

Baseline survey on the implementation of laboratory chemical safety, health and security within health faculties laboratories at Universitas Indonesia

Many chemical accidents occur in the laboratories including fire, toxic chemical spills, hazardous materials leakage, fatalities and adverse health effects involving the use of hazardous materials. This research investigates the implementation of Chemical Health, Safety and Security Program within the health faculties laboratories at Universitas Indonesia. The method used in this study employed a Chemical Health, Safety and Security Checklist developed from several references including the: American Chemical Society Safety Audit/Inspection Manual, American Chemical Society Security Vulnerability Checklist for Academic and Small Chemical Laboratory Facilities, and Universitas Indonesia (UI) procedures for laboratory safety, health and security inspections. Inspections and observations are conducted in fifty one laboratories which use chemicals within the health faculties at UI. Result suggested that several laboratories have implemented a good University standard for a laboratory chemical safety, health and security programs, while others needs improvement in particular parameters.

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INTRODUCTION

Chemical security and safety in laboratories has become an important issue at Universitas Indonesia, as there have

been a number of chemical accidents including laboratory fire accidents, fatalities involving the use of hazardous materials and adverse health exposures. Other emerging issues are misuse of chemicals for non-academic purposes. This research investigates the implementation of a Chemical Health, Safety & Security Program within the health based faculties laboratories at Universitas Indonesia. Faculties involved

include the faculties of Medicine, Nursing, and Public Health.

Chemicals used in the laboratories can be hazardous. Studies indicate laboratory chemists *may* have shorter life spans, more diseases,^{1,2} higher cancer incidence,¹ and higher suicide rates particularly for females.¹ Workers in biomedical and chemical laboratories have potential exposures to a variety occupational hazards.³ Possible

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chemical health problems include liver cancer, mesothelioma, hepatotoxin (jaundice), neurotoxin, CNS (Central Nervous System), narcosis, reprotoxin, birth defects, developmental defects, blindness, hematopoietic, hemoglobin, cyanosis and death.⁵ The increases of recent female breast and reproductive cancers also may be attributable to occupational exposures.³ Many factors contribute to development of diseases such as genetics, specific chemical, protection controls used, dose, concentration, duration, frequency, life style, and the environment.⁴ Deaths from multiple myeloma, a cancer of the blood, were higher among women chemical laboratory workers at DOE facilities compared to women in the general population.⁵

Several accidents have occurred in the laboratories, e.g., the death of staff researcher Sheri Sangji resulting from burn injuries in a 2008 chemistry laboratory fire at UCLA, which required the University of California system to quickly and effectively respond by reassessing and revamping their safety program. This incident attracted widespread attention including scientists, academia, research institutions and public media. Another laboratory incident occurred at the University of California Santa Cruz. A fire occurred on January 11, 2002, about 5:30 am, on the 4th floor of the Sinsheimer Lab building, in the Department of Molecular, Cell and Developmental Biology. Firefighters responded based on an alert from heat-detection system in the building. An up-to-date inventory of hazardous materials allowed firefighters to enter building and contain the fire. However, it was found that the building did not have an automatic sprinkler system. After the accident, there were major consequences involving the lost of equipment, notes, materials, and samples of researchers, professors and students. Other laboratories in the building remained closed for weeks to months. There was also water and smoke damage consequences caused by the fire, and the burned laboratories took two years to reopen. However, the root cause was never determined.⁶

Campus safety, health and security has become an important issue at the

Universitas Indonesia, as there are more than 44,000 students enrolled and more than 7000 staff working at this university. Universitas Indonesia has a strong commitment to campus safety, health and security. Universitas Indonesia has 209 laboratories and 97 of them (about 50%) involve the use of hazardous chemicals, including 51 laboratories within health faculties. These hazardous conditions could pose a danger for students, researchers, and laboratory staff. Laboratory chemical hazard is one of four main hazards besides transportation, building, and security at Universitas Indonesia. The study was conducted to determine the level of compliance to the University's laboratory chemical safety, health and security standards.

METHOD

This research was conducted as a baseline inspection survey using the Universitas Indonesia's Laboratory Chemical Safety, Health & Security Checklist adopted from several references including the: American Chemical Society Safety Audit/Inspection Manual, American Chemical Society Security Vulnerability Checklist for Academic and Small Chemical Laboratory Facilities and Universitas Indonesia (UI) procedures for laboratory safety, health and security inspections.⁷⁻¹⁰ Chemical safety, health, and security baseline survey inspections were conducted in 51 health-based laboratories at three faculties: Medicine, Public Health, and Nursing. The laboratories were located at two different campuses: 10 laboratories located in UI Campus Depok and 41 laboratories at UI Campus Salemba. Four aspects were inspected including chemical health, chemical safety, chemical security and waste management.

Laboratory observations and interviews of the key personnel (laboratory managers, researchers and laboratory staff) were also conducted. Chemical security aspects laboratory observations included: building security, access control, door and window barriers, security vulnerability assessment, locked access to buildings hazardous materials and facility services.

Observation for chemical health aspects included: chemical risk assessment, chemical hygiene, sanitation facilities, emergency safety showers and eye washers, medical surveillance, and housekeeping. Safety aspects observations included: fire prevention and protection, storage of flammable liquids, electrical hazards, compressed and liquefied gases, chemical and radioactive substances, the use of Personnel Protective Equipment (PPE), and emergency response. Waste management observation included: waste segregation, waste treatment, and waste minimization.

RESULT AND DISCUSSION

The results of the chemical safety, health and security baseline survey within the health faculties laboratories at Universitas Indonesia is presented in [Table 1](#). The Laboratory Chemical Safety, Health & Security (SHS) compliance is presented in [Figure 1](#). The laboratory SHS compliance distribution is presented in [Figure 2](#), and a chemical safety, health and security assessment graph based on each aspect is presented in [Figure 3](#).

Chemical Security

Chemical security assessment was divided into four categories: general security, access to laboratory buildings, storage facilities, and facility services. Laboratory security aspects observations included building security, access control, doors and windows barriers, security vulnerability assessment, locked access to the buildings and hazardous materials and facility services. Laboratory access control included access control of unauthorized persons into the laboratory. Most laboratories had restricted access for a limited number of hazardous chemicals. Toxic chemicals were locked in cabinets and only authorized laboratory staff had access to toxic and hazardous chemicals. The number of laboratories that already complied with security standards was 59% (30 laboratories) from the total of 51 laboratories. Laboratory that did not comply with security standards was about 41% (21 laboratories) and included several aspects of

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