

# Risk Analysis of Chemical Storage Room in Higher Education Laboratory

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## ABSTRACT

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Universities that have testing/experimental laboratories use chemicals and biology to support student competence and support the implementation of lecturer research which is one of the places that has a high enough risk of danger. Laboratory management such as chemical storage rooms should be managed based on the basic elements of laboratory management, namely planning, arrangement, administration, maintenance, security and supervision. so as to avoid the danger of poisoning, corrosive, skin irritation, fire, explosion which can pose a bad risk to health and the work environment. The aim of this research is to know the risks of chemical storage rooms with data collection techniques in the form of interviews, observation, and documentation which are analyzed using the Miles and Liberman model. The results showed the dangers of chemical storage rooms in the form of exposure to organic solvents, exposure to acidic liquids, irritants which are at risk of dizziness, nausea, shortness of breath, irritation, material damage and fire. With the potential coming from a lack of user knowledge, the absence of SOPs and MSDS and a lack of discipline in implementing PPE.

*Keywords:* Risk Analysis, Chemical Storage, Laboratory

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## INTRODUCTION

Occupational Safety and Health (K3) is essentially an effort to create protection and security from various risks of accidents and hazards both physically and mentally for workers, workplaces, society and the environment. With the hope of creating high work comfort and safety in all sectors.<sup>1</sup> Without exception, this includes the Education sector, which is also emphasized in RI Law No. 14 of 2005 concerning teachers and lecturers, article 39 paragraph 2 that it is important to protect occupational safety and health. The health sector is also emphasized in the Republic of Indonesia Law. No. 36 of 2009 concerning Health in article 4 everyone has the right to health, article 6 everyone has the right to a healthy environment for achieving health degrees, and article 7 everyone has the right to receive balanced and responsible information and education about health.

Based on data from the Directorate General of Binwasnaker and K3 annual reports of the Ministry of Manpower in 2022 work accident cases (KK) and work-related diseases (PAK) in 2019 the number of 15,486 families, PAK 48; in 2020 the number of households is 6,037, PAK 81; in 2021 the number of families is 7,298, PAK 6. The results of Putu Subania ID's research, etc. (2019) explain that the types of chemical risks in the FMIPA UNDIKSHA chemical laboratory are the risks of poisoning, corrosive, skin irritation, fire, explosion.<sup>2</sup> The results of Ridasta Bagus Anggoro's research (2020) explain that SMK3 achievement in chemical laboratories is in the low rating category.<sup>3</sup>The

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<sup>1</sup> Tarwana. 2014. Kesehatan dan keselamatan kerja manajemen dan implementasi K3 di tempat kerja. Surakarta: harapan press

<sup>2</sup> Putu subania I.D, Sri wahyuni I.G.A.N, Widiarsi Ni Nyoman. 2019. Analisis resiko bahan kimia berbahaya di laboratorium kimia organik. jurnal matematika, Sains, dan Pembelajarannya, Vol 13 No. 1

<sup>3</sup> Ridasta bagus anggoro. 2020. Penilaian system manajemen Kesehatan dan keselamatan kerja di labotarium kimia. HIGEIA Journal of public health research and development, Universitas negeri semarang, eISSN 1475-222656

high cases of work accidents and work-related diseases must be able to provide information to all sectors that Occupational Health and Safety (K3) is very important to pay attention to.<sup>4</sup>

Universities that have testing/experimental laboratories use chemicals and biology to support student competence and support the implementation of lecturer research which is one of the places that has a high enough risk of danger. Occurrence of work accidents and occupational diseases can originate from the conditions of the workplace, workers and the interaction of workers with the elements in the workplace. Laboratory management such as chemical storage rooms should be managed based on the basic elements of laboratory management, namely planning, arrangement, administration, maintenance, security and supervision. Based on PERMEN RI No.

Based on the description of the background, it is necessary to carry out research with the aim of knowing the risks of chemical storage rooms in private higher education laboratories in Gorontalo.

## METHODS

The type and approach used in this study is descriptive analytic with a qualitative approach. Which aims to understand social problems based on the creation of holistic pictures formed by words, reported views of detailed information and arranged as a natural setting.

The primary data used is in the form of interview results with the head of the laboratory, the person in charge of the chemical room, laboratory staff and observations related to material storage procedures, material safety data sheets (MSDS), chemical characteristics, material storage areas, material storage environmental conditions, personal protective equipment in storage or use of chemicals.<sup>5</sup> Meanwhile, secondary data was obtained using documentation methods related to work accident reports and other supporting data. The research subjects were laboratory managers and research objects in the integrated laboratory chemical storage room at Bina Mandiri University, Gorontalo. The data obtained was analyzed using the Milles and Liberman model and then technical triangulation was carried out to validate the data.<sup>6</sup>

## RESULTS AND DISCUSSION

Results of interviews, observations and documentation of risk management in chemical storage rooms including material storage procedures, material safety data sheets (MSDS), chemical characteristics, material storage areas, material storage environmental conditions, personal protective equipment in chemical storage or use are presented in table 1 below:

**Table 1. Research Results of Risk Analysis of Laboratory Chemical Storage Space**

Aspect	Research findings	Potency	Danger	Risk
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<sup>4</sup> Ditjen binwasnaker dan K3 Kemnaker. 2022. Laporan tahunan profil K3 nasional di Indonesia 2022. Jakarta

<sup>5</sup> Mendikbut. 2018. Panduan keamanan penyimpanan bahan kimia. Jakarta

<sup>6</sup> Sugiyono. 2016. *Metode Penelitian kombinasi (mixed methods)*. Bandung: Alfabeta.

Material storage procedures	There is no SOP for the flow of procurement, receipt and storage of chemicals	Managers do not follow procedures  Environment: the arrangement of materials is not appropriate  method: do not use PPE	Exposure to organic solvents, exposure to acidic materials (corrosive), irritating materials, punctured by sharp objects	Dizziness, nausea, shortness of breath, hurt
Material safety data sheet (MSDS) or natural product catalogue	Existing chemicals, not all are equipped with an MSDS both in the form of labels, sheets and MSDS reports for laboratory materials	Managers do not have knowledge of the nature and character of the material  Environment: irregular storage arrangement  Method: no identification of the chemical	Exposure to organic solvents, exposure to acidic materials (corrosive), irritants, environmental contamination	Dizziness, nausea, shortness of breath, skin irritation, fire, environmental pollution
Material characteristics	Most of the chemicals in the storage room do not have material characteristics such as a. Explosive b. Easily oxidized (oxidizing) c. flammable d. toxic e. danger of irritation (harmful irritant) f. corrosive g. hazardous materials for the environment (dangerous for environmental	Managers do not have knowledge of the nature and character of the material  Environment: the arrangement of materials does not match the characteristics of the materials  Method: there is no grouping of materials according to material characteristics	Exposure to organic solvents, exposed to acidic materials (corrosive), irritating materials, infected with bacteria	Dizziness, nausea, shortness of breath, irritation, stomach pain, burns

	h. Biological hazards or biohazards			
Chemical storage requirements	Not all chemicals are stored in an appropriate place such as organic solvents in plastic containers that do not tightly cover, substances that are easily oxidized stored in bright containers, bacterial cultures that accumulate in the refrigerator.	Managers do not have material handling knowledge environment polluted by gas from volatile materials  Method: do not tightly cover the B3 material	Exposure to organic solvents	Dizziness, nausea, shortness of breath, poisoning
Environmental conditions for chemical storage	Supporting facilities for storage of materials such as temperature control, air circulation, and light sources are not functioning properly. Meanwhile, the storage space is relatively small and the material storage rack is too high and the barrier on the edge of the shelf is very low.	Managers do not understand the influence of the environment on the condition of the material  An environment that does not support a large number of material characters  Control over the material room is still very lacking	Falling, touching, lack of concentration, exposed to acids, irritants and corrosive	Fainted, injured, scratched, fire, material damage
Personal protective equipment in chemical storage	There is laboratory safety equipment such as LAB coats, masks, gloves, shoes and goggles, first aid	Lack of user discipline in the use of PPE	Exposure to acidic materials, irritation	Irritation, dizziness, poisoning

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kits but there is  
still a lack of  
consistency in  
their use

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*Standard operating procedure*(SOP) is an absolute thing that must exist in laboratory management as a reference for the technical implementation of handling chemicals for the work units involved, preventing/minimizing as little as possible the occurrence of unwanted things such as fire, poisoning, explosions, occupational diseases, spills or spills and other things that can harm the company, employees, society and the environment, as well as improve the quality of workers who are directly involved in direct handling of chemicals.<sup>7</sup> The importance of the Standard operating procedure (SOP) is a guideline that must exist within the scope of managing a laboratory.

SOPs are in the form of standard operational procedures that exist within an organization's scope that are used to ensure that all actions, as well as all use of facilities, processes carried out can run effectively, efficiently, consistently, systematically and safely.<sup>8</sup> In addition to the availability of SOPs, it is important to have materials safety data sheets (MSDS) in managing chemicals which can provide general information regarding the properties of materials, storage, transfer, handling and management of these chemical wastes. The MSDS contains information related to product name, industry, material composition, material characteristics (Radioactive > pyrophoric > flammable > corrosive > reactive to water > oxidizing agents > combustible > toxic), first aid in case of accident if exposed to materials, material storage, physical protection measures, conditions of stability, activity, ecology, disposal as well as by-laws.

HRM data is used as a standard occupational safety and security protocol to reduce/eliminate hazards that can be bad risks to health and safety at work.

In addition to MSDS, material storage conditions must pay attention to material grouping, material storage height, closed storage containers such as in cabinets, lockers, and so on. Storage area must be clean, dry and away from heat sources or sunburn. In addition, the storage area must be equipped with temperature control, ventilation that leads to the smoke room or exits the room. When interacting with chemicals the user must be equipped with personal protective equipment in the form of a laboratory coat, eye protection, hand protection, respiratory protection, and leg protection. The correct use of PPE when working in the laboratory will help minimize the risk of work accidents.

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<sup>7</sup> Djojogito, A. (2003). Pedoman Kesehatan dan Keselamatan Kerja Laboratorium Kesehatan. Jakarta: Direktur Jenderal Pelayanan Kesehatan.

<sup>8</sup> Malaha A. (2019). Analisis Upaya Pencegahan Kecelakaan Kerja Pada Tenaga Laboran di Laboratorium Sekolah Tinggi Ilmu Kesehatan Bina Mandiri Gorontalo

<sup>9</sup> Peraturan Menteri Kesehatan No. 43 Tahun 2013. Tentang cara penyelenggaraan laboratorium klinik yang baik. Jakarta

## CONCLUSION

Based on the research results, it is known that the dangers of chemical storage rooms are: exposure to organic solvents, exposure to acidic liquids, irritants which can be at risk of dizziness, nausea, shortness of breath, irritation, material damage and fire. With the potential coming from a lack of user knowledge, the absence of SOPs and MSDS and a lack of discipline in implementing PPE.

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