intake of a risk agent is directly proportional to the concentration of an agent, respiratory rate, exposure time, frequency of exposure, duration of exposure and inversely proportional to body weight and time average[13] In line with the research[12], the high TSP intake received by respondents by: the concentration of TSP received by the respondent exceeds the environmental quality standard threshold, the duration of the respondent's exposure over 8 hours and the duration of exposure for more than 30 years[20].

The average value of realtime and lifetime risk levels in production workers of PT XXX industrial crumb rubber for personal inhalable dust can be seen in table 3.

Table 3: Frequency Distribution of Health Risks Dust Exposure Inhalable, Realtime and Lifetime In Workers in Production Section PT XXX Crumb Rubber Industry Palembang City 2016.

Exposure Group	RQ DAI		
	C Min (0, 97 mg/m3)	C Mean (1, 60 mg/m3)	C Maks (2, 15 mg/m3)
Realtime			
Drying Room	0.091	0.452	1.448
Non Drying Room	0.018	0.091	0.339
Lifetime			
Drying Room	0.452	1.131	2.262
Non Drying Room	0.204	0.226	1.041

Description: DPI (Dust Personal *Inhalable)*

C Min (Concentrasi Minimum), C mean (Concentrasi mean),

C Maks (Concentrasi Maksimum);mg/m3

Based on the result of data analysis showed that the exposure group in the drying room has a RQ > 1 value at the concentration of dust area inhaled maximum of 2.15 mg/kg/day for realtime exposure. Whereas in exposure of lifetime RQ > 1 is found in exposure group of drying room and non drying room. This condition illustrates that workers working with concentrations of dust in the working environment are 1.60 mg/kg/day and 2.15 mg/ kg/day. The concentration of dust when viewed from the aspect of the threshold value is still below standard, but from result of health risk analysis turns out worker working in work environment already have value RQ> 1, meaning that environment condition is not safe for respiratory health of worker. The four equations above have been calculated and obtained the numbers are safe for workers. As at a maximum concentration of 2.15 mg/m3 should be reduced dust concentration in the maximum working environment of 1.03 mg/m3. The maximum exposure time variable of 10 hours is reduced to a maximum exposure time per day up to 5 hours. The frequency variable of exposure per year is safe for workers maximum of 138 days per year. While vaiabel duration of safe dust exposure for workers max 7 years.

Conclusion

Dust inhaled in the working environment of the production at PT. XXX Crumb Rubber Palembang City ranges from 0.97 to 2.15 mg/m3 and is still below the Threshold Value (NAB). The results of the health risk analysis (Risk Quotien = RQ) of dust exposure in the working environment for lifetime exposure in both jet room and non drying room have RQ > 1 (risky) and realtime exposure only in drying room has RQ > 1 meaning worker working in environment drying rooms have a risk to respiratory health.

Ethical Considerations: Research proposal addressed to the examiner team of Postgraduate Environmental Study, Universitas Sriwijaya Indonesia. Ethical clearance was obtained from Public Health Faculty, Universitas Diponegoro, Semarang, Indonesia. Written informed consent was gained from the respondent before data collection and confidentiality was ensured.

Source of funding: Self **Conflict of**

Interest: Nil

Reference

Soeripto, M. 2008. Industrial Hygiene. Jakarta: Medical Faculty Publishing, Indonesia University.

Zaman, C. 2015. Respiratory Health of Workers in Pensoil Slat and Playwood Industry at South Sumatera Province. Dissertation. Postgraduate of Sriwijaya University, Palembang

Depkes RI. 2002. Occupational Health Efforts for Leather Craftman, Battery, Tofu and Tempe, batik craftsmen. Puskerja. Secretary General of Indonesia Health Department. Jakarta.

Sintorini, M. 2002. The Association of Ambient Air PM_{10} Levels related Case of Respiratory Disease Symptoms. Thesis of Postgraduate Program of Indonesia University. Jakarta.

Suma'mur, PK., 2009. Company Hygiene and Occupational Health (Hyperkes), Jakarta, Gunung Agung Store.

Lestari, F., 2009. Chemical Hazards Sampling and Measurement of Contaminants in the Air, Jakarta, Medical Book of EGC Publishing.

Malaka, T. and Kodama, AM., 1990. *Respiratory Health of Plywood Workers Occupationally Exposed to Formaldehyde. A*rc. Environ Health; 45:288-9

Sripaibookij, P., W. Phanprasit and M.S. Jaakkola, 2009., *Respiratory and Skin Effect of Exposure to Wood Dust from the Rubber Tree Hevea Brasilliensis*. Occup Environ Med;66;442-447.

Kemennakertrans, RI. 2011. Labor Ministry Regulations number 13 of 2011, about The Threshold Limit Value of Physical Factors and Chemical Factors in the Workplace, Jakarta.

American Conference of Govermental Industrial Hygienist (ACGIH). 2011. *Threshold Limit ValuesOf Chemical Substance and Physical Agents and Biological Exposure Indices*. Cincinnati, OH, USA.

Quadarusman Emanuel, Sutji Pratiwi Rahardjo, Abdul Qadar Punagi, Riskiana Djamin, 2011. The Risk of Occurrence of Occupational Rhinitis in the Worker Exposed to Dust Flour. ORLI Vol. 41 Num. 1 Year 2011.

Basri Syahrul, Emmi Bujawati, Munawir Amansyah, Habibi, Samsiana, 2014. Analysis of Environmental Health Risk (Risk Assessment Model of Air Pollution of Health Effects), Health Journal Volume VII Num.2 pp.427-447.

Louvar, FL and Louvar BD., 1988. Health and Environmental Risk Analysis: Fundamental With Aplication.

IPCS, 2004. IPCS Risk Asssessment Terminology, Part I : IPCS/OECD Key Generic Term used in Chemical Hazards/Risk Assessment; Part

IPCS Glosary of key Exposure Assessment Terminology, Geneva: World Health Organization and Environmental Program on Chemical Safety.

Rahman, A., Nukman, A., Setyadi, Akib, CR, Sofwan, Jarot, 2008. Analysis of Environmental Health Risk of Lime Mining at Sukabumi, Cirebon, tegal, Jepara and Tulung Agung, Health Ecology Journal Vol 7 No.1:665-677.

Arbianto, H. (2004). Analysis of the Risk of Pollution of Inhaled Dust Particle (PM10) on Students in the Area of Elementary School 1 Pondok Cina, Depok City, West Java. Thesis of Indonesia University.

Nukman, A., Rahman, A., Warouw, S., Setiadi, IM., Akib CR, 2005. Analysis and Investigation of Air Pollution: A Case Study in the Nine Big Cities. Health Ecology Journal, Vol 4 Num.2 Agust. Pp.271-284.

Mangampe, Anggraini, Daud Anwar, Hirawida, Agus Hintara, 2014. Mercury Risk Analysis (Hg) of Chub Mackerel and Tegillarca Granosa in Society of Coastal Area of Makassar City. Health Environment Department. Public Health Faculty of Hasanuddin University, Makassar.pp 1-10.

Kolluru, RV., 1996. Risk Assessment and Management Handbook for Environmental Health, and Safety Professionals, Megraw-Hill.

Huboyo, HS and Syafrudin, 2007. Analysis of Dust Concentration Factor (TSP) and Lead on Road Side for Human Health "A Case Study of Yogyakarta City". Engineering Journal. Vol.28 Num.2 Year 2007. ISSN 0852-1697.

Call for Papers / Article Submission

The editor invites scholarly articles that contribute to the development and understanding of all aspects of Public Health and all medical specialities. All manuscripts are double blind peer reviewed. If there is a requirement, medical statistician review statistical content. Invitation to submit paper: A general invitation is extended to authors to submit papers papers for publication in IJPHRD.

The following guidelines should be noted:

- The article must be submitted by e-mail only. Hard copy not needed. Send article as attachment in e-mail.
- The article should be accompanied by a declaration from all authors that it is an original work and has not been sent to any other journal for publication.
- As a policy matter, journal encourages articles regarding new concepts and new information.
- Article should have a Title
- Names of authors
- Your Affiliation (designations with college address)
- Abstract
- Key words
- Introduction or back ground
- Material and Methods
- Findings
- Conclusion
- Acknowledgements
- Interest of conflict
- References in Vancouver style.
- Please quote references in text by superscripting
- Word limit 2500-3000 words, MSWORD Format, single file

All articles should be sent to: **editor.ijphrd@gmail.com**

Our Contact Info:

Institute of Medico-Legal Publications

501, Manisha Building, 75-76, Nehru Place, New Delhi-110019,
Mob: 09971888542, Fax No. +91 11 3044 6500
E-mail: editor.ijphrd@gmail.com, Website: www.ijphrd.com

Published, Printed and Owned : Dr. R.K. Sharma
Printed : Printpack Electrostat G-2, Eros Apartment, 56, Nehru Place, New Delhi-110019
Published at: Institute of Medico Legal Publications Pvt. Ltd. 501, Manisha Building, 75-76, Nehru Place, New Delhi-110019
Editor : Dr. R.K. Sharma, Mobile: + 91 9971888542, Fax No: +91 11 3044 6500

Environmental Health Risk Assessment of Inhaled Dust Exposure on Workers at Industry Crumb Rubber Palembang City 2016.pdf

ORIGINALITY REPORT

9%	8%	1%	6%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

MATCH ALL SOURCES (ONLY SELECTED SOURCE PRINTED)

3%

★ Submitted to Universitas Airlangga

Student Paper

Exclude quotes	On	Exclude matches	< 1%
Exclude bibliography	On		