Analysis of Worker's Level of Knowledge on Handling Chemicals in Oil and Gas Industry Laboratory of Pt "X" Indonesia

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Abstract

The oil and gas industry is one of a large-scale industry, which is when carrying out the production process, they contain several hazard posed that can threaten labor, assets, and other people in industrial environment such as chemical hazards. The chemical groups have special characteristics in disturbing and threatening labor. Knowledge is one of the important factors in preventing work accidents and work-related diseases due to chemicals. This study is a descriptive study, and the data was collected by observational. The object of research in this study is knowledge of workers on handling chemicals. The sample is a total population of 28 workers. The results of the research obtained were that most workers already had adequate knowledge regarding handling chemicals in the laboratory. The highest concentration of chemicals in the laboratory is Benzene (19.1 ppm), Toluene (30.56 ppm) and Xylene (20.48 ppm). The conclusion of this study is that knowledge is a very important domain for the formation of a person's behavior. In this case, it is related to the handling of chemicals found in the laboratory. If the level of knowledge of the workers is high, the handling of chemicals in the workplace can be carried out maximally, so that workplace accidents can be prevented and the safety of workers can be maintained.

Keywords: *chemicals, workers' knowloedge, laboratory.*

Introduction

OHS (Occupational Health and Safety) is a program created by workers and employers as an effort to prevent accidents and occupational diseases (OD). Based on Article 86 paragraph (1) letter a of Law Number 13 of 2003 concerning Labor, every worker has the right to obtain protection for Occupational Health and Safety. The lack of care of the company towards OHS is reflected in the high rate of work accidents and the less optimal detection of OD[1].

The International Labor Organization (ILO) stated that 160 workers experienced work-related illness every 15 seconds[2]. Workplace accidents and OD are a health and economic burden in Indonesia because not only do they need services and health costs, but they also reduce the productivity. Occupational Disease is a disease caused by work or work environment that will result in partial or total disability. Part of the defect is the loss or non-functioning of some members of the body of labor forever. Whereas total disability is a state of labor without being able to work at all forever[3].

In general, the causes of OD can be grouped into five groups, namely the physical group: noise, radiation, temperature, very high pressure, vibration, poor lighting. Chemical group: chemicals used in work processes, as well as those found in the work environment, can be in the form of dust, steam, gas, solution, clouds or fog. Biological group: bacteria, viruses or fungi. Physiological group: usually caused by workplace arrangement and work methods. Psycho-social group: stressful work environment.

The chemical group has special characteristics in disturbing and threatening the safety and health of

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workers. This can happen because some chemicals have physical and chemical properties like invisible color, odor that does not smell. Therefore handling and knowledge of chemicals in the workplace is very important. Knowledge is one of the important factors in preventing work accidents and work-related diseases due to chemicals. Through good knowledge, the workforce can take the right actions at work.

The oil and gas industry is a large-scale industry with labor intensive and capital intensive. In carrying out the production process, there are several dangers posed that can threaten human. Some of these hazards are noise due to work processes, extreme temperatures, and lighting in the workplace. Chemical hazards such as benzene, toluene, xylene and H_2S. Biological hazards such as the presence of wild animals, bacterial, viruses or fungus contamination. Before being marketed, all the oil and gas that has been produced will be tested in the laboratory. This shows that workers in the laboratory are also exposed to chemicals hazards.

Material and Method

This study is a descriptive study, with observational to collecting some data. Based on the method of retrieval of data, this research is observational, because the data obtained through observation and not being treated on the object of research.

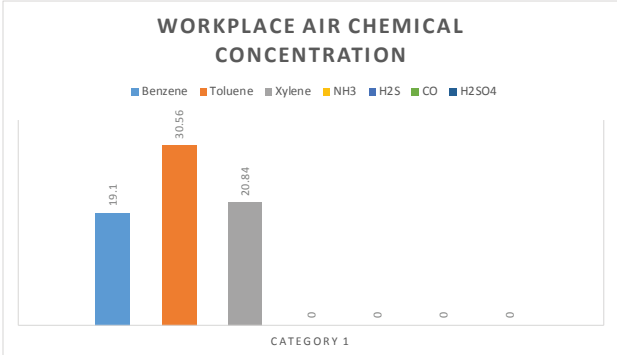
The object of research in this study is the workers's knowledge on handling chemicals. The population was 28 workers in the oil and gas industry laboratory. The sample is a total population of 28 workers.

The data collected is primary data and secondary data. Primary data obtained from interviews are workers 's knowledge regarding chemicals. This data includes the workers 's knowledge on the identification of chemicals, how to handle products, regarding the use of RPE, regarding maintenance of Respiratory Protective Equipment (RPE) and regarding management support. Secondary data is obtained from data recorded in the oil and gas industry, such as: industrial profile data, and data on the number of workers.

Findings

Data collection was conducted on 28 respondents who worked in oil and gas industry laboratory of PT "X" Indonesia by distributing questionnaires and conducting interviews directly.

A. Overview of Air Chemical Concentration in the PT "X" Indonesia Oil and Gas Laboratory



Based on the chart above, it can be seen that the highest concentration of chemicals in oil and gas laboratory of PT "X" Indonesia in the form of Benzene is 19.1 ppm, the highest concentration of Toluene is 30.56 ppm, and the concentration of Xylene is 20.84 ppm, while the concentration of NH3, H2S, CO and H2SO4 in the laboratory is still not detected which is 0.00. Although the concentration of these chemicals has not exceeded the TLV (Threshold Limit Value) that has been determined based on the Minister of Manpower and Transmigration Regulation of the Republic of Indonesia Number PER.5 / MEN / X / 2018 concerning occupational health and safety and work environment, it still needs to be watched out for the effect the exposure caused can affect the health and safety of workers.

B. Questionnaire Result of Oil and Gas Laboratory of PT "X" Indonesia

1. Workers' Knowledge Level on Identifying Chemical Products

Based on the results of the questionnaire, it was found that 100% of workers knew the identification of chemical products containing hazardous materials in their workplaces (BTX, caustic soda, DMDS), and 100% of workers knew the source of information regarding chemical products in the workplace.

2. Level of Worker Knowledge on How to Handle Products

Based on the results of the questionnaire 71% of workers stated that there were measurements of gas testing in their workplaces. 100% of workers know the type of respiratory protective equipment that must be used in handling the hazard products they encounter at work.

3. Workers' Knowledge Level regarding the Use of RPE

Based on the results of the questionnaires, 100% of workers know the health effects of chemical products in their workplaces, workers also know the type of respiratory protective equipment they use, know how to use the correct RPE, know the disposable RPE, know that disposable RPE can only be used once, knowing that reusable RPE cannot be used alternately, knowing the function of the RPE they use, and 43% of workers stating that there are no complaints when using RPE.

4. Maintenance of Respiratory Protective Equipment (RPE)

Based on the results of the questionnaire, it was found that 79% of workers stated that there was an RPE maintenance procedure at their place of work. 68% stated that treatment performed on RPE can affect the effectiveness of RPE function. 71% of workers stated that they knew the condition of the RPE that needed cleaning. 96% of workers stated that they kept RPE in clean and sealed plastic before putting it in a locker. 79% of workers stated that they had checked the RPE condition before using it. 79% of workers stated that they knew how the RPE could be used.

5. Level of Knowledge regarding Management Support

Based on the results of the questionnaire, it was found that 100% of workers had received RPE-related training, 100% of workers stated that the RPE they received was in accordance with their type of work, and 100% of workers stated that there had never been cases of shortness of workers when wearing RPE.

Chemicals in the Laboratory

Benzene, Toluene and Xylene or commonly known as BTX are several types of air pollutants which are Polycyclic Aromatic Hydrocarbon (PAH) compounds. PAHs are formed due to incomplete combustion of organic matter, spread to the environment and in mixed form. The main sources of exposure of PAH to humans come from the work environment, passive and active smokers, food and water and air pollution[4].

BTX is a chemical including chemicals that are toxic to health, both carcinogenic and trigger cancer and increase oxidative and non-carcinogenic stresses such as affecting the hematopoietic system, central nervous system and reproductive system[5].

1. Benzene

Exposure to benzene on humans through inhalation is carcinogenic. The presence of benzene exposure in the work environment has been associated with an increased incidence of acute and chronic myeloid myeloblastic or erythroblastic leukemia and lymphoid leukemia in workers.

The Indonesian National Standard 2005 which refers to Minister of Manpower Regulation No. 13 of 2011 contains the Threshold Value (TLV) of the time weighted avarage of chemicals in the workplace air, with the number of hours worked 8 hours per day or 40 hours per week, stating that benzene included in group A2 (chemicals that are estimated to be carcinogens for humans) have NAB of 10 ppm or 32 mg / m3 of benzene in the air[6].

In contrast to xylene and toluene, benzene is a material that is proven to be carcinogenic which can interact with RNA, proteins or other molecular compounds that can trigger carcinogenic effects without being directly related to exposure concentration[7].

The health effects of benzene exposure at low levels can cause dizziness or drowsiness, a rapid heartbeat, headaches, tremors, and confusion. At a higher level can cause unconsciousness or even death. Long-term exposure can have serious health consequences, especially in the bone marrow, or through loss of red blood cells, which can cause anemia. This can disrupt the immune system, and make patients vulnerable to other diseases, benzene can also cause cancer, especially leukemia and other cancers in the blood.

2. Toluene

Toluene is one of the aromatic hydrocarbon compounds, colorless substances, flammable liquid with a distinctive aroma, not corrosive, explosive vapor, insoluble in water but soluble in ketones, alcohols, esters and other aromatic hydrocarbon compounds[8].

Effect of toluene toxin:

2,5 ppm	threshold of pungent odor
37 ppm	still acceptable to humans
50-100 ppm	subjective complaints (fatigue, feeling sleepy and headache)
200 ppm	Eye and respiratory tract irritation, cognitive damage, headache, dizziness, hangover, fatigue, confusion, insomnia
300 ppm	Coordination damage if exposure is up to 8 hours
400 ppm	Eye, respiratory, and tear gland irritations, skin paresthesia, signs of lack of coordination and mental disorders if severe for more than 8 hours
500-600 ppm	Anorexia, staggering pathways, weak nausea, reduced memory, reduced time to recreation
800 ppm	Very nauseous (after 3 hours of exposure), confused, low self-control, very anxious, memory loss (insomnia) for several days
1500 ppm	Uncoordinated, very tired
4000 ppm	Can cause damage to response, necrosis and death
10000-30000	Necrosis, death.

3. Xylene

Xylene is a colorless, flammable, volatile and sweet-scented liquid9. Xylene is naturally found in kerosene, coal and forest fire processes or through the process of automation of petroleum hydrocarbons. On an industrial scale, xylene is produced through the heating process of organic compounds and catalyst processes for kerosene products10.

Xylene exposure can also occur through inhalation (breathing), ingestion, eye contact and in some rare cases, xylene can be absorbed in small amounts on the skin, which is the main effect that can arise from xylene exposure is a result of breathing in xylene vapor10.

The negative impact that can be caused from xylene exposure is depression in the central nervous system, with symptoms such as headache, dizziness, nausea and vomiting. Like benzene, xylene can also cause a decrease in red blood cells (anemia)11.

Xylene which is ingested into the body can cause stomach problems and cause toxic effects on the liver. Exposure to high concentrations of xylene vapors that occur acutely can cause impaired function and swelling and bleeding11.

Xylene concentrations below 200 ppm will irritate the eyes and membranes of the lenders, while at high concentrations xylene can cause narcotic effects. Estimated LD50 orally in humans is 50 mg / kg12.

The Importance of Knowledge

Knowledge is the result of knowing, and this happens to someone who does sensing a particular object. Most human knowledge is obtained through the eyes and ears. Knowledge is a very important domain for the formation of one's behavior. Besides knowledge or cognitive is a domain that is very important for the formation of one's actions (Overt Behavior).

Some studies that have been conducted also show that a conclusion is obtained that there is a relationship between knowledge and attitude with the use of personal protective equipment[13].

Knowledge of the characteristics of chemicals in the workplace can provide facts and information related to handling the chemicals and take actions when the problems occur. One important knowledge must be possessed while in the laboratory and direct exposure to chemicals including: Knowledge of the identification of chemicals, Knowledge of how to handle products, Knowledge of how to use and maintain RPE, and Knowledge of Management Support.

Hazard identification is an effort to prevent and reduce the occurrence of workplace accidents that occur in the company, and avoid and minimize risks in the right way by avoiding and reducing the risk of workplace accidents and their control in carrying out repair and maintenance activities so that the process is safe. Hazard identification includes identification of aspects of the Company's environmental impacts on the environment and surrounding residents in the Company's area[14].

Knowledge of how to use and maintain respiratory protective equipment (RPE) is very important because it is a device that can protect workers from exposure to hazardous substances. The use of respiratory protectors prevents workers from directly inhaling contaminants in the work area.

Respiratory Protective Equipment according to Regulation of the Minister of Labour and Transmigration Number 8; 2010 concerning Personal Protective Equipment is a protective device that serves to protect respiratory organs by channeling clean and healthy air and / or filtering out contamination of chemicals, micro-organisms, particles in the form of: dust, fog (aerosol), steam, smoke, gas / fume and so on[15].

Based on its function, RPE is divided into: Respirator which functions to purify the air (air purifying respirator), respirator which functions to supply oxygen or air (water supplying respirator), respirator with a canister containing chemicals, mechanical respirator (mechanical respirator), filter combination respirator and chemicals, respirators with suppliers of air or oxygen.

Conclusion

From the research that has been done, some conclusions can be drawn as follows.

1. Most workers already have adequate knowledge regarding handling chemicals in the oil and gas laboratory of PT "X" Indonesia in accordance with procedures that have been included in the OHS norms in the workplace.

2. The highest concentration of chemicals in the oil and gas industry laboratory of PT "X" Indonesia is Benzene (19.1 ppm), Toluene (30.56 ppm) and Xylene (20.48 ppm).

3. Knowledge is a very important domain for the formation of a person's behavior, in this case is related to the handling of chemicals found in the oil and gas industry laboratory of PT "X" Indonesia.

4. If the level of knowledge of the workers is good, then the handling of chemicals in the workplace can be done to the maximum, so that work accidents can be prevented and the safety of workers can be maintained.

Ethical Clereance: This Research Already pass Ethical Cleareance From FPH Universitas AIrlangga

Conflicts of Interest: The authors have no conflicts of interest to declare for this study.

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