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## **HAZARD IDENTIFICATION USING THE HAZARD IDENTIFICATION AND RISK ASSESSMENT AND DETERMINING CONTROL (HIRADC) TECHNIQUE (CASE STUDY AT LABORATORIES AT UNIVERSITAS ISLAM NEGERI SUMATERA UTARA)**

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### **Abstract**

*Every workplace has a risk of accidents and health problems. The university is a workplace that has a variety of laboratories with a variety of risks, so prevention and control efforts are needed to prevent accidents and health problems for lecturers, staff, and students. Prevention and control efforts are attempts to build a culture of Occupational Safety and Health (OSH) in Higher Education. This study was conducted to determine the type of hazard, risk assessment based on the source of danger and risk assessment based on the type of hazard in all laboratories at UINSU. Hazard identification and risk assessment were analyzed with Hazard Identification and Risk Assessment and Determining Control (HIRADC) Technique. The identification results obtained by sources of hazards in the form of chemical hazard. Public Health Science Faculty has 2 sources of potential hazard in high risk level and 2 sources of potential hazards in high risk level were in Science and Technology Faculty. It is expected that the identification results can be evaluated and used as reference material to determine efforts to repair and control the risk of hazards in the laboratory at UINSU. The laboratories need to have guidelines and procedures for Occupational Safety Health.*

**Keywords:** *Occupational Safety and Health, laboratory*

### **1. INTRODUCTION**

Every workplace has a risk of accidents and health problems. The university is a workplace that has a variety of laboratories with a variety of risks, so prevention and control efforts are needed to prevent accidents and health problems for lecturers, staff, students, and visitors. Prevention and control efforts are attempts to

build a culture of Occupational Safety and Health (OSH) in Higher Education.

The Laboratories in the Faculty of Public Health Science and Science and Technology Faculty of Universitas Islam Negeri Sumatera Utara is a site for students to conduct numerous activities, such as experiments, research, and tests and/or

calibration. Those activities are supposed to be containing potential hazards.

A hazard is any source of potential damage, harm or adverse health effects on something or someone, for example, to people as health effects, to organizations as property or equipment losses, or to the environment). (Canadian Center for Occupational of Health, 2020).

Risk management is now the main thing of conversation, practice, and job preparation. This clearly demonstrated the implication of risk management in working atmosphere. Management policies related to risk anticipation, risk identification, and risk management of occupational safety and health companies.(1)

At work, HIRADC can work in a systematic manner to ensure that almost all risks have been identified and reported without fail, as well as perform risk assessments on the hazards and establish a safe work protocol to reduce the risk of the hazards. The final component, after having all of these, is to enforce and track the agreed-upon work safe plan or framework that has been established, as well as to look for ways to improve work safe practices. Briefly, HIRADC comprises the procedure of Strategic Planning, Hazard Identification, Risk Assessment, prepare risk control action and periodically review. Under "Strategic Planning" the management in the company establishes risk assessment team which includes workforce representatives and competent

personnel within the organization. Periodically, all relevant essential HIRADC documents will be collected, and planned according to agreed methodology. During any assessment, action plan are prepared and collated for each evaluated and defined risk.(2)

HIRADC was applied in manufacturing process to prevent accident in workplace. The integrated method could reduce the risk and create necessary recommendations to improve worker safety. 10 types of high risk hazard using HIRA method in spare part manufacturing are found.(9) HIRA also used to assess and prioritizing hazards in automotive industry(10). There are five types of hazards that are identified, and a recommendation is to minimize the risk level.

The objective of this research was implementing the method of hazards identification, risk assessment, and determine control at the laboratories of Universitas Islam Negeri Sumatera Utara as a control effort toward the available potential hazards.

## **2. METHOD**

Hazard identification and risk assessment were carried out in 4 laboratories in Public Health Science Faculty and 2 laboratories at Science and Technology Faculty at Universitas Islam Negeri Sumatera Utara. Hazard identification used HIRADC technique.

## **3. RESULT**

Risk Assessment in 4 laboratories of Public Health Faculty is mostly included in the level of

moderate risk (medium) with a total of 10 sources of potential hazards, 1 source in low risk level, and there are 2 sources of potential hazards with a high level of risk (high) from 13 sources of identified potential hazards (table 1).

Risk Assessment in 2 laboratories of Science and Technology Faculty had been done toward the available 20 sources, there were 6 sources in low risk level, 12 sources in moderate risk level, and 2 sources in high risk level (table 2).

**Table 1.** Hazard identification and risk assessment at Public Health Science Faculty

Stages of work / activities / Facilities used	Hazard Description	Hazard Inform	Risk	Severity	Probability	Risk Level
<b>Environmental Health Laboratory:</b>						
Solution Mn SO4	Chemical	Inhaled Skin/eye contact Swallowed	Eye/skin respiratory irritation	3	3	9
Solution Acetic Acid 100% (Glacial)	Chemical	Inhaled Skin/eye contact Swallowed	Eye/skin/ respiratory irritation	3	2	6
<b>Nutrition Laboratory:</b>						
Carbohydrate Test:						
Methylated spirits	Chemical	Inhaled Skin/eye contact swallowed flammable	Eye/skin/ respiratory irritation fire/explosion	2	3	6
Protein Test:						
Sedimentation test with alcohol (HgCl) 2%	Chemical	Inhaled Skin/eye contact swallowed flammable	Eye/skin/ respiratory irritation fire/explosion	2	3	6
Fat Test:						
Gasoline	Chemical	Inhaled Skin/eye contact swallowed flammable	Eye/skin/ respiratory irritation fire/explosion	3	4	12
Sodium Carbonate (Na2CO3)	Chemical	Inhaled Swallowed	Eye/skin/ respiratory irritation	2	2	4
Sodium Hydroxide	Chemical	Inhaled/ Skin/eye	Eye/skin/ respiratory	3	2	6

Stages of work / activities / Facilities used	Hazard		Risk	Severity	Probability	Risk Level
	Description	Inform				
(NaOH) 10%		contact Swallowed	irritation			
Vitamin C Test: Burn the solution	Chemical	Inhaled Skin/eye contact swallowed flammable	Eye/skin/ respiratory irritation fire/explosion	3	3	9
<b>Epidemiology Laboratory:</b>						
K <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>	Chemical	Inhaled/ Skin/eye Contact flammable	Eye/skin/ respiratory irritation fire/explosion	3	4	12
Kalium Iodida (KI 10%)	Chemical	Inhaled/ Swallowed	Eye/skin/ respiratory irritation	3	3	9
Sodium Thiosulfate (Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> )	Chemical	Inhaled/ Skin/eye contact	Eye/skin/ respiratory irritation	3	3	9
Solvent 96%	Chemical	Inhaled/	Eye/skin/ respiratory irritation	3	3	9

**Table 2.** Hazard identification and risk assessment at Science and Technology Faculty

Stages of work / activities / Facilities used	Hazard		Risk	Severity	Probability	Risk Level
	Description	Inform				
<b>Biology/Chemical Laboratory:</b>						
Chloroform	Chemical	Inhaled	Eye/respiratory irritation	3	3	9
Copper Sulfate (CuSO <sub>4</sub> )	Chemical	Inhaled Skin/eye contact Swallowed	Eye/skin/ respiratory irritation	3	2	6
(NH <sub>4</sub> ) <sub>2</sub> C <sub>2</sub> O <sub>4</sub>	Chemical	Inhaled Skin/eye contact	Eye/skin irritation	3	2	6
CaCl <sub>2</sub>	Chemical	Inhaled Skin/eye contact	Eye/skin/ respiratory irritation	3	2	6

Stages of work / activities / Facilities used	Hazard Description	Hazard Inform	Risk	Severity	Probability	Risk Level
Ammonia	Chemical	Inhaled	Eye/skin/ respiratory irritation Metabolism	2	2	4
Barium Acetate	Chemical	Inhaled	Eye/skin/ respiratory irritation	4	2	8
Pb (NO <sub>3</sub> ) <sub>2</sub> 0,1 M	Chemical	Inhaled Skin/eye contact	Eye/skin/ respiratory irritation Fetus Autism	4	1	4
MgSO <sub>4</sub>	Chemical	Inhaled	Eye/skin/ respiratory irritation	3	2	6
NaOH Solid	Chemical	Inhaled Skin/eye contact	Eye/skin/ respiratory irritation	4	1	4
Methylated spirits	Chemical	Inhaled Skin/eye contact	Eye/skin/ respiratory irritation	2	3	6
NaOH 10%	Chemical	Inhaled Skin/eye Contact	Flammable fire/explosion Eye/skin/ respiratory irritation	3	4	12
CH <sub>3</sub> COONa	Chemical	Inhaled Skin/eye Contact	Eye/skin/ respiratory irritation chronic bronchitis	3	2	6
CH <sub>3</sub> COOH	Chemical	Inhaled Skin/eye contact	Eye/skin/ respiratory irritation	4	1	4
Alcohol 96%	Chemical	Inhaled Skin/eye contact	Eye/skin/ respiratory irritation	3	4	12
Pb (CH <sub>3</sub> COO) <sub>2</sub>	Chemical	Inhaled Skin/eye Contact	Flammable fire/explosion Eye/skin/ respiratory irritation neuron	4	1	4
FeCl <sub>3</sub> Kristal	Chemical	Inhaled Skin/eye Contact	Eye/skin/ respiratory irritation	3	2	6

Stages of work / activities / Facilities used	Hazard		Risk	Severity	Probability	Risk Level
	Description	Inform				
MgCl <sub>2</sub>	Chemical	Inhaled Skin/eye Contact	Eye/skin/ respiratory irritation	3	2	6
BaCl <sub>2</sub>	Chemical	Inhaled Skin/eye Contact	Eye/skin/ respiratory irritation swallowed	3	2	6

#### 4. DISCUSSION

A laboratory is a place to carry out experiments. Working in a laboratory means having zero chance to perform reckless behaviors in performing or using equipment and materials provided in a laboratory.(3) A laboratory as a place with high chances of hazard occurrence is required to be examined by implementing HIRADC analysis, which also an essential element in occupational safety and health management system due to the fact that it relates to the endeavor to prevent and control hazards used to determine the objectives and intentions of occupational safety and health.

Study in 2 Nutrition laboratories in the Faculty of Public Health, Universitas Airlangga showed that there are 15 hazard identifications, the highest hazard level is medium-risk, which consists of 3 hazard identifications.(4)

Study in Audio-Visual Aids (AVA) Laboratory at the Faculty of Public Health of Universitas Airlangga found 6 activities that could lead to hazard potential and 7

sources of hazard that could cause 8 risks of occupational health and safety(5)

Study in Environmental health laboratory owned by the Faculty of Public Health, Universitas Airlangga Showed that there are 3 high risks category, 4 moderate risks category and 5 low risks category(6).

Study in Chemistry laboratory at Universitas Airlangga showed that there are 10 risks including 4 low risk level, 2 moderate risk level, 2 high risk level, and 2 extreme risk level.(7)

Another study in the Laboratory of Epidemiology in Faculty of Public Health of Universitas Airlangga showed that there are 12 risks discovered, namely 10 low-risk level of hazards and 2 moderate-risk levels of hazards.(8)

Other studies that already exist, UINSU Environmental Laboratory, Nutrition laboratories and Epidemiology Laboratory has a lower level of risk that will happened than other studies from different University. For Biology and Chemistry Laboratory of UINSU, has a highest risk than a study in

Universitas Airlangga Chemistry Lab.

To avoid another Risk, UINSU can do preventive action such as provide training or instructions to lab users before entering the laboratory, using appropriate safety equipment, clean all the chemical that have been used, conduct a review after the laboratory was used and equip the fire extinguisher in each laboratory room.

## 5. CONCLUSION

The identification results obtained by sources of hazards in the form of chemical hazard. It is expected that the identification results can be evaluated and used as reference material to determine efforts to repair and control the risk of hazards in the laboratory at UINSU. Risk controls need to be continuously implemented to control hazards that might be occurred.

The recommendation was providing warning signs, practical guidelines on Chemical Safety in Laboratory, use of standard personal protective equipment (PPE), operating procedure and job safety analysis for all practical modules, safety induction, and providing the First Aid Kits and its content.

The mentioned controls and recommendations are expected to facilitate the attempt to reduce the risk level occurrences in the Laboratories of Universitas Islam Negeri Sumatera Utara (UINSU).

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