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, and also 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).

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

| Stages of work / activities / Facilities used | Hazard Description | Hazard | Risk | Severity | Probability | Risk Level |
|---------------------------------------------|--------------------|--------|------|----------|-------------|------------|
| **Environmental Health Laboratory:**        |                    |        |      |          |             |            |
| Solution Mn SO4                             | Chemical Inhaled   | Skin/eye | 3   | 3        | 9           |            |
|                                             | Skin/eye contact   | 3      | 3   | 9        |             |            |
|                                             | Swallowed          | 3      | 3   | 9        |             |            |
| Solution Acetic Acid 100% (Glacial)         | Chemical Inhaled   | Skin/eye | 3   | 2        | 6           |            |
|                                             | Skin/eye contact   | 3      | 2   | 6        |             |            |
|                                             | Swallowed          | 3      | 2   | 6        |             |            |
| **Nutrition Laboratory:**                   |                    |        |      |          |             |            |
| Carbohydrate Test:                          |                    |        |      |          |             |            |
| Methylated spirits                          | Chemical Inhaled   | Skin/eye | 2   | 3        | 6           |            |
|                                             | Skin/eye contact   | 2      | 3   | 6        |             |            |
|                                             | swallowed          |        |      |          |             |            |
|                                             | flammable          |        |      |          |             |            |
| Protein Test:                               |                    |        |      |          |             |            |
| Sedimentation test with alcohol (HgCl) 2%   | Chemical Inhaled   | Skin/eye | 2   | 3        | 6           |            |
|                                             | Skin/eye contact   | 2      | 3   | 6        |             |            |
|                                             | swallowed          |        |      |          |             |            |
|                                             | flammable          |        |      |          |             |            |
|                                             | fire/explosion      |        |      |          |             |            |
| Fat Test:                                   |                    |        |      |          |             |            |
| Gasoline                                    | Chemical Inhaled   | Skin/eye | 3   | 4        | 12          |            |
|                                             | Skin/eye contact   | 3      | 4   | 12       |             |            |
|                                             | swallowed          |        |      |          |             |            |
|                                             | flammable          |        |      |          |             |            |
|                                             | fire/explosion      |        |      |          |             |            |
| Sodium Carbonate (Na2CO3)                   | Chemical Inhaled   | Swallowed | 2  | 2        | 4           |            |
| Sodium Hydroxide                            | Chemical Inhaled/  | Skin/eye | 3   | 2        | 6           |            |
|                                             | Skin/eye           | 3      | 2   | 6        |             |            |
| Stages of work / activities / Facilities used | Hazard Description | Inform | Risk | Severity | Probability | Risk Level |
|---------------------------------------------|--------------------|--------|------|----------|-------------|------------|
| (NaOH) 10%                                  | contact Swallowed   | irritation | 3    | 3        | 9           |            |
| Vitamin C Test: Burn the solution           | Chemical Inhaled    | Eye/skin/respiratory irritation | 3    | 3        | 9           |            |
|                                             | Skin/eye contact    | fire/explosion | 3    | 3        | 9           |            |
|                                             | swallowed flammable |         |      |          |             |            |

**Epidemiology Laboratory:**

| Hazard Description | Inform | Risk | Severity | Probability | Risk Level |
|--------------------|--------|------|----------|-------------|------------|
| K2Cr2O7            | Chemical Inhaled/Skin/eye Contact flammable | Eye/skin/respiratory irritation | 3    | 4        | 12         |
|                    |        |      | fire/explosion | 3    | 3        | 9          |
| Kalium Iodia (KI 10%) | Chemical Inhaled/Swallowed | Eye/skin/respiratory irritation | 3    | 3        | 9          |
| Sodium Thiosulfate (Na2S2O3) Solvent 96% | Chemical Inhaled/Skin/eye contact | 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 Description | Inform | Risk | Severity | Probability | Risk Level |
|---------------------------------------------|--------------------|--------|------|----------|-------------|------------|
| Biology/Chemical Laboratory:                |                    |        |      |          |             |            |
| Chloroform                                  | Chemical Inhaled   | Eye/respiratory irritation | 3    | 3        | 9           |            |
| Copper Sulfate (CuSO4)                      | Chemical Inhaled   | Eye/skin/respiratory irritation | 3    | 2        | 6           |            |
|                                             | Skin/eye contact   |         |      |          |             |            |
|                                             | Swallowed          |         |      |          |             |            |
| (NH4)2 C2O4                                 | Chemical Inhaled   | Eye/skin irritation | 3    | 2        | 6           |            |
|                                             | Skin/eye contact   |         |      |          |             |            |
| CaCl2                                       | Chemical Inhaled   | Eye/skin/respiratory irritation | 3    | 2        | 6           |            |
|                                             | Skin/eye contact   |         |      |          |             |            |
| 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 (NO3)2 0,1 M                            | Chemical Inhaled  | Eye/skin/ respiratory irritation, Autism | 4    | 1        |             | 4          |
| MgSO4                                      | Chemical Inhaled  | Eye/skin/ respiratory irritation | 3    | 2        |             | 6          |
| NaOH Solid                                 | Chemical Inhaled  | Eye/skin/ respiratory irritation | 4    | 1        |             | 4          |
| Methylated spirits                         | Chemical Inhaled  | Eye/skin/ respiratory irritation | 2    | 3        |             | 6          |
| NaOH 10%                                   | Chemical Inhaled  | Eye/skin/ respiratory irritation, fire/explosion | 3    | 4        |             | 12         |
| CH3COONa                                   | Chemical Inhaled  | Eye/skin/ respiratory irritation, chronic bronchitis | 3    | 2        |             | 6          |
| CH3COOH                                    | Chemical Inhaled  | Eye/skin/ respiratory irritation | 4    | 1        |             | 4          |
| Alcohol 96%                                 | Chemical Inhaled  | Eye/skin/ respiratory irritation | 3    | 4        |             | 12         |
| Pb (CH3COO)2                                | Chemical Inhaled  | Eye/skin/ respiratory irritation, neuron | 4    | 1        |             | 4          |
| FeCl3 Kristal                               | Chemical Inhaled  | Eye/skin/ respiratory irritation | 3    | 2        |             | 6          |
| Stages of work / activities / Facilities used | Hazard Description | Inform | Risk | Severity | Probability | Risk Level |
|---------------------------------------------|--------------------|--------|------|----------|-------------|------------|
| MgCl2                                        | Chemical           | Inhaled Skin/eye Contact | Eye/skin/ respiratory irritation | 3      | 2          | 6          |
| BaCl2                                        | 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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